Invalidity Claim Chart Against U.S. Patent No. 11,835,421 ("'421 Patent")
Based on U.S. Publication No. 2021/0370727 ("Yamaguchi-727")

U.S. Publication No. 2021/0370727 ("Yamaguchi-727") claims priority to PCT/JP2018/028506, which was filed on July 19, 2019 and further claims priority to Foreign Application No. JP2018-186736, which was filed on October 1, 2018. Yamaguchi-727 qualifies as prior art under 35 U.S.C. § 102. Yamaguchi-727 anticipates and/or renders obvious the Asserted Claims of the '421 Patent (at least as Revvo understands Plaintiff's application of the Asserted Claims in an effort to show infringement).

To the extent Plaintiff argues that any element below is not disclosed by Yamaguchi-727, a person of ordinary skill in the art would have found it obvious to combine the teachings of Yamaguchi-727 with the background knowledge of a person of ordinary skill in the art and/or the additional references and exemplary teachings set forth in the chart below, to arrive at the claim limitation with a reasonable expectation of success. The chart below provides representative examples of where each element of each claim is found within Yamaguchi-727. Citations are meant to be exemplary, not exhaustive, and Revvo reserves the right to identify and discuss additional portions of the reference in support of its contentions and/or to rebut arguments made by Plaintiff. Citations to figures, drawings, tables, and the link include reference to any accompanying or related text. All internal cross-references are meant to incorporate the cross-referenced material as if fully set forth therein.

It is Revvo's position that Plaintiff's October 30, 2024 Infringement Contentions have not established that any accused product or service infringes any valid claim. Thus, Revvo's statements below should not be treated as an admission, implication, or suggestion that Revvo agrees with Plaintiff regarding either the scope, construction, or interpretation of any of the Asserted Claims or the infringement theories advanced by Plaintiff in its Infringement Contentions, including whether any Asserted Claim satisfies 35 U.S.C. §§ 101 or 112. In certain cases, Revvo has specified non-limiting examples of where its application of the prior art is based on Plaintiff's apparent application of the claim element. These statements are not intended to suggest that Revvo agrees with Plaintiff's application of any claim element, suggest a proposed construction at this stage of the case, or suggest that construction is needed, as the parties are not required to exchange terms for construction or propose claim constructions until a later date.

Plaintiff has yet to identify any limitation of the Asserted Claims that it contends is not anticipated and/or rendered obvious by Yamaguchi-727. Revvo therefore expressly reserves the right to respond to any such contention, including by identifying additional obviousness combinations, if Plaintiff makes any such contention.

Where Revvo states that Yamaguchi-727 "discloses" a limitation, that disclosure may be express, implicit, and/or inherent.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
1[pre]. A sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising:	*To the extent that the preamble is limiting, Yamaguchi-727 discloses, teaches, and/or suggests a sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising. For example:* **[ABSTRACT]** A functional component in which an electronic component capable of acquiring information inside a tire is housed and which is attachable to an inner peripheral surface of the tire, the functional component including a housing having a housing part for the electronic component and a bottom surface facing the inner peripheral surface of the tire, and a tubular part extending from a peripheral edge of the bottom surface toward the inner peripheral surface. **[0025]** FIGS. 1A and 1B are diagrams illustrating an attachment state of a functional component **1** attached to a tire **10**. As illustrated in FIG. 1A, the tire **10** is assembled to a wheel rim **15**, and an inner space of the tire **10** is filled with gas such as air. **[0026]** As illustrated in FIGS. 1A and 1B, the functional component **1** is fixed by an adhesive agent B to an inner surface (inner peripheral surface **10** *s*) of the tire **10** and is disposed in the center in a width direction of the inner peripheral surface **10** *s* that is a back side of a tread **11**, which contacts with a road surface, of the tire **10**. **[0027]** The functional component **1** has a housing (housing part) **2**, a skirt (tubular part) **4** and a module **6**. Incidentally, the type of the tire **10** to which the functional component **1** is to be attached is not particularly limited, but the functional component **1** is attached mainly to tires of automobiles traveling on ordinary paved roads (general roads and highways) such as passenger cars, trucks and buses, and of aircraft, and the like.

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FIG.1A

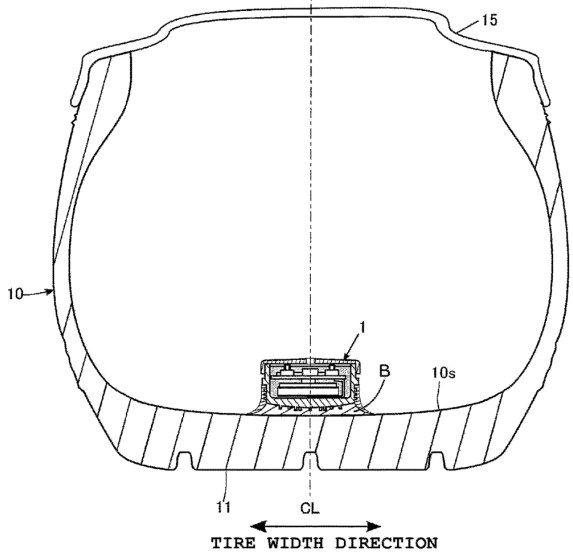
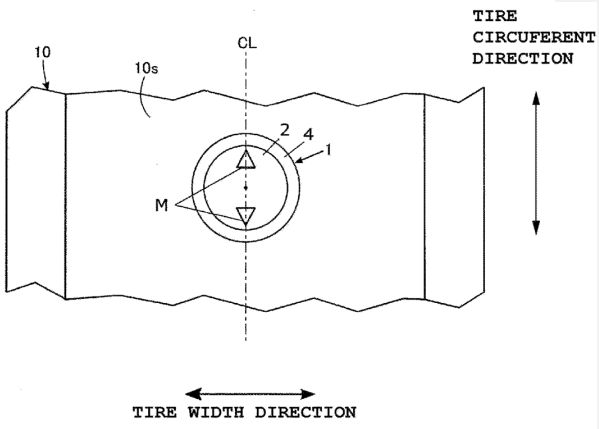
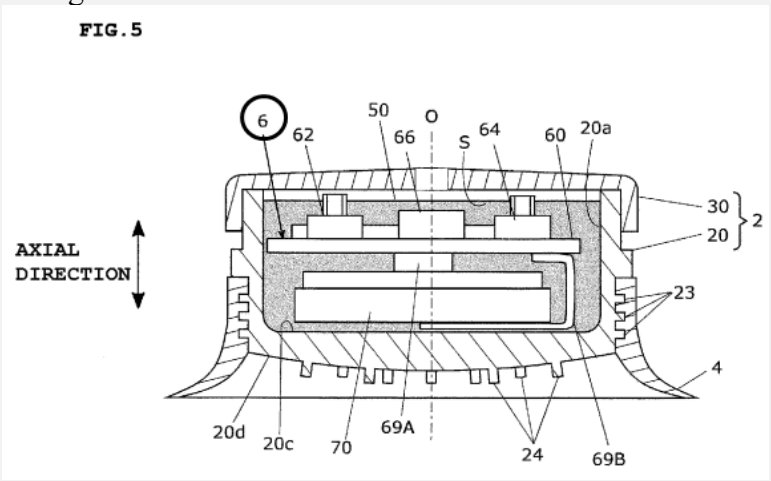
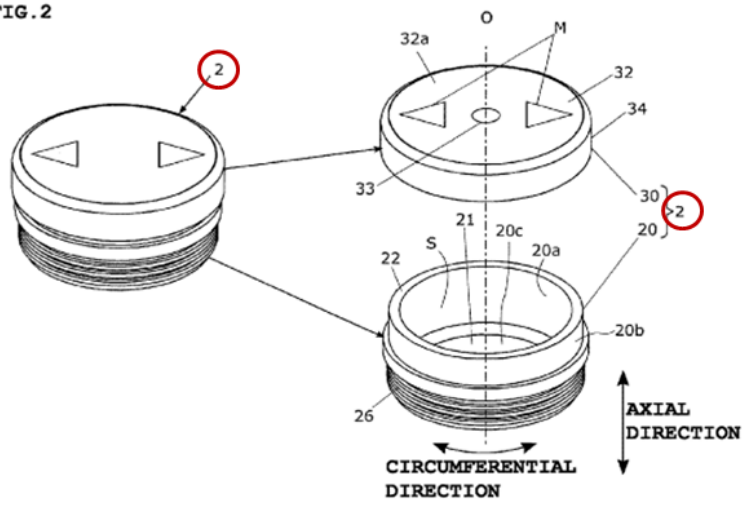


FIG.1B

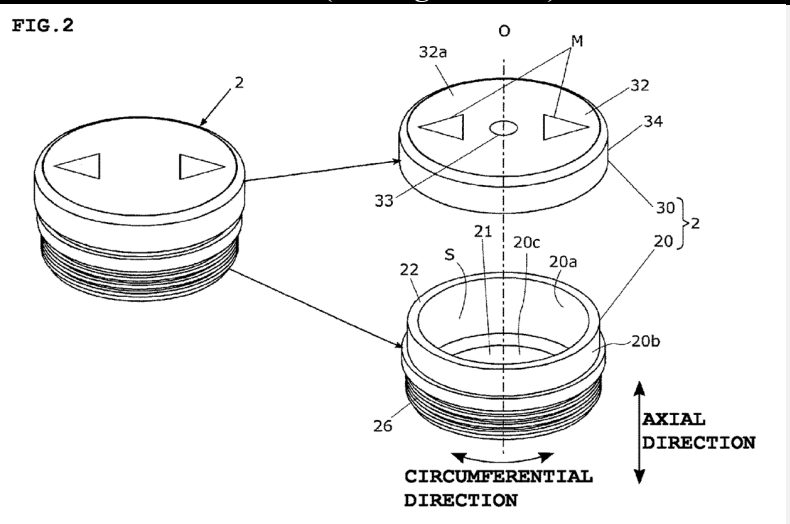


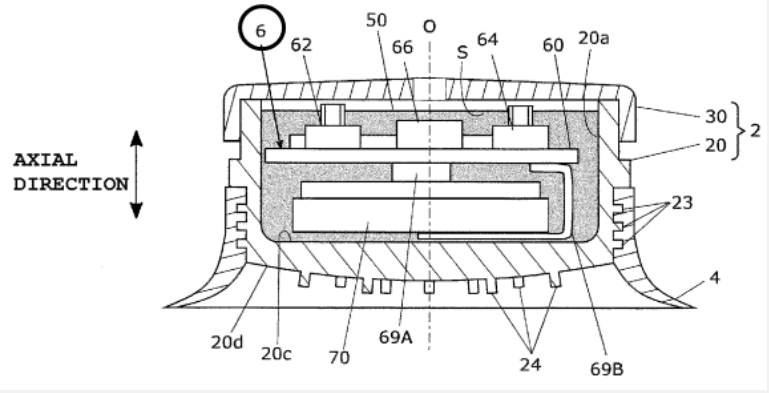
[0040] FIG. 5 is a cross-sectional view of the functional component 1 with the module 6 housed in the housing case 20. As illustrated in FIG. 5, the module 6 is configured to be able to be housed in the housing space S of the above-mentioned housing case 20. The module 6 is provided with a circuit board 60 having electronic components mounted thereon and a battery 70. The circuit board 60 includes the electronic components which are, for example, a plurality of sensors such as a temperature sensor 62, a pressure sensor 64 and an acceleration sensor 66 and the like, each of which functions as a state acquiring means that acquires a state inside the tire, a transmitting means, which is not shown in the figure, for outputting detected values detected by each of the sensors 62, 64 and 66 to the outside of the tire, a control means that controls operations of the plurality of sensors 62, 64 and 66 and of the transmitting means, and a memory means that stores histories of the detected values detected by each of the sensors 62, 64 and 66; and metal terminals 69A and 69B for supplying power

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	from the battery 70 to these components. Incidentally, the configuration of the circuit board 60 is not limited thereto.  *See also following limitations.*
[1a] a housing comprising an outer surface and an internal cavity that is enclosed within the housing;	*Yamaguchi-727 discloses, teaches, and/or suggests a housing comprising an outer surface and an internal cavity that is enclosed within the housing. For example:* **[0028]** FIG. 2 is a perspective view of the housing 2. FIGS. 3A to 3C are plan views and a partial cross-sectional view of a housing case 20 of the housing 2. As illustrated in FIG. 2, the housing 2 includes the housing case 20 having a housing space S (housing part) for a module 6, and a cap 30 functioning as a lid member for the housing case 20, and is formed in a generally disk shape by combining the housing case 20 and the cap 30 together. For the housing case 20 and the cap 30, synthetic resin or the like is employed, for example, from the viewpoint of weight reduction and the strength of the functional component 1. **[0029]** As illustrated in FIG. 2, the housing case 20 is formed, in a bottomed cylindrical shape with an opening on one side, by a circular bottom part 21 and a peripheral wall part 22 extending along the outer periphery from the outer peripheral edge of the bottom part 21 and rising annularly from the bottom part 21. In the housing case 20, a housing space S that can house the module 6 is formed by an inner bottom surface 20 c of the bottom part 21 and an inner peripheral surface 20 a of the peripheral wall part 22. In the following description, terms such as an axial direction, a circumferential direction and a radial direction will be used with an axis O of the peripheral wall part 22 as a reference.

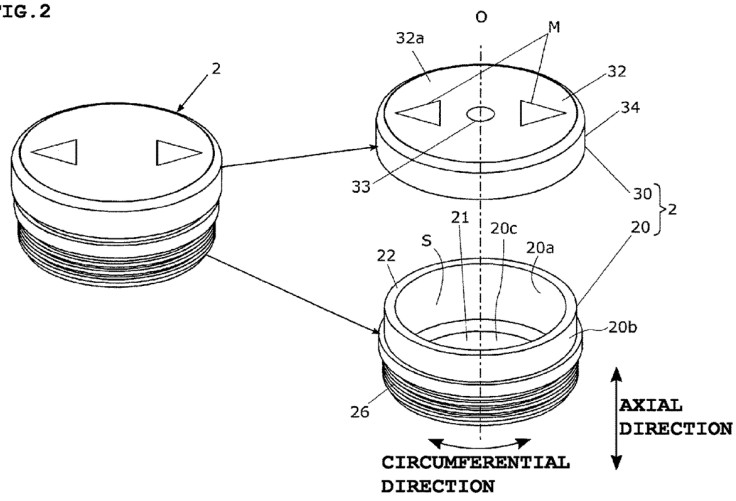
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	FIG.2  **[0034]** As illustrated in FIG. 2, a cap 30 has a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 a of the ceiling part 32, attachment marks M are formed to indicate a direction for attaching the functional component 1 to the tire 10. The attachment marks M are indicated, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M show that the functional component 1 is to be attached on the inner peripheral surface 10 s of the tire 10 in such a manner that the arrows are oriented in the tire circumferential direction. The direction indicated by the attachment marks M may be set appropriately in accordance with a detection direction of the module 6. Furthermore, a hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 allows for communication between the housing space S of the housing case 20 and the outside when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 b of the peripheral wall part 22. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 a are oriented in a predetermined direction with respect to the housing case 20.
[1b] an electrical sensor device that is disposed within the internal cavity and attached therein to prevent	*Yamaguchi-727 discloses, teaches, and/or suggests an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity. For example:*

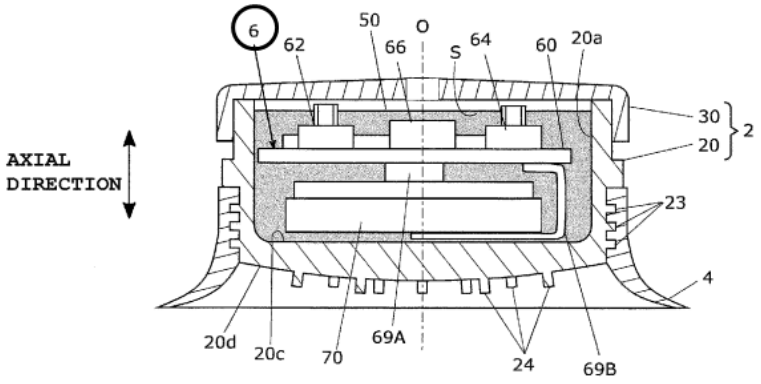
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movement of the device within the internal cavity,	**[0029]** As illustrated in FIG. 2, the housing case 20 is formed, in a bottomed cylindrical shape with an opening on one side, by a circular bottom part 21 and a peripheral wall part 22 extending along the outer periphery from the outer peripheral edge of the bottom part 21 and rising annularly from the bottom part 21. In the housing case 20, a housing space S that can house the module 6 is formed by an inner bottom surface 20 c of the bottom part 21 and an inner peripheral surface 20 a of the peripheral wall part 22. In the following description, terms such as an axial direction, a circumferential direction and a radial direction will be used with an axis O of the peripheral wall part 22 as a reference. **[0031]** On the inner bottom surface 20 c of the bottom part 21, a support means such as a protrusion, which is not shown in the figure, is formed for preventing the module 6 from directly contacting the inner bottom surface 20 c. As illustrated in FIG. 3B, an outer bottom surface 20 d of the bottom part 21 is formed in a convexed shape where a central part of the outer bottom surface 20 d is convexed outwardly in the axial direction than the outer peripheral edge side of the outer bottom surface 20 d. The outer bottom surface 20 d is a surface that faces the inner peripheral surface 10 s of the tire 10 when attached on the inner peripheral surface 10 s of the tire 10. In more detail, the outer bottom surface 20 d is formed in a spherical shape having a predetermined radius of curvature and of which center of curvature is set on the axis O. Incidentally, the bulging shape of the outer bottom surface 20 d is not limited to the spherical shape. For example, it may be a polygonal pyramid shape such as a cone or a square pyramid with the position of the apex being set on the axis O, or any other curved shape such as a frustum formed by a part of an elliptic sphere. The outer bottom surface 20 d does not need to be bulged out over its entirety, but may be partially bulged out in a curved shape as described above. For example, in a case where the tire outer diameter is large, the outer bottom surface 20 d may be formed in a flat shape.

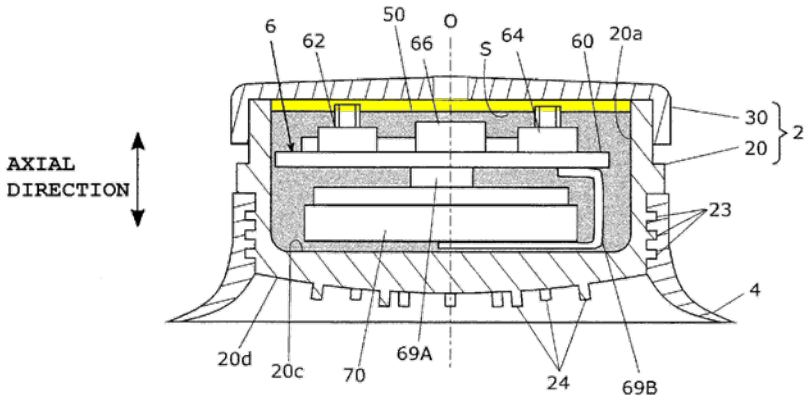
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	 **[0040]** FIG. 5 is a cross-sectional view of the functional component 1 with the module 6 housed in the housing case 20. As illustrated in FIG. 5, the module 6 is configured to be able to be housed in the housing space S of the above-mentioned housing case 20. The module 6 is provided with a circuit board 60 having electronic components mounted thereon and a battery 70. The circuit board 60 includes the electronic components which are, for example, a plurality of sensors such as a temperature sensor 62, a pressure sensor 64 and an acceleration sensor 66 and the like, each of which functions as a state acquiring means that acquires a state inside the tire, a transmitting means, which is not shown in the figure, for outputting detected values detected by each of the sensors 62, 64 and 66 to the outside of the tire, a control means that controls operations of the plurality of sensors 62, 64 and 66 and of the transmitting means, and a memory means that stores histories of the detected values detected by each of the sensors 62, 64 and 66; and metal terminals 69A and 69B for supplying power from the battery 70 to these components. Incidentally, the configuration of the circuit board 60 is not limited thereto.

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	FIG.5  **[0042]** The circuit board 60 and the housing case 20 are provided with a positioning means, which is not shown in the figure, that are mutually fitted with each other. Whereby, a measurement direction of the acceleration sensor 66 relative to the housing case 20 is defined. **[0047]** The module 6 configured as mentioned above is housed in the housing case 20 in the state that the battery 70 is connected to the circuit board 60, and positioned so that the battery 70 faces the inner bottom surface 20 *c* of the housing space S, and the measurement direction of the acceleration sensor 66 mounted on the circuit board 60 faces the predetermined direction relative to the housing case 20. **[0048]** As illustrated in FIG. 5, the housing space S is filled with a potting material 50 so as to eliminate a gap between the module 6 and the inner bottom surface 20 *c* and the inner peripheral surf the ace 20 *a* forming the housing space S. Whereby, the entire module 6 is covered with the potting material 50. Incidentally, even in the state of being filled with the potting material 50, the communication between respective measurement parts of the temperature sensor 62 and the pressure sensor 64 and the tire air chamber is maintained. As a material of the potting material 50, urethane-silicone resin or epoxy resin is preferable. By employing such a material to the potting material 50, the potting material 50 can maintain sufficient resistance to forces received from the battery 70 and the circuit board 60 even when the tire 10 is rotating, especially when the tire 10 is rotating at a high speed.

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[1c] wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing,	*Yamaguchi-727 discloses, teaches, and/or suggests wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing. For example:* **[0029]** As illustrated in FIG. 2, the housing case 20 is formed, in a bottomed cylindrical shape with an opening on one side, by a circular bottom part 21 and a peripheral wall part 22 extending along the outer periphery from the outer peripheral edge of the bottom part 21 and rising annularly from the bottom part 21. In the housing case 20, a housing space S that can house the module 6 is formed by an inner bottom surface 20 c of the bottom part 21 and an inner peripheral surface 20 a of the peripheral wall part 22. In the following description, terms such as an axial direction, a circumferential direction and a radial direction will be used with an axis O of the peripheral wall part 22 as a reference. **[0031]** On the inner bottom surface 20 c of the bottom part 21, a support means such as a protrusion, which is not shown in the figure, is formed for preventing the module 6 from directly contacting the inner bottom surface 20 c. As illustrated in FIG. 3B, an outer bottom surface 20 d of the bottom part 21 is formed in a convexed shape where a central part of the outer bottom surface 20 d is convexed outwardly in the axial direction than the outer peripheral edge side of the outer bottom surface 20 d. The outer bottom surface 20 d is a surface that faces the inner peripheral surface 10 s of the tire 10 when attached on the inner peripheral surface 10 s of the tire 10. In more detail, the outer bottom surface 20 d is formed in a spherical shape having a predetermined radius of curvature and of which center of curvature is set on the axis O. Incidentally, the bulging shape of the outer bottom surface 20 d is not limited to the spherical shape. For example, it may be a polygonal pyramid shape such as a cone or a square pyramid with the position of the apex being set on the axis O, or any other curved shape such as a frustum formed by a part of an elliptic sphere. The outer bottom surface 20 d does not need to be bulged out over its entirety, but may be partially bulged out in a curved shape as described above. For example, in a case where the tire outer diameter is large, the outer bottom surface 20 d may be formed in a flat shape. **[0034]** As illustrated in FIG. 2, a cap 30 has a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 a of the ceiling part 32, attachment marks M are formed to indicate a direction for attaching the functional component 1 to the tire 10.

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	The attachment marks M are indicated, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M show that the functional component 1 is to be attached on the inner peripheral surface 10 s of the tire 10 in such a manner that the arrows are oriented in the tire circumferential direction. The direction indicated by the attachment marks M may be set appropriately in accordance with a detection direction of the module 6. Furthermore, a hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 allows for communication between the housing space S of the housing case 20 and the outside when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 b of the peripheral wall part 22. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 a are oriented in a predetermined direction with respect to the housing case 20. FIG.2  **[0040]** FIG. 5 is a cross-sectional view of the functional component 1 with the module 6 housed in the housing case 20. As illustrated in FIG. 5, the module 6 is configured to be able to be housed in the housing space S of the above-mentioned housing case 20. The module 6 is provided with a circuit board 60 having electronic components mounted thereon and a battery 70. The circuit board 60 includes the electronic components which are, for example, a plurality of sensors such as a temperature sensor 62, a pressure sensor 64 and an acceleration sensor 66 and the like, each

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	of which functions as a state acquiring means that acquires a state inside the tire, a transmitting means, which is not shown in the figure, for outputting detected values detected by each of the sensors 62, 64 and 66 to the outside of the tire, a control means that controls operations of the plurality of sensors 62, 64 and 66 and of the transmitting means, and a memory means that stores histories of the detected values detected by each of the sensors 62, 64 and 66; and metal terminals 69A and 69B for supplying power from the battery 70 to these components. Incidentally, the configuration of the circuit board 60 is not limited thereto. FIG.5  **[0042]** The circuit board 60 and the housing case 20 are provided with a positioning means, which is not shown in the figure, that are mutually fitted with each other. Whereby, a measurement direction of the acceleration sensor 66 relative to the housing case 20 is defined. **[0043]** The temperature sensor 62 and the pressure sensor 64 measure, as respective measuring parts thereof are brought in communication with a tire air chamber via the hole 33 formed in the cap 30, a temperature and a pressure in the tire air chamber, respectively. **[0048]** As illustrated in FIG. 5, the housing space S is filled with a potting material 50 so as to eliminate a gap between the module 6 and the inner bottom surface 20 *c* and the inner peripheral surf the ace 20 *a* forming the housing space S. Whereby, the entire module 6 is covered with the potting material 50. Incidentally, even in the state of being filled with the potting material 50, the communication between respective measurement parts of the temperature sensor 62 and the pressure sensor 64 and the tire air chamber is maintained. As a material of the potting material 50, urethane-silicone resin or

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	epoxy resin is preferable. By employing such a material to the potting material 50, the potting material 50 can maintain sufficient resistance to forces received from the battery 70 and the circuit board 60 even when the tire 10 is rotating, especially when the tire 10 is rotating at a high speed. FIG.5 
[1d] wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use; and	*Yamaguchi-727 discloses, teaches, and/or suggests wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use. For example:* **[0040]** FIG. 5 is a cross-sectional view of the functional component 1 with the module 6 housed in the housing case 20. As illustrated in FIG. 5, the module 6 is configured to be able to be housed in the housing space S of the above-mentioned housing case 20. The module 6 is provided with a circuit board 60 having electronic components mounted thereon and a battery 70. The circuit board 60 includes the electronic components which are, for example, a plurality of sensors such as a temperature sensor 62, a pressure sensor 64 and an acceleration sensor 66 and the like, each of which functions as a state acquiring means that acquires a state inside the tire, a transmitting means, which is not shown in the figure, for outputting detected values detected by each of the sensors 62, 64 and 66 to the outside of the tire, a control means that controls operations of the plurality of sensors 62, 64 and 66 and of the transmitting means, and a memory means that stores histories of the detected values detected by each of the sensors 62, 64 and 66; and metal terminals 69A and 69B for supplying power

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	from the battery 70 to these components. Incidentally, the configuration of the circuit board 60 is not limited thereto.
[1e] a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.	*Yamaguchi-727 discloses, teaches, and/or suggests a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.. For example:* **[0027]** The functional component **1** has a housing (housing part) **2**, a skirt (tubular part) **4** and a module **6**. Incidentally, the type of the tire **10** to which the functional component **1** is to be attached is not particularly limited, but the functional component **1** is attached mainly to tires of automobiles traveling on ordinary paved roads (general roads and highways) such as passenger cars, trucks and buses, and of aircraft, and the like. **[0030]** As illustrated in FIGS. 3A to 3C, a skirt attachment part 26, to which a skirt 4 described later can be attached, is formed on an outer peripheral surface 20 b of the peripheral wall part 22. The skirt attachment part 26 is configured by a plurality of annular convex parts 23 formed on a lower half of the peripheral wall part 22. The annular convex part 23 is an annular member extending over the circumferential direction of the outer peripheral surface 20 b, and is provided in plural numbers (three in the present embodiment) at a predetermined interval in the axial direction. Incidentally, the annular convex parts 23 may be configured to extend intermittently in the circumferential direction without extending over the entire circumference. **[0035]** FIGS. 4A to 4C are perspective views and a cross-sectional view of the skirt 4 including the axis O. As illustrated in FIG. 1A, the skirt 4 is attached to the above-described skirt attachment part 26 formed in the housing case 20, and extends from the outer bottom surface 20 d of the housing 2 toward the inner peripheral surface 10 s side of the tire 10. In other words, the skirt 4 extends in a direction away from the outer bottom surface 20 d of the housing case 2, with the outer bottom surface 20 d of the housing 2 being a base point. **[0036]** As illustrated in FIGS. 4A to 4C, the skirt 4 has an annular tubular part 40 and an enlarged part 42 extending from the tubular part 40 toward the inner peripheral surface 10 *s* side. The tubular part 40 is formed in a cylindrical shape enclosing the skirt attachment part 26. Annular recesses 43 extending along

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	the circumferential direction and recessed in the radial direction are formed on an inner peripheral surface 40 *a* of the tubular part 40. The annular recess 43 is provided in plural numbers (three in the present embodiment), extends over the inner peripheral surface 40 *a* all the way around, and is formed so as to be able to be mated with the annular convex part 23 provided in the housing case 20. In other words, the annular concave parts 43 are provided at intervals and in quantity corresponding to the annular convex parts 23. **[0037]** The enlarged part 42 is formed in a fun-like shape that is continuous from the tubular part 40. An inner peripheral surface 42 *a* of the enlarged part 42 is formed as a curved surface that, in the axial cross section, gradually expands in diameter from the outer peripheral edge of the outer bottom surface 20 *d* of the housing case 20 toward the inner peripheral surface 10 *s* side of the tire 10. Furthermore, an outer peripheral surface 42 *b* is formed, for example, as a curved surface that is smoothly continuous with the outer peripheral surface 40 *b* of the tubular part 40 and gradually expands in diameter toward the inner peripheral surface 10 *s* of the tire 10. That is, the enlarged part 42 is formed in a generally trumpet shape that expands in diameter and extends from the outer bottom surface 20 *d* of the housing case 20 toward the inner peripheral surface 10 *s* side. **[0038]** Furthermore, the thicknesses of the inner peripheral surface 42 *a* and the outer peripheral surface 42 *b* that form the enlarged part 42 are set in a tapered shape so that the thicknesses gradually become thinner toward end parts of the inner peripheral surface 10S side in the axial direction. The distal end 44A of the inner peripheral surface 42 *a* and a distal end 44B of the outer peripheral surface 42 *b* are connected via a flat surface 42 *c*. In other words, the flat surface 42 *c* is an annular surface enclosed by the distal end 44A of the inner peripheral surface 42 *a*, the distal end 44B of the outer peripheral surface 42 *b* and a plane perpendicular to the axis O. **[0039]** The skirt **4** is preferably made of an elastic material, for example, such as rubber or elastomer and the like, or a material having flexibility. The type of rubber is not particularly limited, and natural rubber and synthetic rubbers such as dienic rubber or non-dienic rubber are enumerated. Furthermore, when the rubber is used as the material, for example, the skirt **4** is in a state of having been vulcanized and is formed into a stable shape. In other words, the skirt **4** is in a complete state as a single part.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	[0052] As illustrated in FIG. 7, in the functional component preparation process, an adhesive agent B is filled so that a concave filling part 100 formed by the outer bottom surface 20 d of the housing 2 and the inner peripheral surface 42 a of the skirt 4 is filled with the adhesive agent B. At this conjuncture, it is preferable that an amount of the adhesive agent B is adjusted to be flush with or past the distal end 44A of the inner peripheral surface 42 a of the skirt 4. **[0053]** As illustrated in FIG. 8, in the attaching process, the distal end 44A and the distal end 44B, which are the end parts of the skirt 4 filled with the adhesive agent B in the filling part 100, are pressed toward the inner peripheral surface 10 *s* of the tire 10 with a predetermined force P in a state of being abutted, and then dried by blowing hot air of about 100° by, the dryer for a predetermined time, for example. The functional component 1 is thereby bonded to the inner peripheral surface 10 *s* of the tire 10. When pressing, care should be taken to avoid overflow of the adhesive more than necessary due to too much of the pressing force. If the adhesive agent overflows more than necessary, a bonding height cannot be maintained. **[0054]** As discussed above, the functional component 1 is configured to be attached in a state that the adhesive agent B is densely filled in the filling space R enclosed by the outer bottom surface 20 *d* facing the inner peripheral surface 10 *s* of the tire 10, the inner peripheral surface 42 *a* of the skirt 4 that expands in diameter and extends in a tubular shape from the peripheral edge of the outer bottom surface 20 *d* toward the inner peripheral surface 10 *s*, and the inner peripheral surface 10 *s* of the tire 10. **[0059]** As for the thickness of the adhesive agent B after solidification, although it depends on the size of the tire 10, in order to set the thickness of the adhesive agent B to be in between 1 mm and 3 mm at the thinnest point, it is preferable to set a degree of buldging of the outer bottom surface 20 *d* of the housing 2 and a length in the axis O direction to the distal end 44A of the skirt 4 extending from the peripheral edge of the outer bottom surface 20 *d* According to the present embodiment, the thickness of the adhesive agent B can be freely set according to the shape of the filling part 100. However, if the thickness of the adhesive agent B is set too thick, the material cost of the adhesive agent B increases and it becomes a factor of increase in the weight, which

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	may also be a factor of unbalance of the tire 10, thus it is preferable to set the thickness within the above-described range.

FIG.2

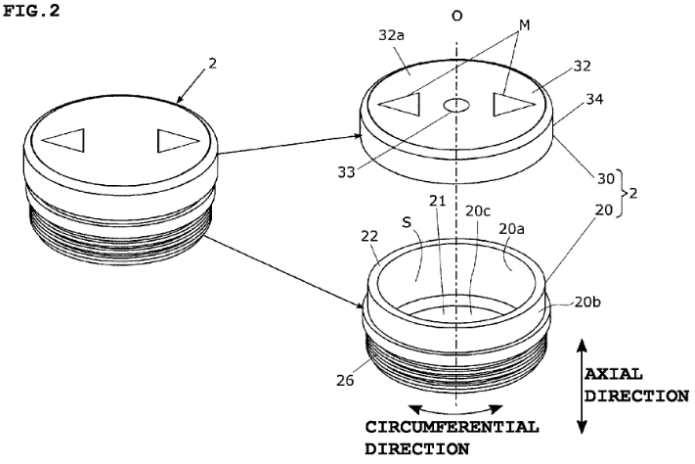


FIG.4A

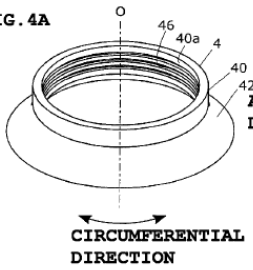


FIG.4B

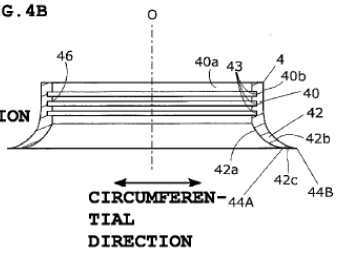


FIG.4C

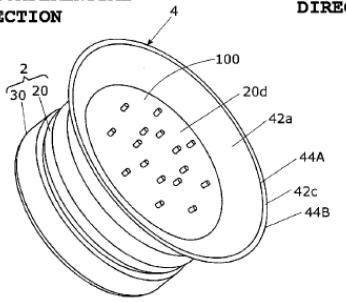
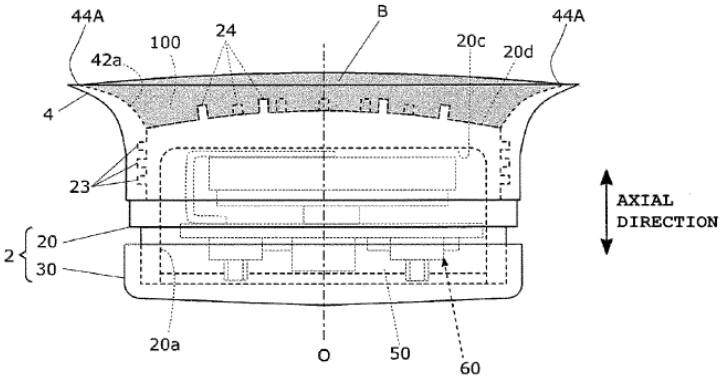
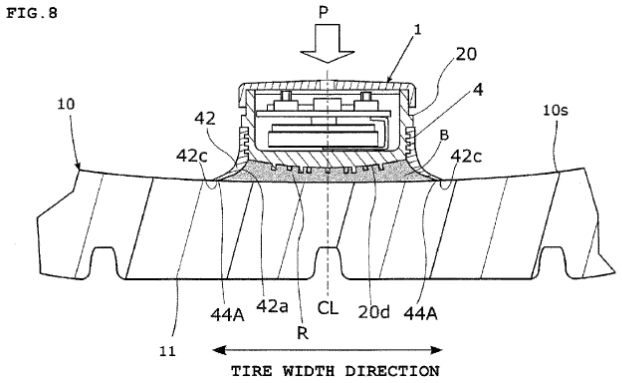
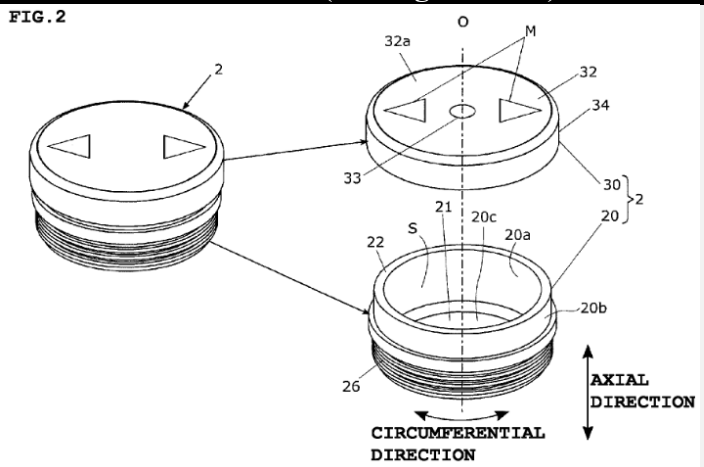
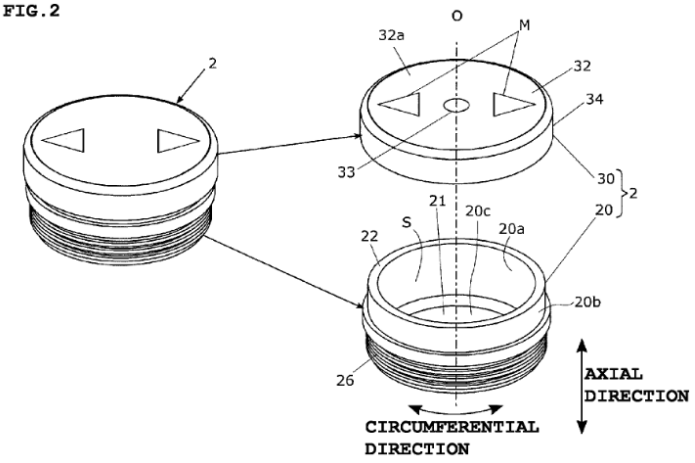
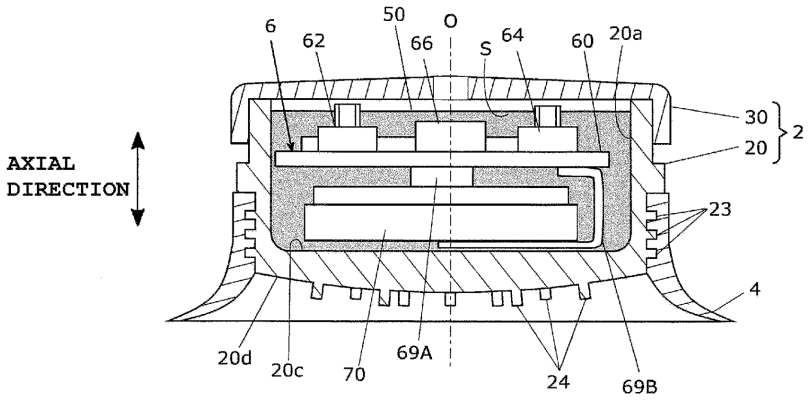


FIG.7

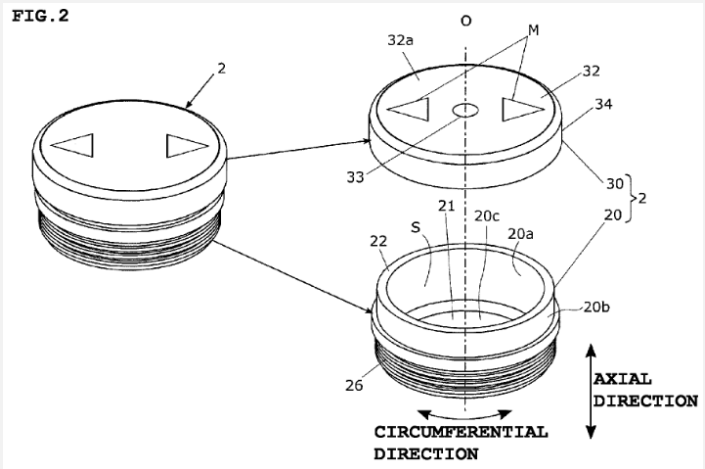
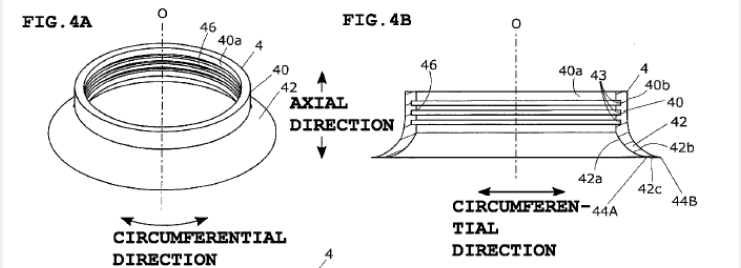
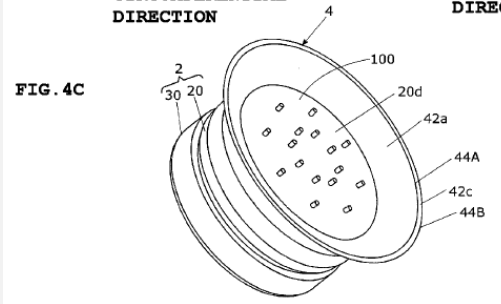


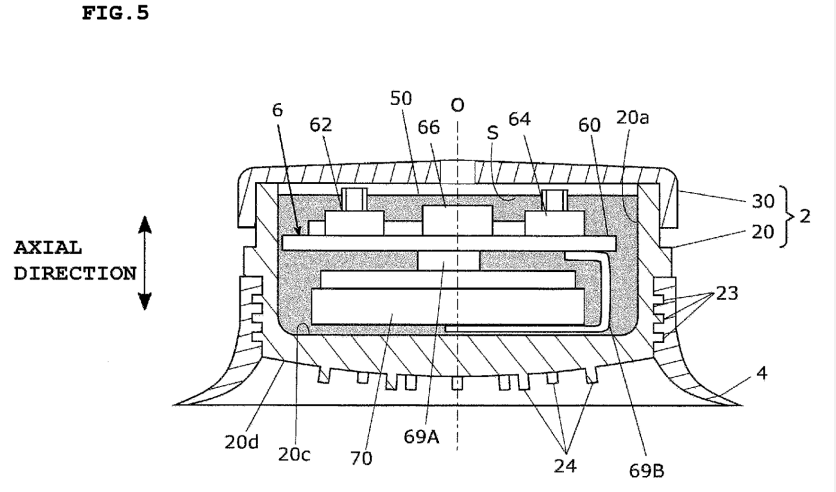
’421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	
2. The sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member assembly. For example:* **[0034]** As illustrated in FIG. 2, a cap 30 has a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 a of the ceiling part 32, attachment marks M are formed to indicate a direction for attaching the functional component 1 to the tire 10. The attachment marks M are indicated, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M show that the functional component 1 is to be attached on the inner peripheral surface 10 s of the tire 10 in such a manner that the arrows are oriented in the tire circumferential direction. The direction indicated by the attachment marks M may be set appropriately in accordance with a detection direction of the module 6. Furthermore, a hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 allows for communication between the housing space S of the housing case 20 and the outside when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 b of the peripheral wall part 22. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 a are oriented in a predetermined direction with respect to the housing case 20.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	FIG.2 
5. The sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein. For example:* **[0042]** The circuit board 60 and the housing case 20 are provided with a positioning means, which is not shown in the figure, that are mutually fitted with each other. Whereby, a measurement direction of the acceleration sensor 66 relative to the housing case 20 is defined. **[0047]** The module 6 configured as mentioned above is housed in the housing case 20 in the state that the battery 70 is connected to the circuit board 60, and positioned so that the battery 70 faces the inner bottom surface 20 *c* of the housing space S, and the measurement direction of the acceleration sensor 66 mounted on the circuit board 60 faces the predetermined direction relative to the housing case 20. **[0048]** As illustrated in FIG. 5, the housing space S is filled with a potting material 50 so as to eliminate a gap between the module 6 and the inner bottom surface 20 *c* and the inner peripheral surf the ace 20 *a* forming the housing space S. Whereby, the entire module 6 is covered with the potting material 50. Incidentally, even in the state of being filled with the potting material 50, the communication between respective measurement parts of the temperature sensor 62 and the pressure sensor 64 and the tire air chamber is maintained. As a material of the potting material 50, urethane-silicone resin or epoxy resin is preferable. By employing such a material to the potting material 50, the potting material 50 can maintain

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	sufficient resistance to forces received from the battery 70 and the circuit board 60 even when the tire 10 is rotating, especially when the tire 10 is rotating at a high speed. FIG.2  FIG.5 
7. The sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member. For example:* **[0027]** The functional component **1** has a housing (housing part) **2**, a skirt (tubular part) **4** and a module **6**. Incidentally, the type of the tire **10** to which the functional component **1** is to be attached is not particularly limited, but the functional component **1** is attached mainly to tires of automobiles traveling on ordinary paved roads (general roads and highways) such as passenger cars, trucks and buses, and of aircraft, and the like.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	[0028] FIG. 2 is a perspective view of the housing **2**. FIGS. 3A to 3C are plan views and a partial cross-sectional view of a housing case **20** of the housing **2**. As illustrated in FIG. 2, the housing **2** includes the housing case **20** having a housing space S (housing part) for a module **6**, and a cap **30** functioning as a lid member for the housing case **20**, and is formed in a generally disk shape by combining the housing case **20** and the cap **30** together. For the housing case **20** and the cap **30**, synthetic resin or the like is employed, for example, from the viewpoint of weight reduction and the strength of the functional component **1**. **[0029]** As illustrated in FIG. 2, the housing case **20** is formed, in a bottomed cylindrical shape with an opening on one side, by a circular bottom part **21** and a peripheral wall part **22** extending along the outer periphery from the outer peripheral edge of the bottom part **21** and rising annularly from the bottom part **21**. In the housing case **20**, a housing space S that can house the module **6** is formed by an inner bottom surface **20** *c* of the bottom part **21** and an inner peripheral surface **20** *a* of the peripheral wall part **22**. In the following description, terms such as an axial direction, a circumferential direction and a radial direction will be used with an axis O of the peripheral wall part **22** as a reference. **[0030]** As illustrated in FIGS. 3A to 3C, a skirt attachment part 26, to which a skirt 4 described later can be attached, is formed on an outer peripheral surface 20 b of the peripheral wall part 22. The skirt attachment part 26 is configured by a plurality of annular convex parts 23 formed on a lower half of the peripheral wall part 22. The annular convex part 23 is an annular member extending over the circumferential direction of the outer peripheral surface 20 b, and is provided in plural numbers (three in the present embodiment) at a predetermined interval in the axial direction. Incidentally, the annular convex parts 23 may be configured to extend intermittently in the circumferential direction without extending over the entire circumference. **[0035]** FIGS. 4A to 4C are perspective views and a cross-sectional view of the skirt 4 including the axis O. As illustrated in FIG. 1A, the skirt 4 is attached to the above-described skirt attachment part 26 formed in the housing case 20, and extends from the outer bottom surface 20 d of the housing 2 toward the inner peripheral surface 10 s side of the tire 10. In other words, the skirt 4 extends in a direction away from the outer bottom surface 20 d of the

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	housing case 2, with the outer bottom surface 20 d of the housing 2 being a base point. **[0036]** As illustrated in FIGS. 4A to 4C, the skirt 4 has an annular tubular part 40 and an enlarged part 42 extending from the tubular part 40 toward the inner peripheral surface 10 *s* side. The tubular part 40 is formed in a cylindrical shape enclosing the skirt attachment part 26. Annular recesses 43 extending along the circumferential direction and recessed in the radial direction are formed on an inner peripheral surface 40 *a* of the tubular part 40. The annular recess 43 is provided in plural numbers (three in the present embodiment), extends over the inner peripheral surface 40 *a* all the way around, and is formed so as to be able to be mated with the annular convex part 23 provided in the housing case 20. In other words, the annular concave parts 43 are provided at intervals and in quantity corresponding to the annular convex parts 23.   

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	
8. The sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith. For example:* **[0027]** The functional component **1** has a housing (housing part) **2**, a skirt (tubular part) **4** and a module **6**. Incidentally, the type of the tire **10** to which the functional component **1** is to be attached is not particularly limited, but the functional component **1** is attached mainly to tires of automobiles traveling on ordinary paved roads (general roads and highways) such as passenger cars, trucks and buses, and of aircraft, and the like. **[0028]** FIG. 2 is a perspective view of the housing **2**. FIGS. 3A to 3C are plan views and a partial cross-sectional view of a housing case **20** of the housing **2**. As illustrated in FIG. 2, the housing **2** includes the housing case **20** having a housing space S (housing part) for a module **6**, and a cap **30** functioning as a lid member for the housing case **20**, and is formed in a generally disk shape by combining the housing case **20** and the cap **30** together. For the housing case **20** and the cap **30**, synthetic resin or the like is employed, for example, from the viewpoint of weight reduction and the strength of the functional component **1**. **[0029]** As illustrated in FIG. 2, the housing case **20** is formed, in a bottomed cylindrical shape with an opening on one side, by

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	a circular bottom part **21** and a peripheral wall part **22** extending along the outer periphery from the outer peripheral edge of the bottom part **21** and rising annularly from the bottom part **21**. In the housing case **20**, a housing space S that can house the module **6** is formed by an inner bottom surface **20** *c* of the bottom part **21** and an inner peripheral surface **20** *a* of the peripheral wall part **22**. In the following description, terms such as an axial direction, a circumferential direction and a radial direction will be used with an axis O of the peripheral wall part **22** as a reference. **[0030]** As illustrated in FIGS. 3A to 3C, a skirt attachment part 26, to which a skirt 4 described later can be attached, is formed on an outer peripheral surface 20 b of the peripheral wall part 22. The skirt attachment part 26 is configured by a plurality of annular convex parts 23 formed on a lower half of the peripheral wall part 22. The annular convex part 23 is an annular member extending over the circumferential direction of the outer peripheral surface 20 b, and is provided in plural numbers (three in the present embodiment) at a predetermined interval in the axial direction. Incidentally, the annular convex parts 23 may be configured to extend intermittently in the circumferential direction without extending over the entire circumference. **[0035]** FIGS. 4A to 4C are perspective views and a cross-sectional view of the skirt 4 including the axis O. As illustrated in FIG. 1A, the skirt 4 is attached to the above-described skirt attachment part 26 formed in the housing case 20, and extends from the outer bottom surface 20 d of the housing 2 toward the inner peripheral surface 10 s side of the tire 10. In other words, the skirt 4 extends in a direction away from the outer bottom surface 20 d of the housing case 2, with the outer bottom surface 20 d of the housing 2 being a base point. **[0036]** As illustrated in FIGS. 4A to 4C, the skirt 4 has an annular tubular part 40 and an enlarged part 42 extending from the tubular part 40 toward the inner peripheral surface 10 *s* side. The tubular part 40 is formed in a cylindrical shape enclosing the skirt attachment part 26. Annular recesses 43 extending along the circumferential direction and recessed in the radial direction are formed on an inner peripheral surface 40 *a* of the tubular part 40. The annular recess 43 is provided in plural numbers (three in the present embodiment), extends over the inner peripheral surface 40 *a* all the way around, and is formed so as to be able to be mated with the annular convex part 23 provided

’421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	in the housing case 20. In other words, the annular concave parts 43 are provided at intervals and in quantity corresponding to the annular convex parts 23.

FIG.2

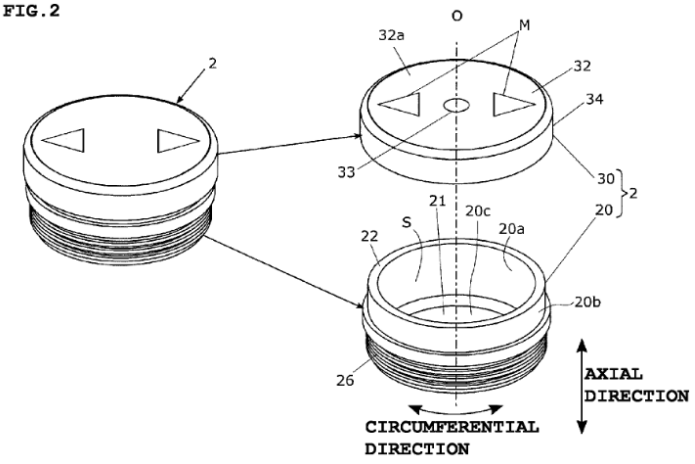


FIG.4A

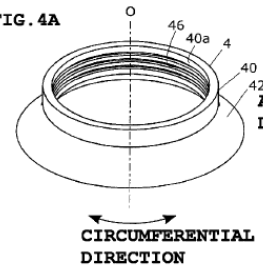


FIG.4B

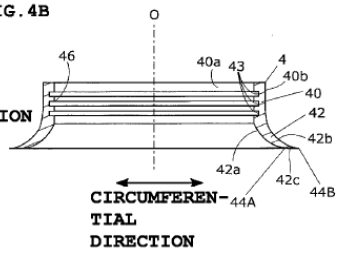
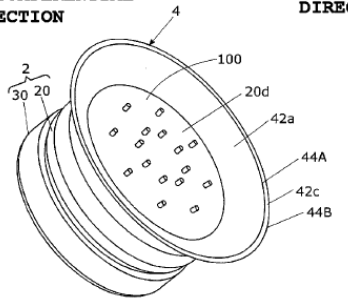
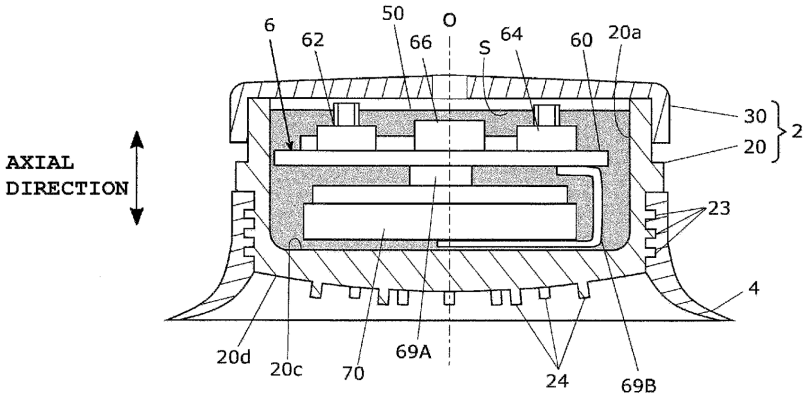
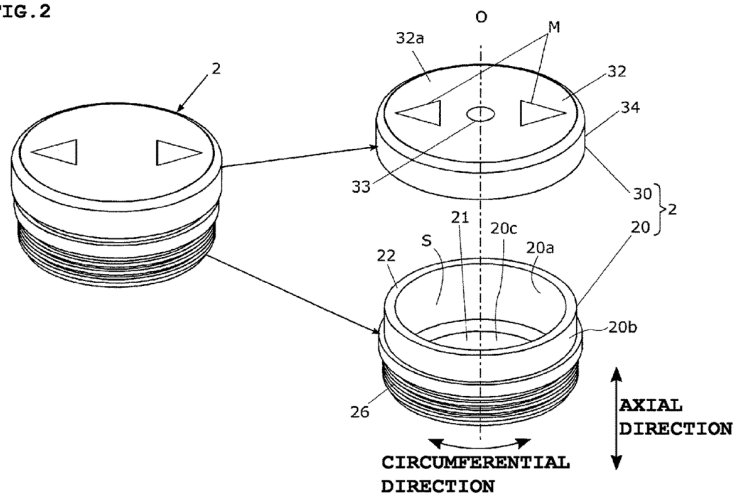


FIG.4C



'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	FIG.5 
9. The sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member. For example:* **[0039]** The skirt **4** is preferably made of an elastic material, for example, such as rubber or elastomer and the like, or a material having flexibility. The type of rubber is not particularly limited, and natural rubber and synthetic rubbers such as dienic rubber or non-dienic rubber are enumerated. Furthermore, when the rubber is used as the material, for example, the skirt **4** is in a state of having been vulcanized and is formed into a stable shape. In other words, the skirt **4** is in a complete state as a single part.
10. The sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device. For example:* **[0034]** As illustrated in FIG. 2, a cap 30 has a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 a of the ceiling part 32, attachment marks M are formed to indicate a direction for attaching the functional component 1 to the tire 10. The attachment marks M are indicated, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M show that the functional component 1 is to be attached on the inner peripheral surface 10 s of the tire 10 in such a manner that the

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	arrows are oriented in the tire circumferential direction. The direction indicated by the attachment marks M may be set appropriately in accordance with a detection direction of the module 6. Furthermore, a hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 allows for communication between the housing space S of the housing case 20 and the outside when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 b of the peripheral wall part 22. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 a are oriented in a predetermined direction with respect to the housing case 20. **[0043]** The temperature sensor 62 and the pressure sensor 64 measure, as respective measuring parts thereof are brought in communication with a tire air chamber via the hole 33 formed in the cap 30, a temperature and a pressure in the tire air chamber, respectively. FIG.2 
11. A sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive	*Yamaguchi-727 discloses, teaches, and/or suggests a sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication. For example:*

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
data from the electrical sensor device by wireless communication.	**[0045]** The transmitting means is mounted on the circuit board as a transmitting circuit and transmits the measured temperature, the pressure, and the acceleration and so on to the outside of the tire via an antenna which is not shown in the figure. Signals such as the temperature, the pressure and the acceleration transmitted wirelessly from the transmitting means are received, for example, by a wireless circuit of a main unit provided in a vehicle, which is not shown in the figure, and information about states of the tire (the temperature, the pressure, or presence/absence of abnormality) are displayed on a display unit provided in the vehicle.
12. The sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* **[0040]** FIG. 5 is a cross-sectional view of the functional component 1 with the module 6 housed in the housing case 20. As illustrated in FIG. 5, the module 6 is configured to be able to be housed in the housing space S of the above-mentioned housing case 20. The module 6 is provided with a circuit board 60 having electronic components mounted thereon and a battery 70. The circuit board 60 includes the electronic components which are, for example, a plurality of sensors such as a temperature sensor 62, a pressure sensor 64 and an acceleration sensor 66 and the like, each of which functions as a state acquiring means that acquires a state inside the tire, a transmitting means, which is not shown in the figure, for outputting detected values detected by each of the sensors 62, 64 and 66 to the outside of the tire, a control means that controls operations of the plurality of sensors 62, 64 and 66 and of the transmitting means, and a memory means that stores histories of the detected values detected by each of the sensors 62, 64 and 66; and metal terminals 69A and 69B for supplying power from the battery 70 to these components. Incidentally, the configuration of the circuit board 60 is not limited thereto. **[0045]** The transmitting means is mounted on the circuit board as a transmitting circuit and transmits the measured temperature, the pressure, and the acceleration and so on to the outside of the tire via an antenna which is not shown in the figure. Signals such as the temperature, the pressure and the acceleration transmitted wirelessly from the transmitting means are received, for example, by a wireless circuit of a main unit provided in a vehicle, which is

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	not shown in the figure, and information about states of the tire (the temperature, the pressure, or presence/absence of abnormality) are displayed on a display unit provided in the vehicle.
20. The sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device. For example:* **[0040]** FIG. 5 is a cross-sectional view of the functional component 1 with the module 6 housed in the housing case 20. As illustrated in FIG. 5, the module 6 is configured to be able to be housed in the housing space S of the above-mentioned housing case 20. The module 6 is provided with a circuit board 60 having electronic components mounted thereon and a battery 70. The circuit board 60 includes the electronic components which are, for example, a plurality of sensors such as a temperature sensor 62, a pressure sensor 64 and an acceleration sensor 66 and the like, each of which functions as a state acquiring means that acquires a state inside the tire, a transmitting means, which is not shown in the figure, for outputting detected values detected by each of the sensors 62, 64 and 66 to the outside of the tire, a control means that controls operations of the plurality of sensors 62, 64 and 66 and of the transmitting means, and a memory means that stores histories of the detected values detected by each of the sensors 62, 64 and 66; and metal terminals 69A and 69B for supplying power from the battery 70 to these components. Incidentally, the configuration of the circuit board 60 is not limited thereto. **[0045]** The transmitting means is mounted on the circuit board as a transmitting circuit and transmits the measured temperature, the pressure, and the acceleration and so on to the outside of the tire via an antenna which is not shown in the figure. Signals such as the temperature, the pressure and the acceleration transmitted wirelessly from the transmitting means are received, for example, by a wireless circuit of a main unit provided in a vehicle, which is not shown in the figure, and information about states of the tire (the temperature, the pressure, or presence/absence of abnormality) are displayed on a display unit provided in the vehicle.

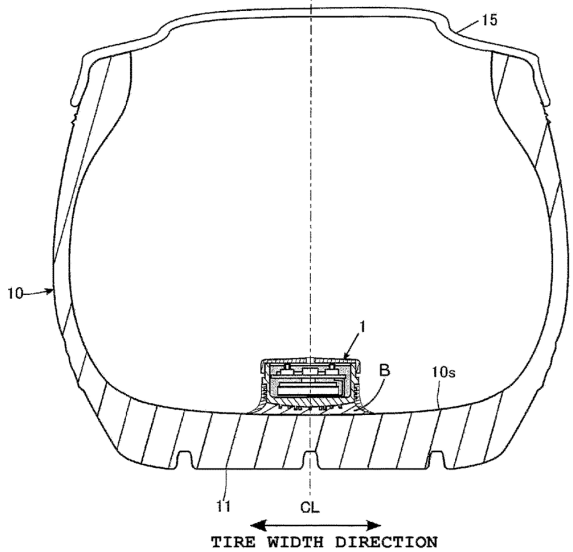
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
21. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor. For example:* **[0040]** FIG. 5 is a cross-sectional view of the functional component 1 with the module 6 housed in the housing case 20. As illustrated in FIG. 5, the module 6 is configured to be able to be housed in the housing space S of the above-mentioned housing case 20. The module 6 is provided with a circuit board 60 having electronic components mounted thereon and a battery 70. The circuit board 60 includes the electronic components which are, for example, a plurality of sensors such as a temperature sensor 62, a pressure sensor 64 and an acceleration sensor 66 and the like, each of which functions as a state acquiring means that acquires a state inside the tire, a transmitting means, which is not shown in the figure, for outputting detected values detected by each of the sensors 62, 64 and 66 to the outside of the tire, a control means that controls operations of the plurality of sensors 62, 64 and 66 and of the transmitting means, and a memory means that stores histories of the detected values detected by each of the sensors 62, 64 and 66; and metal terminals 69A and 69B for supplying power from the battery 70 to these components. Incidentally, the configuration of the circuit board 60 is not limited thereto.
22. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device. For example:* **[0040]** FIG. 5 is a cross-sectional view of the functional component 1 with the module 6 housed in the housing case 20. As illustrated in FIG. 5, the module 6 is configured to be able to be housed in the housing space S of the above-mentioned housing case 20. The module 6 is provided with a circuit board 60 having electronic components mounted thereon and a battery 70. The circuit board 60 includes the electronic components which are, for example, a plurality of sensors such as a temperature sensor 62, a pressure sensor 64 and an acceleration sensor 66 and the like, each of which functions as a state acquiring means that acquires a state inside the tire, a transmitting means, which is not shown in the figure, for outputting detected values detected by each of the sensors 62, 64 and 66 to the outside of the tire, a control means

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	that controls operations of the plurality of sensors 62, 64 and 66 and of the transmitting means, and a memory means that stores histories of the detected values detected by each of the sensors 62, 64 and 66; and metal terminals 69A and 69B for supplying power from the battery 70 to these components. Incidentally, the configuration of the circuit board 60 is not limited thereto.
23. The sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object. For example:* **[0040]** FIG. 5 is a cross-sectional view of the functional component 1 with the module 6 housed in the housing case 20. As illustrated in FIG. 5, the module 6 is configured to be able to be housed in the housing space S of the above-mentioned housing case 20. The module 6 is provided with a circuit board 60 having electronic components mounted thereon and a battery 70. The circuit board 60 includes the electronic components which are, for example, a plurality of sensors such as a temperature sensor 62, a pressure sensor 64 and an acceleration sensor 66 and the like, each of which functions as a state acquiring means that acquires a state inside the tire, a transmitting means, which is not shown in the figure, for outputting detected values detected by each of the sensors 62, 64 and 66 to the outside of the tire, a control means that controls operations of the plurality of sensors 62, 64 and 66 and of the transmitting means, and a memory means that stores histories of the detected values detected by each of the sensors 62, 64 and 66; and metal terminals 69A and 69B for supplying power from the battery 70 to these components. Incidentally, the configuration of the circuit board 60 is not limited thereto. **[0044]** The acceleration sensor 66 is a sensor capable of measuring acceleration in three axial directions, for example, the tire width direction, the radial direction and the circumferential direction (rotational tangential direction), and is mounted so that each measurement direction faces a predetermined direction relative to the circuit board 60. The acceleration sensor 66 is preferably mounted on the circuit board 60 so as to be located on the axis O, when the circuit board 60 is housed in the housing case 20.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	[0046] The control means is mounted on the circuit board 60 as a transmission circuit, and executes a predetermined program on the basis of, for example, the detection of rotation (centrifugal force) of the tire 10 by the acceleration sensor 66, and controls the operation of the transmitting means that transmits the temperature, the pressure and the acceleration inside the tire 10 detected by the temperature sensor 62, the pressure sensor 64 and the acceleration sensor 66. The memory means records the history of the temperature, the pressure and the acceleration inside the tire 10 detected by the temperature sensor 62, the pressure sensor 64 and the acceleration sensor 66, as well as manufacture information and quality information of the tire. **[0082]** In other words, in the method of estimating the wear of the tire, the load applied to the tire and so on, on the basis of the acceleration information detected by the acceleration sensor 66, physical phenomena that cause the wear of the tire or the change in the load are obtained indirectly. Therefore, in order to obtain as highly precise result as possible that is trustable, an enormous amount of acceleration information and an extensive processing are required, which leads to severe consumption of the battery that is to be the power source of the functional component 1, hence there is concern that the life of the functional component 1 tends to be easily shortened.
24. The sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire. For example:* **[0027]** The functional component **1** has a housing (housing part) **2**, a skirt (tubular part) **4** and a module **6**. Incidentally, the type of the tire **10** to which the functional component **1** is to be attached is not particularly limited, but the functional component **1** is attached mainly to tires of automobiles traveling on ordinary paved roads (general roads and highways) such as passenger cars, trucks and buses, and of aircraft, and the like. **[0030]** As illustrated in FIGS. 3A to 3C, a skirt attachment part 26, to which a skirt 4 described later can be attached, is formed on an outer peripheral surface 20 b of the peripheral wall part 22. The skirt attachment part 26 is configured by a plurality of annular convex parts 23 formed on a lower half of the peripheral wall part

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	22. The annular convex part 23 is an annular member extending over the circumferential direction of the outer peripheral surface 20 b, and is provided in plural numbers (three in the present embodiment) at a predetermined interval in the axial direction. Incidentally, the annular convex parts 23 may be configured to extend intermittently in the circumferential direction without extending over the entire circumference. **[0035]** FIGS. 4A to 4C are perspective views and a cross-sectional view of the skirt 4 including the axis O. As illustrated in FIG. 1A, the skirt 4 is attached to the above-described skirt attachment part 26 formed in the housing case 20, and extends from the outer bottom surface 20 d of the housing 2 toward the inner peripheral surface 10 s side of the tire 10. In other words, the skirt 4 extends in a direction away from the outer bottom surface 20 d of the housing case 2, with the outer bottom surface 20 d of the housing 2 being a base point. **[0036]** As illustrated in FIGS. 4A to 4C, the skirt 4 has an annular tubular part 40 and an enlarged part 42 extending from the tubular part 40 toward the inner peripheral surface 10 *s* side. The tubular part 40 is formed in a cylindrical shape enclosing the skirt attachment part 26. Annular recesses 43 extending along the circumferential direction and recessed in the radial direction are formed on an inner peripheral surface 40 *a* of the tubular part 40. The annular recess 43 is provided in plural numbers (three in the present embodiment), extends over the inner peripheral surface 40 *a* all the way around, and is formed so as to be able to be mated with the annular convex part 23 provided in the housing case 20. In other words, the annular concave parts 43 are provided at intervals and in quantity corresponding to the annular convex parts 23. **[0037]** The enlarged part 42 is formed in a fun-like shape that is continuous from the tubular part 40. An inner peripheral surface 42 *a* of the enlarged part 42 is formed as a curved surface that, in the axial cross section, gradually expands in diameter from the outer peripheral edge of the outer bottom surface 20 *d* of the housing case 20 toward the inner peripheral surface 10 *s* side of the tire 10. Furthermore, an outer peripheral surface 42 *b* is formed, for example, as a curved surface that is smoothly continuous with the outer peripheral surface 40 *b* of the tubular part 40 and gradually expands in diameter toward the inner peripheral surface 10 *s* of the tire 10. That is, the enlarged part 42 is formed in a generally trumpet shape that expands in

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	diameter and extends from the outer bottom surface 20 *d* of the housing case 20 toward the inner peripheral surface 10 *s* side. **[0038]** Furthermore, the thicknesses of the inner peripheral surface 42 *a* and the outer peripheral surface 42 *b* that form the enlarged part 42 are set in a tapered shape so that the thicknesses gradually become thinner toward end parts of the inner peripheral surface 10S side in the axial direction. The distal end 44A of the inner peripheral surface 42 *a* and a distal end 44B of the outer peripheral surface 42 *b* are connected via a flat surface 42 *c*. In other words, the flat surface 42 *c* is an annular surface enclosed by the distal end 44A of the inner peripheral surface 42 *a*, the distal end 44B of the outer peripheral surface 42 *b* and a plane perpendicular to the axis O. **[0039]** The skirt **4** is preferably made of an elastic material, for example, such as rubber or elastomer and the like, or a material having flexibility. The type of rubber is not particularly limited, and natural rubber and synthetic rubbers such as dienic rubber or non-dienic rubber are enumerated. Furthermore, when the rubber is used as the material, for example, the skirt **4** is in a state of having been vulcanized and is formed into a stable shape. In other words, the skirt **4** is in a complete state as a single part. **[0052]** As illustrated in FIG. 7, in the functional component preparation process, an adhesive agent B is filled so that a concave filling part 100 formed by the outer bottom surface 20 d of the housing 2 and the inner peripheral surface 42 a of the skirt 4 is filled with the adhesive agent B. At this conjuncture, it is preferable that an amount of the adhesive agent B is adjusted to be flush with or past the distal end 44A of the inner peripheral surface 42 a of the skirt 4. **[0053]** As illustrated in FIG. 8, in the attaching process, the distal end 44A and the distal end 44B, which are the end parts of the skirt 4 filled with the adhesive agent B in the filling part 100, are pressed toward the inner peripheral surface 10 *s* of the tire 10 with a predetermined force P in a state of being abutted, and then dried by blowing hot air of about 100° by, the dryer for a predetermined time, for example. The functional component 1 is thereby bonded to the inner peripheral surface 10 *s* of the tire 10. When pressing, care should be taken to avoid overflow of the adhesive more than necessary due to too much of the pressing force. If the adhesive agent overflows more than necessary, a bonding height cannot be maintained.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	[0054] As discussed above, the functional component 1 is configured to be attached in a state that the adhesive agent B is densely filled in the filling space R enclosed by the outer bottom surface 20 *d* facing the inner peripheral surface 10 *s* of the tire 10, the inner peripheral surface 42 *a* of the skirt 4 that expands in diameter and extends in a tubular shape from the peripheral edge of the outer bottom surface 20 *d* toward the inner peripheral surface 10 *s*, and the inner peripheral surface 10 *s* of the tire 10. **[0059]** As for the thickness of the adhesive agent B after solidification, although it depends on the size of the tire 10, in order to set the thickness of the adhesive agent B to be in between 1 mm and 3 mm at the thinnest point, it is preferable to set a degree of buldging of the outer bottom surface 20 *d* of the housing 2 and a length in the axis O direction to the distal end 44A of the skirt 4 extending from the peripheral edge of the outer bottom surface 20 *d* According to the present embodiment, the thickness of the adhesive agent B can be freely set according to the shape of the filling part 100. However, if the thickness of the adhesive agent B is set too thick, the material cost of the adhesive agent B increases and it becomes a factor of increase in the weight, which may also be a factor of unbalance of the tire 10, thus it is preferable to set the thickness within the above-described range. FIG.1A 

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)

FIG.2

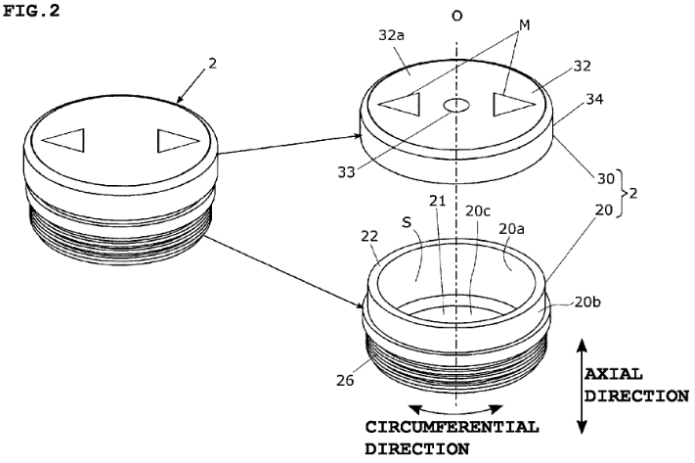


FIG.4A

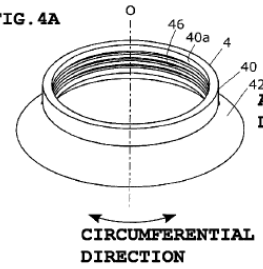


FIG.4B

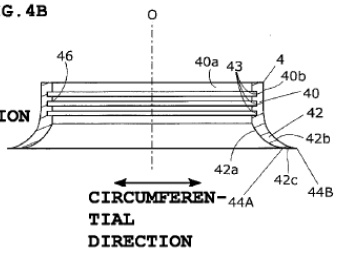


FIG.4C

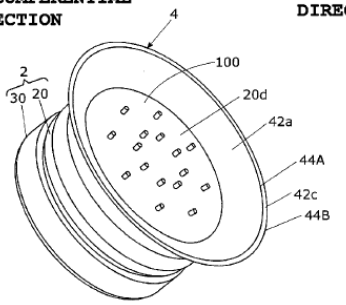
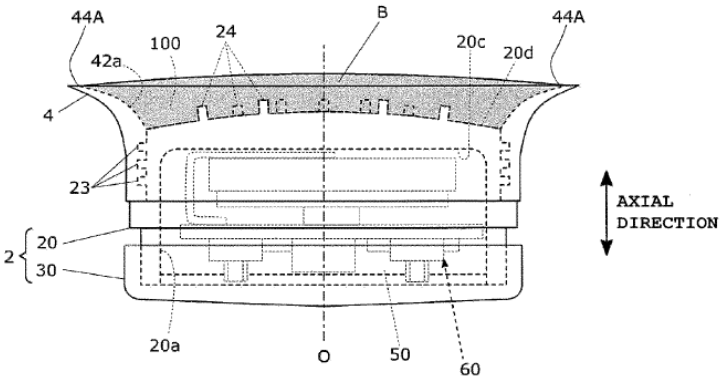
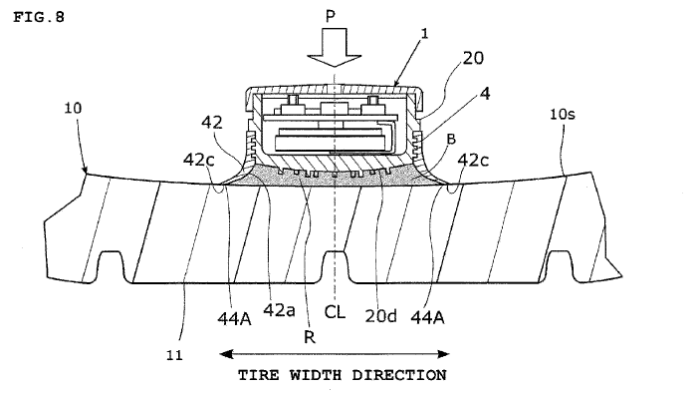


FIG.7



'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
	
28[pre]. A sensor assembly and sensing system for use with an object that rotates in use comprising:	*To the extent that the preamble is limiting, Yamaguchi-727 discloses, teaches, and/or suggests a* sensor assembly and sensing system for use with an object that rotates in use comprising. *For example:* *See, e.g.,* **1[pre]**, **11** above. **[0045]** The transmitting means is mounted on the circuit board as a transmitting circuit and transmits the measured temperature, the pressure, and the acceleration and so on to the outside of the tire via an antenna which is not shown in the figure. Signals such as the temperature, the pressure and the acceleration transmitted wirelessly from the transmitting means are received, for example, by a wireless circuit of a main unit provided in a vehicle, which is not shown in the figure, and information about states of the tire (the temperature, the pressure, or presence/absence of abnormality) are displayed on a display unit provided in the vehicle. *See also following limitations.*
[28a] a housing comprising an outer structure that defines an open internal cavity therein,	*Yamaguchi-727 discloses, teaches, and/or suggests a housing comprising an outer structure that defines an open internal cavity therein. For example:* *See, e.g.,* **[1a]-[1c]**, above.
[28b] an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to	*Yamaguchi-727 discloses, teaches, and/or suggests an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device. For example:* *See, e.g.,* **[1a]-[1c]**, above.

'421 Claim Element	**Disclosures from Prior Art (Yamaguchi-727)**
contact the electrical sensor device,	
[28c] wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location.	*Yamaguchi-727 discloses, teaches, and/or suggests wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location. For example:* *See, e.g.,* **[1d]**, above.
[28d] wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor;	*Yamaguchi-727 discloses, teaches, and/or suggests wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor. For example:* *See, e.g.,* **20**, above.
[28e] a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member; and	*Yamaguchi-727 discloses, teaches, and/or suggests a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member. For example:* *See, e.g.,* **[1e]**, above.
[28f] a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly.	*Yamaguchi-727 discloses, teaches, and/or suggests a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly. For example:* *See, e.g.,* **11**, above.
31. The sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity. For example:* *See, e.g.,* **[1c]**, above.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
32. The sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member. For example:* *See, e.g.,* **[1c]**, above.
33. The sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.,* **[1b]**, **11** above.
34. The sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data.	*Yamaguchi-727 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data. For example:* *See, e.g.,* **1[pre]**, **[1b]**, **[1d]**, **[1e]**, **11**, **12**, **20**, above.
41[pre] A method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of:	*To the extent that the preamble is limiting, Yamaguchi-727 discloses, teaches, and/or suggests a method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of: vulcanized rubber tire comprising. For example:* *See, e.g.,* **1[pre]**, **[1b]**, **[1d]**, **[1e]**, **11**, **12**, **20**, above. *See also following limitations.*
[41a] installing an electrical sensor device within an	*Yamaguchi-727 discloses, teaches, and/or suggests installing an electrical sensor device within an internal cavity of a housing,*

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity, and	*wherein the housing includes an outer structure that defines the internal cavity. For example:* *See, e.g.*, **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41b] wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry,	*Yamaguchi-727 discloses, teaches, and/or suggests wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry. For example:* *See, e.g.*, **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41c] wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity;	*Yamaguchi-727 discloses, teaches, and/or suggests wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity. For example:* *See, e.g.*, **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41d] attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object; and	*Yamaguchi-727 discloses, teaches, and/or suggests attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41e] monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly.	*Yamaguchi-727 discloses, teaches, and/or suggests monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
43. The method as recited in claim 41, wherein during the	*Yamaguchi-727 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of installing, the*

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity.	*electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
44. The method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed.	*Yamaguchi-727 discloses, teaches, and/or suggests the method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above
48. The method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire.	*Yamaguchi-727 discloses, teaches, and/or suggests the method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above
50. The method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing.	*Yamaguchi-727 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
51. The method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from	*Yamaguchi-727 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-727)
an external device to change one or more feature of the electrical sensor device.	
52. The method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor.	*Yamaguchi-727 discloses, teaches, and/or suggests the method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
53. The method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly.	*Yamaguchi-727 discloses, teaches, and/or suggests the method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

Invalidity Claim Chart Against U.S. Patent No. 11,835,421 ("'421 Patent")
Based on U.S. Publication No. 2021/0394566 ("Yamaguchi-566")

U.S. Publication No. 2021/0394566 ("Yamaguchi-566") claims priority to PCT/JP2018/028502, which was filed on July 19, 2019 and further claims priority to Foreign Application No. JP2018-234655, which was filed on December 14, 2018. Yamaguchi-566 qualifies as prior art under 35 U.S.C. § 102. Yamaguchi-566 anticipates and/or renders obvious the Asserted Claims of the '421 Patent (at least as Revvo understands Plaintiff's application of the Asserted Claims in an effort to show infringement).

To the extent Plaintiff argues that any element below is not disclosed by Yamaguchi-566, a person of ordinary skill in the art would have found it obvious to combine the teachings of Yamaguchi-566 with the background knowledge of a person of ordinary skill in the art and/or the additional references and exemplary teachings set forth in the chart below, to arrive at the claim limitation with a reasonable expectation of success. The chart below provides representative examples of where each element of each claim is found within Yamaguchi-566. Citations are meant to be exemplary, not exhaustive, and Revvo reserves the right to identify and discuss additional portions of the reference in support of its contentions and/or to rebut arguments made by Plaintiff. Citations to figures, drawings, tables, and the link include reference to any accompanying or related text. All internal cross-references are meant to incorporate the cross-referenced material as if fully set forth therein.

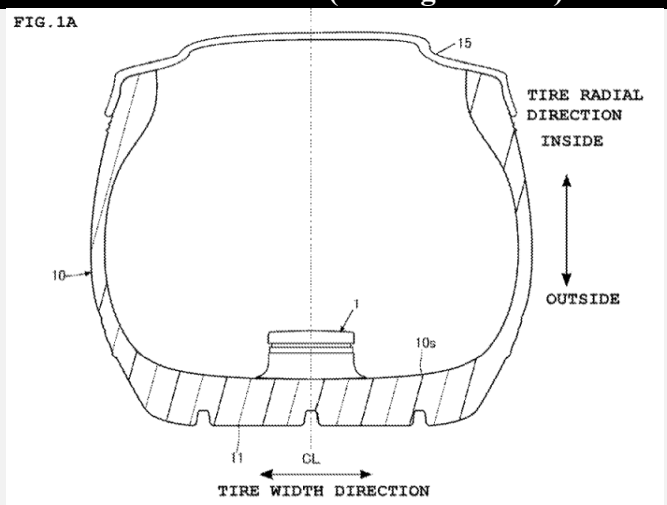
It is Revvo's position that Plaintiff's October 30, 2024 Infringement Contentions have not established that any accused product or service infringes any valid claim. Thus, Revvo's statements below should not be treated as an admission, implication, or suggestion that Revvo agrees with Plaintiff regarding either the scope, construction, or interpretation of any of the Asserted Claims or the infringement theories advanced by Plaintiff in its Infringement Contentions, including whether any Asserted Claim satisfies 35 U.S.C. §§ 101 or 112. In certain cases, Revvo has specified non-limiting examples of where its application of the prior art is based on Plaintiff's apparent application of the claim element. These statements are not intended to suggest that Revvo agrees with Plaintiff's application of any claim element, suggest a proposed construction at this stage of the case, or suggest that construction is needed, as the parties are not required to exchange terms for construction or propose claim constructions until a later date.

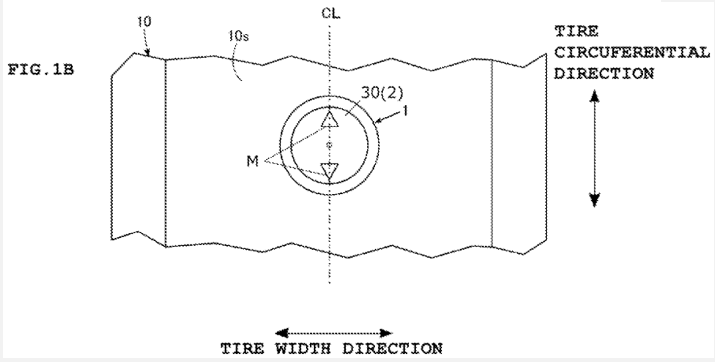
Plaintiff has yet to identify any limitation of the Asserted Claims that it contends is not anticipated and/or rendered obvious by Yamaguchi-566. Revvo therefore expressly reserves the right to respond to any such contention, including by identifying additional obviousness combinations, if Plaintiff makes any such contention.

Where Revvo states that Yamaguchi-566 "discloses" a limitation, that disclosure may be express, implicit, and/or inherent.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
1[pre]. A sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising:	*To the extent that the preamble is limiting, Yamaguchi-566 discloses, teaches, and/or suggests a sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising. For example:* **[ABSTRACT]** A functional component to be attached inside a tire, for detecting a state of the tire as information, including: a first substrate having a first sensor that detects a state of the tire; a second substrate having a second sensor that detects a state of the tire different from the state of the tire detected by the first sensor; and a connection means that electrically connects the first substrate and the second substrate, in which the first substrate further includes a communication means that outputs the information detected by the first sensor and the second sensor to outside of the tire, and in which the first substrate and the second substrate are stacked in a tire radial direction, and the second substrate is disposed on an outer side in the tire radial direction. **[0006]** As the configuration of a functional component for solving the above-mentioned problems, there is provided a functional component to be attached inside a tire, for detecting a state of the tire as information. The functional component includes: a first substrate having a first sensor that detects one state of the tire; a second substrate having a second sensor that detects a state of the tire different from the one state of the tire detected by the first sensor; and a connection section that electrically connects the first substrate and the second substrate, in which the first substrate further includes a communication means that outputs the information detected by the first sensor and the second sensor to outside of the tire, and in which the first substrate and the second substrate are stacked in a tire radial direction, and the second substrate is disposed on an outer side in the tire radial direction. **[0007]** FIGS. 1A and 1B are diagrams illustrating an example of how a functional component is attached to a tire.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)

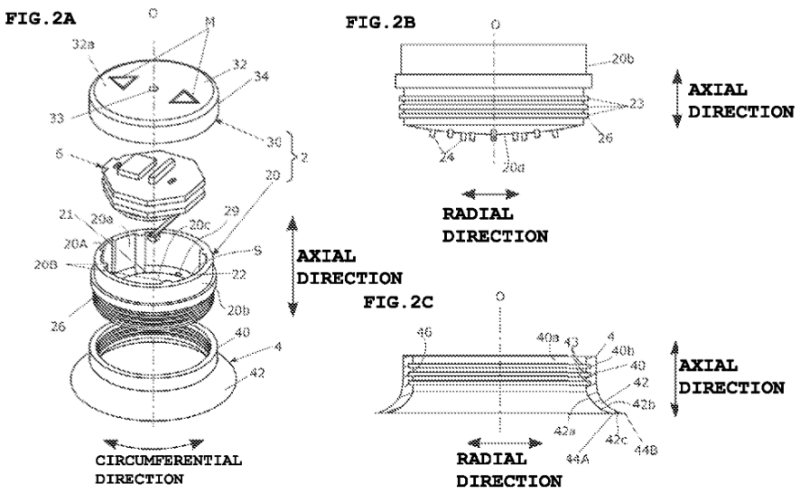




[0017] FIGS. 1A and 1B are diagrams illustrating an example of how a functional component 1 is attached to a tire 10. As illustrated in FIGS. 1A and 1B, the functional component 1 is disposed at the width direction center of an inner peripheral surface 10 *s* that is a rear side of a tread 11, which contacts with a road surface, of the tire 10. The functional component 1 is firmly fixed by, for example, an adhesive agent or the like to the inner surface (the inner peripheral surface) 10 *s* of the tire 10.

[0018] The functional component 1 is so configured as to be able to detect information indicative of states of the tire 10, including the pressure and temperature of the air filled in a closed space (hereinafter referred to as the tire air chamber) formed by assembling the tire 10 to a wheel rim 15, and transmit the detected information to, for example, a main unit provided in a vehicle which is not shown in the figure.

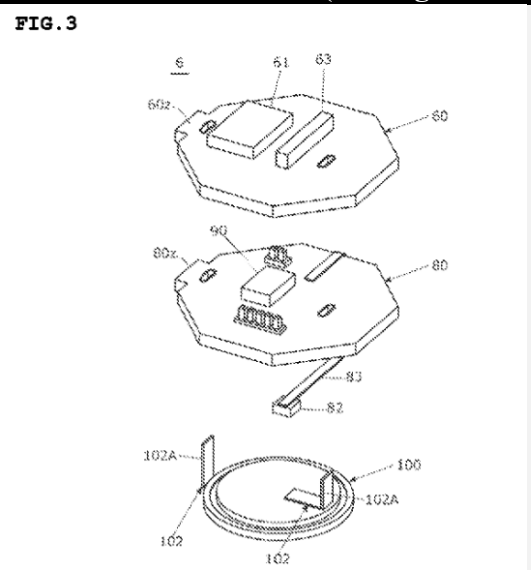
[0061] The functional component 1 configured as described above is bonded to the inner peripheral surface 10 *s* of the tire 10 by filling the adhesive agent in the cup-shaped space formed by the inner peripheral surface 42 *a* of the skirt 4 attached

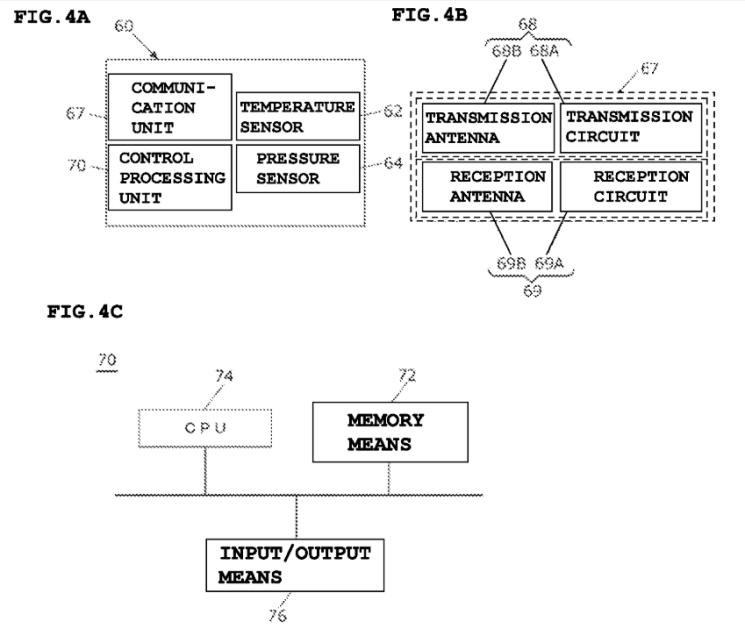
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	to the outer circumference of the housing 2 and the outer bottom surface 20 *d* of the housing 2. In other words, the strain sensor 82 is adhered to the inner peripheral surface 10 *s* of the tire 10 in a state of being embedded in the adhesive agent. **[0008]** FIGS. 2A to 2C are respectively an exploded perspective view of the functional component, a plan view and a partial sectional view of a housing case**.**  **[0019]** FIG. 2A is an exploded perspective view illustrating an example of the configuration of the functional component 1, FIG. 2B is a plan view of a housing case 20, and FIG. 2C is a cross-sectional view of a skirt 4. As illustrated in FIG. 2A, the functional component 1 is roughly configured by a module 6 that detects the state of the tire 10 and a housing 2 that houses the module 6. **[0020]** The housing 2 is provided with a housing case 20 having a housing space S (housing section) for the module 6, and a cap 30 that functions as a lid for the housing case 20, and is formed generally in a disk shape by combining the housing case 20 and the cap 30 together. **[0021]** The housing case 20 is formed into a bottomed cylindrical shape with an opening on one side, by a circular bottom part 21 and a peripheral wall part 22 which extends along the outer periphery from an outer peripheral edge of the bottom part 21 and rises up annularly from the bottom part 21. A housing space S capable of housing the module 6 is formed by an inner bottom surface 20 *c* of the bottom part 21 and an inner peripheral surface 20 *a* of the peripheral wall part 22. In the following

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	description, the description will be made with the use of terms such as an axial direction, a circumferential direction, and a radial direction and so on while taking an axis O of the peripheral wall part 22 as a reference. **[0022]** On the inner peripheral surface 20 *a* of the peripheral wall part 22, a concave part 20A recessed outwardly in the radial direction relative to the axis O and a plurality of convex parts 20B protruding toward the direction of the axis O and extending along the axis O are formed so as to position the module 6 housed in the housing space S at a predetermined position. The bottom part 21 of the housing case 20 is provided with a through hole 29 that penetrates from the inner bottom surface 20 *c* to an outer bottom surface 20 *d*. Furthermore, the inner bottom surface 20 *c* of the bottom part 21 is provided with a support means such as a protrusion, which is not shown in the figure, that supports the module 6 housed in the housing space S from a lower side. **[0023]** As illustrated in FIG. 2B, the outer bottom surface 20 *d* of the bottom part 21 is formed, for example, in a spherical shape, of which center of curvature is set on the axis O and the central part of the outer bottom surface 20 *d* is protruded outwardly in the axial direction than the outer peripheral edge side of the outer bottom surface 20 *d*. Incidentally, the shape of the outer bottom surface 20 *d* described above is not limited to the spherical shape, but may be set appropriately. On the outer bottom surface 20 *d*, a plurality of convex parts 24 are formed which protrude from the outer bottom surface 20 *d* toward the inner peripheral surface 10 *s* of the tire 10. The plurality of convex parts 24 are formed so as to be, for example, arranged radially about the axis O of the outer bottom surface 20 *d* and at equal intervals in the circumferential direction (equal intervals around the axis O), and so as to extend in the normal direction of the outer bottom surface 20 *d*. The extension length of the convex parts 24 may be set to be, for example, a length that does not protrude beyond a tip end part 44A of a skirt 4, which is described later, when the skirt 4 is attached to the housing 2. The plurality of convex parts 24 may be formed to be, for example, a columnar shape such as a pillar shape or a pyramidal shape, or a combination of these shapes, or instead of the convex parts 24, concave parts may be formed that recess from the outer bottom surface 20 *d* toward the inner bottom surface 20 *c* side, or the convex parts and the concave parts may also be combined.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0024] A skirt attachment part 26 for attaching the skirt 4 described later is provided on the outer periphery surface 20 *b* of the peripheral wall part 22. The skirt attachment part 26 is configured, for example, by a plurality of annular convex parts 23 provided on the lower half of the peripheral wall part 22. The annular convex part 23 is an annular body extending over the circumferential direction of the outer circumferential surface 20 *b*, and is provided in plural numbers at predetermined intervals (three in this embodiment) in the axial direction. The annular convex part 23 may be configured to extend intermittently in the circumferential direction without extending over the entire circumference. **[0025]** As illustrated in FIG. 2C, the skirt 4 is provided with a cylindrical part 40 cylindrically formed to be able to enclose the skirt attachment part 26, and an enlarged part 42 extending from the cylindrical part 40 toward the inner peripheral surface 10 *s* side. On an inner peripheral surface 40 *a* of the cylindrical part 40, an annular concave part 43 extending along the circumferential direction and recessed in the radial direction is formed in plural numbers to provide a case attachment part 46 to be fitted with the annular convex parts 23 constituting the skirt attachment part 26 formed on the outer circumference of the housing case 20. **[0026]** The enlarged part 42 is formed in a fun-like trumpet shape and is continuous from the tubular part 40. An inner peripheral surface 42 *a* of the enlarged part 42 is formed as a curved surface that, in the axial cross section, gradually expands in diameter from the outer peripheral edge of the outer bottom surface 20 *d* of the housing case 20 toward the inner peripheral surface 10 *s* side of the tire 10. Furthermore, an outer peripheral surface 42 *b* is formed as a curved surface and is smoothly continuous with the outer peripheral surface 40 *b* of the tubular part 40 and gradually expands in diameter toward the inner peripheral surface 10 *s* of the tire 10. The thickness of the enlarged part 42 formed by the inner peripheral surface 42 *a* and the outer peripheral surface 42 *b* is set in a tapered shape so that the thicknesses gradually become thinner toward axial direction end parts on the inner peripheral surface 10 *s* side. The tip end 44A of the inner peripheral surface 42 *a* and a tip end 44B of the outer peripheral surface 42 *b* are connected via a flat surface 42 *c*. That is, the flat surface 42 *c* is an annular surface enclosed by the tip end 44A of the inner peripheral surface 42 *a*, the tip end 44B of the outer peripheral surface 42 *b* and a plane perpendicular to the axis O.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0027] The skirt **4**, by being attached to the skirt attachment part **26** of the housing case **20**, extends from the outer bottom surface **20** *d* of the housing **2** toward the inner peripheral surface **10** *s* side of the tire **10** (in the direction away from the outer bottom surface **20** *d*). **[0028]** As illustrated in FIG. 2A, the cap 30 is provided with a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 *a* of the ceiling part 32, attachment marks M are formed that indicate a direction for attaching the functional component 1 to the tire 10. The attachment marks M are formed, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M indicate that the functional component 1 is to be attached on the inner peripheral surface 10 *s* of the tire 10 in such a manner that the arrows are oriented in the tire circumferential direction. Incidentally, the direction indicated by the attachment marks M may be set appropriately in correspondence with a detection direction of the module 6. A hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 functions as an introduction hole for taking in air inside the tire into the housing space S of the housing case 20 when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 *b* of the peripheral wall part 22 of the housing case 20. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 *a* are oriented in a predetermined direction with respect to the housing case 20. **[0029]** For the above-described housing case 20 and the cap 30, a material such as synthetic resin or the like is suitable, for example, from the viewpoint of weight reduction and the strength of the functional component 1. For the skirt 4, an elastic material made of elastomer such as rubber, or resin or the like having flexibility is preferable. **[0009]** FIG. 3A is an exploded perspective view of a module.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	FIG. 3  **[0030]** FIG. 3 is an exploded perspective view of the module 6. The module 6 according to the present embodiment is provided with a plurality of substrates 60 and 80 as a first substrate and a second substrate, and a battery 100 that supplies the power to the substrate 60 and the substrate 80. The substrate 60 and the substrate 80 are formed in a roughly octagonal shape, for example, so as to correspond to the concave part 20A and the plurality of convex parts 20B provided in the housing case 20, and so as to be able to be housed in the housing case 20 by bringing the peripheral edges of the substrates 60 and 80 into contact with the convex portions 20B, and making protruding pieces 60 *z* and 80 *z* each protruding from a part of each of the peripheral edges to coincide with the concave portion 20A. **[0031]** The substrate 60 and the substrate 80 are each configured to have a different function for detecting the state of the tire 10. For example, the substrate 60 is provided with a detection means that detects, as basic information, whether or not the tire 10 is in a normal state, and the substrate 80 is provided, in order to add extended functionality, with a detection means that detects, in addition to the information detected by the substrate 60, another state of the tire 10. Hereinafter, the substrate 60 is referred to as the basic substrate 60 and the substrate 80B is referred to as the expansion substrate 80. **[0045]** As illustrated in FIG. 3, the temperature sensor 62, the pressure sensor 64, the transmission circuit 68A and the reception circuit 69A of the communication unit 67, and the control circuit functioning as the control processing unit 70 described above are

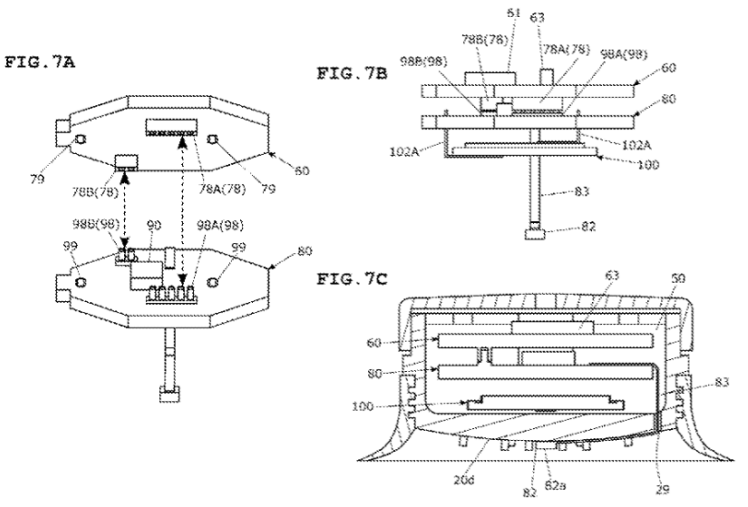
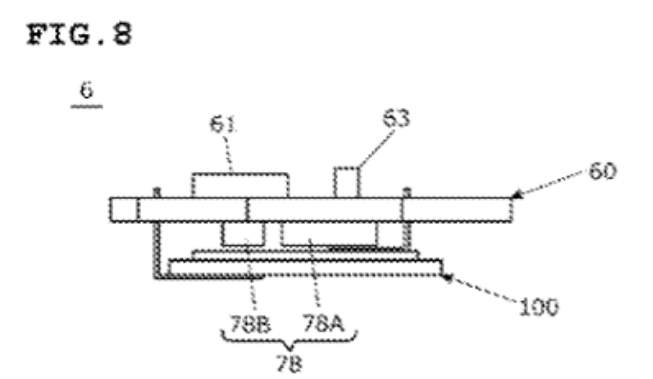
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	integrated, for example, as a module that integrates the functions in a single chip, and mounted on the surface of the substrate as the sensor unit 61. The transmission antenna 68B and the reception antenna 69B, which constitute the communication unit 67, are mounted on the surface of the substrate as an antenna unit 63, as a separate unit from the sensor unit 61, for example, on the same surface of the substrate. **[0010]** FIGS. 4A to 4C are block diagrams of a basic substrate.  **[0032]** FIGS. 4A to 4C are block diagrams of the basic substrate **60**. An example of the functions set in the basic substrate **60** and the expansion substrate **80** will be described below. As illustrated in FIG. 4A, the basic substrate **60** is provided with a temperature sensor **62** as a first sensor for acquiring temperature in the air chamber of the tire **10**, a pressure sensor **64** for acquiring pressure in the air chamber, a communication unit **67** for outputting, to the outside of the tire, the detected value detected by each of the sensors **62** and **64**, and a control processing unit **70** as a first processing means for processing the information detected by the plurality of sensors **62** and **64**, and processing the operations of the plurality of sensors **62** and **64** and the communication unit **67**, and processing the exchange of information with the expansion substrate **80**. **[0033]** The temperature sensor 62 and the pressure sensor 64 detect the temperature and the pressure of the air inside

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	the tire air chamber, by the air inside the tire air chamber introduced into the housing space S through the hole 33 provided in the cap 30. The temperature sensor 62 and the pressure sensor 64 operate on the basis of signals output from the control processing unit 70. **[0034]** As illustrated in FIG. 4B, the communication unit **67** is provided with a transmission section **68** and a reception section **69**. The transmission section **68** is configured roughly by a transmission circuit **68**A and a transmission antenna **68**B, and the reception section **69** is configured roughly by a reception circuit **69**A and a reception antenna **69**B. **[0035]** The transmitter **68** converts the information input from the control processing unit **70** into a predetermined signal by the transmission circuit **68**A, and transmits the predetermined signal from the transmission antenna **68**B to a main unit installed in a vehicle, which is not shown in the figure. The transmission section **68** operates, for example, each time the information is input from the control processing unit **70**. **[0036]** The reception section 69, when a predetermined radio wave is input to the reception antenna 69B from a functional component management device, which is not shown in the figure, for managing the functional component 1, judges that the reception circuit 69A has received the radio wave, opens a communication circuit from the outside to the control processing unit 70, and outputs the input information to the control processing unit 70. In a case where no radio wave is received for a predetermined period of time, the reception section 69 stops functioning. **[0037]** The control processing unit 70 is provided with a memory means 72 such as a memory in which programs or the like are stored, a CPU 74 that functions as an arithmetic processing means, and an input/output means 76, and operates as a so-called computer. **[0038]** The memory means 72 stores, for example, a unique identification number set in the basic substrate 60, a program for controlling the operations of the temperature sensor 62 and the pressure sensor 64, a program for causing the communication unit 67 to operate, a program for executing processing when a signal is input from the outside to the reception section 69 of the communication unit 67, and a program for controlling

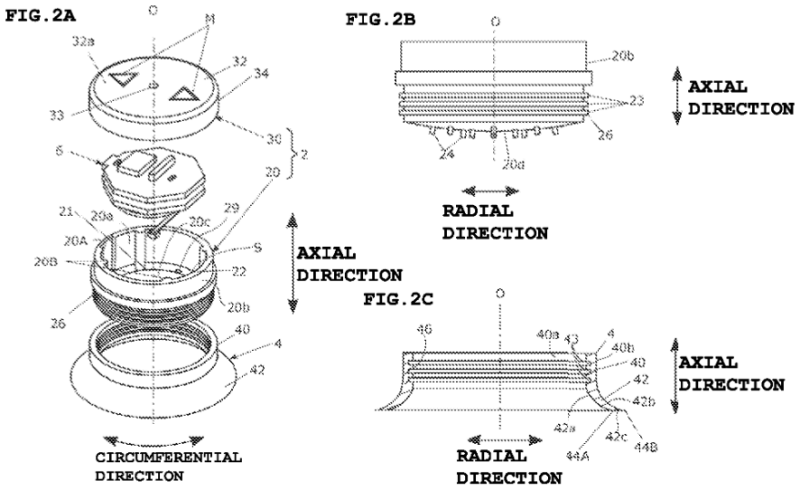
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	the expansion substrate 80, and so on. In addition, the memory means 72 stores, as a history, the information such as the temperature and the pressure inside the tire 10 detected by the temperature sensor 62 and the pressure sensor 64. **[0039]** The input/output means 76 functions as an interface for outputting signals for causing the temperature sensor 62 and the pressure sensor 64 to operate and for inputting the temperature and the pressure detected by the temperature sensor 62 and the pressure sensor 64, and as an interface for enabling communication with the expansion substrate 80. **[0040]** The control processing unit 70 controls, by executing the program stored in the memory means 72 by the CPU 74, for example, the operations of the sensors that control the detection of the temperature and the pressure by the temperature sensor 62 and the pressure sensor 64, the operation of the communication unit 67, and the operation of the exchange of the information with the expansion substrate 80. **[0041]** The control processing unit 70 outputs signals to the temperature sensor 62 and the pressure sensor 64 on the basis of a sampling time set in the memory means, for example, and causes the temperature sensor 62 and the pressure sensor 64 to detect the temperature and the pressure. The control processing unit 70 converts the information of the temperature and the pressure detected by the temperature sensor 62 and the pressure sensor 64 into predetermined signals, such as digital signals, for example, and outputs the predetermined signals to the communication unit 67. **[0042]** The control processing unit 70, when the communication circuit to the reception section 69 is opened, outputs, updates, or adds the information stored in the memory means 72 on the basis of commands input by means of radio waves from the functional component management device, which is not shown in the figure, that manages the functional component 1. For example, in a case where an identification number is input from the functional component management device, the control processing unit 70 causes the memory means 72 to store the identification number, and in a case where the identification number is requested, outputs the identification number via the transmission section 68.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0050] As illustrated in FIG. 5B, the control processing unit 90 is provided with a memory means 92 in which programs and the like are stored, a CPU 94 that functions as an arithmetic processing means and an input/output means 96, and has functions as a so-called computer. The control processing unit 90 executes, for example, the processing for the operation of detecting the strain of the tire by the strain sensor 82 and the processing for outputting the strain detected by the strain sensor 82 in the format defined in the control processing unit 70 provided on the basic substrate 60, and also stores the strain in the memory means 92. Furthermore, the control processing unit 90 operates, via the control processing unit 70, on the basis of the command input from the functional component management device, and outputs a result of the processing based on the command to the basic substrate 60. As illustrated in FIG. 3, the control processing unit 90 is configured, for example, as a one-chip computer and is mounted on the expansion substrate 80. **[0059]** Then the module 6 is housed in the housing case 20 in a state in which the battery 100 is mounted on the expansion substrate 80 which is integrated with the basic substrate 60. First, while passing the strain sensor 82 and the connecting wire 83 through the through hole 29 provided in the bottom part 21 of the housing case 20, the module 6 is placed at a predetermined position in the housing space S and the strain sensor 82 is disposed at the center of the outer bottom part 20 *d*, and the strain sensor 82 and the connecting wire 83 are fixed to the outer bottom surface 20 *d* by a fixing means such as an adhesive agent. **[0060]** Next, a filler 50 is filled in the housing space S in which the module 6 is housed and by letting the filler 50 to harden, the basic substrate 60 and the expansion substrate 80 are fixed, and the expansion substrate 80 and the battery 100 are fixed. As a result, the module 6 composed of the basic substrate 60, the expansion substrate 80 and the battery 100 which are fixed to each other by the filler 50 is fixed to the housing case 20, and the through hole 29 provided in the bottom part 21 is closed. As to a position where the filler 50 is to be filled, since the temperature sensor 62 and the pressure sensor 64 are integrated as the sensor unit 61, the filler 50 may be filled up to a position not reaching the upper surface of the sensor unit 61, for example, so as not to block the air intake hole provided in the sensor unit 61. For the filler 50, a material made of synthetic resin, for example, is suitable. As the material of the filler 50, a material capable of waterproofing,

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	dustproofing, and protecting the substrate with respect to the module 6 housed in the housing 2 may be used, for example, there may be mentioned synthetic resin such as urethane-based resin or epoxy-based resin. By applying such a material to the filler 50, the filler 50 can maintain sufficient resistance to the forces received from the battery 100, the basic substrate 60 and the expansion substrate 80 when the tire 10 is rotating, especially even when rotating at a high speed. In particular, by using the epoxy-based resin, weather resistance can further be improved in addition to the waterproofing, the dustproofing and the substrate protection. **[0063]** FIGS. 9A and 9B are block diagrams illustrating another forms of the expansion substrate 80. In the above-described embodiment, it has been explained that the strain sensor 82 is mounted on the expansion substrate 80, however, without being limited to this, the functions to be mounted on the expansion substrate 80 may be set as required. Namely, it may be an acceleration sensor, or as illustrated in FIG. 9A, it may be a pressure sensor 82 for high pressure that measures a higher-pressure range than the pressure sensor 64 provided on the basic substrate 60, or in a case where water is injected into the tire air chamber, such as in the case of tires for heavy duty vehicles used in mines or the like, it may be a pressure sensor 82 for water pressure or the like. In any cases, it is preferable to configure such that the expansion substrate 80 is provided with a control processing unit 90 associated with each sensor, and the information detected by the sensors are output to the basic substrate 60 in a format which can be handled by the control processing unit 70 of the basic substrate 60. Furthermore, by storing the information detected by the expansion substrate 80 in the memory means 92 of the control processing unit 90 provided on the expansion substrate 80, the burden on the memory means 72 of the basic substrate 60 can be reduced. With this configuration, the capacity of the memory means 72 can be made smaller, that is, the memory as the memory means 72 can be made small-sized. **[0066]** As described above, by producing the basic substrate 60 provided with the detection means that detects the basic state of the tire and the communication unit 67, and producing the expansion substrate 80 in accordance with the type of tire or applications, the number of man-hours required for development and production can be reduced since it is only need to use the basic substrate 60 provided with the communication unit 67 as a common substrate, and develop and produce

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	the expansion substrate 80 that expands the function of the basic substrate 60 in accordance with the performance required as the functional component. **[0013]** FIGS. 7A to 7C are diagrams roughly illustrating the assembly process of the functional component.  **[0014]** FIG. 8 is a plan view illustrating a state in which a battery is connected to the basic substrate. 
[1a] a housing comprising an outer surface and an internal cavity that is enclosed within the housing;	*Yamaguchi-566 discloses, teaches, and/or suggests a housing comprising an outer surface and an internal cavity that is enclosed within the housing. For example:* *See, e.g.,* **1[pre]**, above.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0008] FIGS. 2A to 2C are respectively an exploded perspective view of the functional component, a plan view and a partial sectional view of a housing case**.**



[0019] FIG. 2A is an exploded perspective view illustrating an example of the configuration of the functional component 1, FIG. 2B is a plan view of a housing case 20, and FIG. 2C is a cross-sectional view of a skirt 4. As illustrated in FIG. 2A, the functional component 1 is roughly configured by a module 6 that detects the state of the tire 10 and a housing 2 that houses the module 6.

[0020] The housing 2 is provided with a housing case 20 having a housing space S (housing section) for the module 6, and a cap 30 that functions as a lid for the housing case 20, and is formed generally in a disk shape by combining the housing case 20 and the cap 30 together.

[0021] The housing case 20 is formed into a bottomed cylindrical shape with an opening on one side, by a circular bottom part 21 and a peripheral wall part 22 which extends along the outer periphery from an outer peripheral edge of the bottom part 21 and rises up annularly from the bottom part 21. A housing space S capable of housing the module 6 is formed by an inner bottom surface 20 *c* of the bottom part 21 and an inner peripheral surface 20 *a* of the peripheral wall part 22. In the following description, the description will be made with the use of terms such as an axial direction, a circumferential direction, and a radial direction and so on while taking an axis O of the peripheral wall part 22 as a reference.

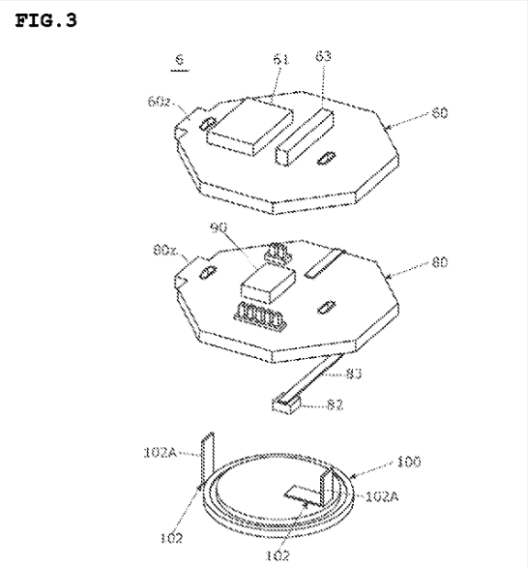
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0022] On the inner peripheral surface 20 *a* of the peripheral wall part 22, a concave part 20A recessed outwardly in the radial direction relative to the axis O and a plurality of convex parts 20B protruding toward the direction of the axis O and extending along the axis O are formed so as to position the module 6 housed in the housing space S at a predetermined position. The bottom part 21 of the housing case 20 is provided with a through hole 29 that penetrates from the inner bottom surface 20 *c* to an outer bottom surface 20 *d*. Furthermore, the inner bottom surface 20 *c* of the bottom part 21 is provided with a support means such as a protrusion, which is not shown in the figure, that supports the module 6 housed in the housing space S from a lower side. **[0023]** As illustrated in FIG. 2B, the outer bottom surface 20 *d* of the bottom part 21 is formed, for example, in a spherical shape, of which center of curvature is set on the axis O and the central part of the outer bottom surface 20 *d* is protruded outwardly in the axial direction than the outer peripheral edge side of the outer bottom surface 20 *d*. Incidentally, the shape of the outer bottom surface 20 *d* described above is not limited to the spherical shape, but may be set appropriately. On the outer bottom surface 20 *d*, a plurality of convex parts 24 are formed which protrude from the outer bottom surface 20 *d* toward the inner peripheral surface 10 *s* of the tire 10. The plurality of convex parts 24 are formed so as to be, for example, arranged radially about the axis O of the outer bottom surface 20 *d* and at equal intervals in the circumferential direction (equal intervals around the axis O), and so as to extend in the normal direction of the outer bottom surface 20 *d*. The extension length of the convex parts 24 may be set to be, for example, a length that does not protrude beyond a tip end part 44A of a skirt 4, which is described later, when the skirt 4 is attached to the housing 2. The plurality of convex parts 24 may be formed to be, for example, a columnar shape such as a pillar shape or a pyramidal shape, or a combination of these shapes, or instead of the convex parts 24, concave parts may be formed that recess from the outer bottom surface 20 *d* toward the inner bottom surface 20 *c* side, or the convex parts and the concave parts may also be combined. **[0024]** A skirt attachment part 26 for attaching the skirt 4 described later is provided on the outer periphery surface 20 *b* of the peripheral wall part 22. The skirt attachment part 26 is configured, for example, by a plurality of annular convex parts 23 provided on the lower half of the peripheral wall

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	part 22. The annular convex part 23 is an annular body extending over the circumferential direction of the outer circumferential surface 20 *b*, and is provided in plural numbers at predetermined intervals (three in this embodiment) in the axial direction. The annular convex part 23 may be configured to extend intermittently in the circumferential direction without extending over the entire circumference. **[0025]** As illustrated in FIG. 2C, the skirt 4 is provided with a cylindrical part 40 cylindrically formed to be able to enclose the skirt attachment part 26, and an enlarged part 42 extending from the cylindrical part 40 toward the inner peripheral surface 10 *s* side. On an inner peripheral surface 40 *a* of the cylindrical part 40, an annular concave part 43 extending along the circumferential direction and recessed in the radial direction is formed in plural numbers to provide a case attachment part 46 to be fitted with the annular convex parts 23 constituting the skirt attachment part 26 formed on the outer circumference of the housing case 20. **[0026]** The enlarged part 42 is formed in a fun-like trumpet shape and is continuous from the tubular part 40. An inner peripheral surface 42 *a* of the enlarged part 42 is formed as a curved surface that, in the axial cross section, gradually expands in diameter from the outer peripheral edge of the outer bottom surface 20 *d* of the housing case 20 toward the inner peripheral surface 10 *s* side of the tire 10. Furthermore, an outer peripheral surface 42 *b* is formed as a curved surface and is smoothly continuous with the outer peripheral surface 40 *b* of the tubular part 40 and gradually expands in diameter toward the inner peripheral surface 10 *s* of the tire 10. The thickness of the enlarged part 42 formed by the inner peripheral surface 42 *a* and the outer peripheral surface 42 *b* is set in a tapered shape so that the thicknesses gradually become thinner toward axial direction end parts on the inner peripheral surface 10 *s* side. The tip end 44A of the inner peripheral surface 42 *a* and a tip end 44B of the outer peripheral surface 42 *b* are connected via a flat surface 42 *c*. That is, the flat surface 42 *c* is an annular surface enclosed by the tip end 44A of the inner peripheral surface 42 *a*, the tip end 44B of the outer peripheral surface 42 *b* and a plane perpendicular to the axis O. **[0027]** The skirt **4**, by being attached to the skirt attachment part **26** of the housing case **20**, extends from the outer bottom surface **20** *d* of the housing **2** toward the inner peripheral

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	surface **10** *s* side of the tire **10** (in the direction away from the outer bottom surface **20** *d*). **[0028]** As illustrated in FIG. 2A, the cap 30 is provided with a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 *a* of the ceiling part 32, attachment marks M are formed that indicate a direction for attaching the functional component 1 to the tire 10. The attachment marks M are formed, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M indicate that the functional component 1 is to be attached on the inner peripheral surface 10 *s* of the tire 10 in such a manner that the arrows are oriented in the tire circumferential direction. Incidentally, the direction indicated by the attachment marks M may be set appropriately in correspondence with a detection direction of the module 6. A hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 functions as an introduction hole for taking in air inside the tire into the housing space S of the housing case 20 when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 *b* of the peripheral wall part 22 of the housing case 20. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 *a* are oriented in a predetermined direction with respect to the housing case 20. **[0029]** For the above-described housing case 20 and the cap 30, a material such as synthetic resin or the like is suitable, for example, from the viewpoint of weight reduction and the strength of the functional component 1. For the skirt 4, an elastic material made of elastomer such as rubber, or resin or the like having flexibility is preferable. **[0033]** The temperature sensor 62 and the pressure sensor 64 detect the temperature and the pressure of the air inside the tire air chamber, by the air inside the tire air chamber introduced into the housing space S through the hole 33 provided in the cap 30. The temperature sensor 62 and the pressure sensor 64 operate on the basis of signals output from the control processing unit 70. **[0059]** Then the module 6 is housed in the housing case 20 in a state in which the battery 100 is mounted on the expansion

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	substrate 80 which is integrated with the basic substrate 60. First, while passing the strain sensor 82 and the connecting wire 83 through the through hole 29 provided in the bottom part 21 of the housing case 20, the module 6 is placed at a predetermined position in the housing space S and the strain sensor 82 is disposed at the center of the outer bottom part 20 *d*, and the strain sensor 82 and the connecting wire 83 are fixed to the outer bottom surface 20 *d* by a fixing means such as an adhesive agent. **[0060]** Next, a filler 50 is filled in the housing space S in which the module 6 is housed and by letting the filler 50 to harden, the basic substrate 60 and the expansion substrate 80 are fixed, and the expansion substrate 80 and the battery 100 are fixed. As a result, the module 6 composed of the basic substrate 60, the expansion substrate 80 and the battery 100 which are fixed to each other by the filler 50 is fixed to the housing case 20, and the through hole 29 provided in the bottom part 21 is closed. As to a position where the filler 50 is to be filled, since the temperature sensor 62 and the pressure sensor 64 are integrated as the sensor unit 61, the filler 50 may be filled up to a position not reaching the upper surface of the sensor unit 61, for example, so as not to block the air intake hole provided in the sensor unit 61. For the filler 50, a material made of synthetic resin, for example, is suitable. As the material of the filler 50, a material capable of waterproofing, dustproofing, and protecting the substrate with respect to the module 6 housed in the housing 2 may be used, for example, there may be mentioned synthetic resin such as urethane-based resin or epoxy-based resin. By applying such a material to the filler 50, the filler 50 can maintain sufficient resistance to the forces received from the battery 100, the basic substrate 60 and the expansion substrate 80 when the tire 10 is rotating, especially even when rotating at a high speed. In particular, by using the epoxy-based resin, weather resistance can further be improved in addition to the waterproofing, the dustproofing and the substrate protection.
[1b] an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity,	*Yamaguchi-566 discloses, teaches, and/or suggests an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity. For example:* *See, e.g.*, **1[pre]**, **1[a]**, above. **[0022]** On the inner peripheral surface 20 a of the peripheral wall part 22, a concave part 20A recessed outwardly in the radial

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	direction relative to the axis O and a plurality of convex parts 20B protruding toward the direction of the axis O and extending along the axis O are formed so as to position the module 6 housed in the housing space S at a predetermined position. The bottom part 21 of the housing case 20 is provided with a through hole 29 that penetrates from the inner bottom surface 20 c to an outer bottom surface 20 d. Furthermore, the inner bottom surface 20 c of the bottom part 21 is provided with a support means such as a protrusion, which is not shown in the figure, that supports the module 6 housed in the housing space S from a lower side. **[0028]** As illustrated in FIG. 2A, the cap 30 is provided with a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 *a* of the ceiling part 32, attachment marks M are formed that indicate a direction for attaching the functional component 1 to the tire 10. The attachment marks M are formed, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M indicate that the functional component 1 is to be attached on the inner peripheral surface 10 *s* of the tire 10 in such a manner that the arrows are oriented in the tire circumferential direction. Incidentally, the direction indicated by the attachment marks M may be set appropriately in correspondence with a detection direction of the module 6. A hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 functions as an introduction hole for taking in air inside the tire into the housing space S of the housing case 20 when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 *b* of the peripheral wall part 22 of the housing case 20. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 *a* are oriented in a predetermined direction with respect to the housing case 20. **[0029]** For the above-described housing case 20 and the cap 30, a material such as synthetic resin or the like is suitable, for example, from the viewpoint of weight reduction and the strength of the functional component 1. For the skirt 4, an elastic material made of elastomer such as rubber, or resin or the like having flexibility is preferable.

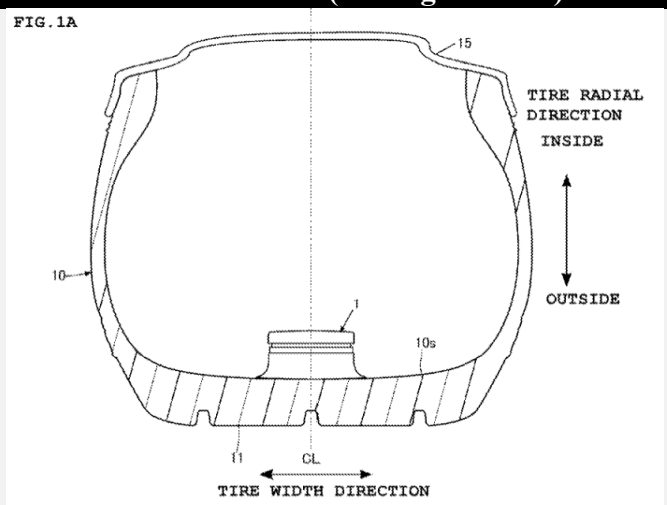
’421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0009] FIG. 3A is an exploded perspective view of a module. FIG.3  **[0030]** FIG. 3 is an exploded perspective view of the module 6. The module 6 according to the present embodiment is provided with a plurality of substrates 60 and 80 as a first substrate and a second substrate, and a battery 100 that supplies the power to the substrate 60 and the substrate 80. The substrate 60 and the substrate 80 are formed in a roughly octagonal shape, for example, so as to correspond to the concave part 20A and the plurality of convex parts 20B provided in the housing case 20, and so as to be able to be housed in the housing case 20 by bringing the peripheral edges of the substrates 60 and 80 into contact with the convex portions 20B, and making protruding pieces 60 *z* and 80 *z* each protruding from a part of each of the peripheral edges to coincide with the concave portion 20A. **[0059]** Then the module 6 is housed in the housing case 20 in a state in which the battery 100 is mounted on the expansion substrate 80 which is integrated with the basic substrate 60. First, while passing the strain sensor 82 and the connecting wire 83 through the through hole 29 provided in the bottom part 21 of the housing case 20, the module 6 is placed at a predetermined position in the housing space S and the strain sensor 82 is disposed at the center of the outer bottom part 20 d, and the strain sensor 82 and the connecting wire 83 are fixed to the outer bottom surface 20 d by a fixing means such as an adhesive agent. **[0060]** Next, a filler 50 is filled in the housing space S in which the module 6 is housed and by letting the filler 50 to harden, the

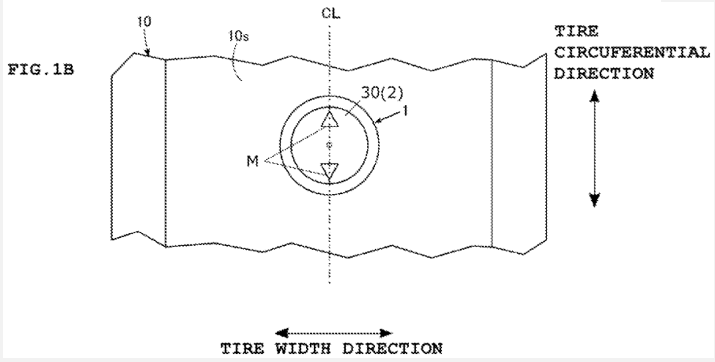
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	basic substrate 60 and the expansion substrate 80 are fixed, and the expansion substrate 80 and the battery 100 are fixed. As a result, the module 6 composed of the basic substrate 60, the expansion substrate 80 and the battery 100 which are fixed to each other by the filler 50 is fixed to the housing case 20, and the through hole 29 provided in the bottom part 21 is closed. As to a position where the filler 50 is to be filled, since the temperature sensor 62 and the pressure sensor 64 are integrated as the sensor unit 61, the filler 50 may be filled up to a position not reaching the upper surface of the sensor unit 61, for example, so as not to block the air intake hole provided in the sensor unit 61. For the filler 50, a material made of synthetic resin, for example, is suitable. As the material of the filler 50, a material capable of waterproofing, dustproofing, and protecting the substrate with respect to the module 6 housed in the housing 2 may be used, for example, there may be mentioned synthetic resin such as urethane-based resin or epoxy-based resin. By applying such a material to the filler 50, the filler 50 can maintain sufficient resistance to the forces received from the battery 100, the basic substrate 60 and the expansion substrate 80 when the tire 10 is rotating, especially even when rotating at a high speed. In particular, by using the epoxy-based resin, weather resistance can further be improved in addition to the waterproofing, the dustproofing and the substrate protection.
[1c] wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing,	*Yamaguchi-566 discloses, teaches, and/or suggests wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, above**.** **[0028]** As illustrated in FIG. 2A, the cap 30 is provided with a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 a of the ceiling part 32, attachment marks M are formed that indicate a direction for attaching the functional component 1 to the tire 10. The attachment marks M are formed, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M indicate that the functional component 1 is to be attached on the inner peripheral surface 10 s of the tire 10 in such a manner that the arrows are oriented in the tire circumferential direction. Incidentally, the direction indicated by the attachment marks M may be set appropriately in correspondence with a detection direction of the module 6. A hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 functions as an introduction hole for taking in air

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	inside the tire into the housing space S of the housing case 20 when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 b of the peripheral wall part 22 of the housing case 20. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 a are oriented in a predetermined direction with respect to the housing case 20. **[0033]** The temperature sensor 62 and the pressure sensor 64 detect the temperature and the pressure of the air inside the tire air chamber, by the air inside the tire air chamber introduced into the housing space S through the hole 33 provided in the cap 30. The temperature sensor 62 and the pressure sensor 64 operate on the basis of signals output from the control processing unit 70. **[0060]** Next, a filler 50 is filled in the housing space S in which the module 6 is housed and by letting the filler 50 to harden, the basic substrate 60 and the expansion substrate 80 are fixed, and the expansion substrate 80 and the battery 100 are fixed. As a result, the module 6 composed of the basic substrate 60, the expansion substrate 80 and the battery 100 which are fixed to each other by the filler 50 is fixed to the housing case 20, and the through hole 29 provided in the bottom part 21 is closed. As to a position where the filler 50 is to be filled, since the temperature sensor 62 and the pressure sensor 64 are integrated as the sensor unit 61, the filler 50 may be filled up to a position not reaching the upper surface of the sensor unit 61, for example, so as not to block the air intake hole provided in the sensor unit 61. For the filler 50, a material made of synthetic resin, for example, is suitable. As the material of the filler 50, a material capable of waterproofing, dustproofing, and protecting the substrate with respect to the module 6 housed in the housing 2 may be used, for example, there may be mentioned synthetic resin such as urethane-based resin or epoxy-based resin. By applying such a material to the filler 50, the filler 50 can maintain sufficient resistance to the forces received from the battery 100, the basic substrate 60 and the expansion substrate 80 when the tire 10 is rotating, especially even when rotating at a high speed. In particular, by using the epoxy-based resin, weather resistance can further be improved in addition to the waterproofing, the dustproofing and the substrate protection.

’421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
[1d] wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use; and	*Yamaguchi-566 discloses, teaches, and/or suggests wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, above**.** **[ABSTRACT]** A functional component to be attached inside a tire, for detecting a state of the tire as information, including: a first substrate having a first sensor that detects a state of the tire; a second substrate having a second sensor that detects a state of the tire different from the state of the tire detected by the first sensor; and a connection means that electrically connects the first substrate and the second substrate, in which the first substrate further includes a communication means that outputs the information detected by the first sensor and the second sensor to outside of the tire, and in which the first substrate and the second substrate are stacked in a tire radial direction, and the second substrate is disposed on an outer side in the tire radial direction. **[0006]** As the configuration of a functional component for solving the above-mentioned problems, there is provided a functional component to be attached inside a tire, for detecting a state of the tire as information. The functional component includes: a first substrate having a first sensor that detects one state of the tire; a second substrate having a second sensor that detects a state of the tire different from the one state of the tire detected by the first sensor; and a connection section that electrically connects the first substrate and the second substrate, in which the first substrate further includes a communication means that outputs the information detected by the first sensor and the second sensor to outside of the tire, and in which the first substrate and the second substrate are stacked in a tire radial direction, and the second substrate is disposed on an outer side in the tire radial direction. **[0007]** FIGS. 1A and 1B are diagrams illustrating an example of how a functional component is attached to a tire.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)

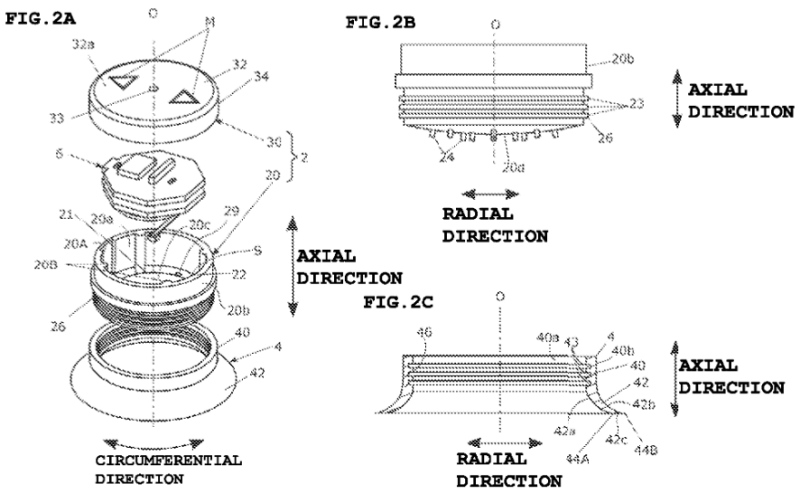


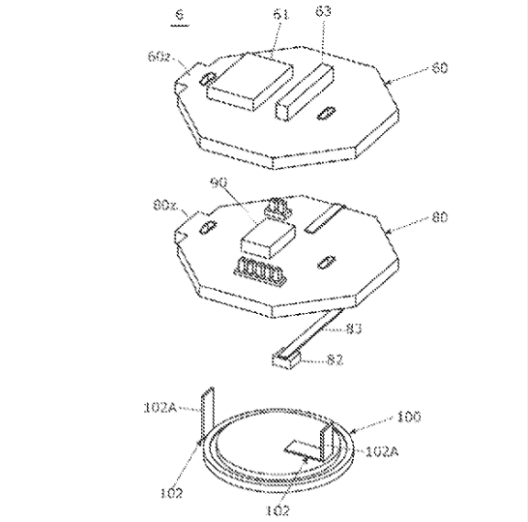


[0017] FIGS. 1A and 1B are diagrams illustrating an example of how a functional component 1 is attached to a tire 10. As illustrated in FIGS. 1A and 1B, the functional component 1 is disposed at the width direction center of an inner peripheral surface 10 *s* that is a rear side of a tread 11, which contacts with a road surface, of the tire 10. The functional component 1 is firmly fixed by, for example, an adhesive agent or the like to the inner surface (the inner peripheral surface) 10 *s* of the tire 10.

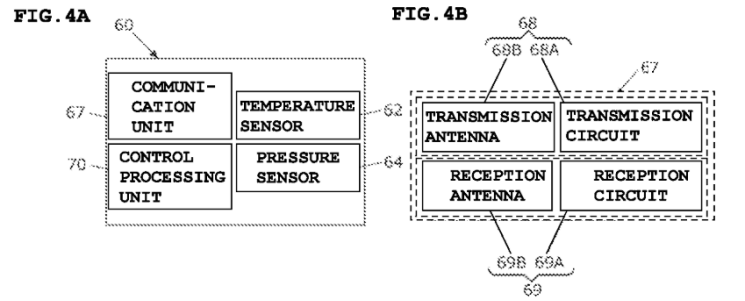
[0018] The functional component 1 is so configured as to be able to detect information indicative of states of the tire 10, including the pressure and temperature of the air filled in a closed space (hereinafter referred to as the tire air chamber) formed by assembling the tire 10 to a wheel rim 15, and transmit the detected information to, for example, a main unit provided in a vehicle which is not shown in the figure.

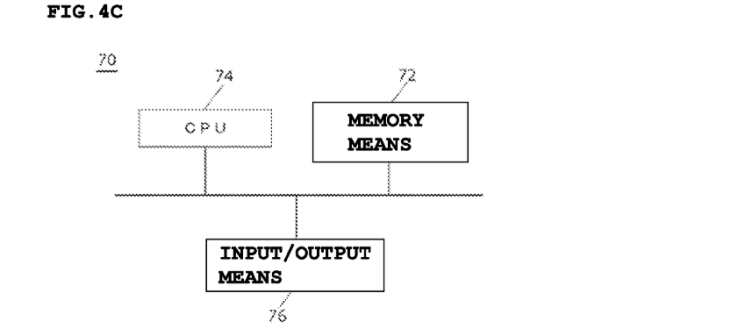
[0061] The functional component 1 configured as described above is bonded to the inner peripheral surface 10 *s* of the tire 10 by filling the adhesive agent in the cup-shaped space formed by the inner peripheral surface 42 *a* of the skirt 4 attached

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	to the outer circumference of the housing 2 and the outer bottom surface 20 *d* of the housing 2. In other words, the strain sensor 82 is adhered to the inner peripheral surface 10 *s* of the tire 10 in a state of being embedded in the adhesive agent. **[0008]** FIGS. 2A to 2C are respectively an exploded perspective view of the functional component, a plan view and a partial sectional view of a housing case**.**  **[0019]** FIG. 2A is an exploded perspective view illustrating an example of the configuration of the functional component 1, FIG. 2B is a plan view of a housing case 20, and FIG. 2C is a cross-sectional view of a skirt 4. As illustrated in FIG. 2A, the functional component 1 is roughly configured by a module 6 that detects the state of the tire 10 and a housing 2 that houses the module 6. **[0045]** As illustrated in FIG. 3, the temperature sensor 62, the pressure sensor 64, the transmission circuit 68A and the reception circuit 69A of the communication unit 67, and the control circuit functioning as the control processing unit 70 described above are integrated, for example, as a module that integrates the functions in a single chip, and mounted on the surface of the substrate as the sensor unit 61. The transmission antenna 68B and the reception antenna 69B, which constitute the communication unit 67, are mounted on the surface of the substrate as an antenna unit 63, as a separate unit from the sensor unit 61, for example, on the same surface of the substrate. **[0009]** FIG. 3A is an exploded perspective view of a module.

’421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	FIG.3  **[0030]** FIG. 3 is an exploded perspective view of the module 6. The module 6 according to the present embodiment is provided with a plurality of substrates 60 and 80 as a first substrate and a second substrate, and a battery 100 that supplies the power to the substrate 60 and the substrate 80. The substrate 60 and the substrate 80 are formed in a roughly octagonal shape, for example, so as to correspond to the concave part 20A and the plurality of convex parts 20B provided in the housing case 20, and so as to be able to be housed in the housing case 20 by bringing the peripheral edges of the substrates 60 and 80 into contact with the convex portions 20B, and making protruding pieces 60 *z* and 80 *z* each protruding from a part of each of the peripheral edges to coincide with the concave portion 20A. **[0010]** FIGS. 4A to 4C are block diagrams of a basic substrate.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)





[0032] FIGS. 4A to 4C are block diagrams of the basic substrate **60**. An example of the functions set in the basic substrate **60** and the expansion substrate **80** will be described below. As illustrated in FIG. 4A, the basic substrate **60** is provided with a temperature sensor **62** as a first sensor for acquiring temperature in the air chamber of the tire **10**, a pressure sensor **64** for acquiring pressure in the air chamber, a communication unit **67** for outputting, to the outside of the tire, the detected value detected by each of the sensors **62** and **64**, and a control processing unit **70** as a first processing means for processing the information detected by the plurality of sensors **62** and **64**, and processing the operations of the plurality of sensors **62** and **64** and the communication unit **67**, and processing the exchange of information with the expansion substrate **80**.

[0033] The temperature sensor 62 and the pressure sensor 64 detect the temperature and the pressure of the air inside the tire air chamber, by the air inside the tire air chamber introduced into the housing space S through the hole 33 provided in the cap 30. The temperature sensor 62 and the pressure sensor 64 operate on the basis of signals output from the control processing unit 70.

[0034] As illustrated in FIG. 4B, the communication unit **67** is provided with a transmission section **68** and a reception section **69**. The transmission section **68** is configured roughly by a transmission circuit **68**A and a transmission antenna **68**B, and

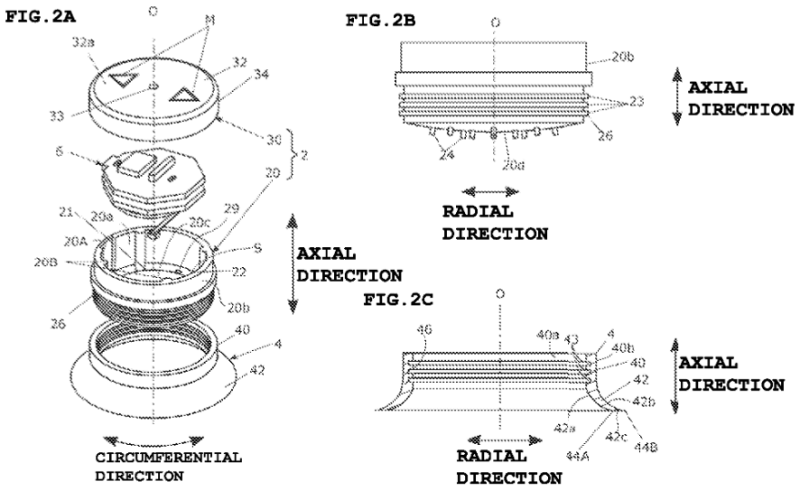
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	the reception section **69** is configured roughly by a reception circuit **69**A and a reception antenna **69**B. **[0035]** The transmitter **68** converts the information input from the control processing unit **70** into a predetermined signal by the transmission circuit **68**A, and transmits the predetermined signal from the transmission antenna **68**B to a main unit installed in a vehicle, which is not shown in the figure. The transmission section **68** operates, for example, each time the information is input from the control processing unit **70**. **[0036]** The reception section 69, when a predetermined radio wave is input to the reception antenna 69B from a functional component management device, which is not shown in the figure, for managing the functional component 1, judges that the reception circuit 69A has received the radio wave, opens a communication circuit from the outside to the control processing unit 70, and outputs the input information to the control processing unit 70. In a case where no radio wave is received for a predetermined period of time, the reception section 69 stops functioning. **[0037]** The control processing unit 70 is provided with a memory means 72 such as a memory in which programs or the like are stored, a CPU 74 that functions as an arithmetic processing means, and an input/output means 76, and operates as a so-called computer. **[0038]** The memory means 72 stores, for example, a unique identification number set in the basic substrate 60, a program for controlling the operations of the temperature sensor 62 and the pressure sensor 64, a program for causing the communication unit 67 to operate, a program for executing processing when a signal is input from the outside to the reception section 69 of the communication unit 67, and a program for controlling the expansion substrate 80, and so on. In addition, the memory means 72 stores, as a history, the information such as the temperature and the pressure inside the tire 10 detected by the temperature sensor 62 and the pressure sensor 64. **[0039]** The input/output means 76 functions as an interface for outputting signals for causing the temperature sensor 62 and the pressure sensor 64 to operate and for inputting the temperature and the pressure detected by the temperature sensor 62 and the

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	pressure sensor 64, and as an interface for enabling communication with the expansion substrate 80. **[0040]** The control processing unit 70 controls, by executing the program stored in the memory means 72 by the CPU 74, for example, the operations of the sensors that control the detection of the temperature and the pressure by the temperature sensor 62 and the pressure sensor 64, the operation of the communication unit 67, and the operation of the exchange of the information with the expansion substrate 80. **[0041]** The control processing unit 70 outputs signals to the temperature sensor 62 and the pressure sensor 64 on the basis of a sampling time set in the memory means, for example, and causes the temperature sensor 62 and the pressure sensor 64 to detect the temperature and the pressure. The control processing unit 70 converts the information of the temperature and the pressure detected by the temperature sensor 62 and the pressure sensor 64 into predetermined signals, such as digital signals, for example, and outputs the predetermined signals to the communication unit 67. **[0042]** The control processing unit 70, when the communication circuit to the reception section 69 is opened, outputs, updates, or adds the information stored in the memory means 72 on the basis of commands input by means of radio waves from the functional component management device, which is not shown in the figure, that manages the functional component 1. For example, in a case where an identification number is input from the functional component management device, the control processing unit 70 causes the memory means 72 to store the identification number, and in a case where the identification number is requested, outputs the identification number via the transmission section 68. **[0050]** As illustrated in FIG. 5B, the control processing unit 90 is provided with a memory means 92 in which programs and the like are stored, a CPU 94 that functions as an arithmetic processing means and an input/output means 96, and has functions as a so-called computer. The control processing unit 90 executes, for example, the processing for the operation of detecting the strain of the tire by the strain sensor 82 and the processing for outputting the strain detected by the strain sensor 82 in the format defined in the control processing unit 70 provided on the basic substrate 60, and also stores the strain in the memory means 92. Furthermore,

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	the control processing unit 90 operates, via the control processing unit 70, on the basis of the command input from the functional component management device, and outputs a result of the processing based on the command to the basic substrate 60. As illustrated in FIG. 3, the control processing unit 90 is configured, for example, as a one-chip computer and is mounted on the expansion substrate 80. **[0059]** Then the module 6 is housed in the housing case 20 in a state in which the battery 100 is mounted on the expansion substrate 80 which is integrated with the basic substrate 60. First, while passing the strain sensor 82 and the connecting wire 83 through the through hole 29 provided in the bottom part 21 of the housing case 20, the module 6 is placed at a predetermined position in the housing space S and the strain sensor 82 is disposed at the center of the outer bottom part 20 *d*, and the strain sensor 82 and the connecting wire 83 are fixed to the outer bottom surface 20 *d* by a fixing means such as an adhesive agent. **[0060]** Next, a filler 50 is filled in the housing space S in which the module 6 is housed and by letting the filler 50 to harden, the basic substrate 60 and the expansion substrate 80 are fixed, and the expansion substrate 80 and the battery 100 are fixed. As a result, the module 6 composed of the basic substrate 60, the expansion substrate 80 and the battery 100 which are fixed to each other by the filler 50 is fixed to the housing case 20, and the through hole 29 provided in the bottom part 21 is closed. As to a position where the filler 50 is to be filled, since the temperature sensor 62 and the pressure sensor 64 are integrated as the sensor unit 61, the filler 50 may be filled up to a position not reaching the upper surface of the sensor unit 61, for example, so as not to block the air intake hole provided in the sensor unit 61. For the filler 50, a material made of synthetic resin, for example, is suitable. As the material of the filler 50, a material capable of waterproofing, dustproofing, and protecting the substrate with respect to the module 6 housed in the housing 2 may be used, for example, there may be mentioned synthetic resin such as urethane-based resin or epoxy-based resin. By applying such a material to the filler 50, the filler 50 can maintain sufficient resistance to the forces received from the battery 100, the basic substrate 60 and the expansion substrate 80 when the tire 10 is rotating, especially even when rotating at a high speed. In particular, by using the epoxy-based resin, weather resistance can further be improved in addition to the waterproofing, the dustproofing and the substrate protection.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0063] FIGS. 9A and 9B are block diagrams illustrating another forms of the expansion substrate 80. In the above-described embodiment, it has been explained that the strain sensor 82 is mounted on the expansion substrate 80, however, without being limited to this, the functions to be mounted on the expansion substrate 80 may be set as required. Namely, it may be an acceleration sensor, or as illustrated in FIG. 9A, it may be a pressure sensor 82 for high pressure that measures a higher-pressure range than the pressure sensor 64 provided on the basic substrate 60, or in a case where water is injected into the tire air chamber, such as in the case of tires for heavy duty vehicles used in mines or the like, it may be a pressure sensor 82 for water pressure or the like. In any cases, it is preferable to configure such that the expansion substrate 80 is provided with a control processing unit 90 associated with each sensor, and the information detected by the sensors are output to the basic substrate 60 in a format which can be handled by the control processing unit 70 of the basic substrate 60. Furthermore, by storing the information detected by the expansion substrate 80 in the memory means 92 of the control processing unit 90 provided on the expansion substrate 80, the burden on the memory means 72 of the basic substrate 60 can be reduced. With this configuration, the capacity of the memory means 72 can be made smaller, that is, the memory as the memory means 72 can be made small-sized.
[1e] a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.	*Yamaguchi-566 discloses, teaches, and/or suggests a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, above. **[0008]** FIGS. 2A to 2C are respectively an exploded perspective view of the functional component, a plan view and a partial sectional view of a housing case**.**

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[0019] FIG. 2A is an exploded perspective view illustrating an example of the configuration of the functional component 1, FIG. 2B is a plan view of a housing case 20, and FIG. 2C is a cross-sectional view of a skirt 4. As illustrated in FIG. 2A, the functional component 1 is roughly configured by a module 6 that detects the state of the tire 10 and a housing 2 that houses the module 6.

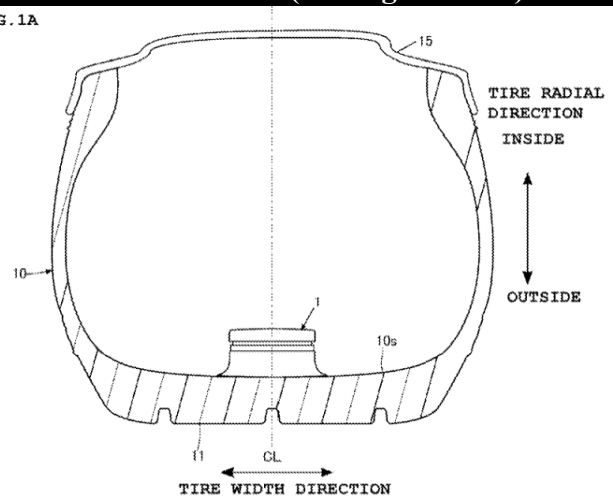
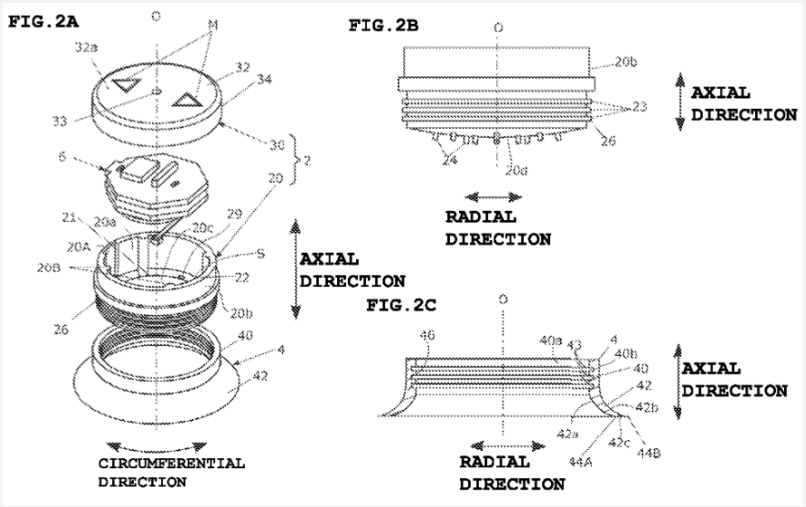
[0020] The housing 2 is provided with a housing case 20 having a housing space S (housing section) for the module 6, and a cap 30 that functions as a lid for the housing case 20, and is formed generally in a disk shape by combining the housing case 20 and the cap 30 together.

[0021] The housing case 20 is formed into a bottomed cylindrical shape with an opening on one side, by a circular bottom part 21 and a peripheral wall part 22 which extends along the outer periphery from an outer peripheral edge of the bottom part 21 and rises up annularly from the bottom part 21. A housing space S capable of housing the module 6 is formed by an inner bottom surface 20 *c* of the bottom part 21 and an inner peripheral surface 20 *a* of the peripheral wall part 22. In the following description, the description will be made with the use of terms such as an axial direction, a circumferential direction, and a radial direction and so on while taking an axis O of the peripheral wall part 22 as a reference.

[0022] On the inner peripheral surface 20 *a* of the peripheral wall part 22, a concave part 20A recessed outwardly in the radial direction relative to the axis O and a plurality of convex parts 20B protruding toward the direction of the axis O and extending along

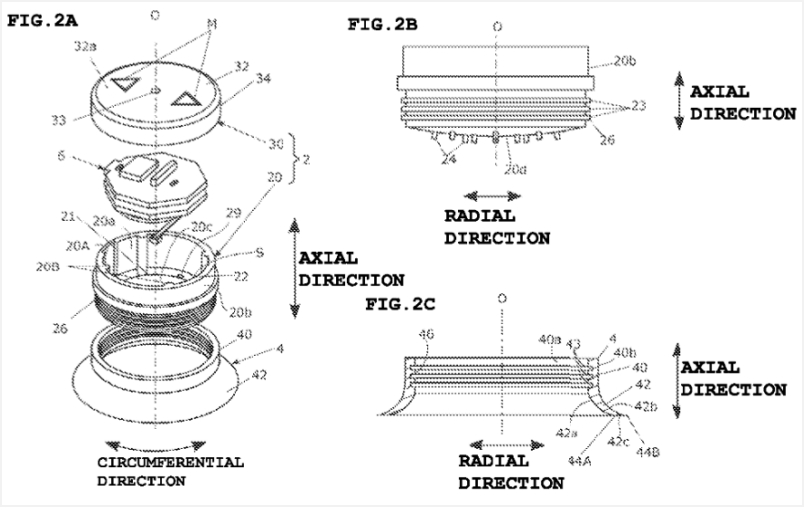
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	the axis O are formed so as to position the module 6 housed in the housing space S at a predetermined position. The bottom part 21 of the housing case 20 is provided with a through hole 29 that penetrates from the inner bottom surface 20 *c* to an outer bottom surface 20 *d*. Furthermore, the inner bottom surface 20 *c* of the bottom part 21 is provided with a support means such as a protrusion, which is not shown in the figure, that supports the module 6 housed in the housing space S from a lower side. **[0023]** As illustrated in FIG. 2B, the outer bottom surface 20 *d* of the bottom part 21 is formed, for example, in a spherical shape, of which center of curvature is set on the axis O and the central part of the outer bottom surface 20 *d* is protruded outwardly in the axial direction than the outer peripheral edge side of the outer bottom surface 20 *d*. Incidentally, the shape of the outer bottom surface 20 *d* described above is not limited to the spherical shape, but may be set appropriately. On the outer bottom surface 20 *d*, a plurality of convex parts 24 are formed which protrude from the outer bottom surface 20 *d* toward the inner peripheral surface 10 *s* of the tire 10. The plurality of convex parts 24 are formed so as to be, for example, arranged radially about the axis O of the outer bottom surface 20 *d* and at equal intervals in the circumferential direction (equal intervals around the axis O), and so as to extend in the normal direction of the outer bottom surface 20 *d*. The extension length of the convex parts 24 may be set to be, for example, a length that does not protrude beyond a tip end part 44A of a skirt 4, which is described later, when the skirt 4 is attached to the housing 2. The plurality of convex parts 24 may be formed to be, for example, a columnar shape such as a pillar shape or a pyramidal shape, or a combination of these shapes, or instead of the convex parts 24, concave parts may be formed that recess from the outer bottom surface 20 *d* toward the inner bottom surface 20 *c* side, or the convex parts and the concave parts may also be combined. **[0024]** A skirt attachment part 26 for attaching the skirt 4 described later is provided on the outer periphery surface 20 *b* of the peripheral wall part 22. The skirt attachment part 26 is configured, for example, by a plurality of annular convex parts 23 provided on the lower half of the peripheral wall part 22. The annular convex part 23 is an annular body extending over the circumferential direction of the outer circumferential surface 20 *b*, and is provided in plural numbers at predetermined intervals (three in this embodiment) in the axial direction. The

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	annular convex part 23 may be configured to extend intermittently in the circumferential direction without extending over the entire circumference. **[0025]** As illustrated in FIG. 2C, the skirt 4 is provided with a cylindrical part 40 cylindrically formed to be able to enclose the skirt attachment part 26, and an enlarged part 42 extending from the cylindrical part 40 toward the inner peripheral surface 10 *s* side. On an inner peripheral surface 40 *a* of the cylindrical part 40, an annular concave part 43 extending along the circumferential direction and recessed in the radial direction is formed in plural numbers to provide a case attachment part 46 to be fitted with the annular convex parts 23 constituting the skirt attachment part 26 formed on the outer circumference of the housing case 20. **[0026]** The enlarged part 42 is formed in a fun-like trumpet shape and is continuous from the tubular part 40. An inner peripheral surface 42 *a* of the enlarged part 42 is formed as a curved surface that, in the axial cross section, gradually expands in diameter from the outer peripheral edge of the outer bottom surface 20 *d* of the housing case 20 toward the inner peripheral surface 10 *s* side of the tire 10. Furthermore, an outer peripheral surface 42 *b* is formed as a curved surface and is smoothly continuous with the outer peripheral surface 40 *b* of the tubular part 40 and gradually expands in diameter toward the inner peripheral surface 10 *s* of the tire 10. The thickness of the enlarged part 42 formed by the inner peripheral surface 42 *a* and the outer peripheral surface 42 *b* is set in a tapered shape so that the thicknesses gradually become thinner toward axial direction end parts on the inner peripheral surface 10 *s* side. The tip end 44A of the inner peripheral surface 42 *a* and a tip end 44B of the outer peripheral surface 42 *b* are connected via a flat surface 42 *c*. That is, the flat surface 42 *c* is an annular surface enclosed by the tip end 44A of the inner peripheral surface 42 *a*, the tip end 44B of the outer peripheral surface 42 *b* and a plane perpendicular to the axis O. **[0027]** The skirt 4, by being attached to the skirt attachment part 26 of the housing case 20, extends from the outer bottom surface 20 *d* of the housing 2 toward the inner peripheral surface 10 *s* side of the tire 10 (in the direction away from the outer bottom surface 20 *d*).

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	FIG.1A 
2. The sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member assembly. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, above.  **[0028]** As illustrated in FIG. 2A, the cap 30 is provided with a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 *a* of the ceiling part 32, attachment marks M are formed that indicate a direction for attaching the functional component 1 to the tire 10. The attachment marks M are formed, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M indicate that the functional

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	component 1 is to be attached on the inner peripheral surface 10 *s* of the tire 10 in such a manner that the arrows are oriented in the tire circumferential direction. Incidentally, the direction indicated by the attachment marks M may be set appropriately in correspondence with a detection direction of the module 6. A hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 functions as an introduction hole for taking in air inside the tire into the housing space S of the housing case 20 when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 *b* of the peripheral wall part 22 of the housing case 20. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 *a* are oriented in a predetermined direction with respect to the housing case 20. **[0029]** For the above-described housing case 20 and the cap 30, a material such as synthetic resin or the like is suitable, for example, from the viewpoint of weight reduction and the strength of the functional component 1. For the skirt 4, an elastic material made of elastomer such as rubber, or resin or the like having flexibility is preferable. **[0061]** The functional component 1 configured as described above is bonded to the inner peripheral surface 10 *s* of the tire 10 by filling the adhesive agent in the cup-shaped space formed by the inner peripheral surface 42 *a* of the skirt 4 attached to the outer circumference of the housing 2 and the outer bottom surface 20 *d* of the housing 2. In other words, the strain sensor 82 is adhered to the inner peripheral surface 10 *s* of the tire 10 in a state of being embedded in the adhesive agent.
5. The sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, above. **[0022]** On the inner peripheral surface 20 *a* of the peripheral wall part 22, a concave part 20A recessed outwardly in the radial direction relative to the axis O and a plurality of convex parts 20B

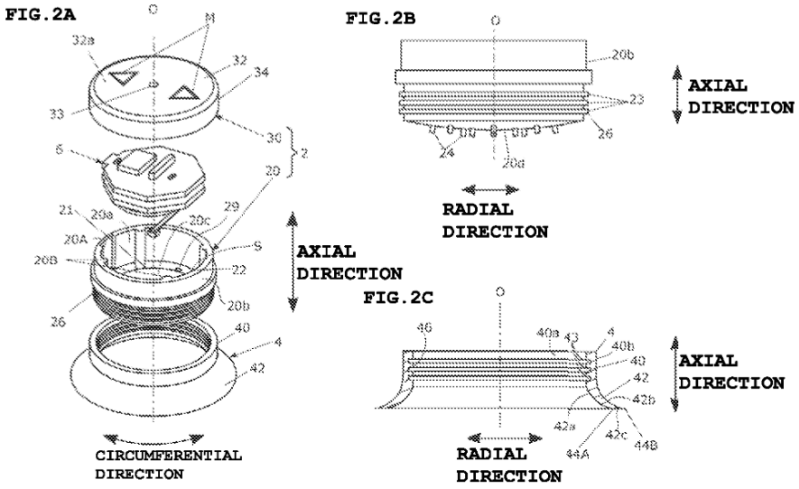
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	protruding toward the direction of the axis O and extending along the axis O are formed so as to position the module 6 housed in the housing space S at a predetermined position. The bottom part 21 of the housing case 20 is provided with a through hole 29 that penetrates from the inner bottom surface 20 *c* to an outer bottom surface 20 *d*. Furthermore, the inner bottom surface 20 *c* of the bottom part 21 is provided with a support means such as a protrusion, which is not shown in the figure, that supports the module 6 housed in the housing space S from a lower side. **[0059]** Then the module 6 is housed in the housing case 20 in a state in which the battery 100 is mounted on the expansion substrate 80 which is integrated with the basic substrate 60. First, while passing the strain sensor 82 and the connecting wire 83 through the through hole 29 provided in the bottom part 21 of the housing case 20, the module 6 is placed at a predetermined position in the housing space S and the strain sensor 82 is disposed at the center of the outer bottom part 20 *d*, and the strain sensor 82 and the connecting wire 83 are fixed to the outer bottom surface 20 *d* by a fixing means such as an adhesive agent. **[0060]** Next, a filler 50 is filled in the housing space S in which the module 6 is housed and by letting the filler 50 to harden, the basic substrate 60 and the expansion substrate 80 are fixed, and the expansion substrate 80 and the battery 100 are fixed. As a result, the module 6 composed of the basic substrate 60, the expansion substrate 80 and the battery 100 which are fixed to each other by the filler 50 is fixed to the housing case 20, and the through hole 29 provided in the bottom part 21 is closed. As to a position where the filler 50 is to be filled, since the temperature sensor 62 and the pressure sensor 64 are integrated as the sensor unit 61, the filler 50 may be filled up to a position not reaching the upper surface of the sensor unit 61, for example, so as not to block the air intake hole provided in the sensor unit 61. For the filler 50, a material made of synthetic resin, for example, is suitable. As the material of the filler 50, a material capable of waterproofing, dustproofing, and protecting the substrate with respect to the module 6 housed in the housing 2 may be used, for example, there may be mentioned synthetic resin such as urethane-based resin or epoxy-based resin. By applying such a material to the filler 50, the filler 50 can maintain sufficient resistance to the forces received from the battery 100, the basic substrate 60 and the expansion substrate 80 when the tire 10 is rotating, especially even when

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	rotating at a high speed. In particular, by using the epoxy-based resin, weather resistance can further be improved in addition to the waterproofing, the dustproofing and the substrate protection.
7. The sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, above. **[0008]** FIGS. 2A to 2C are respectively an exploded perspective view of the functional component, a plan view and a partial sectional view of a housing case**.**  **[0019]** FIG. 2A is an exploded perspective view illustrating an example of the configuration of the functional component 1, FIG. 2B is a plan view of a housing case 20, and FIG. 2C is a cross-sectional view of a skirt 4. As illustrated in FIG. 2A, the functional component 1 is roughly configured by a module 6 that detects the state of the tire 10 and a housing 2 that houses the module 6. **[0020]** The housing 2 is provided with a housing case 20 having a housing space S (housing section) for the module 6, and a cap 30 that functions as a lid for the housing case 20, and is formed generally in a disk shape by combining the housing case 20 and the cap 30 together. **[0021]** The housing case 20 is formed into a bottomed cylindrical shape with an opening on one side, by a circular bottom

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	part 21 and a peripheral wall part 22 which extends along the outer periphery from an outer peripheral edge of the bottom part 21 and rises up annularly from the bottom part 21. A housing space S capable of housing the module 6 is formed by an inner bottom surface 20 *c* of the bottom part 21 and an inner peripheral surface 20 *a* of the peripheral wall part 22. In the following description, the description will be made with the use of terms such as an axial direction, a circumferential direction, and a radial direction and so on while taking an axis O of the peripheral wall part 22 as a reference. **[0022]** On the inner peripheral surface 20 *a* of the peripheral wall part 22, a concave part 20A recessed outwardly in the radial direction relative to the axis O and a plurality of convex parts 20B protruding toward the direction of the axis O and extending along the axis O are formed so as to position the module 6 housed in the housing space S at a predetermined position. The bottom part 21 of the housing case 20 is provided with a through hole 29 that penetrates from the inner bottom surface 20 *c* to an outer bottom surface 20 *d*. Furthermore, the inner bottom surface 20 *c* of the bottom part 21 is provided with a support means such as a protrusion, which is not shown in the figure, that supports the module 6 housed in the housing space S from a lower side. **[0023]** As illustrated in FIG. 2B, the outer bottom surface 20 *d* of the bottom part 21 is formed, for example, in a spherical shape, of which center of curvature is set on the axis O and the central part of the outer bottom surface 20 *d* is protruded outwardly in the axial direction than the outer peripheral edge side of the outer bottom surface 20 *d*. Incidentally, the shape of the outer bottom surface 20 *d* described above is not limited to the spherical shape, but may be set appropriately. On the outer bottom surface 20 *d*, a plurality of convex parts 24 are formed which protrude from the outer bottom surface 20 *d* toward the inner peripheral surface 10 *s* of the tire 10. The plurality of convex parts 24 are formed so as to be, for example, arranged radially about the axis O of the outer bottom surface 20 *d* and at equal intervals in the circumferential direction (equal intervals around the axis O), and so as to extend in the normal direction of the outer bottom surface 20 *d*. The extension length of the convex parts 24 may be set to be, for example, a length that does not protrude beyond a tip end part 44A of a skirt 4, which is described later, when the skirt 4 is attached to the housing 2. The plurality of convex parts 24 may be formed to be, for example, a columnar shape such

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	as a pillar shape or a pyramidal shape, or a combination of these shapes, or instead of the convex parts 24, concave parts may be formed that recess from the outer bottom surface 20 *d* toward the inner bottom surface 20 *c* side, or the convex parts and the concave parts may also be combined. **[0024]** A skirt attachment part 26 for attaching the skirt 4 described later is provided on the outer periphery surface 20 *b* of the peripheral wall part 22. The skirt attachment part 26 is configured, for example, by a plurality of annular convex parts 23 provided on the lower half of the peripheral wall part 22. The annular convex part 23 is an annular body extending over the circumferential direction of the outer circumferential surface 20 *b*, and is provided in plural numbers at predetermined intervals (three in this embodiment) in the axial direction. The annular convex part 23 may be configured to extend intermittently in the circumferential direction without extending over the entire circumference. **[0025]** As illustrated in FIG. 2C, the skirt 4 is provided with a cylindrical part 40 cylindrically formed to be able to enclose the skirt attachment part 26, and an enlarged part 42 extending from the cylindrical part 40 toward the inner peripheral surface 10 *s* side. On an inner peripheral surface 40 *a* of the cylindrical part 40, an annular concave part 43 extending along the circumferential direction and recessed in the radial direction is formed in plural numbers to provide a case attachment part 46 to be fitted with the annular convex parts 23 constituting the skirt attachment part 26 formed on the outer circumference of the housing case 20. **[0026]** The enlarged part 42 is formed in a fun-like trumpet shape and is continuous from the tubular part 40. An inner peripheral surface 42 *a* of the enlarged part 42 is formed as a curved surface that, in the axial cross section, gradually expands in diameter from the outer peripheral edge of the outer bottom surface 20 *d* of the housing case 20 toward the inner peripheral surface 10 *s* side of the tire 10. Furthermore, an outer peripheral surface 42 *b* is formed as a curved surface and is smoothly continuous with the outer peripheral surface 40 *b* of the tubular part 40 and gradually expands in diameter toward the inner peripheral surface 10 *s* of the tire 10. The thickness of the enlarged part 42 formed by the inner peripheral surface 42 *a* and the outer peripheral surface 42 *b* is set in a tapered shape so that the thicknesses gradually become thinner toward axial direction end parts on the

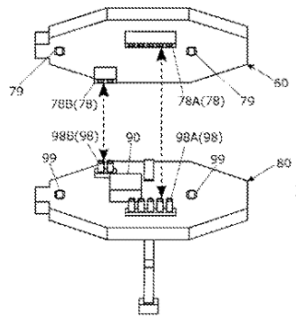
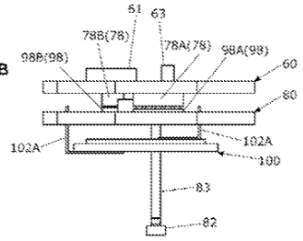
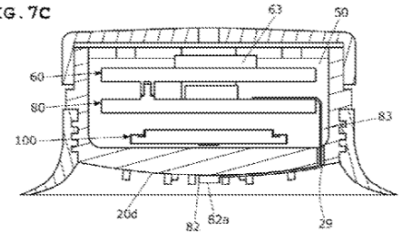
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	inner peripheral surface 10 *s* side. The tip end 44A of the inner peripheral surface 42 *a* and a tip end 44B of the outer peripheral surface 42 *b* are connected via a flat surface 42 *c*. That is, the flat surface 42 *c* is an annular surface enclosed by the tip end 44A of the inner peripheral surface 42 *a*, the tip end 44B of the outer peripheral surface 42 *b* and a plane perpendicular to the axis O. **[0027]** The skirt 4, by being attached to the skirt attachment part 26 of the housing case 20, extends from the outer bottom surface 20 *d* of the housing 2 toward the inner peripheral surface 10 *s* side of the tire 10 (in the direction away from the outer bottom surface 20 *d*). **[0028]** As illustrated in FIG. 2A, the cap 30 is provided with a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 *a* of the ceiling part 32, attachment marks M are formed that indicate a direction for attaching the functional component 1 to the tire 10. The attachment marks M are formed, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M indicate that the functional component 1 is to be attached on the inner peripheral surface 10 *s* of the tire 10 in such a manner that the arrows are oriented in the tire circumferential direction. Incidentally, the direction indicated by the attachment marks M may be set appropriately in correspondence with a detection direction of the module 6. A hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 functions as an introduction hole for taking in air inside the tire into the housing space S of the housing case 20 when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 *b* of the peripheral wall part 22 of the housing case 20. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 *a* are oriented in a predetermined direction with respect to the housing case 20. **[0029]** For the above-described housing case 20 and the cap 30, a material such as synthetic resin or the like is suitable, for example, from the viewpoint of weight reduction and the strength of the functional component 1. For the skirt 4, an elastic material made of elastomer such as rubber, or resin or the like having flexibility is preferable.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
8. The sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **1[e]**, above. **[0008]** FIGS. 2A to 2C are respectively an exploded perspective view of the functional component, a plan view and a partial sectional view of a housing case**.**  **[0019]** FIG. 2A is an exploded perspective view illustrating an example of the configuration of the functional component 1, FIG. 2B is a plan view of a housing case 20, and FIG. 2C is a cross-sectional view of a skirt 4. As illustrated in FIG. 2A, the functional component 1 is roughly configured by a module 6 that detects the state of the tire 10 and a housing 2 that houses the module 6. **[0020]** The housing 2 is provided with a housing case 20 having a housing space S (housing section) for the module 6, and a cap 30 that functions as a lid for the housing case 20, and is formed generally in a disk shape by combining the housing case 20 and the cap 30 together.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0021] The housing case 20 is formed into a bottomed cylindrical shape with an opening on one side, by a circular bottom part 21 and a peripheral wall part 22 which extends along the outer periphery from an outer peripheral edge of the bottom part 21 and rises up annularly from the bottom part 21. A housing space S capable of housing the module 6 is formed by an inner bottom surface 20 *c* of the bottom part 21 and an inner peripheral surface 20 *a* of the peripheral wall part 22. In the following description, the description will be made with the use of terms such as an axial direction, a circumferential direction, and a radial direction and so on while taking an axis O of the peripheral wall part 22 as a reference. **[0022]** On the inner peripheral surface 20 *a* of the peripheral wall part 22, a concave part 20A recessed outwardly in the radial direction relative to the axis O and a plurality of convex parts 20B protruding toward the direction of the axis O and extending along the axis O are formed so as to position the module 6 housed in the housing space S at a predetermined position. The bottom part 21 of the housing case 20 is provided with a through hole 29 that penetrates from the inner bottom surface 20 *c* to an outer bottom surface 20 *d*. Furthermore, the inner bottom surface 20 *c* of the bottom part 21 is provided with a support means such as a protrusion, which is not shown in the figure, that supports the module 6 housed in the housing space S from a lower side. **[0023]** As illustrated in FIG. 2B, the outer bottom surface 20 *d* of the bottom part 21 is formed, for example, in a spherical shape, of which center of curvature is set on the axis O and the central part of the outer bottom surface 20 *d* is protruded outwardly in the axial direction than the outer peripheral edge side of the outer bottom surface 20 *d*. Incidentally, the shape of the outer bottom surface 20 *d* described above is not limited to the spherical shape, but may be set appropriately. On the outer bottom surface 20 *d*, a plurality of convex parts 24 are formed which protrude from the outer bottom surface 20 *d* toward the inner peripheral surface 10 *s* of the tire 10. The plurality of convex parts 24 are formed so as to be, for example, arranged radially about the axis O of the outer bottom surface 20 *d* and at equal intervals in the circumferential direction (equal intervals around the axis O), and so as to extend in the normal direction of the outer bottom surface 20 *d*. The extension length of the convex parts 24 may be set to be, for example, a length that does not protrude beyond a tip end part 44A of a skirt 4, which is described later, when the

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	skirt 4 is attached to the housing 2. The plurality of convex parts 24 may be formed to be, for example, a columnar shape such as a pillar shape or a pyramidal shape, or a combination of these shapes, or instead of the convex parts 24, concave parts may be formed that recess from the outer bottom surface 20 *d* toward the inner bottom surface 20 *c* side, or the convex parts and the concave parts may also be combined. **[0024]** A skirt attachment part 26 for attaching the skirt 4 described later is provided on the outer periphery surface 20 *b* of the peripheral wall part 22. The skirt attachment part 26 is configured, for example, by a plurality of annular convex parts 23 provided on the lower half of the peripheral wall part 22. The annular convex part 23 is an annular body extending over the circumferential direction of the outer circumferential surface 20 *b*, and is provided in plural numbers at predetermined intervals (three in this embodiment) in the axial direction. The annular convex part 23 may be configured to extend intermittently in the circumferential direction without extending over the entire circumference. **[0025]** As illustrated in FIG. 2C, the skirt 4 is provided with a cylindrical part 40 cylindrically formed to be able to enclose the skirt attachment part 26, and an enlarged part 42 extending from the cylindrical part 40 toward the inner peripheral surface 10 *s* side. On an inner peripheral surface 40 *a* of the cylindrical part 40, an annular concave part 43 extending along the circumferential direction and recessed in the radial direction is formed in plural numbers to provide a case attachment part 46 to be fitted with the annular convex parts 23 constituting the skirt attachment part 26 formed on the outer circumference of the housing case 20. **[0026]** The enlarged part 42 is formed in a fun-like trumpet shape and is continuous from the tubular part 40. An inner peripheral surface 42 *a* of the enlarged part 42 is formed as a curved surface that, in the axial cross section, gradually expands in diameter from the outer peripheral edge of the outer bottom surface 20 *d* of the housing case 20 toward the inner peripheral surface 10 *s* side of the tire 10. Furthermore, an outer peripheral surface 42 *b* is formed as a curved surface and is smoothly continuous with the outer peripheral surface 40 *b* of the tubular part 40 and gradually expands in diameter toward the inner peripheral surface 10 *s* of the tire 10. The thickness of the enlarged part 42 formed by the inner peripheral surface 42 *a* and the outer peripheral

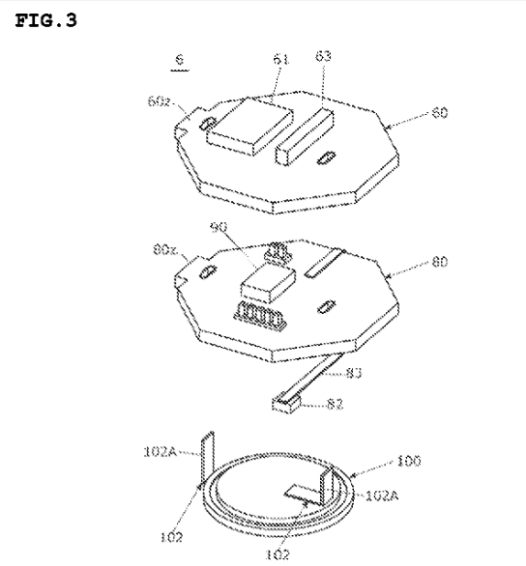
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	surface 42 *b* is set in a tapered shape so that the thicknesses gradually become thinner toward axial direction end parts on the inner peripheral surface 10 *s* side. The tip end 44A of the inner peripheral surface 42 *a* and a tip end 44B of the outer peripheral surface 42 *b* are connected via a flat surface 42 *c*. That is, the flat surface 42 *c* is an annular surface enclosed by the tip end 44A of the inner peripheral surface 42 *a*, the tip end 44B of the outer peripheral surface 42 *b* and a plane perpendicular to the axis O. **[0027]** The skirt 4, by being attached to the skirt attachment part 26 of the housing case 20, extends from the outer bottom surface 20 *d* of the housing 2 toward the inner peripheral surface 10 *s* side of the tire 10 (in the direction away from the outer bottom surface 20 *d*). **[0028]** As illustrated in FIG. 2A, the cap 30 is provided with a circular ceiling part 32 and a peripheral wall part 34 extending along an outer peripheral edge of the ceiling part 32. On an outer side surface 32 *a* of the ceiling part 32, attachment marks M are formed that indicate a direction for attaching the functional component 1 to the tire 10. The attachment marks M are formed, for example, by engraving or printing. As illustrated in FIG. 1B, the attachment marks M indicate that the functional component 1 is to be attached on the inner peripheral surface 10 *s* of the tire 10 in such a manner that the arrows are oriented in the tire circumferential direction. Incidentally, the direction indicated by the attachment marks M may be set appropriately in correspondence with a detection direction of the module 6. A hole 33 penetrating in the axis O direction is formed in the ceiling part 32. The hole 33 functions as an introduction hole for taking in air inside the tire into the housing space S of the housing case 20 when the opening of the housing case 20 is closed by the cap 30. The peripheral wall part 34 has an inner diameter capable of enclosing the outer periphery of the outer peripheral surface 20 *b* of the peripheral wall part 22 of the housing case 20. The cap 30 configured as described above is integrated with the housing case 20 by a fitting and fixing means or the like, which is not shown in the figure, in a state in which the attachment marks M provided on the outer side surface 32 *a* are oriented in a predetermined direction with respect to the housing case 20. **[0029]** For the above-described housing case 20 and the cap 30, a material such as synthetic resin or the like is suitable, for example, from the viewpoint of weight reduction and the strength of the functional component 1. For the skirt 4, an elastic material

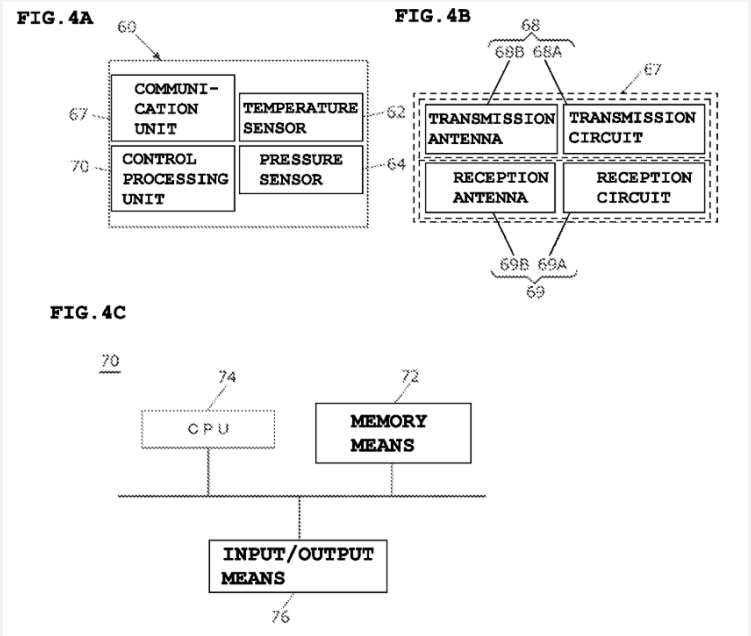
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	made of elastomer such as rubber, or resin or the like having flexibility is preferable. **[0013]** FIGS. 7A to 7C are diagrams roughly illustrating the assembly process of the functional component. FIG. 7A  FIG. 7B  FIG. 7C 
9. The sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **1[e]**, above. **[0029]** For the above-described housing case 20 and the cap 30, a material such as synthetic resin or the like is suitable, for example, from the viewpoint of weight reduction and the strength of the functional component 1. For the skirt 4, an elastic material made of elastomer such as rubber, or resin or the like having flexibility is preferable.
10. The sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, above.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
into the internal cavity before reaching the electrical sensor device.	**[0022]** On the inner peripheral surface 20 *a* of the peripheral wall part 22, a concave part 20A recessed outwardly in the radial direction relative to the axis O and a plurality of convex parts 20B protruding toward the direction of the axis O and extending along the axis O are formed so as to position the module 6 housed in the housing space S at a predetermined position. The bottom part 21 of the housing case 20 is provided with a through hole 29 that penetrates from the inner bottom surface 20 *c* to an outer bottom surface 20 *d*. Furthermore, the inner bottom surface 20 *c* of the bottom part 21 is provided with a support means such as a protrusion, which is not shown in the figure, that supports the module 6 housed in the housing space S from a lower side. **[0060]** Next, a filler 50 is filled in the housing space S in which the module 6 is housed and by letting the filler 50 to harden, the basic substrate 60 and the expansion substrate 80 are fixed, and the expansion substrate 80 and the battery 100 are fixed. As a result, the module 6 composed of the basic substrate 60, the expansion substrate 80 and the battery 100 which are fixed to each other by the filler 50 is fixed to the housing case 20, and the through hole 29 provided in the bottom part 21 is closed. As to a position where the filler 50 is to be filled, since the temperature sensor 62 and the pressure sensor 64 are integrated as the sensor unit 61, the filler 50 may be filled up to a position not reaching the upper surface of the sensor unit 61, for example, so as not to block the air intake hole provided in the sensor unit 61. For the filler 50, a material made of synthetic resin, for example, is suitable. As the material of the filler 50, a material capable of waterproofing, dustproofing, and protecting the substrate with respect to the module 6 housed in the housing 2 may be used, for example, there may be mentioned synthetic resin such as urethane-based resin or epoxy-based resin. By applying such a material to the filler 50, the filler 50 can maintain sufficient resistance to the forces received from the battery 100, the basic substrate 60 and the expansion substrate 80 when the tire 10 is rotating, especially even when rotating at a high speed. In particular, by using the epoxy-based resin, weather resistance can further be improved in addition to the waterproofing, the dustproofing and the substrate protection.
11. A sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system	*Yamaguchi-566 discloses, teaches, and/or suggests a sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object*

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication.	*and that is configured to receive data from the electrical sensor device by wireless communication. For example:* *See, e.g.,* **1**, above. **[0018]** The functional component 1 is so configured as to be able to detect information indicative of states of the tire 10, including the pressure and temperature of the air filled in a closed space (hereinafter referred to as the tire air chamber) formed by assembling the tire 10 to a wheel rim 15, and transmit the detected information to, for example, a main unit provided in a vehicle which is not shown in the figure. **[0035]** The transmitter **68** converts the information input from the control processing unit **70** into a predetermined signal by the transmission circuit **68**A, and transmits the predetermined signal from the transmission antenna **68**B to a main unit installed in a vehicle, which is not shown in the figure. The transmission section **68** operates, for example, each time the information is input from the control processing unit **70**. **[0036]** The reception section 69, when a predetermined radio wave is input to the reception antenna 69B from a functional component management device, which is not shown in the figure, for managing the functional component 1, judges that the reception circuit 69A has received the radio wave, opens a communication circuit from the outside to the control processing unit 70, and outputs the input information to the control processing unit 70. In a case where no radio wave is received for a predetermined period of time, the reception section 69 stops functioning. **[0042]** The control processing unit 70, when the communication circuit to the reception section 69 is opened, outputs, updates, or adds the information stored in the memory means 72 on the basis of commands input by means of radio waves from the functional component management device, which is not shown in the figure, that manages the functional component 1. For example, in a case where an identification number is input from the functional component management device, the control processing unit 70 causes the memory means 72 to store the identification number, and in a case where the identification number is requested, outputs the identification number via the transmission section 68.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
12. The sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.,* **1**, **11**, above. **[0063]** FIGS. 9A and 9B are block diagrams illustrating another forms of the expansion substrate 80. In the above-described embodiment, it has been explained that the strain sensor 82 is mounted on the expansion substrate 80, however, without being limited to this, the functions to be mounted on the expansion substrate 80 may be set as required. Namely, it may be an acceleration sensor, or as illustrated in FIG. 9A, it may be a pressure sensor 82 for high pressure that measures a higher-pressure range than the pressure sensor 64 provided on the basic substrate 60, or in a case where water is injected into the tire air chamber, such as in the case of tires for heavy duty vehicles used in mines or the like, it may be a pressure sensor 82 for water pressure or the like. In any cases, it is preferable to configure such that the expansion substrate 80 is provided with a control processing unit 90 associated with each sensor, and the information detected by the sensors are output to the basic substrate 60 in a format which can be handled by the control processing unit 70 of the basic substrate 60. Furthermore, by storing the information detected by the expansion substrate 80 in the memory means 92 of the control processing unit 90 provided on the expansion substrate 80, the burden on the memory means 72 of the basic substrate 60 can be reduced. With this configuration, the capacity of the memory means 72 can be made smaller, that is, the memory as the memory means 72 can be made small-sized.
20. The sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device. For example:* *See, e.g.,* **1**, **11**, **12**, above. **[0009]** FIG. 3A is an exploded perspective view of a module.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
information from the electrical sensor device.	 **[0030]** FIG. 3 is an exploded perspective view of the module 6. The module 6 according to the present embodiment is provided with a plurality of substrates 60 and 80 as a first substrate and a second substrate, and a battery 100 that supplies the power to the substrate 60 and the substrate 80. The substrate 60 and the substrate 80 are formed in a roughly octagonal shape, for example, so as to correspond to the concave part 20A and the plurality of convex parts 20B provided in the housing case 20, and so as to be able to be housed in the housing case 20 by bringing the peripheral edges of the substrates 60 and 80 into contact with the convex portions 20B, and making protruding pieces 60 *z* and 80 *z* each protruding from a part of each of the peripheral edges to coincide with the concave portion 20A. **[0031]** The substrate 60 and the substrate 80 are each configured to have a different function for detecting the state of the tire 10. For example, the substrate 60 is provided with a detection means that detects, as basic information, whether or not the tire 10 is in a normal state, and the substrate 80 is provided, in order to add extended functionality, with a detection means that detects, in addition to the information detected by the substrate 60, another state of the tire 10. Hereinafter, the substrate 60 is referred to as the basic substrate 60 and the substrate 80B is referred to as the expansion substrate 80. **[0045]** As illustrated in FIG. 3, the temperature sensor 62, the pressure sensor 64, the transmission circuit 68A and the reception circuit 69A of the communication unit 67, and the control circuit

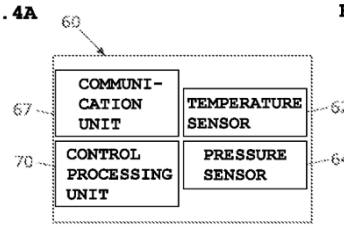
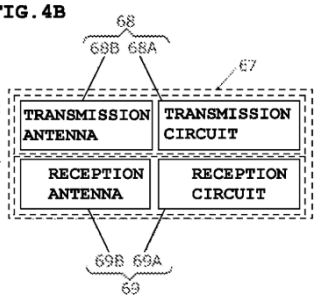
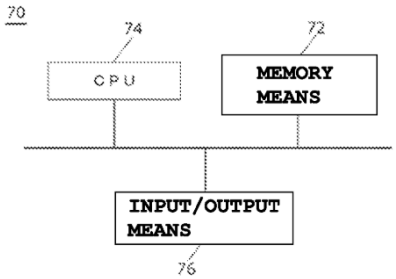
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	functioning as the control processing unit 70 described above are integrated, for example, as a module that integrates the functions in a single chip, and mounted on the surface of the substrate as the sensor unit 61. The transmission antenna 68B and the reception antenna 69B, which constitute the communication unit 67, are mounted on the surface of the substrate as an antenna unit 63, as a separate unit from the sensor unit 61, for example, on the same surface of the substrate. **[0010]** FIGS. 4A to 4C are block diagrams of a basic substrate.  **[0032]** FIGS. 4A to 4C are block diagrams of the basic substrate **60**. An example of the functions set in the basic substrate **60** and the expansion substrate **80** will be described below. As illustrated in FIG. 4A, the basic substrate **60** is provided with a temperature sensor **62** as a first sensor for acquiring temperature in the air chamber of the tire **10**, a pressure sensor **64** for acquiring pressure in the air chamber, a communication unit **67** for outputting, to the outside of the tire, the detected value detected by each of the sensors **62** and **64**, and a control processing unit **70** as a first processing means for processing the information detected by the plurality of sensors **62** and **64**, and processing the operations of the plurality of sensors **62** and **64** and the communication unit **67**, and processing the exchange of information with the expansion substrate **80**.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0033] The temperature sensor 62 and the pressure sensor 64 detect the temperature and the pressure of the air inside the tire air chamber, by the air inside the tire air chamber introduced into the housing space S through the hole 33 provided in the cap 30. The temperature sensor 62 and the pressure sensor 64 operate on the basis of signals output from the control processing unit 70. **[0034]** As illustrated in FIG. 4B, the communication unit **67** is provided with a transmission section **68** and a reception section **69**. The transmission section **68** is configured roughly by a transmission circuit **68**A and a transmission antenna **68**B, and the reception section **69** is configured roughly by a reception circuit **69**A and a reception antenna **69**B. **[0035]** The transmitter **68** converts the information input from the control processing unit **70** into a predetermined signal by the transmission circuit **68**A, and transmits the predetermined signal from the transmission antenna **68**B to a main unit installed in a vehicle, which is not shown in the figure. The transmission section **68** operates, for example, each time the information is input from the control processing unit **70**. **[0036]** The reception section 69, when a predetermined radio wave is input to the reception antenna 69B from a functional component management device, which is not shown in the figure, for managing the functional component 1, judges that the reception circuit 69A has received the radio wave, opens a communication circuit from the outside to the control processing unit 70, and outputs the input information to the control processing unit 70. In a case where no radio wave is received for a predetermined period of time, the reception section 69 stops functioning. **[0037]** The control processing unit 70 is provided with a memory means 72 such as a memory in which programs or the like are stored, a CPU 74 that functions as an arithmetic processing means, and an input/output means 76, and operates as a so-called computer. **[0038]** The memory means 72 stores, for example, a unique identification number set in the basic substrate 60, a program for controlling the operations of the temperature sensor 62 and the pressure sensor 64, a program for causing the communication unit 67 to operate, a program for executing processing when a

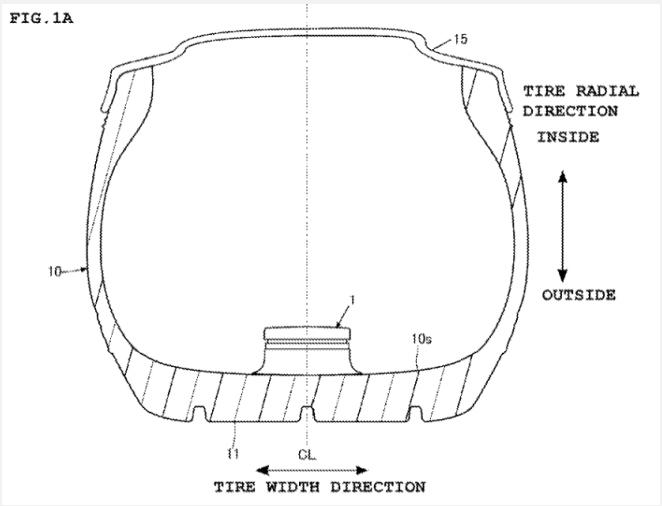
'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	signal is input from the outside to the reception section 69 of the communication unit 67, and a program for controlling the expansion substrate 80, and so on. In addition, the memory means 72 stores, as a history, the information such as the temperature and the pressure inside the tire 10 detected by the temperature sensor 62 and the pressure sensor 64. **[0039]** The input/output means 76 functions as an interface for outputting signals for causing the temperature sensor 62 and the pressure sensor 64 to operate and for inputting the temperature and the pressure detected by the temperature sensor 62 and the pressure sensor 64, and as an interface for enabling communication with the expansion substrate 80. **[0040]** The control processing unit 70 controls, by executing the program stored in the memory means 72 by the CPU 74, for example, the operations of the sensors that control the detection of the temperature and the pressure by the temperature sensor 62 and the pressure sensor 64, the operation of the communication unit 67, and the operation of the exchange of the information with the expansion substrate 80. **[0041]** The control processing unit 70 outputs signals to the temperature sensor 62 and the pressure sensor 64 on the basis of a sampling time set in the memory means, for example, and causes the temperature sensor 62 and the pressure sensor 64 to detect the temperature and the pressure. The control processing unit 70 converts the information of the temperature and the pressure detected by the temperature sensor 62 and the pressure sensor 64 into predetermined signals, such as digital signals, for example, and outputs the predetermined signals to the communication unit 67. **[0042]** The control processing unit 70, when the communication circuit to the reception section 69 is opened, outputs, updates, or adds the information stored in the memory means 72 on the basis of commands input by means of radio waves from the functional component management device, which is not shown in the figure, that manages the functional component 1. For example, in a case where an identification number is input from the functional component management device, the control processing unit 70 causes the memory means 72 to store the identification number, and in a case where the identification number is requested, outputs the identification number via the transmission section 68.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0050] As illustrated in FIG. 5B, the control processing unit 90 is provided with a memory means 92 in which programs and the like are stored, a CPU 94 that functions as an arithmetic processing means and an input/output means 96, and has functions as a so-called computer. The control processing unit 90 executes, for example, the processing for the operation of detecting the strain of the tire by the strain sensor 82 and the processing for outputting the strain detected by the strain sensor 82 in the format defined in the control processing unit 70 provided on the basic substrate 60, and also stores the strain in the memory means 92. Furthermore, the control processing unit 90 operates, via the control processing unit 70, on the basis of the command input from the functional component management device, and outputs a result of the processing based on the command to the basic substrate 60. As illustrated in FIG. 3, the control processing unit 90 is configured, for example, as a one-chip computer and is mounted on the expansion substrate 80.
21. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor. For example:* *See, e.g.,* **1**, **11**, **12**, **20**, above. **[0050]** As illustrated in FIG. 5B, the control processing unit 90 is provided with a memory means 92 in which programs and the like are stored, a CPU 94 that functions as an arithmetic processing means and an input/output means 96, and has functions as a so-called computer. The control processing unit 90 executes, for example, the processing for the operation of detecting the strain of the tire by the strain sensor 82 and the processing for outputting the strain detected by the strain sensor 82 in the format defined in the control processing unit 70 provided on the basic substrate 60, and also stores the strain in the memory means 92. Furthermore, the control processing unit 90 operates, via the control processing unit 70, on the basis of the command input from the functional component management device, and outputs a result of the processing based on the command to the basic substrate 60. As illustrated in FIG. 3, the control processing unit 90 is configured, for example, as a one-chip computer and is mounted on the expansion substrate 80.

'421 Claim Element	**Disclosures from Prior Art (Yamaguchi-566)**
22. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device. For example:* *See, e.g.,* **1**, **12**, above. **[0063]** FIGS. 9A and 9B are block diagrams illustrating another forms of the expansion substrate 80. In the above-described embodiment, it has been explained that the strain sensor 82 is mounted on the expansion substrate 80, however, without being limited to this, the functions to be mounted on the expansion substrate 80 may be set as required. Namely, it may be an acceleration sensor, or as illustrated in FIG. 9A, it may be a pressure sensor 82 for high pressure that measures a higher-pressure range than the pressure sensor 64 provided on the basic substrate 60, or in a case where water is injected into the tire air chamber, such as in the case of tires for heavy duty vehicles used in mines or the like, it may be a pressure sensor 82 for water pressure or the like. In any cases, it is preferable to configure such that the expansion substrate 80 is provided with a control processing unit 90 associated with each sensor, and the information detected by the sensors are output to the basic substrate 60 in a format which can be handled by the control processing unit 70 of the basic substrate 60. Furthermore, by storing the information detected by the expansion substrate 80 in the memory means 92 of the control processing unit 90 provided on the expansion substrate 80, the burden on the memory means 72 of the basic substrate 60 can be reduced. With this configuration, the capacity of the memory means 72 can be made smaller, that is, the memory as the memory means 72 can be made small-sized.
23. The sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object. For example:* *See, e.g.,* **1**, **11**, **12**, **20**, above. **[0045]** As illustrated in FIG. 3, the temperature sensor 62, the pressure sensor 64, the transmission circuit 68A and the reception

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	circuit 69A of the communication unit 67, and the control circuit functioning as the control processing unit 70 described above are integrated, for example, as a module that integrates the functions in a single chip, and mounted on the surface of the substrate as the sensor unit 61. The transmission antenna 68B and the reception antenna 69B, which constitute the communication unit 67, are mounted on the surface of the substrate as an antenna unit 63, as a separate unit from the sensor unit 61, for example, on the same surface of the substrate. **[0010]** FIGS. 4A to 4C are block diagrams of a basic substrate. FIG.4A  FIG.4B  FIG.4C  **[0032]** FIGS. 4A to 4C are block diagrams of the basic substrate **60**. An example of the functions set in the basic substrate **60** and the expansion substrate **80** will be described below. As illustrated in FIG. 4A, the basic substrate **60** is provided with a temperature sensor **62** as a first sensor for acquiring temperature in the air chamber of the tire **10**, a pressure sensor **64** for acquiring pressure in the air chamber, a communication unit **67** for outputting, to the outside of the tire, the detected value detected by each of the sensors **62** and **64**, and a control processing unit **70** as a first processing means for processing the information detected by the plurality of sensors **62** and **64**, and processing the operations of the plurality of sensors **62** and **64** and the communication unit **67**, and processing the exchange of information with the expansion substrate **80**.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	[0033] The temperature sensor 62 and the pressure sensor 64 detect the temperature and the pressure of the air inside the tire air chamber, by the air inside the tire air chamber introduced into the housing space S through the hole 33 provided in the cap 30. The temperature sensor 62 and the pressure sensor 64 operate on the basis of signals output from the control processing unit 70. **[0063]** FIGS. 9A and 9B are block diagrams illustrating another forms of the expansion substrate 80. In the above-described embodiment, it has been explained that the strain sensor 82 is mounted on the expansion substrate 80, however, without being limited to this, the functions to be mounted on the expansion substrate 80 may be set as required. Namely, it may be an acceleration sensor, or as illustrated in FIG. 9A, it may be a pressure sensor 82 for high pressure that measures a higher-pressure range than the pressure sensor 64 provided on the basic substrate 60, or in a case where water is injected into the tire air chamber, such as in the case of tires for heavy duty vehicles used in mines or the like, it may be a pressure sensor 82 for water pressure or the like. In any cases, it is preferable to configure such that the expansion substrate 80 is provided with a control processing unit 90 associated with each sensor, and the information detected by the sensors are output to the basic substrate 60 in a format which can be handled by the control processing unit 70 of the basic substrate 60. Furthermore, by storing the information detected by the expansion substrate 80 in the memory means 92 of the control processing unit 90 provided on the expansion substrate 80, the burden on the memory means 72 of the basic substrate 60 can be reduced. With this configuration, the capacity of the memory means 72 can be made smaller, that is, the memory as the memory means 72 can be made small-sized.
24. The sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire. For example:* *See, e.g.,* **1**, above. **[ABSTRACT]** A functional component to be attached inside a tire, for detecting a state of the tire as information, including: a

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
	first substrate having a first sensor that detects a state of the tire; a second substrate having a second sensor that detects a state of the tire different from the state of the tire detected by the first sensor; and a connection means that electrically connects the first substrate and the second substrate, in which the first substrate further includes a communication means that outputs the information detected by the first sensor and the second sensor to outside of the tire, and in which the first substrate and the second substrate are stacked in a tire radial direction, and the second substrate is disposed on an outer side in the tire radial direction. **[0061]** The functional component 1 configured as described above is bonded to the inner peripheral surface 10 *s* of the tire 10 by filling the adhesive agent in the cup-shaped space formed by the inner peripheral surface 42 *a* of the skirt 4 attached to the outer circumference of the housing 2 and the outer bottom surface 20 *d* of the housing 2. In other words, the strain sensor 82 is adhered to the inner peripheral surface 10 *s* of the tire 10 in a state of being embedded in the adhesive agent. 
28[pre]. A sensor assembly and sensing system for use with an object that rotates in use comprising:	*To the extent that the preamble is limiting, Yamaguchi-566 discloses, teaches, and/or suggests a* sensor assembly and sensing system for use with an object that rotates in use comprising. *For example:* *See, e.g.,* **1[pre]**, **11, 20** above. *See also following limitations.*

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
[28a] a housing comprising an outer structure that defines an open internal cavity therein,	*Yamaguchi-566 discloses, teaches, and/or suggests a housing comprising an outer structure that defines an open internal cavity therein. For example:* *See, e.g.,* **[1a]-[1c]**, above.
[28b] an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device,	*Yamaguchi-566 discloses, teaches, and/or suggests an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device. For example:* *See, e.g.,* **[1a]-[1c]**, above.
[28c] wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location.	*Yamaguchi-566 discloses, teaches, and/or suggests wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location. For example:* *See, e.g.,* **[1d]**, above.
[28d] wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor;	*Yamaguchi-566 discloses, teaches, and/or suggests wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor. For example:* *See, e.g.,* **20**, above.
[28e] a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member; and	*Yamaguchi-566 discloses, teaches, and/or suggests a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member. For example:* *See, e.g.,* **[1e]**, above.
[28f] a receiver external from the object that is configured to receive information from the	*Yamaguchi-566 discloses, teaches, and/or suggests a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly. For example:*

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
electrical sensor device wirelessly.	*See, e.g.,* **11**, above.
31. The sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity. For example:* *See, e.g.,* **[1c]**, above.
32. The sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member. For example:* *See, e.g.,* **[1c]**, above.
33. The sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.,* **[1b]**, **11** above.
34. The sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data.	*Yamaguchi-566 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data. For example:* *See, e.g.,* **1[pre]**, **[1b]**, **[1d]**, **[1e]**, **11**, **12**, **20**, above.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
41[pre] A method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of:	*To the extent that the preamble is limiting, Yamaguchi-566 discloses, teaches, and/or suggests a method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of: vulcanized rubber tire comprising. For example:* *See, e.g.,* **1[pre]**, **[1b]**, **[1d]**, **[1e]**, **11**, **12**, **20**, above. *See also following limitations.*
[41a] installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity, and	*Yamaguchi-566 discloses, teaches, and/or suggests installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity. For example:* *See, e.g.*, **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41b] wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry,	*Yamaguchi-566 discloses, teaches, and/or suggests wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry. For example:* *See, e.g.*, **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41c] wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity;	*Yamaguchi-566 discloses, teaches, and/or suggests wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity. For example:* *See, e.g.*, **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41d] attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object; and	*Yamaguchi-566 discloses, teaches, and/or suggests attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
[41e] monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly.	*Yamaguchi-566 discloses, teaches, and/or suggests monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
43. The method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity.	*Yamaguchi-566 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
44. The method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed.	*Yamaguchi-566 discloses, teaches, and/or suggests the method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above
48. The method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire.	*Yamaguchi-566 discloses, teaches, and/or suggests the method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above
50. The method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing.	*Yamaguchi-566 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
51. The method as recited in claim 41, wherein during the	*Yamaguchi-566 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of monitoring, the sensor*

'421 Claim Element	Disclosures from Prior Art (Yamaguchi-566)
step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device.	*monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
52. The method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor.	*Yamaguchi-566 discloses, teaches, and/or suggests the method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
53. The method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly.	*Yamaguchi-566 discloses, teaches, and/or suggests the method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

Invalidity Claim Chart Against U.S. Patent No. 11,835,421 ("'421 Patent")
Based on U.S. Patent No. 5,971,046 ("Koch-046")

U.S. Patent No. 5,971,046 ("Koch-046") was filed on September 17, 1997 and issued on October 26, 1999. Koch-046 qualifies as prior art under at least 35 U.S.C. § 102. Koch-046 anticipates and/or renders obvious the Asserted Claims of the '421 Patent (at least as Revvo understands Plaintiff's application of the Asserted Claims in an effort to show infringement).

To the extent Plaintiff argues that any element below is not disclosed by Koch-046, a person of ordinary skill in the art would have found it obvious to combine the teachings of Koch-046 with the background knowledge of a person of ordinary skill in the art and/or the additional references and exemplary teachings set forth in the chart below, to arrive at the claim limitation with a reasonable expectation of success. The chart below provides representative examples of where each element of each claim is found within Koch-046. Citations are meant to be exemplary, not exhaustive, and Revvo reserves the right to identify and discuss additional portions of the reference in support of its contentions and/or to rebut arguments made by Plaintiff. Citations to figures, drawings, tables, and the link include reference to any accompanying or related text. All internal cross-references are meant to incorporate the cross-referenced material as if fully set forth therein.

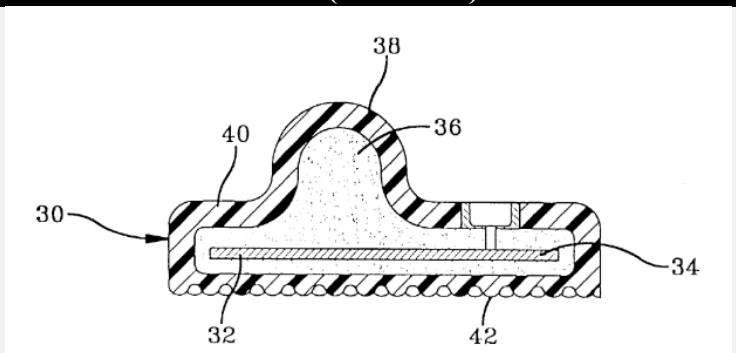
It is Revvo's position that Plaintiff's October 30, 2024 Infringement Contentions have not established that any accused product or service infringes any valid claim. Thus, Revvo's statements below should not be treated as an admission, implication, or suggestion that Revvo agrees with Plaintiff regarding either the scope, construction, or interpretation of any of the Asserted Claims or the infringement theories advanced by Plaintiff in its Infringement Contentions, including whether any Asserted Claim satisfies 35 U.S.C. §§ 101 or 112. In certain cases, Revvo has specified non-limiting examples of where its application of the prior art is based on Plaintiff's apparent application of the claim element. These statements are not intended to suggest that Revvo agrees with Plaintiff's application of any claim element, suggest a proposed construction at this stage of the case, or suggest that construction is needed, as the parties are not required to exchange terms for construction or propose claim constructions until a later date.

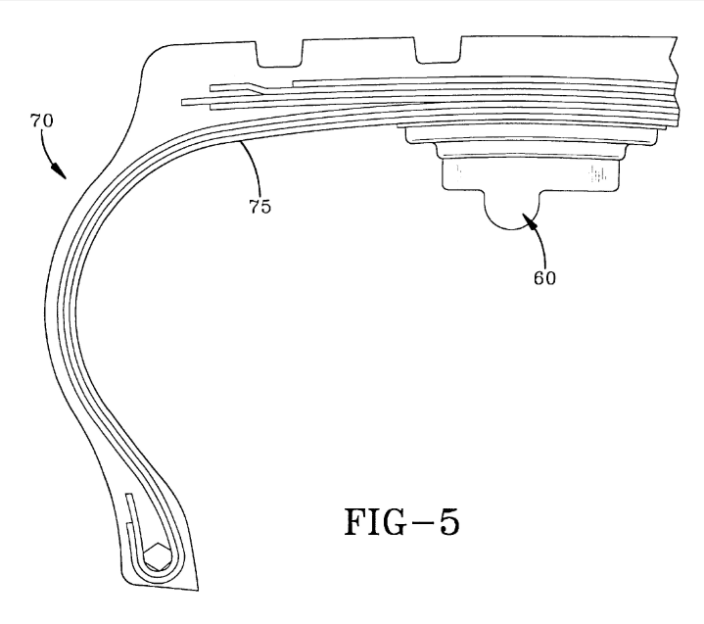
Plaintiff has yet to identify any limitation of the Asserted Claims that it contends is not anticipated and/or rendered obvious by Koch-046. Revvo therefore expressly reserves the right to respond to any such contention, including by identifying additional obviousness combinations, if Plaintiff makes any such contention.

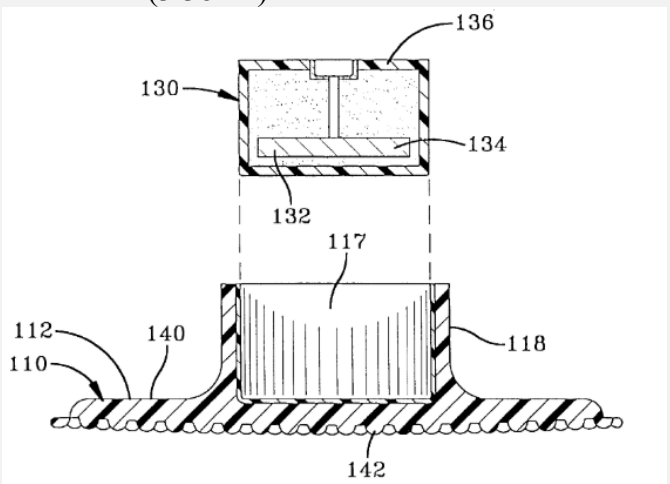
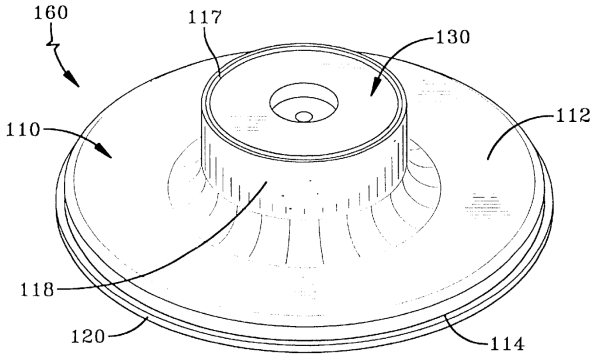
Where Revvo states that Koch-046 "discloses" a limitation, that disclosure may be express, implicit, and/or inherent.

'421 Claim Element	Disclosures from Prior Art (Koch-046)
1[pre]. A sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising:	*To the extent that the preamble is limiting, Koch-046 discloses, teaches, and/or suggests a sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising. For example:* **[Abstract]** A method and apparatus for bonding an active tag to a patch and assembling the patch to a tire is set forth. A patch assembly and a method for securing an electronic monitoring device having electronic and mechanical components for monitoring at least one engineering condition within a tire, comprising an rigid tag assembly encapsulating the electronic monitoring device, bonded to a vulcanized rubber patch which is secured to the inner cavity of a tire utilizing a layer of dual cure bonding rubber. FIELD OF THE INVENTION This invention pertains to an apparatus and a method of bonding an active tag to a patch and to a tire. More particularly, this invention sets forth a method and apparatus for encapsulating an electronic device in a rigid material, mounting the device on a vulcanized rubber patch and bonding the rubber patch to a vulcanized tire. (1:5-10) The improved method and apparatus increases the life of the electronic monitoring device by minimizing the stress, strain, cyclic fatigue, impact and vibration to which the electronic monitoring device is subjected when properly assembled into a tire. While the location of the device is an important factor in determining the life of an electronic monitoring device located within a tire, so too is the manner in which the device is installed into the tire. A method for securing within a tire an electronic monitoring device for monitoring at least one engineering condition of a tire comprises the steps of encapsulating an electronic monitoring device by placing the electronic monitoring device into a mold having a preselected configuration, the preselected configuration including at least one face having an alternating raised and recessed pattern to increase the surface area of the face. The mold is filled with an epoxy potting material so that the electronic monitoring device is encased by the epoxy. The epoxy potting material is cured to form a rigid tag assembly having a preselected configuration. However, certain electronic components comprising the electronic monitoring device, such as pressure sensors, are assembled in such a manner as to remain free from internal contamination while remaining open to the tire atmosphere as necessary. A rubber tire patch having a preselected

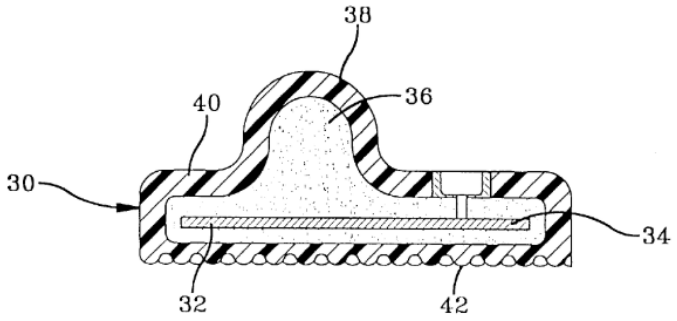
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	configuration is formed. The rubber patch includes a first side for interfacing with the face of the encapsulated rigid tag assembly. This first side has increased surface area, which allows for a better bond with the encapsulated tag. The first side also includes a recessed cavity surrounded by a ridge of material of sufficient height to capture the encapsulated rigid tag assembly This ridge helps to improve the bond between the rubber patch and the encapsulated rigid tag. The patch includes a second opposite side, the second side approximating the contour of the inner liner of the tire. The patch is tapered from the first side toward the second side, with the second side flaring out into a relatively thin configuration, but having a radius approaching the radius of the tire inner liner. The rubber patch is vulcanized at a preselected temperature and for a time sufficient its vulcanization. After vulcanization, a thin layer of dual cure bonding rubber is applied to the second side of the vulcanized rubber patch. This thin layer of dual cure bonding rubber will permit the assembly of the patch assembly to the inner liner of the tire. A fluid epoxy adhesive is applied to an interface between the encapsulated tag assembly and the rubber patch. The encapsulated tag assembly is assembled into the recessed cavity on the first side of the rubber patch so that the fluid epoxy adhesive is evenly distributed across the interface and flows from the interface between the encapsulated tag assembly and the rubber patch. Of course, the increased surface area of the tag assembly allows for better bonding between the rubber patch and the encapsulated tag. The assembly or the encapsulated tag and the rubber patch is allowed to cure to form a patch assembly. The patch assembly is then assembled to the inner liner of a vulcanized tire by applying an activating cement between the dual cure bonding layer and the inner liner of the tire. This curing process permanently bonds the patch assembly to the inner liner and is diffusion-controlled. Because it is diffusion controlled, the curing must be done for a sufficient amount of time and at a sufficient temperature to allow a strong permanent bond to form. To assure that solid contact is maintained at the interface between the inner liner of the tire and the dual cure bonding layer of the patch assembly, a clamping mechanism is applied to secure the patch assembly to the inner liner during the curing process. The clamping mechanism is applied with sufficient pressure across the interface of the patch assembly and the inner liner to assure intimate contact during curing. (2:20-3:21) FIG. 2 is a cross-sectional view of the rigid tag assembly, showing the encapsulated electronic monitoring device. (3:27-28.)

’421 Claim Element	Disclosures from Prior Art (Koch-046)
	 FIG−2 FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) The circuit board including sensors, battery and optional antenna, hereinafter referred to as the electronic monitoring device, are encapsulated in a potting material 40 which solidifies into a rigid material. Referring to FIG. 3, the electronic monitoring device is placed within a mold 50 having a first half 52 and a second half 54. At least one of the mold halves has a face with increased surface area, shown as surface 56 in the second half 54 of mold 40. The mold is then filled with the potting material 40 in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag assembly. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves 52, 54 are separated, yielding a rigid, encapsulated tag assembly 30. Tag assembly 30 has a bottom surface 42 having increased surface finish which is simply the impression of surface 56 from mold half 54. (4:63-5:22) FIG. 5 is a cross-sectional view of the patch assembled to the inner liner of a tire. (3:34-35)  FIG−5 Referring now to FIG. 5, Patch assembly 60 was then assembled to the inner liner 75 of tire 70. Activating cement was first applied to second side (not shown) of dual cure bonding layer 20. The patch assembly was then stitched to the inner liner of the vulcanized tire and the patch assembly/tire assembly was allowed to cure for a sufficient time and temperature to form a strong bond between the tire and the patch assembly. The times and temperatures utilized for this curing may be basically the same times and temperatures as previously discussed. To ensure a strong bond, the patch assembly optionally may be clamped to the tire inner liner 75, until the curing cycle is completed. (5:48-60)

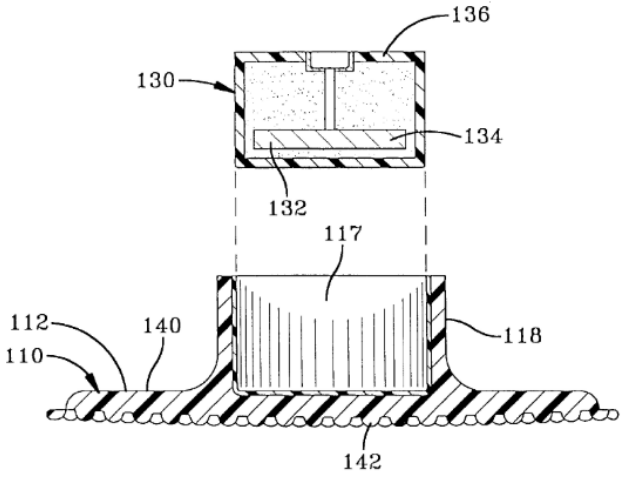
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	FIG. 7 is a cross-sectional view of the rigid tag assembly of FIG. 6, showing the encapsulated electronic monitoring device. FIG. 8 is a perspective view of the patch assembly of the present invention. (3:38-42)  FIG−7  FIG−8 FIG. 6 shows an alternative configuration of a tire patch 110 of the present invention. The tire patch 110 is of a preselected configuration, which as shown, is round in shape. The tire patch 110 has a first side 112 for interfacing with a face of an encapsulated tag assembly 130, shown in cross-section in FIG. 7. First side 112 includes a recessed cavity 116, which in this alternative configuration is formed by a cylindrical rigid insert 117 molded into the rubber patch. Preferably cylindrical insert 117 is a rigid plastic material, such as nylon, epoxy or a rigid composite material such as glass-filled polyimide or glass-filled epoxy, but also may be a metal, as long as the metal does not

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	interfere with the electronic functions and operation of tag assembly 130. Cylindrical rigid insert 117 is surrounded by a ridge 118 of rubbery material. The ridge preferably is of the same material as the remainder of the patch and should be of sufficient height to permanently hold cylindrical insert 117 in place following curing. In a preferred embodiment shown in FIGS. 6 and 7, the ridge 118 is the same height as cylindrical insert 117. The patch is gradually tapered from the ridge 118 of material of the first side of the patch outwardly toward the edges of the patch. Recessed cavity 116 may have a roughened bottom surface to increase its surface area, as previously described, or alternatively may be smooth and made from the same material as the cylindrical insert. The patch has a second opposite side 114 which may approximate the contour of an inner liner of a tire. The contour of the second side 114 preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side 114 is flat, having no contour. Tire patch 110 including cylindrical rigid insert 117 is cured prior to insertion of rigid tag assembly 130 to form a round patch assembly. (5:61-6:28) Rigid tag assembly 130, which includes the encapsulated electronic monitoring device and has the same components as previously described, is essentially identical to rigid tag assembly 30 except for its profile, being round or circular instead of rectangular. Round rigid tag assembly 130 is permanently bonded to the round patch assembly by inserting rigid tag assembly 130 into cylindrical insert 117, as shown in FIG. 8, after applying an epoxy adhesive such as a Fusor system manufactured by Lord Corp. of Erie Pa. to the interface between the rigid tag assembly 130 and the cylindrical insert 117. Of course, the epoxy adhesive also may conveniently be applied to the interface between the bottom of cavity 116, whether it is a roughened surface or made of the same or similar material as cylindrical insert 117. As the rigid tag assembly 130 is inserted into cylindrical insert 117, excess epoxy flows out from the interface, which must be removed before it cures. Cylindrical insert 117 only must be of sufficient height so that after curing of the epoxy, there is sufficient bonding strength between the insert 117 and tag assembly 130 to assure no separation. Although the rigid tag assembly 130 may be of the same height as cylindrical insert 117, as shown in the preferred embodiment, it also may be lower or higher than cylindrical insert 117 upon

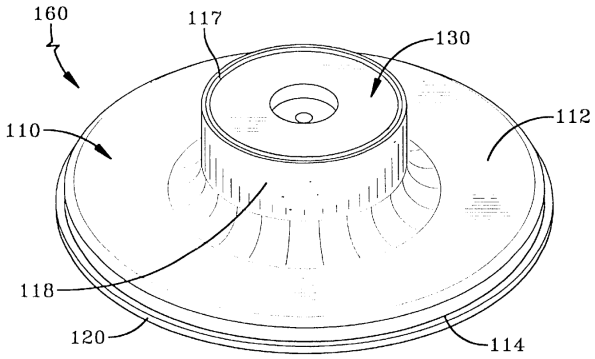
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	assembly. If tag assembly 130 is higher than the cylindrical insert 117, then insert 117 has a lower profile than the rigid tag assembly 130 so that the outer periphery of the rigid tag assembly 130 extends above the outer periphery of the cylindrical insert 117, thereby reducing the overall amount of material required for tire patch 110. (6:29-57) Patch assembly 160 formed by assembling rigid tag assembly 130 into tire patch 110 is bonded to a tire using the same materials and methods described above for Patch assembly 60. As such, a dual cure bonding layer 120 is connected to second side 114 as described above with respect to the first embodiment of the present invention. (6:58-63) *See also following limitations.*
[1a] a housing comprising an outer surface and an internal cavity that is enclosed within the housing;	*Koch-046 discloses, teaches, and/or suggests a housing comprising an outer surface and an internal cavity that is enclosed within the housing. For example:* Additionally, certain components of the device, such as the pressure sensor or a thermistor must remain open to the pressurized tire cavity. The flow of rubber occurring during the vulcanization process can effect the openings to the tire cavity. As set forth in U.S. Pat. No. 5,562,787, the opening to the tire cavity can remain open during the curing operations by placement of a dowel into the opening. (2:3-9) FIG. 2 is a cross-sectional view of the rigid tag assembly, showing the encapsulated electronic monitoring device. (3:27-28.)  FIG−2 FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) The circuit board including sensors, battery and optional antenna, hereinafter referred to as the electronic monitoring device, are encapsulated in a potting material 40 which solidifies into a rigid material. Referring to FIG. 3, the electronic monitoring device is placed within a mold 50 having a first half 52 and a second half 54. At least one of the mold halves has a face with increased surface area, shown as surface 56 in the second half 54 of mold 40. The mold is then filled with the potting material 40 in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag assembly. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves 52, 54 are separated, yielding a rigid, encapsulated tag assembly 30. Tag assembly 30 has a bottom surface 42 having increased surface finish which is simply the impression of surface 56 from mold half 54. (4:63-5:22) FIG. 7 is a cross-sectional view of the rigid tag assembly of FIG. 6, showing the encapsulated electronic monitoring device.

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	FIG. 8 is a perspective view of the patch assembly of the present invention. (3:38-42)



FIG−7



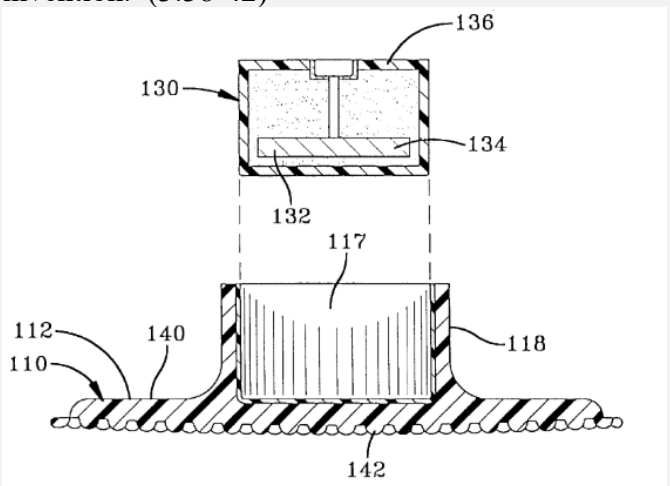
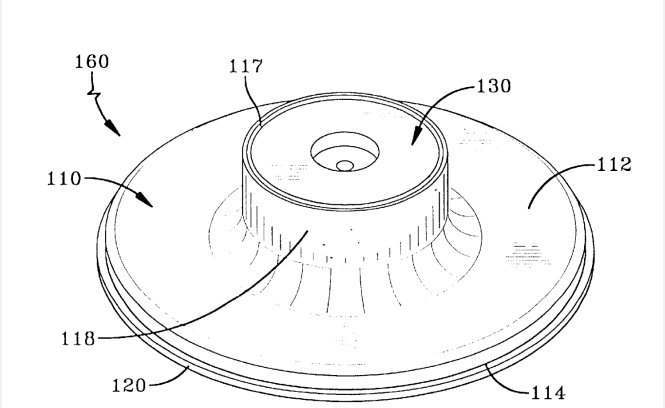
FIG−8

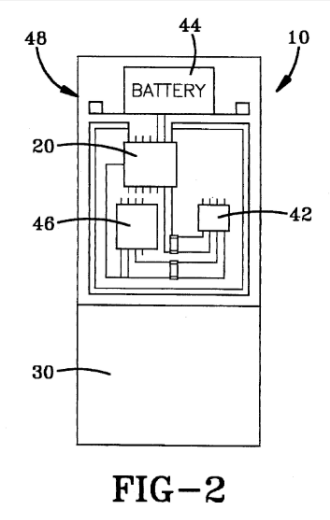
FIG. 6 shows an alternative configuration of a tire patch 110 of the present invention. The tire patch 110 is of a preselected configuration, which as shown, is round in shape. The tire patch 110 has a first side 112 for interfacing with a face of an encapsulated tag assembly 130, shown in cross-section in FIG. 7. First side 112 includes a recessed cavity 116, which in this alternative configuration is formed by a cylindrical rigid insert 117 molded into the rubber patch. Preferably cylindrical insert 117 is a rigid plastic material, such as nylon, epoxy or a rigid composite material such as glass-filled polyimide or glass-filled epoxy, but also may be a metal, as long as the metal does not interfere with the electronic functions and operation of tag assembly 130. Cylindrical rigid insert 117 is surrounded by a ridge 118 of rubbery material. The ridge preferably is of the

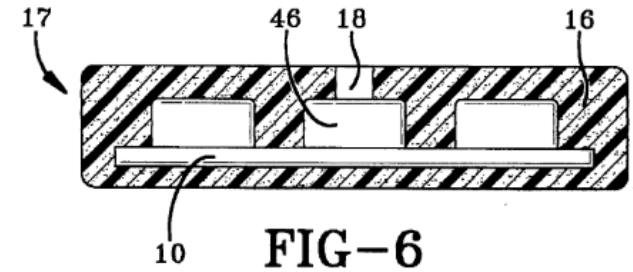
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	same material as the remainder of the patch and should be of sufficient height to permanently hold cylindrical insert 117 in place following curing. In a preferred embodiment shown in FIGS. 6 and 7, the ridge 118 is the same height as cylindrical insert 117. The patch is gradually tapered from the ridge 118 of material of the first side of the patch outwardly toward the edges of the patch. Recessed cavity 116 may have a roughened bottom surface to increase its surface area, as previously described, or alternatively may be smooth and made from the same material as the cylindrical insert. The patch has a second opposite side 114 which may approximate the contour of an inner liner of a tire. The contour of the second side 114 preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side 114 is flat, having no contour. Tire patch 110 including cylindrical rigid insert 117 is cured prior to insertion of rigid tag assembly 130 to form a round patch assembly. (5:61-6:28) Rigid tag assembly 130, which includes the encapsulated electronic monitoring device and has the same components as previously described, is essentially identical to rigid tag assembly 30 except for its profile, being round or circular instead of rectangular. Round rigid tag assembly 130 is permanently bonded to the round patch assembly by inserting rigid tag assembly 130 into cylindrical insert 117, as shown in FIG. 8, after applying an epoxy adhesive such as a Fusor system manufactured by Lord Corp. of Erie Pa. to the interface between the rigid tag assembly 130 and the cylindrical insert 117. Of course, the epoxy adhesive also may conveniently be applied to the interface between the bottom of cavity 116, whether it is a roughened surface or made of the same or similar material as cylindrical insert 117. As the rigid tag assembly 130 is inserted into cylindrical insert 117, excess epoxy flows out from the interface, which must be removed before it cures. Cylindrical insert 117 only must be of sufficient height so that after curing of the epoxy, there is sufficient bonding strength between the insert 117 and tag assembly 130 to assure no separation. Although the rigid tag assembly 130 may be of the same height as cylindrical insert 117, as shown in the preferred embodiment, it also may be lower or higher than cylindrical insert 117 upon assembly. If tag assembly 130 is higher than the cylindrical insert 117, then insert 117 has a lower profile than the rigid tag assembly 130 so that the outer periphery of the rigid tag

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	assembly 130 extends above the outer periphery of the cylindrical insert 117, thereby reducing the overall amount of material required for tire patch 110. (6:29-57) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)
[1b] an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity,	*Koch-046 discloses, teaches, and/or suggests an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity. For example:* Additionally, certain components of the device, such as the pressure sensor or a thermistor must remain open to the pressurized tire cavity. The flow of rubber occurring during the vulcanization process can effect the openings to the tire cavity. As set forth in U.S. Pat. No. 5,562,787, the opening to the tire cavity

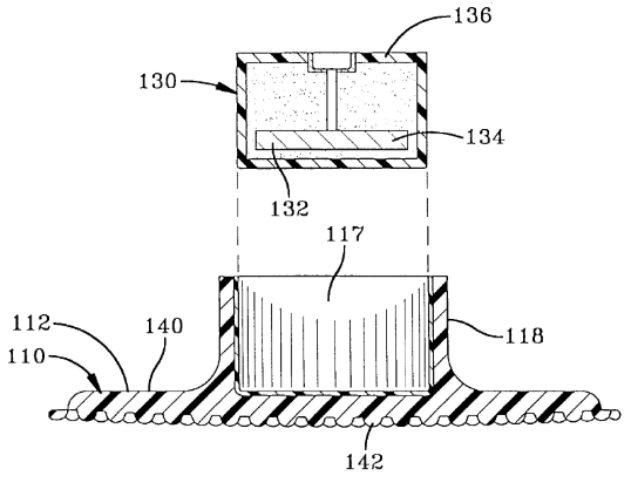
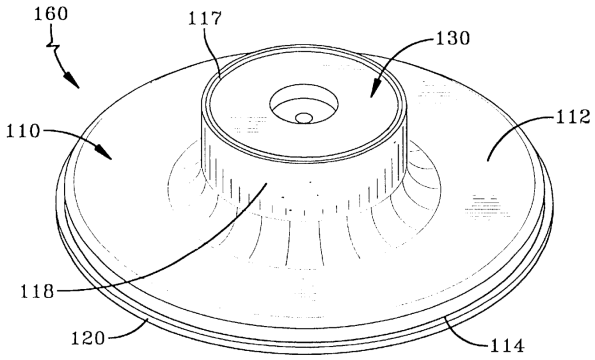
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	can remain open during the curing operations by placement of a dowel into the opening. (2:3-9) FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) The circuit board including sensors, battery and optional antenna, hereinafter referred to as the electronic monitoring device, are encapsulated in a potting material 40 which solidifies into a rigid material. Referring to FIG. 3, the electronic monitoring device is placed within a mold 50 having a first half 52 and a second half 54. At least one of the mold halves has a face with increased surface area, shown as surface 56 in the second half 54 of mold 40. The mold is then filled with the potting material 40 in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag assembly. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves 52, 54 are separated, yielding a rigid, encapsulated tag assembly 30. Tag assembly 30 has a bottom

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	surface 42 having increased surface finish which is simply the impression of surface 56 from mold half 54. (4:63-5:22) FIG. 7 is a cross-sectional view of the rigid tag assembly of FIG. 6, showing the encapsulated electronic monitoring device. FIG. 8 is a perspective view of the patch assembly of the present invention. (3:38-42)  FIG–7  FIG–8 Rigid tag assembly 130, which includes the encapsulated electronic monitoring device and has the same components as previously described, is essentially identical to rigid tag assembly 30 except for its profile, being round or circular instead of rectangular. Round rigid tag assembly 130 is permanently bonded to the round patch assembly by inserting rigid tag assembly 130 into cylindrical insert 117, as shown in FIG. 8, after applying an epoxy adhesive such as a Fusor system manufactured

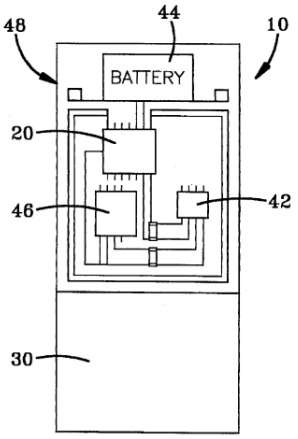
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	by Lord Corp. of Erie Pa. to the interface between the rigid tag assembly 130 and the cylindrical insert 117. Of course, the epoxy adhesive also may conveniently be applied to the interface between the bottom of cavity 116, whether it is a roughened surface or made of the same or similar material as cylindrical insert 117. As the rigid tag assembly 130 is inserted into cylindrical insert 117, excess epoxy flows out from the interface, which must be removed before it cures. Cylindrical insert 117 only must be of sufficient height so that after curing of the epoxy, there is sufficient bonding strength between the insert 117 and tag assembly 130 to assure no separation. Although the rigid tag assembly 130 may be of the same height as cylindrical insert 117, as shown in the preferred embodiment, it also may be lower or higher than cylindrical insert 117 upon assembly. If tag assembly 130 is higher than the cylindrical insert 117, then insert 117 has a lower profile than the rigid tag assembly 130 so that the outer periphery of the rigid tag assembly 130 extends above the outer periphery of the cylindrical insert 117, thereby reducing the overall amount of material required for tire patch 110. (6:29-57) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.)  FIG–2

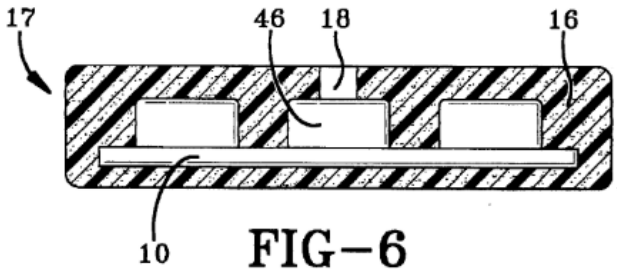
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG–6
[1c] wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing,	*Koch-046 discloses, teaches, and/or suggests wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing. For example:* Additionally, certain components of the device, such as the pressure sensor or a thermistor must remain open to the

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	pressurized tire cavity. The flow of rubber occurring during the vulcanization process can effect the openings to the tire cavity. As set forth in U.S. Pat. No. 5,562,787, the opening to the tire cavity can remain open during the curing operations by placement of a dowel into the opening. (2:3-9) FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) The circuit board including sensors, battery and optional antenna, hereinafter referred to as the electronic monitoring device, are encapsulated in a potting material 40 which solidifies into a rigid material. Referring to FIG. 3, the electronic monitoring device is placed within a mold 50 having a first half 52 and a second half 54. At least one of the mold halves has a face with increased surface area, shown as surface 56 in the second half 54 of mold 40. The mold is then filled with the potting material 40 in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag assembly. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A

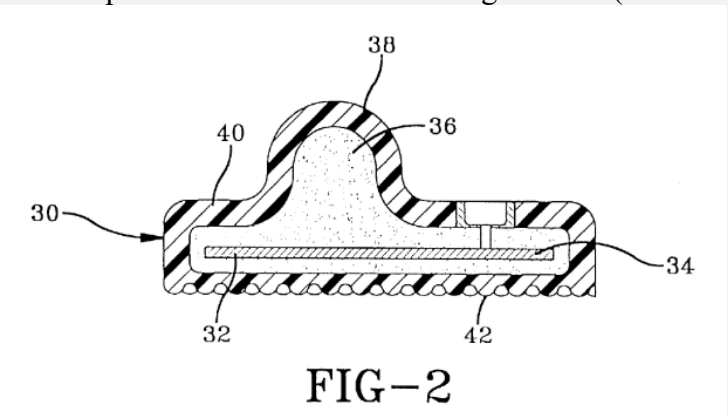
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	preferred temperature is about 80° C. After the epoxy has been cured, the mold halves 52, 54 are separated, yielding a rigid, encapsulated tag assembly 30. Tag assembly 30 has a bottom surface 42 having increased surface finish which is simply the impression of surface 56 from mold half 54. (4:63-5:22) FIG. 7 is a cross-sectional view of the rigid tag assembly of FIG. 6, showing the encapsulated electronic monitoring device. FIG. 8 is a perspective view of the patch assembly of the present invention. (3:38-42)  FIG−7  FIG−8 Rigid tag assembly 130, which includes the encapsulated electronic monitoring device and has the same components as previously described, is essentially identical to rigid tag assembly 30 except for its profile, being round or circular instead of rectangular. Round rigid tag assembly 130 is permanently

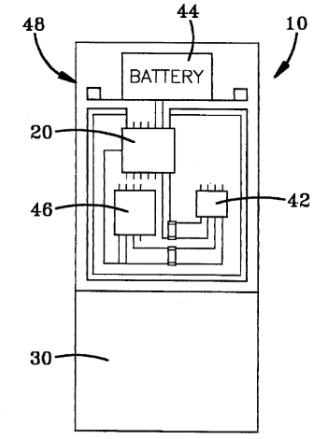
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	bonded to the round patch assembly by inserting rigid tag assembly 130 into cylindrical insert 117, as shown in FIG. 8, after applying an epoxy adhesive such as a Fusor system manufactured by Lord Corp. of Erie Pa. to the interface between the rigid tag assembly 130 and the cylindrical insert 117. Of course, the epoxy adhesive also may conveniently be applied to the interface between the bottom of cavity 116, whether it is a roughened surface or made of the same or similar material as cylindrical insert 117. As the rigid tag assembly 130 is inserted into cylindrical insert 117, excess epoxy flows out from the interface, which must be removed before it cures. Cylindrical insert 117 only must be of sufficient height so that after curing of the epoxy, there is sufficient bonding strength between the insert 117 and tag assembly 130 to assure no separation. Although the rigid tag assembly 130 may be of the same height as cylindrical insert 117, as shown in the preferred embodiment, it also may be lower or higher than cylindrical insert 117 upon assembly. If tag assembly 130 is higher than the cylindrical insert 117, then insert 117 has a lower profile than the rigid tag assembly 130 so that the outer periphery of the rigid tag assembly 130 extends above the outer periphery of the cylindrical insert 117, thereby reducing the overall amount of material required for tire patch 110. (6:29-57) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.)

’421 Claim Element	Disclosures from Prior Art (Koch-046)
	 FIG−2 While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	 FIG–6
[1d] wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use; and	*Koch-046 discloses, teaches, and/or suggests wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use. For example:* **[Abstract]** A method and apparatus for bonding an active tag to a patch and assembling the patch to a tire is set forth. A patch assembly and a method for securing an electronic monitoring device having electronic and mechanical components for monitoring at least one engineering condition within a tire, comprising an rigid tag assembly encapsulating the electronic monitoring device, bonded to a vulcanized rubber patch which is secured to the inner cavity of a tire utilizing a layer of dual cure bonding rubber. FIELD OF THE INVENTION This invention pertains to an apparatus and a method of bonding an active tag to a patch and to a tire. More particularly, this invention sets forth a method and apparatus for encapsulating an electronic device in a rigid material, mounting the device on a vulcanized rubber patch and bonding the rubber patch to a vulcanized tire. (1:5-10) The improved method and apparatus increases the life of the electronic monitoring device by minimizing the stress, strain, cyclic fatigue, impact and vibration to which the electronic monitoring device is subjected when properly assembled into a tire. While the location of the device is an important factor in determining the life of an electronic monitoring device located within a tire, so too is the manner in which the device is installed into the tire. A method for securing within a tire an electronic monitoring device for monitoring at least one engineering condition of a tire comprises the steps of encapsulating an electronic monitoring device by placing the electronic monitoring

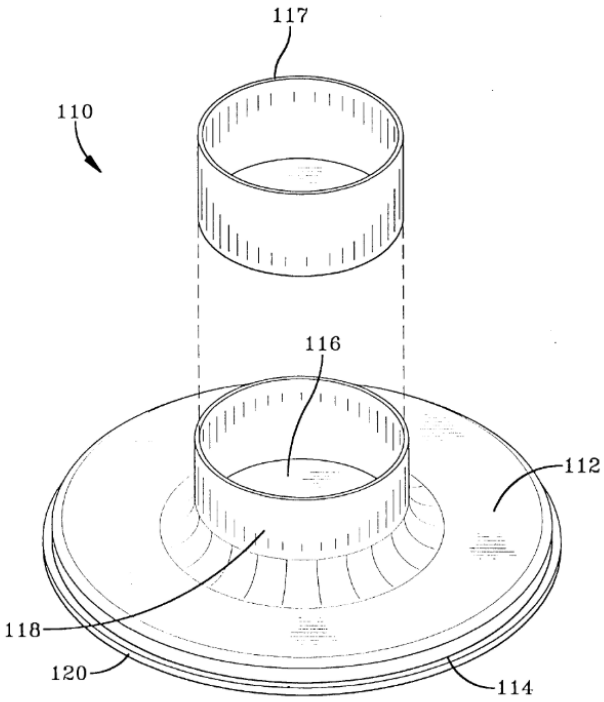
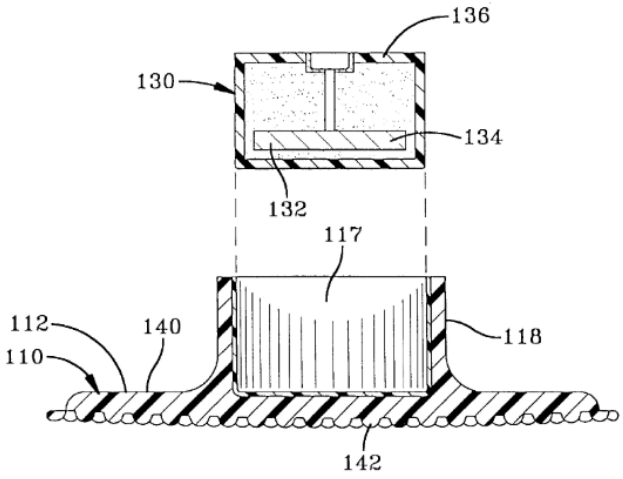
’421 Claim Element	Disclosures from Prior Art (Koch-046)
	device into a mold having a preselected configuration, the preselected configuration including at least one face having an alternating raised and recessed pattern to increase the surface area of the face. The mold is filled with an epoxy potting material so that the electronic monitoring device is encased by the epoxy. The epoxy potting material is cured to form a rigid tag assembly having a preselected configuration. However, certain electronic components comprising the electronic monitoring device, such as pressure sensors, are assembled in such a manner as to remain free from internal contamination while remaining open to the tire atmosphere as necessary. A rubber tire patch having a preselected configuration is formed. The rubber patch includes a first side for interfacing with the face of the encapsulated rigid tag assembly. This first side has increased surface area, which allows for a better bond with the encapsulated tag. The first side also includes a recessed cavity surrounded by a ridge of material of sufficient height to capture the encapsulated rigid tag assembly This ridge helps to improve the bond between the rubber patch and the encapsulated rigid tag. The patch includes a second opposite side, the second side approximating the contour of the inner liner of the tire. The patch is tapered from the first side toward the second side, with the second side flaring out into a relatively thin configuration, but having a radius approaching the radius of the tire inner liner. The rubber patch is vulcanized at a preselected temperature and for a time sufficient its vulcanization. After vulcanization, a thin layer of dual cure bonding rubber is applied to the second side of the vulcanized rubber patch. This thin layer of dual cure bonding rubber will permit the assembly of the patch assembly to the inner liner of the tire. A fluid epoxy adhesive is applied to an interface between the encapsulated tag assembly and the rubber patch. The encapsulated tag assembly is assembled into the recessed cavity on the first side of the rubber patch so that the fluid epoxy adhesive is evenly distributed across the interface and flows from the interface between the encapsulated tag assembly and the rubber patch. Of course, the increased surface area of the tag assembly allows for better bonding between the rubber patch and the encapsulated tag. The assembly or the encapsulated tag and the rubber patch is allowed to cure to form a patch assembly. The patch assembly is then assembled to the inner liner of a vulcanized tire by applying an activating cement between the dual cure bonding layer and the inner liner of the tire. This curing process permanently bonds the patch assembly to the inner liner and is diffusion-controlled. Because it is diffusion controlled, the curing must be done for a sufficient amount of time and at a sufficient temperature to allow a strong permanent bond to form.

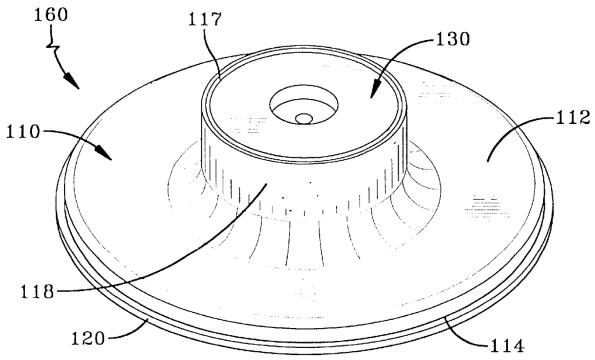
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	To assure that solid contact is maintained at the interface between the inner liner of the tire and the dual cure bonding layer of the patch assembly, a clamping mechanism is applied to secure the patch assembly to the inner liner during the curing process. The clamping mechanism is applied with sufficient pressure across the interface of the patch assembly and the inner liner to assure intimate contact during curing. (2:20-3:21) FIG. 2 is a cross-sectional view of the rigid tag assembly, showing the encapsulated electronic monitoring device. (3:27-28.)  FIG−2 FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) The circuit board including sensors, battery and optional antenna, hereinafter referred to as the electronic monitoring device, are encapsulated in a potting material 40 which solidifies into a rigid material. Referring to FIG. 3, the electronic monitoring device is placed within a mold 50 having a first half 52 and a second

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	half 54. At least one of the mold halves has a face with increased surface area, shown as surface 56 in the second half 54 of mold 40. The mold is then filled with the potting material 40 in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag assembly. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves 52, 54 are separated, yielding a rigid, encapsulated tag assembly 30. Tag assembly 30 has a bottom surface 42 having increased surface finish which is simply the impression of surface 56 from mold half 54. (4:63-5:22) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.)  FIG–2

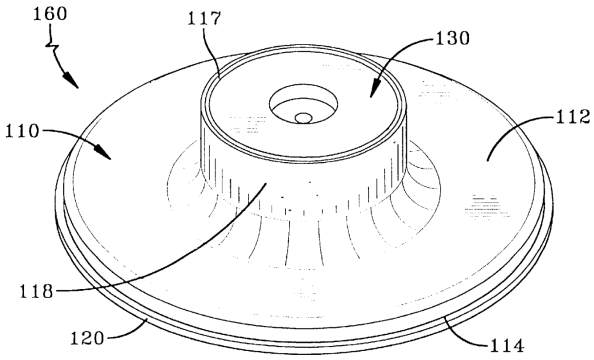
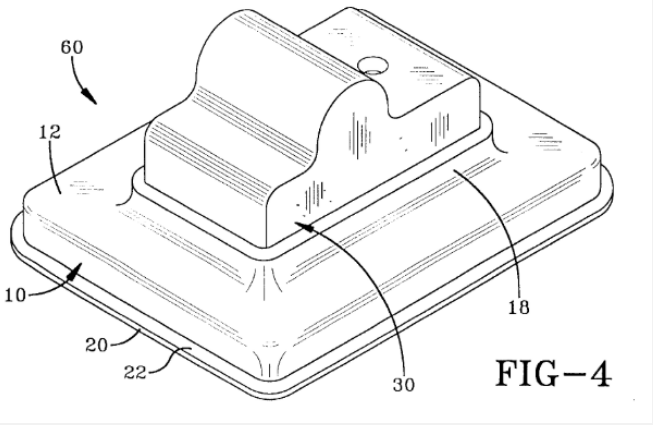
'421 Claim Element	Disclosures from Prior Art (Koch-046)
[1e] a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.	*Koch-046 discloses, teaches, and/or suggests a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.. For example:* The rubber patch is vulcanized at a preselected temperature and for a time sufficient to vulcanize the patch. The patch may be rubber selected from the group consisting of Ethylene Propylene Diene Monomer (EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about 150° C. and holding at this temperature for about 30 minutes. The time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. (Koch-046, 3:63-4:8.) Affixed to the second side 14 of the vulcanized tire patch is a dual cure bonding layer 20, which has a second side (not shown) and a first side 22. This dual cure bonding layer 20 may be assembled to the patch at any time following vulcanization of the patch and prior to assembly of the patch assembly to the tire innerliner. The dual cure bonding layer 20 is permanently assembled to the patch. A non-curing cement (not shown) is applied to side 14 of the patch in order to hold the dual cure bonding layer 20 onto the patch. The non-curing cement and the dual cure bonding layer 20 are products of Patch Rubber Company. The important feature of the dual cure bonding layer 20 is that it can be chemically activated and cured, without the need for heating to an elevated temperature. The process is diffusion controlled, however, and some minimal heating will speed the curing process. The dual cure bonding layer 20 may be any material which can be activated and cured to the vulcanized rubber of the tire inner liner and the vulcanized patch. Preferably, however, the dual cure bonding rubber is natural rubber. The dual cure bonding rubber, after application of the activating cement, may cure at room temperature over a period of seventy two (72) hours. However, if more rapid curing is desired this may be accomplished by heating to 45° C. for at least twenty four hours. (4:20-43)

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	Rigid tag assembly 30 is assembled into the recessed cavity 16 on the first side 12 of tire patch 10 either after vulcanization of the patch or after assembly of the dual bond curing layer 20 to the patch. In order to permanently adhere tag assembly 30 to patch 10, a fluid adhesive is applied to the interface between tag assembly 30 and recess 16. This adhesive, preferably an epoxy adhesive, may be applied conveniently to surface 42 of tag assembly or to the base of recess 16. As tag assembly 30 is pressed into recessed cavity 16, the epoxy adhesive flows evenly along the interface between surface 42 and the base of recess 16. The increased surface area between the base of recessed cavity 16 and surface 52 provides for additional bonding area and a stronger bond. Because the ridges around the recess are closely dimensioned to correspond to the dimensions of tag assembly 30, excess epoxy will flow between tag assembly 30 and ridge 18, and some epoxy may even flow out from this region. Of course, the flow of epoxy in this region will add to the strength of the assembly as the epoxy cures. While the epoxy can be allowed to cure at room temperature, the curing process can be accelerated by heating the assembly at an elevated temperature, for example a temperature of from about 75-90° C. for at least about 30 minutes. If the dual cure bonding layer 20 has not already been assembled to the second side 14 of tire patch 10, it may be added at this time to form patch assembly 60. (5:22-48) FIG. 6 is a perspective view of an alternative configuration of the tire patch of the present invention. FIG. 7 is a cross-sectional view of the rigid tag assembly of FIG. 6, showing the encapsulated electronic monitoring device. FIG. 8 is a perspective view of the patch assembly of the present invention. (3:35-42)

’421 Claim Element	Disclosures from Prior Art (Koch-046)
	 FIG–6  FIG–7

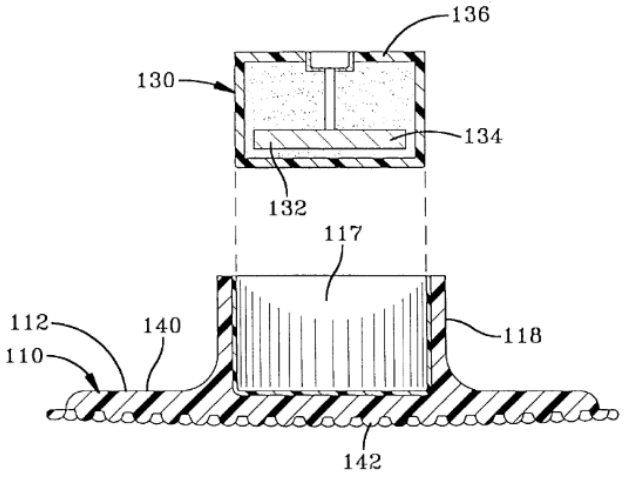
’421 Claim Element	Disclosures from Prior Art (Koch-046)
	 FIG−8 FIG. 6 shows an alternative configuration of a tire patch 110 of the present invention. The tire patch 110 is of a preselected configuration, which as shown, is round in shape. The tire patch 110 has a first side 112 for interfacing with a face of an encapsulated tag assembly 130, shown in cross-section in FIG. 7. First side 112 includes a recessed cavity 116, which in this alternative configuration is formed by a cylindrical rigid insert 117 molded into the rubber patch. Preferably cylindrical insert 117 is a rigid plastic material, such as nylon, epoxy or a rigid composite material such as glass-filled polyimide or glass-filled epoxy, but also may be a metal, as long as the metal does not interfere with the electronic functions and operation of tag assembly 130. Cylindrical rigid insert 117 is surrounded by a ridge 118 of rubbery material. The ridge preferably is of the same material as the remainder of the patch and should be of sufficient height to permanently hold cylindrical insert 117 in place following curing. In a preferred embodiment shown in FIGS. 6 and 7, the ridge 118 is the same height as cylindrical insert 117. The patch is gradually tapered from the ridge 118 of material of the first side of the patch outwardly toward the edges of the patch. Recessed cavity 116 may have a roughened bottom surface to increase its surface area, as previously described, or alternatively may be smooth and made from the same material as the cylindrical insert. The patch has a second opposite side 114 which may approximate the contour of an inner liner of a tire. The contour of the second side 114 preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side 114 is flat, having no

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	contour. Tire patch 110 including cylindrical rigid insert 117 is cured prior to insertion of rigid tag assembly 130 to form a round patch assembly. (5:61-6:28) Rigid tag assembly 130, which includes the encapsulated electronic monitoring device and has the same components as previously described, is essentially identical to rigid tag assembly 30 except for its profile, being round or circular instead of rectangular. Round rigid tag assembly 130 is permanently bonded to the round patch assembly by inserting rigid tag assembly 130 into cylindrical insert 117, as shown in FIG. 8, after applying an epoxy adhesive such as a Fusor system manufactured by Lord Corp. of Erie Pa. to the interface between the rigid tag assembly 130 and the cylindrical insert 117. Of course, the epoxy adhesive also may conveniently be applied to the interface between the bottom of cavity 116, whether it is a roughened surface or made of the same or similar material as cylindrical insert 117. As the rigid tag assembly 130 is inserted into cylindrical insert 117, excess epoxy flows out from the interface, which must be removed before it cures. Cylindrical insert 117 only must be of sufficient height so that after curing of the epoxy, there is sufficient bonding strength between the insert 117 and tag assembly 130 to assure no separation. Although the rigid tag assembly 130 may be of the same height as cylindrical insert 117, as shown in the preferred embodiment, it also may be lower or higher than cylindrical insert 117 upon assembly. If tag assembly 130 is higher than the cylindrical insert 117, then insert 117 has a lower profile than the rigid tag assembly 130 so that the outer periphery of the rigid tag assembly 130 extends above the outer periphery of the cylindrical insert 117, thereby reducing the overall amount of material required for tire patch 110. (6:29-57) Patch assembly 160 formed by assembling rigid tag assembly 130 into tire patch 110 is bonded to a tire using the same materials and methods described above for Patch assembly 60. As such, a dual cure bonding layer 120 is connected to second side 114 as described above with respect to the first embodiment of the present invention. (6:58-63)
2. The sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member assembly. For example:*

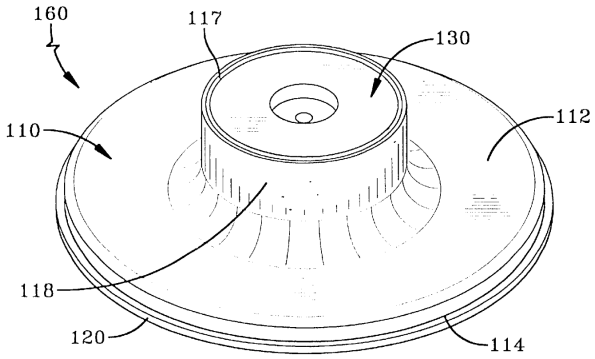
'421 Claim Element	Disclosures from Prior Art (Koch-046)
a user when the housing is attached with the retaining member.	 FIG–8  FIG–4
5. The sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein. For example:* Additionally, certain components of the device, such as the pressure sensor or a thermistor must remain open to the pressurized tire cavity. The flow of rubber occurring during the vulcanization process can effect the openings to the tire cavity. As set forth in U.S. Pat. No. 5,562,787, the opening to the tire cavity can remain open during the curing operations by placement of a dowel into the opening. (2:3-9) FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) The circuit board including sensors, battery and optional antenna, hereinafter referred to as the electronic monitoring device, are encapsulated in a potting material 40 which solidifies into a rigid material. Referring to FIG. 3, the electronic monitoring device is placed within a mold 50 having a first half 52 and a second half 54. At least one of the mold halves has a face with increased surface area, shown as surface 56 in the second half 54 of mold 40. The mold is then filled with the potting material 40 in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag assembly. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves 52, 54 are separated, yielding a rigid, encapsulated tag assembly 30. Tag assembly 30 has a bottom surface 42 having increased surface finish which is simply the impression of surface 56 from mold half 54. (4:63-5:22) FIG. 7 is a cross-sectional view of the rigid tag assembly of FIG. 6, showing the encapsulated electronic monitoring device.

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	FIG. 8 is a perspective view of the patch assembly of the present invention. (3:38-42)

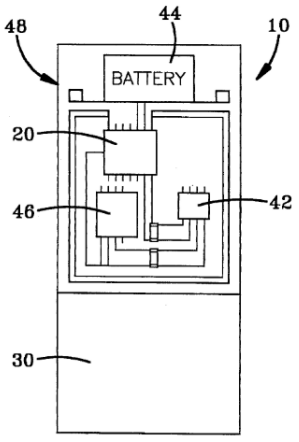


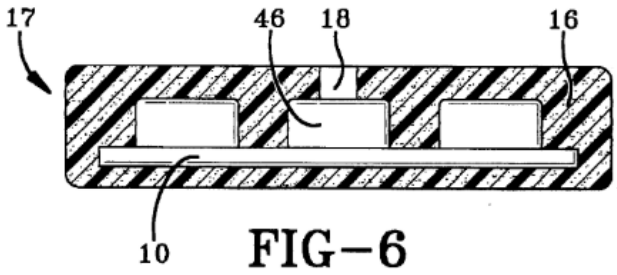
FIG−7

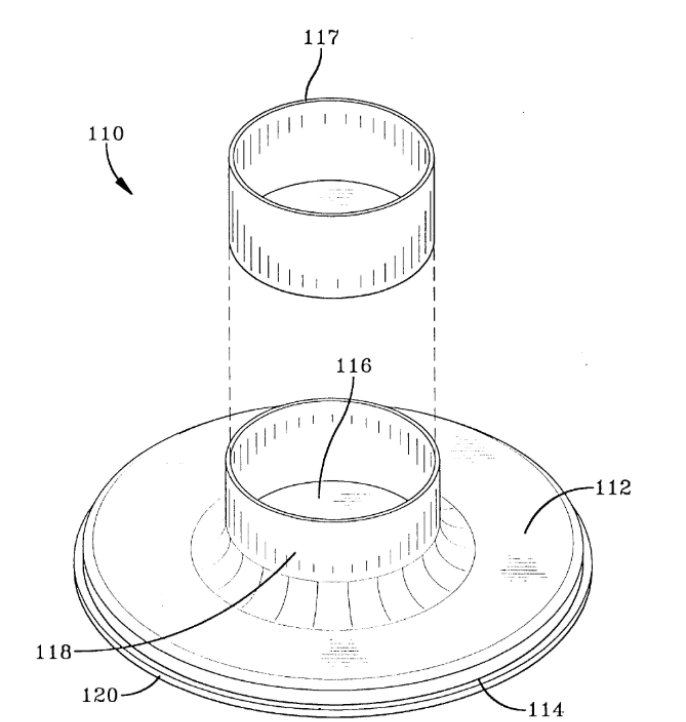
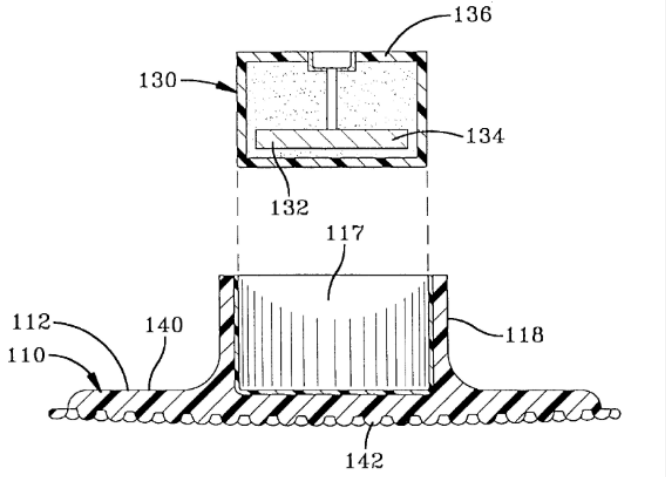


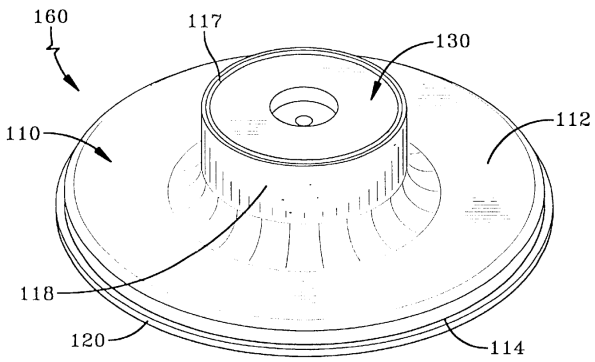
FIG−8

Rigid tag assembly 130, which includes the encapsulated electronic monitoring device and has the same components as previously described, is essentially identical to rigid tag assembly 30 except for its profile, being round or circular instead of rectangular. Round rigid tag assembly 130 is permanently bonded to the round patch assembly by inserting rigid tag assembly 130 into cylindrical insert 117, as shown in FIG. 8, after applying an epoxy adhesive such as a Fusor system manufactured by Lord Corp. of Erie Pa. to the interface between the rigid tag assembly 130 and the cylindrical insert 117. Of course, the epoxy adhesive also may conveniently be applied to the interface between the bottom of cavity 116, whether it is a roughened surface or made of the same or similar material as cylindrical insert 117. As the rigid tag assembly 130 is inserted

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	into cylindrical insert 117, excess epoxy flows out from the interface, which must be removed before it cures. Cylindrical insert 117 only must be of sufficient height so that after curing of the epoxy, there is sufficient bonding strength between the insert 117 and tag assembly 130 to assure no separation. Although the rigid tag assembly 130 may be of the same height as cylindrical insert 117, as shown in the preferred embodiment, it also may be lower or higher than cylindrical insert 117 upon assembly. If tag assembly 130 is higher than the cylindrical insert 117, then insert 117 has a lower profile than the rigid tag assembly 130 so that the outer periphery of the rigid tag assembly 130 extends above the outer periphery of the cylindrical insert 117, thereby reducing the overall amount of material required for tire patch 110. (6:29-57) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.)  FIG–2 While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to

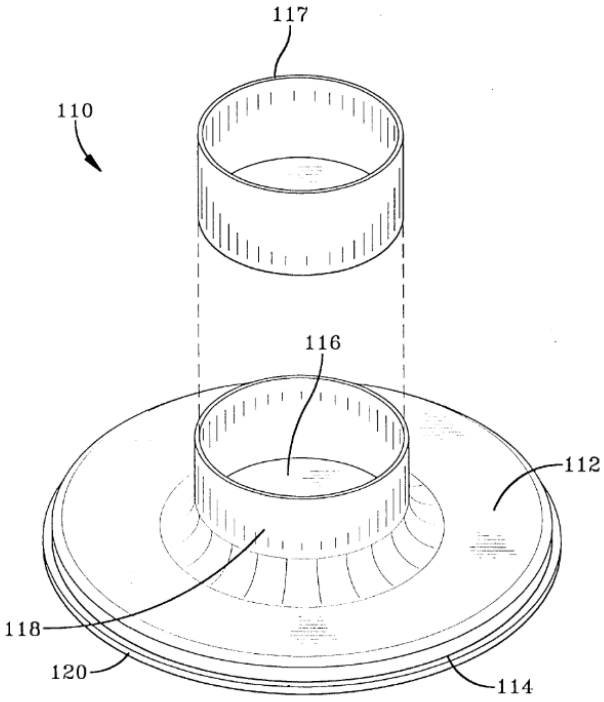
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG–6
7. The sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member. For example:* FIG. 6 is a perspective view of an alternative configuration of the tire patch of the present invention. FIG. 7 is a cross-sectional view of the rigid tag assembly of FIG. 6, showing the encapsulated electronic monitoring device. FIG. 8 is a perspective view of the patch assembly of the present invention. (3:35-42)

’421 Claim Element	Disclosures from Prior Art (Koch-046)
	 FIG–6  FIG–7

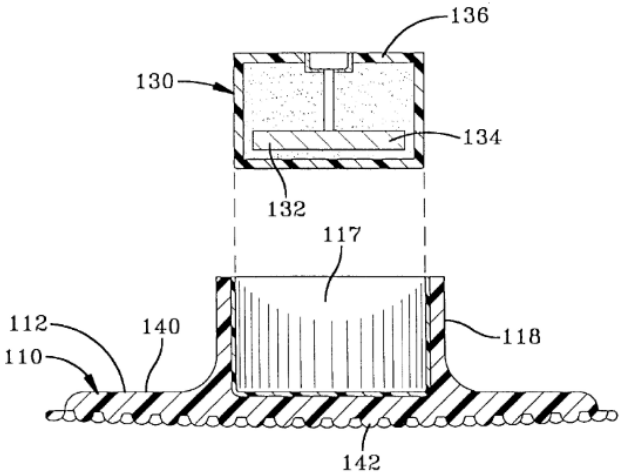
’421 Claim Element	Disclosures from Prior Art (Koch-046)
	 FIG−8 FIG. 6 shows an alternative configuration of a tire patch 110 of the present invention. The tire patch 110 is of a preselected configuration, which as shown, is round in shape. The tire patch 110 has a first side 112 for interfacing with a face of an encapsulated tag assembly 130, shown in cross-section in FIG. 7. First side 112 includes a recessed cavity 116, which in this alternative configuration is formed by a cylindrical rigid insert 117 molded into the rubber patch. Preferably cylindrical insert 117 is a rigid plastic material, such as nylon, epoxy or a rigid composite material such as glass-filled polyimide or glass-filled epoxy, but also may be a metal, as long as the metal does not interfere with the electronic functions and operation of tag assembly 130. Cylindrical rigid insert 117 is surrounded by a ridge 118 of rubbery material. The ridge preferably is of the same material as the remainder of the patch and should be of sufficient height to permanently hold cylindrical insert 117 in place following curing. In a preferred embodiment shown in FIGS. 6 and 7, the ridge 118 is the same height as cylindrical insert 117. The patch is gradually tapered from the ridge 118 of material of the first side of the patch outwardly toward the edges of the patch. Recessed cavity 116 may have a roughened bottom surface to increase its surface area, as previously described, or alternatively may be smooth and made from the same material as the cylindrical insert. The patch has a second opposite side 114 which may approximate the contour of an inner liner of a tire. The contour of the second side 114 preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side 114 is flat, having no

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	contour. Tire patch 110 including cylindrical rigid insert 117 is cured prior to insertion of rigid tag assembly 130 to form a round patch assembly. (5:61-6:28) Rigid tag assembly 130, which includes the encapsulated electronic monitoring device and has the same components as previously described, is essentially identical to rigid tag assembly 30 except for its profile, being round or circular instead of rectangular. Round rigid tag assembly 130 is permanently bonded to the round patch assembly by inserting rigid tag assembly 130 into cylindrical insert 117, as shown in FIG. 8, after applying an epoxy adhesive such as a Fusor system manufactured by Lord Corp. of Erie Pa. to the interface between the rigid tag assembly 130 and the cylindrical insert 117. Of course, the epoxy adhesive also may conveniently be applied to the interface between the bottom of cavity 116, whether it is a roughened surface or made of the same or similar material as cylindrical insert 117. As the rigid tag assembly 130 is inserted into cylindrical insert 117, excess epoxy flows out from the interface, which must be removed before it cures. Cylindrical insert 117 only must be of sufficient height so that after curing of the epoxy, there is sufficient bonding strength between the insert 117 and tag assembly 130 to assure no separation. Although the rigid tag assembly 130 may be of the same height as cylindrical insert 117, as shown in the preferred embodiment, it also may be lower or higher than cylindrical insert 117 upon assembly. If tag assembly 130 is higher than the cylindrical insert 117, then insert 117 has a lower profile than the rigid tag assembly 130 so that the outer periphery of the rigid tag assembly 130 extends above the outer periphery of the cylindrical insert 117, thereby reducing the overall amount of material required for tire patch 110. (6:29-57)
8. The sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith. For example:* FIG. 6 is a perspective view of an alternative configuration of the tire patch of the present invention. FIG. 7 is a cross-sectional view of the rigid tag assembly of FIG. 6, showing the encapsulated electronic monitoring device.

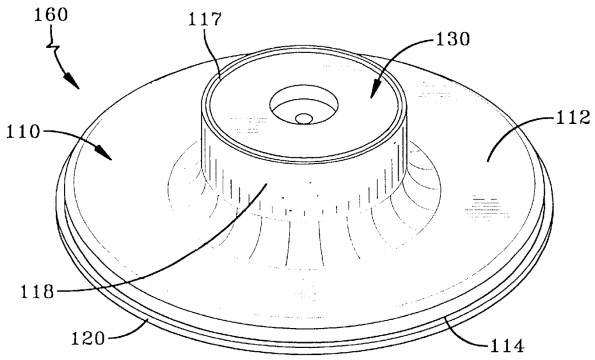
’421 Claim Element	Disclosures from Prior Art (Koch-046)
	FIG. 8 is a perspective view of the patch assembly of the present invention. (3:35-42)



FIG−6



FIG−7

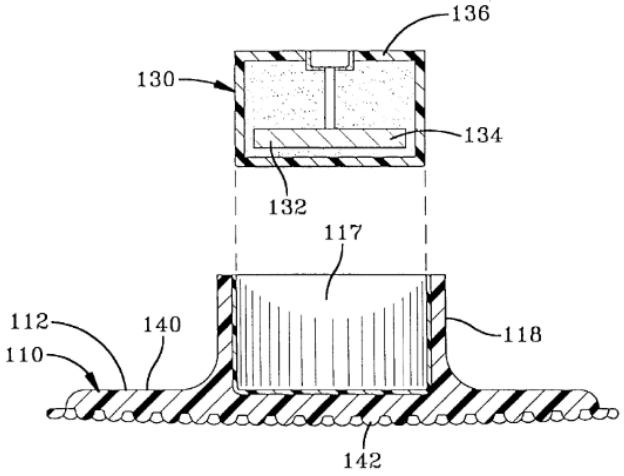
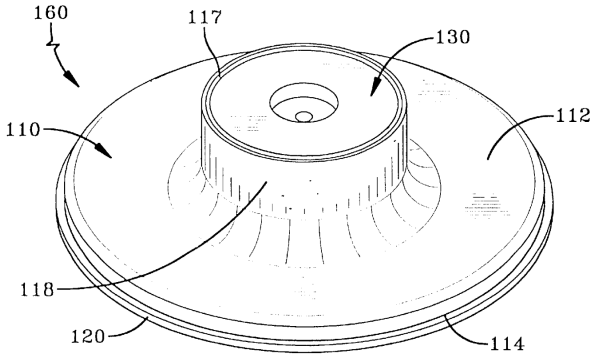
’421 Claim Element	Disclosures from Prior Art (Koch-046)
	 FIG−8 FIG. 6 shows an alternative configuration of a tire patch 110 of the present invention. The tire patch 110 is of a preselected configuration, which as shown, is round in shape. The tire patch 110 has a first side 112 for interfacing with a face of an encapsulated tag assembly 130, shown in cross-section in FIG. 7. First side 112 includes a recessed cavity 116, which in this alternative configuration is formed by a cylindrical rigid insert 117 molded into the rubber patch. Preferably cylindrical insert 117 is a rigid plastic material, such as nylon, epoxy or a rigid composite material such as glass-filled polyimide or glass-filled epoxy, but also may be a metal, as long as the metal does not interfere with the electronic functions and operation of tag assembly 130. Cylindrical rigid insert 117 is surrounded by a ridge 118 of rubbery material. The ridge preferably is of the same material as the remainder of the patch and should be of sufficient height to permanently hold cylindrical insert 117 in place following curing. In a preferred embodiment shown in FIGS. 6 and 7, the ridge 118 is the same height as cylindrical insert 117. The patch is gradually tapered from the ridge 118 of material of the first side of the patch outwardly toward the edges of the patch. Recessed cavity 116 may have a roughened bottom surface to increase its surface area, as previously described, or alternatively may be smooth and made from the same material as the cylindrical insert. The patch has a second opposite side 114 which may approximate the contour of an inner liner of a tire. The contour of the second side 114 preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side 114 is flat, having no

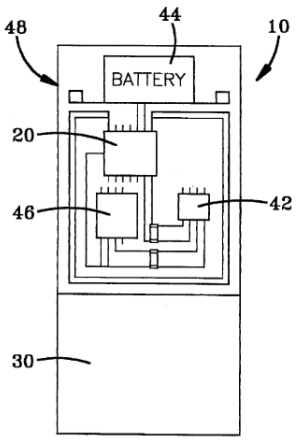
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	contour. Tire patch 110 including cylindrical rigid insert 117 is cured prior to insertion of rigid tag assembly 130 to form a round patch assembly. (5:61-6:28) Rigid tag assembly 130, which includes the encapsulated electronic monitoring device and has the same components as previously described, is essentially identical to rigid tag assembly 30 except for its profile, being round or circular instead of rectangular. Round rigid tag assembly 130 is permanently bonded to the round patch assembly by inserting rigid tag assembly 130 into cylindrical insert 117, as shown in FIG. 8, after applying an epoxy adhesive such as a Fusor system manufactured by Lord Corp. of Erie Pa. to the interface between the rigid tag assembly 130 and the cylindrical insert 117. Of course, the epoxy adhesive also may conveniently be applied to the interface between the bottom of cavity 116, whether it is a roughened surface or made of the same or similar material as cylindrical insert 117. As the rigid tag assembly 130 is inserted into cylindrical insert 117, excess epoxy flows out from the interface, which must be removed before it cures. Cylindrical insert 117 only must be of sufficient height so that after curing of the epoxy, there is sufficient bonding strength between the insert 117 and tag assembly 130 to assure no separation. Although the rigid tag assembly 130 may be of the same height as cylindrical insert 117, as shown in the preferred embodiment, it also may be lower or higher than cylindrical insert 117 upon assembly. If tag assembly 130 is higher than the cylindrical insert 117, then insert 117 has a lower profile than the rigid tag assembly 130 so that the outer periphery of the rigid tag assembly 130 extends above the outer periphery of the cylindrical insert 117, thereby reducing the overall amount of material required for tire patch 110. (6:29-57)
9. The sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member. For example:* FIELD OF THE INVENTION This invention pertains to an apparatus and a method of bonding an active tag to a patch and to a tire. More particularly, this invention sets forth a method and apparatus for encapsulating an

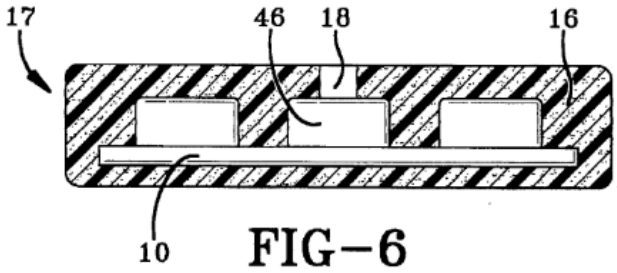
'421 Claim Element	Disclosures from Prior Art (Koch-046)
	electronic device in a rigid material, mounting the device on a vulcanized rubber patch and bonding the rubber patch to a vulcanized tire. (1:5-10) The improved method and apparatus increases the life of the electronic monitoring device by minimizing the stress, strain, cyclic fatigue, impact and vibration to which the electronic monitoring device is subjected when properly assembled into a tire. While the location of the device is an important factor in determining the life of an electronic monitoring device located within a tire, so too is the manner in which the device is installed into the tire. A method for securing within a tire an electronic monitoring device for monitoring at least one engineering condition of a tire comprises the steps of encapsulating an electronic monitoring device by placing the electronic monitoring device into a mold having a preselected configuration, the preselected configuration including at least one face having an alternating raised and recessed pattern to increase the surface area of the face. The mold is filled with an epoxy potting material so that the electronic monitoring device is encased by the epoxy. The epoxy potting material is cured to form a rigid tag assembly having a preselected configuration. However, certain electronic components comprising the electronic monitoring device, such as pressure sensors, are assembled in such a manner as to remain free from internal contamination while remaining open to the tire atmosphere as necessary. A rubber tire patch having a preselected configuration is formed. The rubber patch includes a first side for interfacing with the face of the encapsulated rigid tag assembly. This first side has increased surface area, which allows for a better bond with the encapsulated tag. The first side also includes a recessed cavity surrounded by a ridge of material of sufficient height to capture the encapsulated rigid tag assembly This ridge helps to improve the bond between the rubber patch and the encapsulated rigid tag. The patch includes a second opposite side, the second side approximating the contour of the inner liner of the tire. The patch is tapered from the first side toward the second side, with the second side flaring out into a relatively thin configuration, but having a radius approaching the radius of the tire inner liner. The rubber patch is vulcanized at a preselected temperature and for a time sufficient its vulcanization. After vulcanization, a thin layer of dual cure bonding rubber is applied to the second side of the vulcanized rubber patch. This thin layer of dual cure bonding rubber will permit the assembly of the patch assembly to the inner liner of the tire. A fluid epoxy adhesive is applied to an interface between the encapsulated tag assembly and

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	the rubber patch. The encapsulated tag assembly is assembled into the recessed cavity on the first side of the rubber patch so that the fluid epoxy adhesive is evenly distributed across the interface and flows from the interface between the encapsulated tag assembly and the rubber patch. Of course, the increased surface area of the tag assembly allows for better bonding between the rubber patch and the encapsulated tag. The assembly or the encapsulated tag and the rubber patch is allowed to cure to form a patch assembly. The patch assembly is then assembled to the inner liner of a vulcanized tire by applying an activating cement between the dual cure bonding layer and the inner liner of the tire. This curing process permanently bonds the patch assembly to the inner liner and is diffusion-controlled. Because it is diffusion controlled, the curing must be done for a sufficient amount of time and at a sufficient temperature to allow a strong permanent bond to form. To assure that solid contact is maintained at the interface between the inner liner of the tire and the dual cure bonding layer of the patch assembly, a clamping mechanism is applied to secure the patch assembly to the inner liner during the curing process. The clamping mechanism is applied with sufficient pressure across the interface of the patch assembly and the inner liner to assure intimate contact during curing. (2:20-3:21)
10. The sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device. For example:* Additionally, certain components of the device, such as the pressure sensor or a thermistor must remain open to the pressurized tire cavity. The flow of rubber occurring during the vulcanization process can effect the openings to the tire cavity. As set forth in U.S. Pat. No. 5,562,787, the opening to the tire cavity can remain open during the curing operations by placement of a dowel into the opening. (2:3-9) FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) The circuit board including sensors, battery and optional antenna, hereinafter referred to as the electronic monitoring device, are encapsulated in a potting material 40 which solidifies into a rigid material. Referring to FIG. 3, the electronic monitoring device is placed within a mold 50 having a first half 52 and a second half 54. At least one of the mold halves has a face with increased surface area, shown as surface 56 in the second half 54 of mold 40. The mold is then filled with the potting material 40 in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag assembly. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves 52, 54 are separated, yielding a rigid, encapsulated tag assembly 30. Tag assembly 30 has a bottom surface 42 having increased surface finish which is simply the impression of surface 56 from mold half 54. (4:63-5:22) FIG. 7 is a cross-sectional view of the rigid tag assembly of FIG. 6, showing the encapsulated electronic monitoring device. FIG. 8 is a perspective view of the patch assembly of the present invention. (3:38-42)

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	 FIG–7  FIG–8 Rigid tag assembly 130, which includes the encapsulated electronic monitoring device and has the same components as previously described, is essentially identical to rigid tag assembly 30 except for its profile, being round or circular instead of rectangular. Round rigid tag assembly 130 is permanently bonded to the round patch assembly by inserting rigid tag assembly 130 into cylindrical insert 117, as shown in FIG. 8, after applying an epoxy adhesive such as a Fusor system manufactured by Lord Corp. of Erie Pa. to the interface between the rigid tag assembly 130 and the cylindrical insert 117. Of course, the epoxy adhesive also may conveniently be applied to the interface between the bottom of cavity 116, whether it is a roughened surface or made of the same or similar material as cylindrical insert 117. As the rigid tag assembly 130 is inserted into cylindrical insert 117, excess epoxy flows out from the interface, which must be removed before it cures. Cylindrical

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	insert 117 only must be of sufficient height so that after curing of the epoxy, there is sufficient bonding strength between the insert 117 and tag assembly 130 to assure no separation. Although the rigid tag assembly 130 may be of the same height as cylindrical insert 117, as shown in the preferred embodiment, it also may be lower or higher than cylindrical insert 117 upon assembly. If tag assembly 130 is higher than the cylindrical insert 117, then insert 117 has a lower profile than the rigid tag assembly 130 so that the outer periphery of the rigid tag assembly 130 extends above the outer periphery of the cylindrical insert 117, thereby reducing the overall amount of material required for tire patch 110. (6:29-57) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.)  FIG–2 While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG–6
11. A sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication.	*Koch-046 discloses, teaches, and/or suggests a sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication. For example:* FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering

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	conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) **Abstract** A method for monitoring various physical conditions of pneumatic tires, and to a tire including a monitoring device. More particularly, the invention relates to a method of monitoring tires which uses an active, self-powered programmable electronic device which is installed in or on the interior surface of a pneumatic tire or on a tire rim. This device can be used for monitoring, storing and telemetering information such as temperature, pressure, tire rotations and/or other operating conditions of a pneumatic tire, along with tire identification information. The device includes a power source which can be placed into an active or a dormant mode using a data band switching circuit. The device can be activated by externally transmitted radio frequency waves or microwaves and in response, the device compares or transmits information and provides a warning in the event a preselected limit is exceeded. (Koch-787) In accordance with an aspect of the present invention, a method of monitoring tires is provided in which an activatable monitoring device or tag is mounted within at least one tire of a vehicle, on the interior surface thereof, or on the tire rim. The device is activated by means of an interrogator signal having a frequency in the microwave range. In response to the signal, the monitoring device measures and transmits information relating to one or more conditions such as the internal pressure and temperature of the tire, the number of rotations of the tire, and tire identification information. Desirably, the tire information is received at a monitoring station where the information can be viewed on a color coded, visual display, and even have an audio signal and/or flashing lights to indicate an undesirable condition with respect to acceptable values. The display can show all the tires of a vehicle sequentially or at the same time. Alternatively, the monitoring device can be activated to transmit the various conditions to a host storage device located in a weigh station, a trucking terminal, etc.,

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	which thus can record and contain the history of the transmitted condition values of the individual tires. (Koch-787, 2:7-27) The monitoring device includes an active circuit which is powered by a dedicated, long life, miniature battery and one or more sensors for detecting and transducing operating conditions. The device further includes integrated circuitry; a programmable microprocessor for processing the electrical signals from the sensor and for data storage including tire identification information; and a microwave receiver/transmitter for receiving and telemetering the processed electrical signals from the sensors in response to an electromagnetic signal from an external interrogator. By using microwave frequency transmissions, it is possible to achieve relatively long-range transmissions using a relatively small antenna. The monitoring device can be installed either on new tires during the manufacturing process or added to existing tires. (Koch-787, 27-41) FIG. 5 is a block diagram of a generic type interrogator 60 which can be used to communicate with and retrieve digitally coded information from the electronic monitoring device. The interrogator includes microwave transmitter and receive circuits for communicating with the micro chip. The RF transmitter utilizes dual frequency bands so that only tags (i.e. monitoring devices) programmed to respond to a certain band will be activated, leaving the others dormant and conserving battery power. This is called "data band switching" and is defined as part of the public domain Micron protocol. The interrogator includes circuitry to receive and transmit using spread spectrum modulation as defined in the Micron protocol and as required by the FCC for microwave communication devices. The power level of transmission is user selectable and either one or two antennas can be employed by the interrogator to improve reception. The interrogator includes I/O communications hardware to support interaction with a host computer via parallel, serial RS-232, RS-485 and Ethernet links. A commercially manufactured interrogator of the type described is available from Unisys Corp., Salt Lake City, Utah. The interrogator can be interfaced with a computer 70 to allow downloading, archiving, and analysis of data transmitted from the electronic monitoring device 10. Moreover, different interrogators or a plurality thereof can be utilized with respect to different interrogation situations. (Koch-787, 8:57-9:14)

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	The interrogator can be remotely located in a vehicle, e.g., a truck, to permit intermittent monitoring at regular intervals such as every thirty minutes, to alert the driver of the vehicle of any imminent or impending problems such as over or under inflation or abnormally high temperatures. Alternatively, the interrogator can be located at a vehicle service stop, e.g., fuel station, trucking terminal, or at any other convenient location for archival, and/or current sensor readouts of tire pressure and tire revolutions, etc., as through visual readouts, flashing lights, etc., as noted above. The monitoring devices in each tire can be interrogated for information at regular or arbitrary intervals and the data can be stored on a computer interfaced to the interrogator. The monitoring device 10 can also be programmed to act as an alarm system to warn of extreme temperature or pressure conditions, or it may be used to log pressure and/or temperature histories during tire operation. Such data can be used, for example, to evaluate the retreadability of truck tires. (Koch-787, 9:16-34) The interrogator includes various features such as software protocol for sorting, identifying and communicating with multiple monitoring devices without ambiguity, thus enabling a signal interrogator to quickly sort and retrieve information from a plurality of monitoring devices associated with individual tires on a vehicle or on multiple vehicles. The broadcast range, from within a tire can vary, such as in excess of fifty feet, thus permitting a stationary interrogator to quickly query all tire chips on a vehicle which is passing by the interrogator or from an on board vehicle location. (Koch-787, 9:35-45)
12. The sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*Koch-046 discloses, teaches, and/or suggests the sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) **Abstract** A method for monitoring various physical conditions of pneumatic tires, and to a tire including a monitoring device. More particularly, the invention relates to a method of monitoring tires which uses an active, self-powered programmable electronic device which is installed in or on the interior surface of a pneumatic tire or on a tire rim. This device can be used for monitoring, storing and telemetering information such as temperature, pressure, tire rotations and/or other operating conditions of a pneumatic tire, along with tire identification information. The device includes a power source which can be placed into an active or a dormant mode using a data band switching circuit. The device can be activated by externally transmitted radio frequency waves or microwaves and in response, the device compares or transmits information and provides a warning in the event a preselected limit is exceeded. (Koch-787) In accordance with an aspect of the present invention, a method of monitoring tires is provided in which an activatable monitoring device or tag is mounted within at least one tire of a vehicle, on the interior surface thereof, or on the tire rim. The device is activated by means of an interrogator signal having a frequency in the microwave range. In response to the signal, the monitoring device measures and transmits information relating to one or more conditions such as the internal pressure and temperature of the tire, the number of rotations of the tire, and tire identification information. Desirably, the tire information is received at a monitoring station where the information can be viewed on a color coded, visual display, and even have an audio signal and/or flashing lights to indicate an undesirable condition with respect to acceptable values. The display can show all the tires of a vehicle sequentially or at the same time. Alternatively, the monitoring device can be activated to transmit the various conditions to a host storage device located in a weigh station, a trucking terminal, etc.,

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	which thus can record and contain the history of the transmitted condition values of the individual tires. (Koch-787, 2:7-27) The monitoring device includes an active circuit which is powered by a dedicated, long life, miniature battery and one or more sensors for detecting and transducing operating conditions. The device further includes integrated circuitry; a programmable microprocessor for processing the electrical signals from the sensor and for data storage including tire identification information; and a microwave receiver/transmitter for receiving and telemetering the processed electrical signals from the sensors in response to an electromagnetic signal from an external interrogator. By using microwave frequency transmissions, it is possible to achieve relatively long-range transmissions using a relatively small antenna. The monitoring device can be installed either on new tires during the manufacturing process or added to existing tires. (Koch-787, 27-41)
20. The sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device. For example:* FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) **Abstract**

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	A method for monitoring various physical conditions of pneumatic tires, and to a tire including a monitoring device. More particularly, the invention relates to a method of monitoring tires which uses an active, self-powered programmable electronic device which is installed in or on the interior surface of a pneumatic tire or on a tire rim. This device can be used for monitoring, storing and telemetering information such as temperature, pressure, tire rotations and/or other operating conditions of a pneumatic tire, along with tire identification information. The device includes a power source which can be placed into an active or a dormant mode using a data band switching circuit. The device can be activated by externally transmitted radio frequency waves or microwaves and in response, the device compares or transmits information and provides a warning in the event a preselected limit is exceeded. (Koch-787) In accordance with an aspect of the present invention, a method of monitoring tires is provided in which an activatable monitoring device or tag is mounted within at least one tire of a vehicle, on the interior surface thereof, or on the tire rim. The device is activated by means of an interrogator signal having a frequency in the microwave range. In response to the signal, the monitoring device measures and transmits information relating to one or more conditions such as the internal pressure and temperature of the tire, the number of rotations of the tire, and tire identification information. Desirably, the tire information is received at a monitoring station where the information can be viewed on a color coded, visual display, and even have an audio signal and/or flashing lights to indicate an undesirable condition with respect to acceptable values. The display can show all the tires of a vehicle sequentially or at the same time. Alternatively, the monitoring device can be activated to transmit the various conditions to a host storage device located in a weigh station, a trucking terminal, etc., which thus can record and contain the history of the transmitted condition values of the individual tires. (Koch-787, 2:7-27) The monitoring device includes an active circuit which is powered by a dedicated, long life, miniature battery and one or more sensors for detecting and transducing operating conditions. The device further includes integrated circuitry; a programmable microprocessor for processing the electrical signals from the sensor and for data storage including tire identification information; and a microwave receiver/transmitter for receiving and telemetering the processed electrical signals from the sensors

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	in response to an electromagnetic signal from an external interrogator. By using microwave frequency transmissions, it is possible to achieve relatively long-range transmissions using a relatively small antenna. The monitoring device can be installed either on new tires during the manufacturing process or added to existing tires. (Koch-787, 27-41)
21. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor. For example:* FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) **Abstract** A method for monitoring various physical conditions of pneumatic tires, and to a tire including a monitoring device. More particularly, the invention relates to a method of monitoring tires which uses an active, self-powered programmable electronic device which is installed in or on the interior surface of a pneumatic tire or on a tire rim. This device can be used for monitoring, storing and telemetering information such as temperature, pressure, tire rotations and/or other operating conditions of a pneumatic tire, along with tire identification information. The device includes a power source which can be placed into an active or a dormant mode using a data band switching circuit. The device can be activated by externally transmitted radio frequency waves or microwaves and in response, the device compares or transmits information and

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	provides a warning in the event a preselected limit is exceeded. (Koch-787) In accordance with an aspect of the present invention, a method of monitoring tires is provided in which an activatable monitoring device or tag is mounted within at least one tire of a vehicle, on the interior surface thereof, or on the tire rim. The device is activated by means of an interrogator signal having a frequency in the microwave range. In response to the signal, the monitoring device measures and transmits information relating to one or more conditions such as the internal pressure and temperature of the tire, the number of rotations of the tire, and tire identification information. Desirably, the tire information is received at a monitoring station where the information can be viewed on a color coded, visual display, and even have an audio signal and/or flashing lights to indicate an undesirable condition with respect to acceptable values. The display can show all the tires of a vehicle sequentially or at the same time. Alternatively, the monitoring device can be activated to transmit the various conditions to a host storage device located in a weigh station, a trucking terminal, etc., which thus can record and contain the history of the transmitted condition values of the individual tires. (Koch-787, 2:7-27) The monitoring device includes an active circuit which is powered by a dedicated, long life, miniature battery and one or more sensors for detecting and transducing operating conditions. The device further includes integrated circuitry; a programmable microprocessor for processing the electrical signals from the sensor and for data storage including tire identification information; and a microwave receiver/transmitter for receiving and telemetering the processed electrical signals from the sensors in response to an electromagnetic signal from an external interrogator. By using microwave frequency transmissions, it is possible to achieve relatively long-range transmissions using a relatively small antenna. The monitoring device can be installed either on new tires during the manufacturing process or added to existing tires. (Koch-787, 27-41)
22. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device. For example:* FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32.

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) **Abstract** A method for monitoring various physical conditions of pneumatic tires, and to a tire including a monitoring device. More particularly, the invention relates to a method of monitoring tires which uses an active, self-powered programmable electronic device which is installed in or on the interior surface of a pneumatic tire or on a tire rim. This device can be used for monitoring, storing and telemetering information such as temperature, pressure, tire rotations and/or other operating conditions of a pneumatic tire, along with tire identification information. The device includes a power source which can be placed into an active or a dormant mode using a data band switching circuit. The device can be activated by externally transmitted radio frequency waves or microwaves and in response, the device compares or transmits information and provides a warning in the event a preselected limit is exceeded. (Koch-787) In accordance with an aspect of the present invention, a method of monitoring tires is provided in which an activatable monitoring device or tag is mounted within at least one tire of a vehicle, on the interior surface thereof, or on the tire rim. The device is activated by means of an interrogator signal having a frequency in the microwave range. In response to the signal, the monitoring device measures and transmits information relating to one or more conditions such as the internal pressure and temperature of the tire, the number of rotations of the tire, and tire identification information. Desirably, the tire information is received at a

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	monitoring station where the information can be viewed on a color coded, visual display, and even have an audio signal and/or flashing lights to indicate an undesirable condition with respect to acceptable values. The display can show all the tires of a vehicle sequentially or at the same time. Alternatively, the monitoring device can be activated to transmit the various conditions to a host storage device located in a weigh station, a trucking terminal, etc., which thus can record and contain the history of the transmitted condition values of the individual tires. (Koch-787, 2:7-27) The monitoring device includes an active circuit which is powered by a dedicated, long life, miniature battery and one or more sensors for detecting and transducing operating conditions. The device further includes integrated circuitry; a programmable microprocessor for processing the electrical signals from the sensor and for data storage including tire identification information; and a microwave receiver/transmitter for receiving and telemetering the processed electrical signals from the sensors in response to an electromagnetic signal from an external interrogator. By using microwave frequency transmissions, it is possible to achieve relatively long-range transmissions using a relatively small antenna. The monitoring device can be installed either on new tires during the manufacturing process or added to existing tires. (Koch-787, 27-41)
23. The sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object. For example:* FIG. 2 shows a cross-sectional view of the rigid tag assembly 30, showing the encapsulated electronic monitoring device 32. Monitoring device may be a circuit board 34 which includes electronic memory as well as a variety of sensors for monitoring engineering conditions such as, for example, pressure, temperature and distance traveled. The monitoring device is discussed in detail in U.S. Pat. No. 5,562,787, incorporated herein by reference. Mounted to the board is a power source 36, such a battery, which permits the active monitoring of the engineering conditions, which may be stored in the electronic memory for later use. The power source provides a bulge 38 to the rigid tag assembly, although this feature is expected to become less prominent or even completely eliminated as advances in battery technology produce smaller yet more powerful batteries. The rigid

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	tag assembly may also house an antenna, or may provide for assembly of an antenna which protrudes from the tag assembly so that the circuitry on the board can be activated for transmittal at will. (4:44-62) **Abstract** A method for monitoring various physical conditions of pneumatic tires, and to a tire including a monitoring device. More particularly, the invention relates to a method of monitoring tires which uses an active, self-powered programmable electronic device which is installed in or on the interior surface of a pneumatic tire or on a tire rim. This device can be used for monitoring, storing and telemetering information such as temperature, pressure, tire rotations and/or other operating conditions of a pneumatic tire, along with tire identification information. The device includes a power source which can be placed into an active or a dormant mode using a data band switching circuit. The device can be activated by externally transmitted radio frequency waves or microwaves and in response, the device compares or transmits information and provides a warning in the event a preselected limit is exceeded. (Koch-787) In accordance with an aspect of the present invention, a method of monitoring tires is provided in which an activatable monitoring device or tag is mounted within at least one tire of a vehicle, on the interior surface thereof, or on the tire rim. The device is activated by means of an interrogator signal having a frequency in the microwave range. In response to the signal, the monitoring device measures and transmits information relating to one or more conditions such as the internal pressure and temperature of the tire, the number of rotations of the tire, and tire identification information. Desirably, the tire information is received at a monitoring station where the information can be viewed on a color coded, visual display, and even have an audio signal and/or flashing lights to indicate an undesirable condition with respect to acceptable values. The display can show all the tires of a vehicle sequentially or at the same time. Alternatively, the monitoring device can be activated to transmit the various conditions to a host storage device located in a weigh station, a trucking terminal, etc., which thus can record and contain the history of the transmitted condition values of the individual tires. (Koch-787, 2:7-27) The monitoring device includes an active circuit which is powered by a dedicated, long life, miniature battery and one or more

'421 Claim Element	Disclosures from Prior Art (Koch-046)
	sensors for detecting and transducing operating conditions. The device further includes integrated circuitry; a programmable microprocessor for processing the electrical signals from the sensor and for data storage including tire identification information; and a microwave receiver/transmitter for receiving and telemetering the processed electrical signals from the sensors in response to an electromagnetic signal from an external interrogator. By using microwave frequency transmissions, it is possible to achieve relatively long-range transmissions using a relatively small antenna. The monitoring device can be installed either on new tires during the manufacturing process or added to existing tires. (Koch-787, 27-41)
24. The sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire. For example:* **[Abstract]** A method and apparatus for bonding an active tag to a patch and assembling the patch to a tire is set forth. A patch assembly and a method for securing an electronic monitoring device having electronic and mechanical components for monitoring at least one engineering condition within a tire, comprising an rigid tag assembly encapsulating the electronic monitoring device, bonded to a vulcanized rubber patch which is secured to the inner cavity of a tire utilizing a layer of dual cure bonding rubber. FIELD OF THE INVENTION This invention pertains to an apparatus and a method of bonding an active tag to a patch and to a tire. More particularly, this invention sets forth a method and apparatus for encapsulating an electronic device in a rigid material, mounting the device on a vulcanized rubber patch and bonding the rubber patch to a vulcanized tire. (1:5-10)
28[pre]. A sensor assembly and sensing system for use with an object that rotates in use comprising:	*To the extent that the preamble is limiting, Koch-046 discloses, teaches, and/or suggests a sensor assembly and sensing system for use with an object that rotates in use comprising. For example:* *See, e.g.*, **1**, **11**, above. *See also following limitations.*

'421 Claim Element	Disclosures from Prior Art (Koch-046)
[28a] a housing comprising an outer structure that defines an open internal cavity therein,	*Koch-046 discloses, teaches, and/or suggests a housing comprising an outer structure that defines an open internal cavity therein. For example:* *See, e.g.*, **[1a]-[1c]**, **10**, above.
[28b] an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device,	*Koch-046 discloses, teaches, and/or suggests an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device. For example:* *See, e.g.*, **[1a]-[1c]**, **5**, **10**, above.
[28c] wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location.	*Koch-046 discloses, teaches, and/or suggests wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location. For example:* *See, e.g.*, **[1d]**, above.
[28d] wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor;	*Koch-046 discloses, teaches, and/or suggests wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor. For example:* *See, e.g.*, **[1a]-[1c]**, **20**, above.
[28e] a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member; and	*Koch-046 discloses, teaches, and/or suggests a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member. For example:* *See, e.g.*, **[1e]**, **7**, **8**, above.
[28f] a receiver external from the object that is configured to receive information from the	*Koch-046 discloses, teaches, and/or suggests a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly. For example:*

'421 Claim Element	**Disclosures from Prior Art (Koch-046)**
electrical sensor device wirelessly.	*See, e.g.*, **11**, above.
31. The sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity. For example:* *See, e.g.*, **[1c]**, above.
32. The sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member. For example:* *See, e.g.*, **[1e]**, **9**, above.
33. The sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.*, **[1b]**, **11** above.
34. The sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data.	*Koch-046 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data. For example:* *See, e.g.,* **1[pre]**, **[1b]**, **[1d]**, **[1e]**, **11**, **12**, **20**, above.

'421 Claim Element	Disclosures from Prior Art (Koch-046)
41[pre] A method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of:	*To the extent that the preamble is limiting, Koch-046 discloses, teaches, and/or suggests a method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of: vulcanized rubber tire comprising. For example:* *See, e.g.,* **1**, **11**, **12**, **20**, above. *See also following limitations.*
[41a] installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity, and	*Koch-046 discloses, teaches, and/or suggests installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41b] wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry,	*Koch-046 discloses, teaches, and/or suggests wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41c] wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity;	*Koch-046 discloses, teaches, and/or suggests wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41d] attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object; and	*Koch-046 discloses, teaches, and/or suggests attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object. For example:* *See, e.g.,* **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41e] monitoring an operating parameter of the object	*Koch-046 discloses, teaches, and/or suggests monitoring an operating parameter of the object through the use of the electrical sensing*

'421 Claim Element	Disclosures from Prior Art (Koch-046)
through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly.	*device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
43. The method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity.	*Koch-046 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
44. The method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed.	*Koch-046 discloses, teaches, and/or suggests the method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above
48. The method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire.	*Koch-046 discloses, teaches, and/or suggests the method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
50. The method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing.	*Koch-046 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
51. The method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters	*Koch-046 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the*

'421 Claim Element	Disclosures from Prior Art (Koch-046)
comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device.	*antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
52. The method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor.	*Koch-046 discloses, teaches, and/or suggests the method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
53. The method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly.	*Koch-046 discloses, teaches, and/or suggests the method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

Invalidity Claim Chart Against U.S. Patent No. 11,835,421 ("'421 Patent")
Based on U.S. Patent No. 7,009,506 ("Wilson-506")

U.S. Patent No. 7,009,506 ("Wilson-506") was filed on July 9, 2002 and issued on March 7, 2006. Wilson-506 qualifies as prior art under at least 35 U.S.C. § 102. Wilson-506 anticipates and/or renders obvious the Asserted Claims of the '421 Patent (at least as Revvo understands Plaintiff's application of the Asserted Claims in an effort to show infringement).

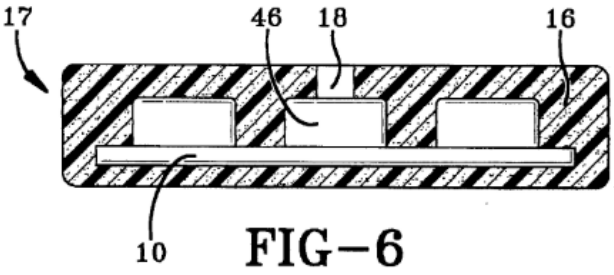
To the extent Plaintiff argues that any element below is not disclosed by Wilson-506, a person of ordinary skill in the art would have found it obvious to combine the teachings of Wilson-506 with the background knowledge of a person of ordinary skill in the art and/or the additional references and exemplary teachings set forth in the chart below, to arrive at the claim limitation with a reasonable expectation of success. The chart below provides representative examples of where each element of each claim is found within Wilson-506. Citations are meant to be exemplary, not exhaustive, and Revvo reserves the right to identify and discuss additional portions of the reference in support of its contentions and/or to rebut arguments made by Plaintiff. Citations to figures, drawings, tables, and the link include reference to any accompanying or related text. All internal cross-references are meant to incorporate the cross-referenced material as if fully set forth therein.

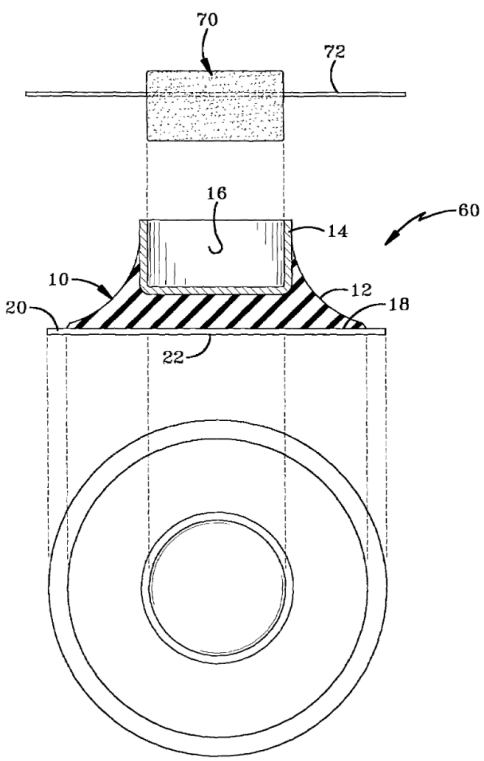
It is Revvo's position that Plaintiff's October 30, 2024 Infringement Contentions have not established that any accused product or service infringes any valid claim. Thus, Revvo's statements below should not be treated as an admission, implication, or suggestion that Revvo agrees with Plaintiff regarding either the scope, construction, or interpretation of any of the Asserted Claims or the infringement theories advanced by Plaintiff in its Infringement Contentions, including whether any Asserted Claim satisfies 35 U.S.C. §§ 101 or 112. In certain cases, Revvo has specified non-limiting examples of where its application of the prior art is based on Plaintiff's apparent application of the claim element. These statements are not intended to suggest that Revvo agrees with Plaintiff's application of any claim element, suggest a proposed construction at this stage of the case, or suggest that construction is needed, as the parties are not required to exchange terms for construction or propose claim constructions until a later date.

Plaintiff has yet to identify any limitation of the Asserted Claims that it contends is not anticipated and/or rendered obvious by Wilson-506. Revvo therefore expressly reserves the right to respond to any such contention, including by identifying additional obviousness combinations, if Plaintiff makes any such contention.

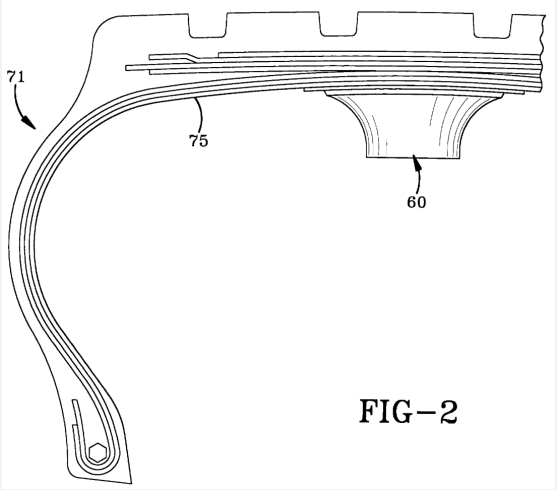
Where Revvo states that Wilson-506 "discloses" a limitation, that disclosure may be express, implicit, and/or inherent.

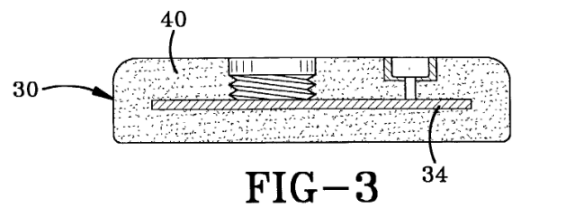
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
1[pre]. A sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising:	*To the extent that the preamble is limiting, Wilson-506 discloses, teaches, and/or suggests a sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising. For example:* **Abstract** A monitoring device and patch assembly includes a patch that removably and re-attachably holds the monitoring device. The patch is adapted to connect the monitoring device to a pneumatic tire when the monitoring device is held by the patch. The patch is configured to hold a monitoring device having a rounded outer surface. The patch holds the rounded monitoring device by having a resilient tube with an outlet having a diameter smaller than the diameter of the monitoring device. The monitoring device of the invention includes a feature that allows it to be removed from the patch. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard

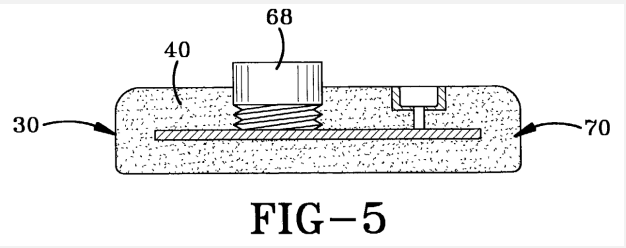
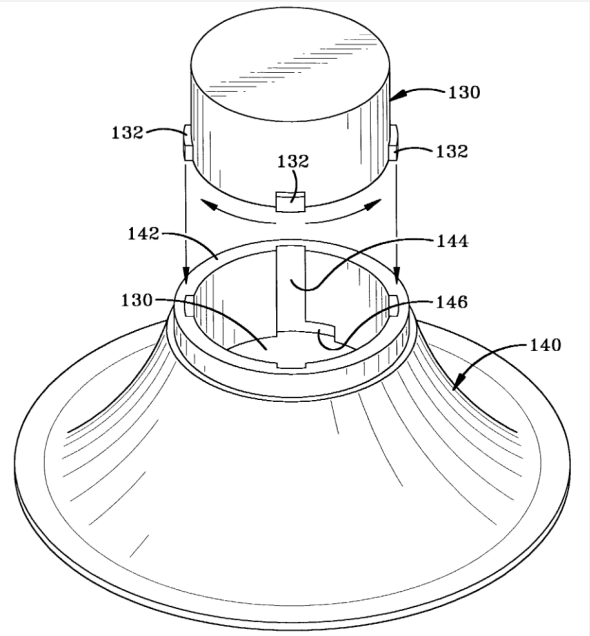
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	rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG–6 The invention provides a monitoring device and patch assembly wherein the patch is configured to removably and re-attachably hold a monitoring device having a body that is outwardly curved. In one embodiment of the invention, the patch includes a tube that removably and re-attachably receives the monitoring device. (Wilson-506, 2:10-15) The invention also provides a monitoring device and patch combination that positions the monitoring device in a predictable orientation with respect to the tire so that the antenna of the monitoring device may be tuned for the orientation. The invention

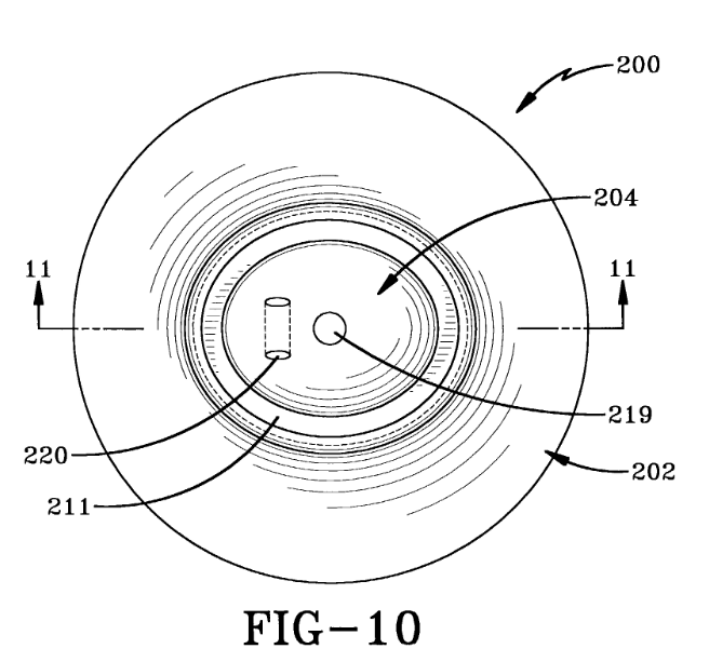
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	provides embodiments wherein the antenna is encapsulated and freely extending. (Wilson-506, 2:22-27) FIG. 1 is an exploded cross-sectional view of the first embodiment of the patch of the invention showing the housing and cavity for the tag assembly. (Wilson-506, 2:38-40)  FIG−1 FIG. 1 shows a rubber patch **10** of the present invention. The patch **10** has a first side **12** which includes a housing **14** with a cavity **16** of a preselected configuration. As shown in FIG. 1, the housing **14** has a cavity **16** which is cylindrical, although the cavity **16** may be of any convenient configuration, as will become apparent from the description which follows. The patch has a second opposite side **18** approximating the contour of an innerliner of a tire (not shown). In a preferred embodiment, the rubber patch is vulcanized and then assembled to the vulcanized tire. Although any method for assembling the vulcanized rubber patch to the vulcanized tire, one acceptable and preferred method is set forth in U.S. Pat. No. 5,971,046; the disclosures of which are incorporated herein by reference. In accordance with the referenced application, the patch may be a rubber selected from the group consisting of Ethylene Propylene Diene Monomer

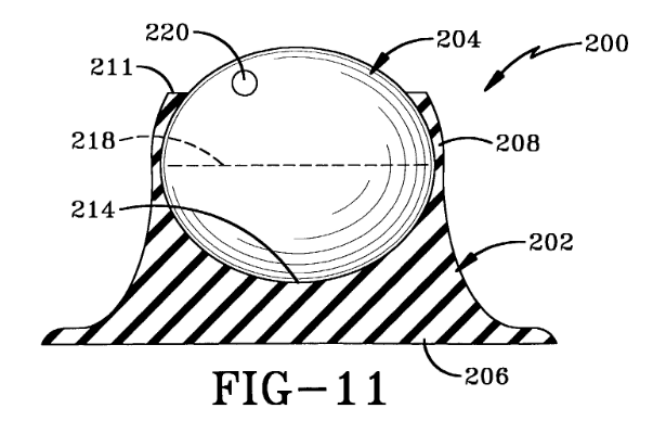
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	(EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about 150° C. and holding at this temperature for about 30 minutes. The time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. The second side **18** of the patch **10** approximates the contour of an innerliner of a tire. The contour of the second side **18** preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side is flat, having no contour. (Wilson-506, 3:35-67) Affixed to the second side **18** of the vulcanized tire patch is a dual cure bonding layer **20**, which has a first side (not shown) and a second side **22**. This dual cure bonding layer may be assembled to the patch at any time following vulcanization of the patch and prior to assembly of the patch assembly to the tire innerliner. The dual cure bonding layer is permanently assembled to the patch to form patch assembly **60**. A non-curing cement (not shown) is applied to side **18** of the patch in order to hold the dual cure bonding layer **20** onto the patch. Exemplary non-curing cement and an exemplary dual cure bonding layer are products of Patch Rubber Company. The important feature of the dual cure bonding layer is that it can be chemically activated and cured, without the need for heating to an elevated temperature. The process is diffusion controlled, however, and some minimal heating will speed the curing process. The dual cure bonding layer may be any material which can be activated and cured to the vulcanized rubber of the tire innerliner and the vulcanized patch. Preferably, however, the dual cure bonding rubber is natural rubber. The dual cure bonding rubber, after application of the activating cement, may cure at room temperature over a period of seventy-two (72) hours. However, if more rapid curing is desired, this may be accomplished by heating to 45° C. for at least twenty-four hours. (Wilson-506, 4:1-25) The tag assembly **70** may be of any configuration which allows it to fit within the contour of the cavity **16**, both of which are cylindrical in the embodiment shown in FIG. 1. In the preferred embodiment, tag assembly **70** is assembled into the cavity **16** as

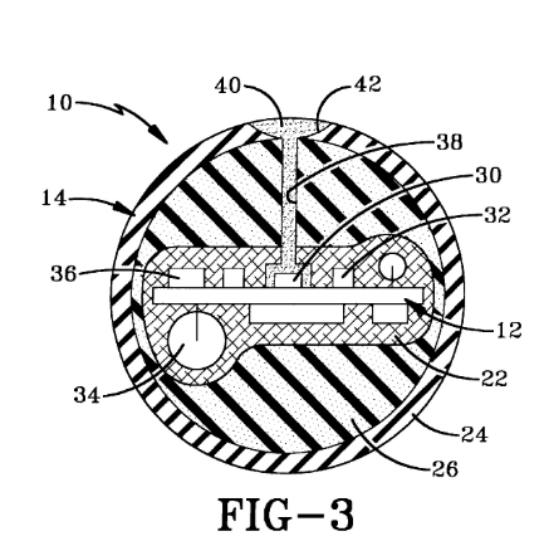
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	shown in FIG. 6. Since the rubber patch assembly can be attached to the tire using an air cure or low temperature cure, it is understood that the sequence of assembling the tag assembly into the rubber patch housing may be accomplished either before or after the rubber patch is attached to the tire innerliner. Tag assembly includes an optional antenna **72**. Housing **14** includes slots **74** to receive the antenna. After the tag assembly **70** is in place within the cavity, at least one lock pin **76** is inserted through a first aperture **78** in housing **80**. As shown in FIG. 6, lock pin **76** is positioned across at least a portion of the top of tag assembly **70**, preferably through a second aperture **82** on the opposite side of the housing. Alternatively, lock pin **76** could extend into the potting of tag assembly **70**. (Wilson-506, 5:7-24) FIG. 2 is a cross-sectional view of the patch of the present invention attached to the innerliner of a tire. (Wilson-506, 2:41-42)  FIG-2 Referring now to FIG. 2, patch assembly **60** is then assembled to the innerliner **75** of tire **71**. Activating cement is first applied to second side **22** of dual cure bonding layer **20**. The patch assembly is then stitched to the innerliner of the vulcanized tire and the patch assembly/tire assembly is allowed to cure for a sufficient time and temperature to form a strong bond between the tire and the patch assembly. The times and temperatures utilized for this curing may be basically the same times and temperatures as previously discussed. To ensure a strong bond, the patch assembly optionally may be clamped to the tire innerliner **75**, until the curing cycle is completed. (Wilson-506, 2:26-37)

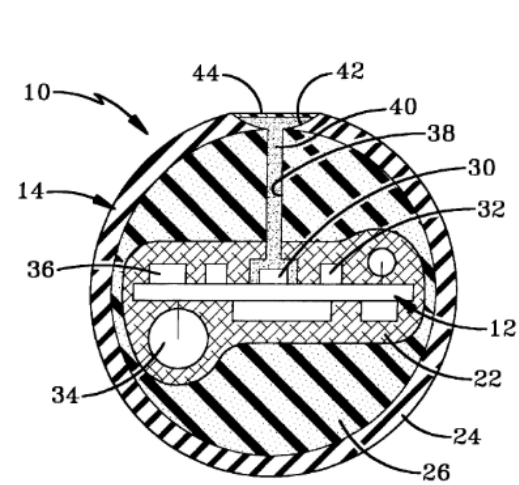
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	FIG. 3 is a cross-sectional view of the electronic monitoring device embedded in potting material. (Wilson-506, 2:43-44)  FIG−3 The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6)

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	FIG. 5 is a cross-sectional view showing a battery attached to the tag; forming a tag assembly. (Wilson-506, 2:46-47)  FIG−5 FIG. 9 is a fourth embodiment of the present invention, shown in perspective, showing a slot and tab arrangement for locking a tag assembly to a rubber patch housing. (Wilson-506, 2:60-62)  FIG−9 In yet another embodiment, depicted in FIG. 9, tag assembly **130** is formed with at least one tab **132**, while housing **142** of rubber patch **140** is formed with slots **144** corresponding to tabs on tag assembly **130**. At the bottom of the slots is a ring **146** having an internal diameter corresponding to the slot depth on the housing and extending from each slot at least partially around the housing bottom. Once tabs **132** of tag assembly **130** are mated with slots **144** of rubber patch and tag assembly **130** is inserted into housing **142**, tag assembly **130** is rotated sufficiently so

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	that tabs **132** are rotated into ring **146** and no longer are aligned with slots **144**, locking the tag assembly to rubber patch **140**. An optional locking mechanism, such as discussed previously, may be added to lock tag assembly **130** to rubber patch **140** if there is a concern about rotation of tag assembly **130** with respect to rubber patch assembly. Another method of locking tag assembly **130** to rubber patch **140** is to insert a piece of material (not shown) into at least one slot **144**, for example by an interference fit between the slot and the material, so that in the event of rotation of the parts with respect to one another, even if the tabs **132** and slots become aligned, tabs **132** are prevented from moving axially in the slot. It is obvious that an equivalent structure can be achieved by reversing the arrangement of slots **144**, ring **146** and tabs **132** between tab assembly **130** and housing **142**. In this arrangement, at least one tab is formed in the housing and at least one slot corresponding to tabs is formed in tab assembly. (Wilson-506, 6:17-44) FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)  FIG–10

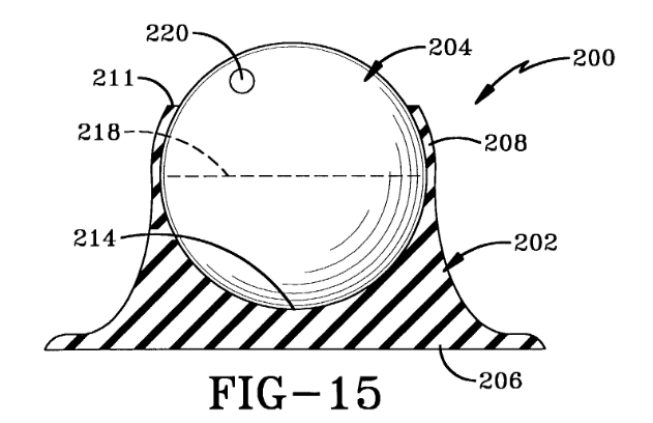
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	 FIG–11 The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)

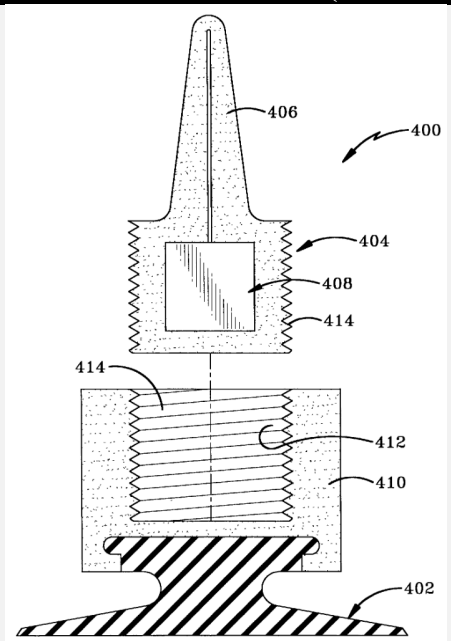
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	 FIG−3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24 and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15)

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	Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)  FIG–9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20 that surrounds monitoring assembly 10. Transfer gel 40 prevents

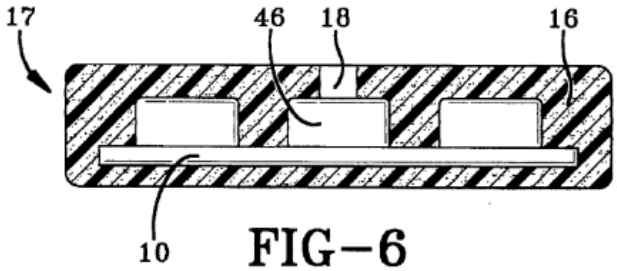
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	breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48) Patch **202** includes a base **206** and a tube section **208** that projects up from base **206**. Patch **202** may include a bonding layer **20** as described above. Tube section **208** is annular and continuous and defines a cavity **210**. Tube section **208** includes a continuous lip **211** that defines an opening **212** that provides access to cavity **210**. Lip **211** and tube section **208** are free of interruptions, such as slits, that would allow lip **211** and tube section **208** to unintentionally open when used with the rounded monitoring devices of the invention. The continuity of lip **211** increases the retaining ability of patch **202** which is important when holding a spherical, oblong sphere, or teardrop shaped monitoring device. The continuity of lip **211** also reduces the risk that lip **211** will tear during extended use. Tube section **208** tapers closed toward lip **211**. (Wilson-506, 7:13-27) The resting position of lip **211** and opening **212** is smaller than the maximum width of monitoring device **204** such that opening **212** must be stretched wider to allow monitoring device **204** to be inserted into and removed from cavity **210**. Lip **211** thus has a closed resting position and an open stretched position. Cavity **210** has a depth that is greater than half of the height of monitoring device **204** such that tube section **208** will close around monitoring device **204** to hold it in place. The walls of tube section **208** have sufficient elasticity and extensibility such that opening **212** may be stretched open to accommodate monitoring device **204** to seat monitoring device **204** within patch **202** as depicted in FIG. 11. The elasticity of the walls allows them to return to their resting position to trap monitoring device **204** with an interference fit within patch **202**. The material of patch **202** is configured to retain these properties overtime in both hot and cold operating conditions. In exemplary embodiments, patch **202** may be fabricated from any of a variety of thermosets or thermoplastics that have desirable resiliency and aged properties. (Wilson-506, 7:28-47)

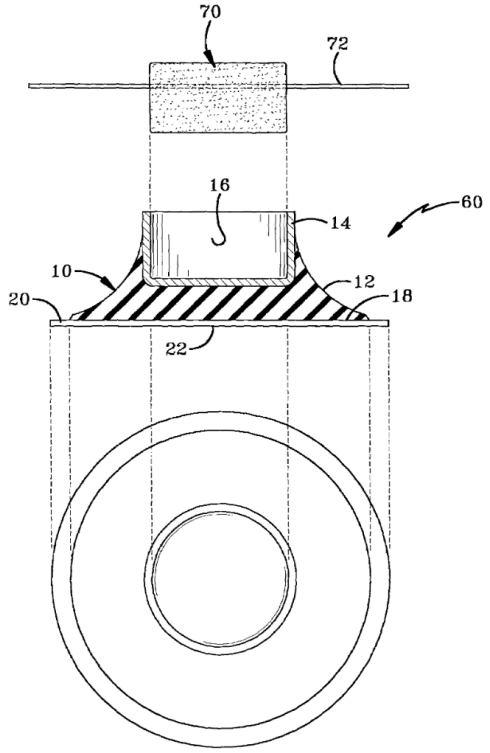
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	The inner surface **214** that defines cavity **210** may be curved to substantially match the outer curvature of monitoring device **204** as shown in FIG. 11. In other embodiments of the invention, the inner surface **214** may be configured such that an air pocket is disposed between base **206** and monitoring device **204**. (Wilson-506, 7:53-58) In the embodiment of the invention depicted in FIG. 11, monitoring device **204** is oblong and is positioned with its largest diameter substantially perpendicular to the longitudinal axis of patch **202**. Device **204** may be 3 to 5 percent out of round to achieve the benefits of an oblong device. The inventors also contemplate that patch **202** may be configured to receive monitoring device **204** with the smallest diameter of monitoring device **204** substantially perpendicular to the longitudinal axis of patch **202**. An oblong configuration helps properly align monitoring device **204** within patch **202** when vibration forces move monitoring device **204** with respect to patch **202**. (Wilson-506, 7:59-8:3) A predictable proper alignment is important when monitoring device **204** has an antenna **218** that is tuned to function better when positioned in a specific direction. For example, antenna **218** may be aligned with the longest dimension of monitoring device **204** so that the user will known the orientation and can orient antenna **218** with respect to tire **71**. (Wilson-506, 8:4-10) The proper alignment of monitoring device **204** is also important so that the breathing tube **219** for the pressure sensor remains positioned within opening **212**. (Wilson-506, 8:11-13) FIG. 15 is a section view of the patch taken along line **15**—**15** of FIG. 14 showing the patch in section with the tag assembly in elevation. (Wilson-506, 3:8-10)

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−15 FIGS. 14 and 15 depict a sixth embodiment wherein monitoring device **204** is spherical. Another method of removing monitoring device **204** from patch **202** is to squeeze tube section **208** adjacent base **206** to force monitoring device **204** out of patch **202**. The squeezing force may be used in conjunction with tool **222**. (Wilson-506, 8:20-25) Patch **202** has rounded and curved walls and surfaces that lack points where stresses are concentrated. The lack of stress concentration increases the durability of patch **202**. Tube section **208** may also be configured to absorb vibrational forces. Assembly **200** also has the advantage that monitoring device **204** will not harm tire **71** if monitoring device **204** falls out of patch **202** because monitoring device is designed to be used loosely within tire **71** and includes no sharp edges that could damage tire **71**. (Wilson-506, 8:26-34) As described above, patch **202** is generally configured to hold monitoring device **304** in a manner that allows monitoring device **304** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **304** to patch **202**. (Wilson-506, 8:43-48) FIG. 20 is a section view showing a tenth embodiment of the invention wherein an encapsulated monitoring device is threaded into a housing that is encapsulated around a portion of the patch. (Wilson-506, 3:22-25)

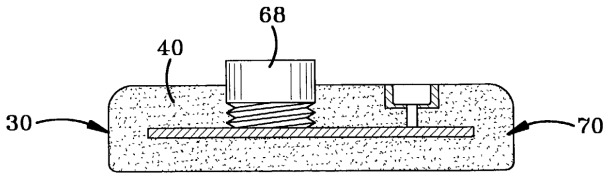
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−20 The tenth embodiment of the assembly is indicated generally by the numeral **400** in FIG. 20. Assembly **400** includes a patch **402** and a monitoring device **404** that includes a protective body **406** and a monitoring assembly **408**. Monitoring device **404** is the same as monitoring device **354** described above. In the tenth embodiment, monitoring device **404** is not directly connected to patch **402**. In this embodiment, assembly **400** includes an intermediate housing **410** that is attached to patch **402**. Monitoring device **404** is connected to housing **410** when it is mounted. (Wilson-506, 9:6-15) Housing **410** may be fabricated from the same material as protective body **406** or another material more rigid than the material of patch **402**. In one embodiment of the invention, housing **410** is encapsulated around the upper portion of patch **402**. In other embodiments, housing **410** may be adhesively connected or mechanically connected to patch **402**. (Wilson-506, 9:16-22) Housing **410** defines a cavity **412** adapted to receive all of, or a portion of, monitoring device **404**. Housing **410** and monitoring device **404** define cooperating threads **414** that allow monitoring device **404** to be selectively attached to and removed from housing **410**. In addition to threads **414**, any of the other

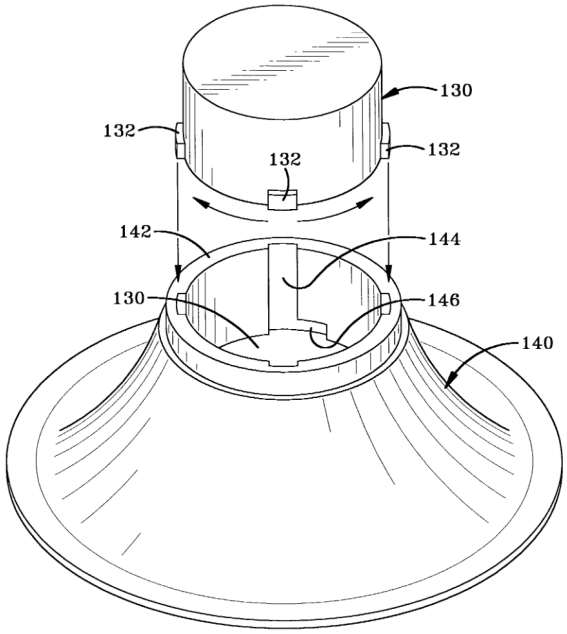
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	attachment arrangements described above may be used without departing from the concepts of the invention. (Wilson-506, 9:23-30) *See also following limitations.*
[1a] a housing comprising an outer surface and an internal cavity that is enclosed within the housing;	*Wilson-506 discloses, teaches, and/or suggests a housing comprising an outer surface and an internal cavity that is enclosed within the housing. For example:* *See, e.g.*, **1[pre]**, above. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that

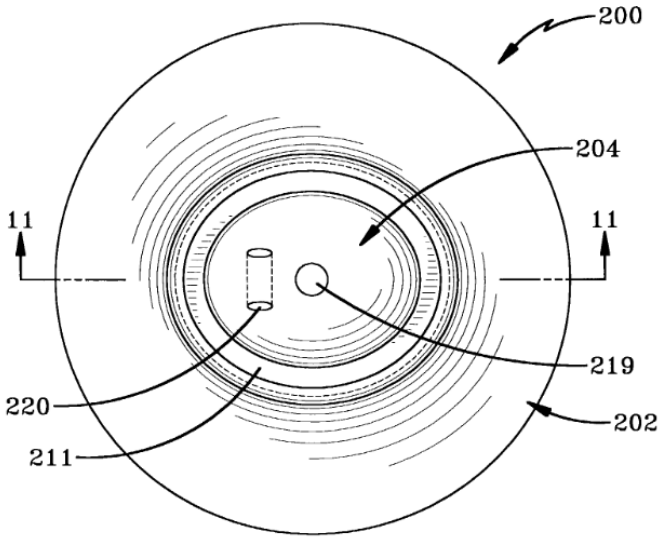
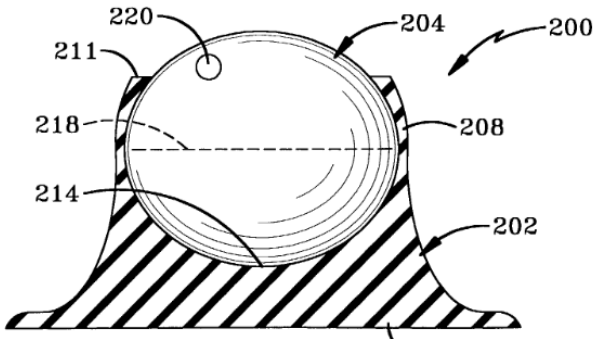
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG−6 FIG. 1 is an exploded cross-sectional view of the first embodiment of the patch of the invention showing the housing and cavity for the tag assembly. (Wilson-506, 2:38-40)

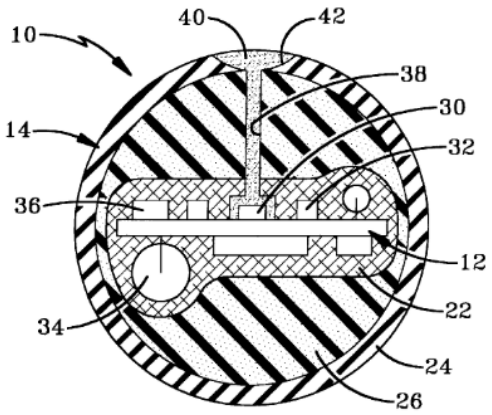
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−1 FIG. 1 shows a rubber patch **10** of the present invention. The patch **10** has a first side **12** which includes a housing **14** with a cavity **16** of a preselected configuration. As shown in FIG. 1, the housing **14** has a cavity **16** which is cylindrical, although the cavity **16** may be of any convenient configuration, as will become apparent from the description which follows. The patch has a second opposite side **18** approximating the contour of an innerliner of a tire (not shown). In a preferred embodiment, the rubber patch is vulcanized and then assembled to the vulcanized tire. Although any method for assembling the vulcanized rubber patch to the vulcanized tire, one acceptable and preferred method is set forth in U.S. Pat. No. 5,971,046; the disclosures of which are incorporated herein by reference. In accordance with the referenced application, the patch may be a rubber selected from the group consisting of Ethylene Propylene Diene Monomer (EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about 150° C. and holding at this temperature for about 30 minutes. The

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. The second side **18** of the patch **10** approximates the contour of an innerliner of a tire. The contour of the second side **18** preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side is flat, having no contour. (Wilson-506, 3:35-67) The tag assembly **70** may be of any configuration which allows it to fit within the contour of the cavity **16**, both of which are cylindrical in the embodiment shown in FIG. 1. In the preferred embodiment, tag assembly **70** is assembled into the cavity **16** as shown in FIG. 6. Since the rubber patch assembly can be attached to the tire using an air cure or low temperature cure, it is understood that the sequence of assembling the tag assembly into the rubber patch housing may be accomplished either before or after the rubber patch is attached to the tire innerliner. Tag assembly includes an optional antenna **72**. Housing **14** includes slots **74** to receive the antenna. After the tag assembly **70** is in place within the cavity, at least one lock pin **76** is inserted through a first aperture **78** in housing **80**. As shown in FIG. 6, lock pin **76** is positioned across at least a portion of the top of tag assembly **70**, preferably through a second aperture **82** on the opposite side of the housing. Alternatively, lock pin **76** could extend into the potting of tag assembly **70**. (Wilson-506, 5:7-24) The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device.

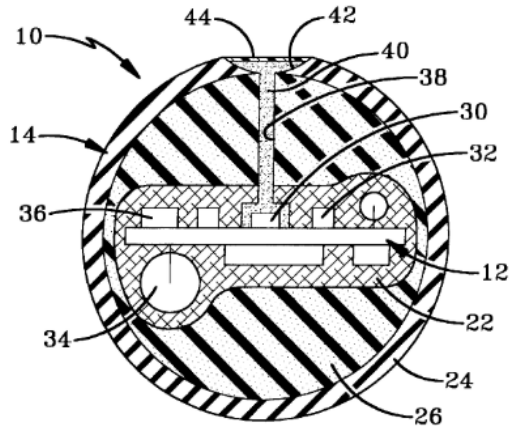
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) FIG. 5 is a cross-sectional view showing a battery attached to the tag; forming a tag assembly. (Wilson-506, 2:46-47)  FIG−5 FIG. 9 is a fourth embodiment of the present invention, shown in perspective, showing a slot and tab arrangement for locking a tag assembly to a rubber patch housing. (Wilson-506, 2:60-62)

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−9 In yet another embodiment, depicted in FIG. 9, tag assembly **130** is formed with at least one tab **132**, while housing **142** of rubber patch **140** is formed with slots **144** corresponding to tabs on tag assembly **130**. At the bottom of the slots is a ring **146** having an internal diameter corresponding to the slot depth on the housing and extending from each slot at least partially around the housing bottom. Once tabs **132** of tag assembly **130** are mated with slots **144** of rubber patch and tag assembly **130** is inserted into housing **142**, tag assembly **130** is rotated sufficiently so that tabs **132** are rotated into ring **146** and no longer are aligned with slots **144**, locking the tag assembly to rubber patch **140**. An optional locking mechanism, such as discussed previously, may be added to lock tag assembly **130** to rubber patch **140** if there is a concern about rotation of tag assembly **130** with respect to rubber patch assembly. Another method of locking tag assembly **130** to rubber patch **140** is to insert a piece of material (not shown) into at least one slot **144**, for example by an interference fit between the slot and the material, so that in the event of rotation of the parts with respect to one another, even if the tabs **132** and slots become aligned, tabs **132** are prevented from moving axially in the slot. It is obvious that an equivalent structure can be achieved by reversing the arrangement of slots **144**, ring **146** and tabs **132** between tab assembly **130** and housing **142**. In this arrangement, at least one

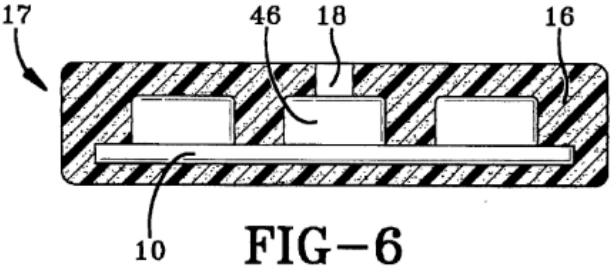
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	tab is formed in the housing and at least one slot corresponding to tabs is formed in tab assembly. (Wilson-506, 6:17-44) FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)  FIG–10  FIG–11 The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring

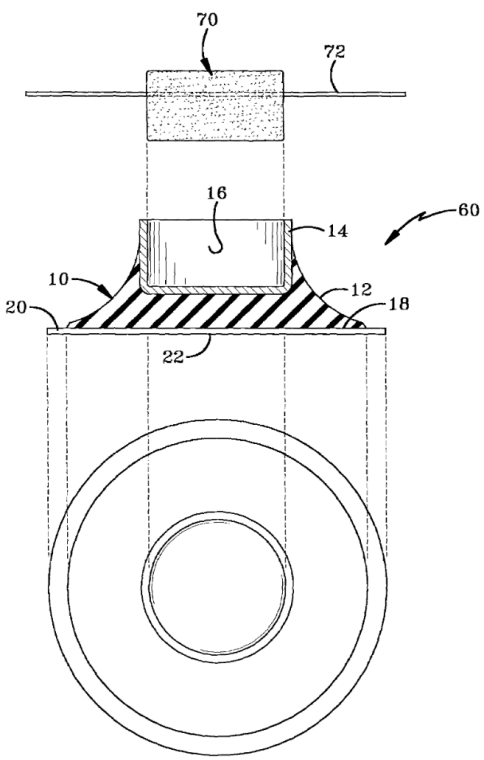
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)  FIG–3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15) Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)

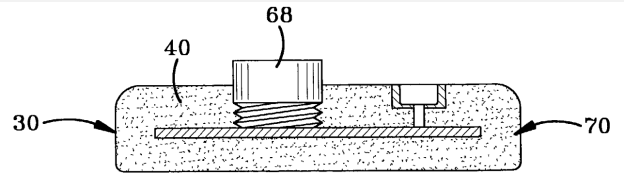
’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG–9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20 that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48) The proper alignment of monitoring device 204 is also important so that the breathing tube 219 for the pressure sensor remains positioned within opening 212. (Wilson-506, 8:11-13)
[1b] an electrical sensor device that is disposed within	*Wilson-506 discloses, teaches, and/or suggests an electrical sensor device that is disposed within the internal cavity and attached therein*

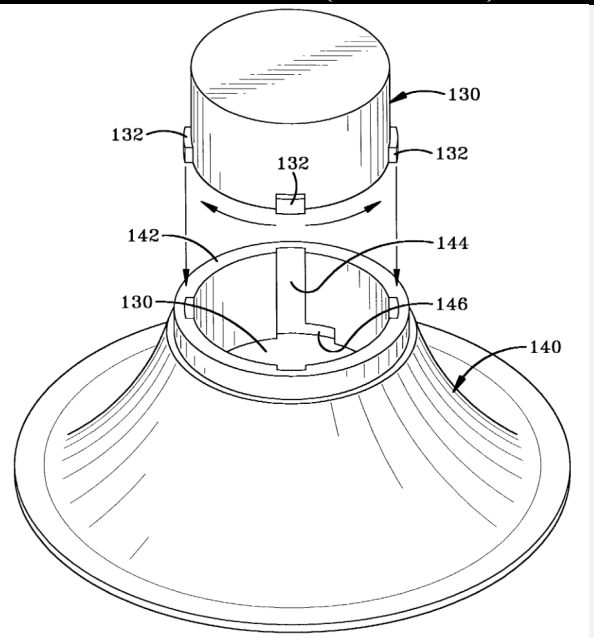
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
the internal cavity and attached therein to prevent movement of the device within the internal cavity,	*to prevent movement of the device within the internal cavity. For example:* *See, e.g.*, **1[pre]**, above. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the

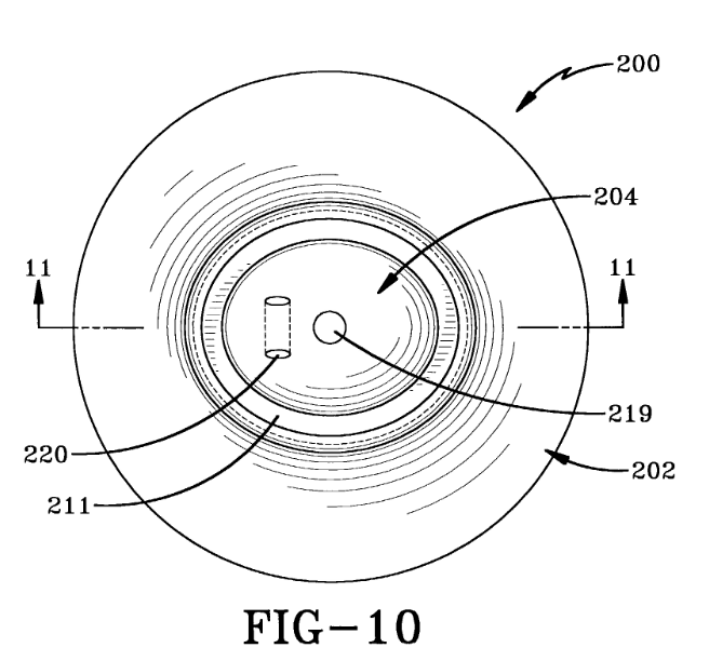
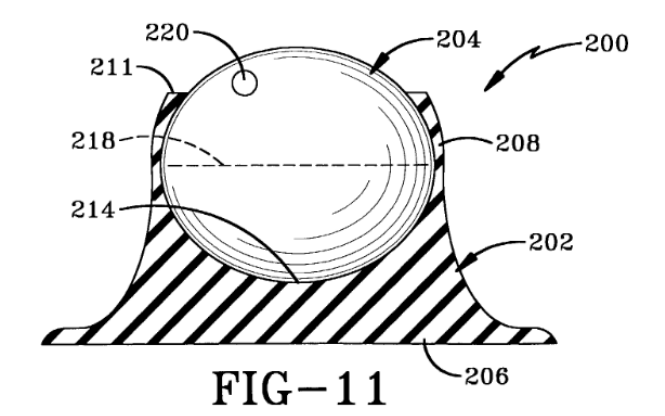
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG−6 FIG. 1 is an exploded cross-sectional view of the first embodiment of the patch of the invention showing the housing and cavity for the tag assembly. (Wilson-506, 2:38-40)

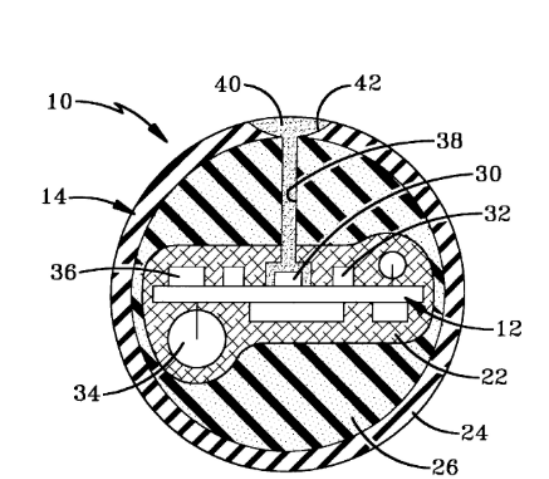
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−1 FIG. 1 shows a rubber patch **10** of the present invention. The patch **10** has a first side **12** which includes a housing **14** with a cavity **16** of a preselected configuration. As shown in FIG. 1, the housing **14** has a cavity **16** which is cylindrical, although the cavity **16** may be of any convenient configuration, as will become apparent from the description which follows. The patch has a second opposite side **18** approximating the contour of an innerliner of a tire (not shown). In a preferred embodiment, the rubber patch is vulcanized and then assembled to the vulcanized tire. Although any method for assembling the vulcanized rubber patch to the vulcanized tire, one acceptable and preferred method is set forth in U.S. Pat. No. 5,971,046; the disclosures of which are incorporated herein by reference. In accordance with the referenced application, the patch may be a rubber selected from the group consisting of Ethylene Propylene Diene Monomer (EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about 150° C. and holding at this temperature for about 30 minutes. The

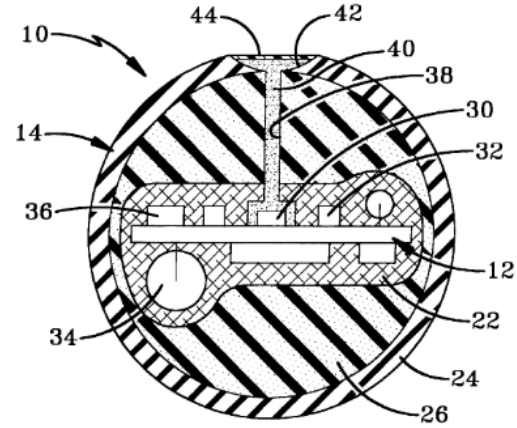
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. The second side **18** of the patch **10** approximates the contour of an innerliner of a tire. The contour of the second side **18** preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side is flat, having no contour. (Wilson-506, 3:35-67) The tag assembly **70** may be of any configuration which allows it to fit within the contour of the cavity **16**, both of which are cylindrical in the embodiment shown in FIG. 1. In the preferred embodiment, tag assembly **70** is assembled into the cavity **16** as shown in FIG. 6. Since the rubber patch assembly can be attached to the tire using an air cure or low temperature cure, it is understood that the sequence of assembling the tag assembly into the rubber patch housing may be accomplished either before or after the rubber patch is attached to the tire innerliner. Tag assembly includes an optional antenna **72**. Housing **14** includes slots **74** to receive the antenna. After the tag assembly **70** is in place within the cavity, at least one lock pin **76** is inserted through a first aperture **78** in housing **80**. As shown in FIG. 6, lock pin **76** is positioned across at least a portion of the top of tag assembly **70**, preferably through a second aperture **82** on the opposite side of the housing. Alternatively, lock pin **76** could extend into the potting of tag assembly **70**. (Wilson-506, 5:7-24) The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device.

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) FIG. 5 is a cross-sectional view showing a battery attached to the tag; forming a tag assembly. (Wilson-506, 2:46-47)  FIG−5 FIG. 9 is a fourth embodiment of the present invention, shown in perspective, showing a slot and tab arrangement for locking a tag assembly to a rubber patch housing. (Wilson-506, 2:60-62)

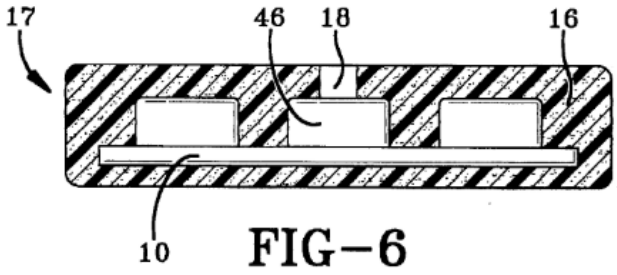
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−9 In yet another embodiment, depicted in FIG. 9, tag assembly **130** is formed with at least one tab **132**, while housing **142** of rubber patch **140** is formed with slots **144** corresponding to tabs on tag assembly **130**. At the bottom of the slots is a ring **146** having an internal diameter corresponding to the slot depth on the housing and extending from each slot at least partially around the housing bottom. Once tabs **132** of tag assembly **130** are mated with slots **144** of rubber patch and tag assembly **130** is inserted into housing **142**, tag assembly **130** is rotated sufficiently so that tabs **132** are rotated into ring **146** and no longer are aligned with slots **144**, locking the tag assembly to rubber patch **140**. An optional locking mechanism, such as discussed previously, may be added to lock tag assembly **130** to rubber patch **140** if there is a concern about rotation of tag assembly **130** with respect to rubber patch assembly. Another method of locking tag assembly **130** to rubber patch **140** is to insert a piece of material (not shown) into at least one slot **144**, for example by an interference fit between the slot and the material, so that in the event of rotation of the parts with respect to one another, even if the tabs **132** and slots become aligned, tabs **132** are prevented from moving axially in the slot. It is obvious that an equivalent structure can be achieved by reversing the arrangement of slots **144**, ring **146** and tabs **132** between tab assembly **130** and housing **142**. In this arrangement, at least one

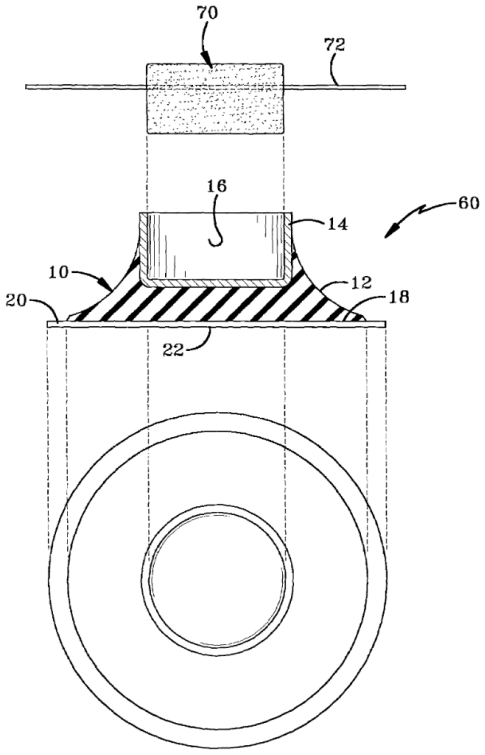
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	tab is formed in the housing and at least one slot corresponding to tabs is formed in tab assembly. (Wilson-506, 6:17-44) FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)  FIG–10  FIG–11 The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)  FIG–3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24 and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface

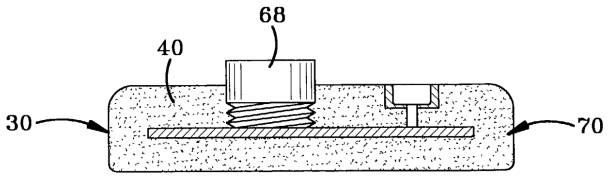
’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15) Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)  FIG−9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10

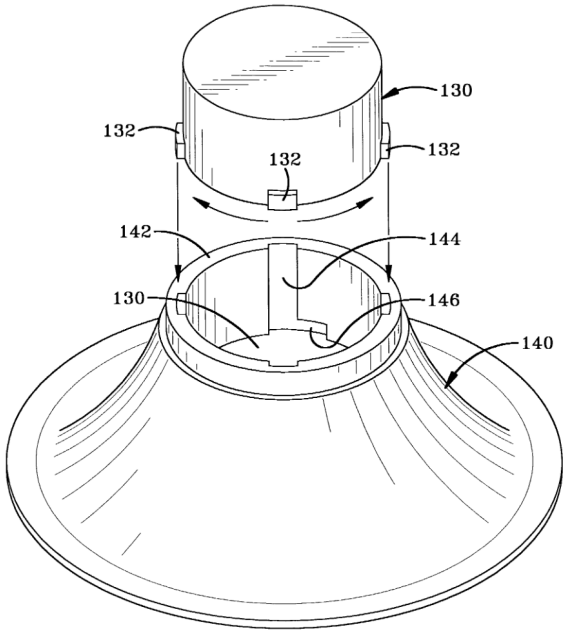
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20 that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48) The proper alignment of monitoring device 204 is also important so that the breathing tube 219 for the pressure sensor remains positioned within opening 212. (Wilson-506, 8:11-13)
[1c] wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing,	*Wilson-506 discloses, teaches, and/or suggests wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing. For example:* *See, e.g.*, **1[pre]**, above. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not

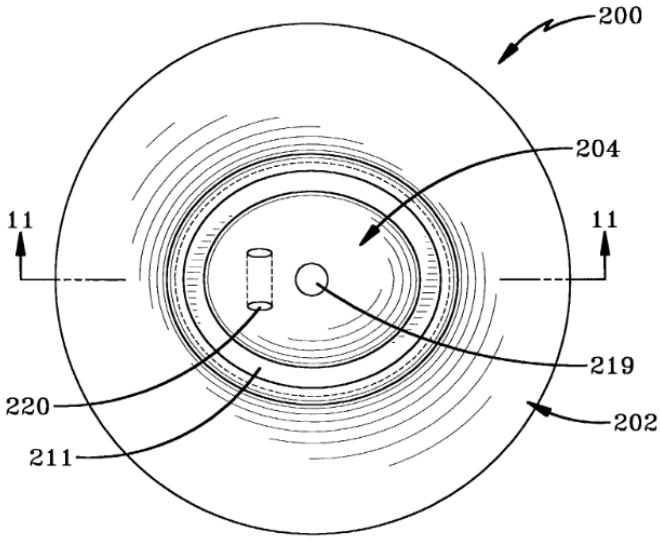
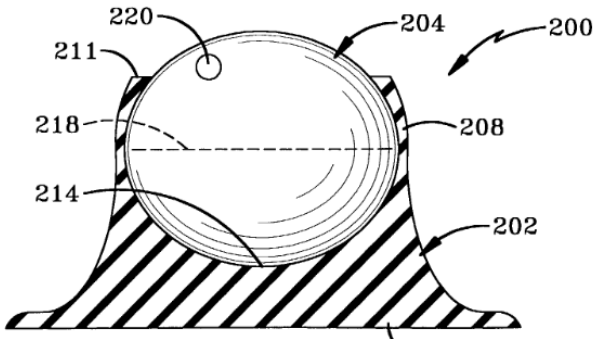
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG–6 FIG. 1 is an exploded cross-sectional view of the first embodiment of the patch of the invention showing the housing and cavity for the tag assembly. (Wilson-506, 2:38-40)

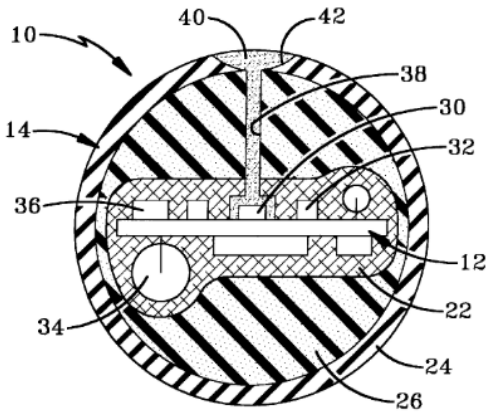
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−1 FIG. 1 shows a rubber patch **10** of the present invention. The patch **10** has a first side **12** which includes a housing **14** with a cavity **16** of a preselected configuration. As shown in FIG. 1, the housing **14** has a cavity **16** which is cylindrical, although the cavity **16** may be of any convenient configuration, as will become apparent from the description which follows. The patch has a second opposite side **18** approximating the contour of an innerliner of a tire (not shown). In a preferred embodiment, the rubber patch is vulcanized and then assembled to the vulcanized tire. Although any method for assembling the vulcanized rubber patch to the vulcanized tire, one acceptable and preferred method is set forth in U.S. Pat. No. 5,971,046; the disclosures of which are incorporated herein by reference. In accordance with the referenced application, the patch may be a rubber selected from the group consisting of Ethylene Propylene Diene Monomer (EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	150° C. and holding at this temperature for about 30 minutes. The time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. The second side **18** of the patch **10** approximates the contour of an innerliner of a tire. The contour of the second side **18** preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side is flat, having no contour. (Wilson-506, 3:35-67) The tag assembly **70** may be of any configuration which allows it to fit within the contour of the cavity **16**, both of which are cylindrical in the embodiment shown in FIG. 1. In the preferred embodiment, tag assembly **70** is assembled into the cavity **16** as shown in FIG. 6. Since the rubber patch assembly can be attached to the tire using an air cure or low temperature cure, it is understood that the sequence of assembling the tag assembly into the rubber patch housing may be accomplished either before or after the rubber patch is attached to the tire innerliner. Tag assembly includes an optional antenna **72**. Housing **14** includes slots **74** to receive the antenna. After the tag assembly **70** is in place within the cavity, at least one lock pin **76** is inserted through a first aperture **78** in housing **80**. As shown in FIG. 6, lock pin **76** is positioned across at least a portion of the top of tag assembly **70**, preferably through a second aperture **82** on the opposite side of the housing. Alternatively, lock pin **76** could extend into the potting of tag assembly **70**. (Wilson-506, 5:7-24) The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device

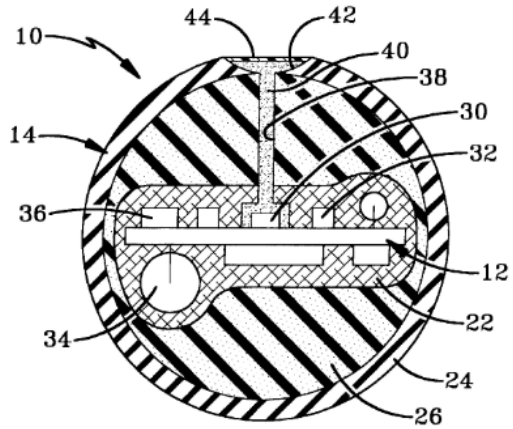
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) FIG. 5 is a cross-sectional view showing a battery attached to the tag; forming a tag assembly. (Wilson-506, 2:46-47)  FIG−5 FIG. 9 is a fourth embodiment of the present invention, shown in perspective, showing a slot and tab arrangement for locking a tag assembly to a rubber patch housing. (Wilson-506, 2:60-62)

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−9 In yet another embodiment, depicted in FIG. 9, tag assembly **130** is formed with at least one tab **132**, while housing **142** of rubber patch **140** is formed with slots **144** corresponding to tabs on tag assembly **130**. At the bottom of the slots is a ring **146** having an internal diameter corresponding to the slot depth on the housing and extending from each slot at least partially around the housing bottom. Once tabs **132** of tag assembly **130** are mated with slots **144** of rubber patch and tag assembly **130** is inserted into housing **142**, tag assembly **130** is rotated sufficiently so that tabs **132** are rotated into ring **146** and no longer are aligned with slots **144**, locking the tag assembly to rubber patch **140**. An optional locking mechanism, such as discussed previously, may be added to lock tag assembly **130** to rubber patch **140** if there is a concern about rotation of tag assembly **130** with respect to rubber patch assembly. Another method of locking tag assembly **130** to rubber patch **140** is to insert a piece of material (not shown) into at least one slot **144**, for example by an interference fit between the slot and the material, so that in the event of rotation of the parts with respect to one another, even if the tabs **132** and slots become aligned, tabs **132** are prevented from moving axially in the slot. It is obvious that an equivalent structure can be achieved by reversing the arrangement of slots **144**, ring **146** and tabs **132** between tab assembly **130** and housing **142**. In this arrangement, at least one

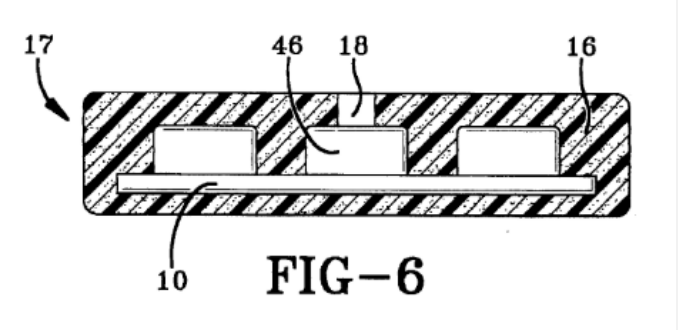
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	tab is formed in the housing and at least one slot corresponding to tabs is formed in tab assembly. (Wilson-506, 6:17-44) FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)  FIG–10  FIG–11 The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring

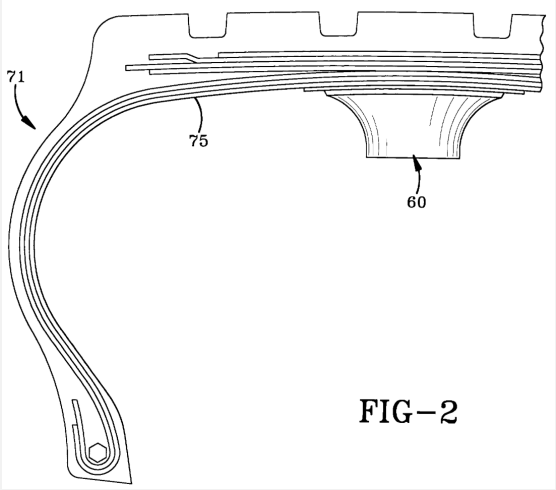
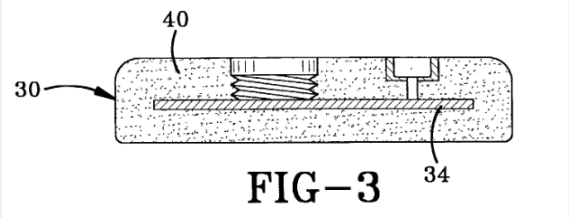
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)  FIG–3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24

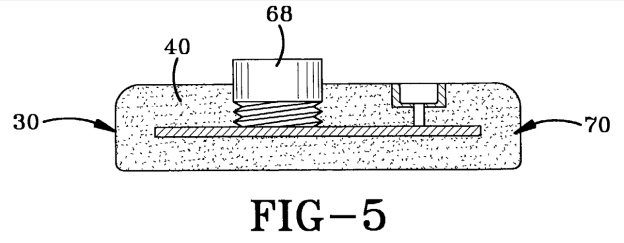
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15) Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)

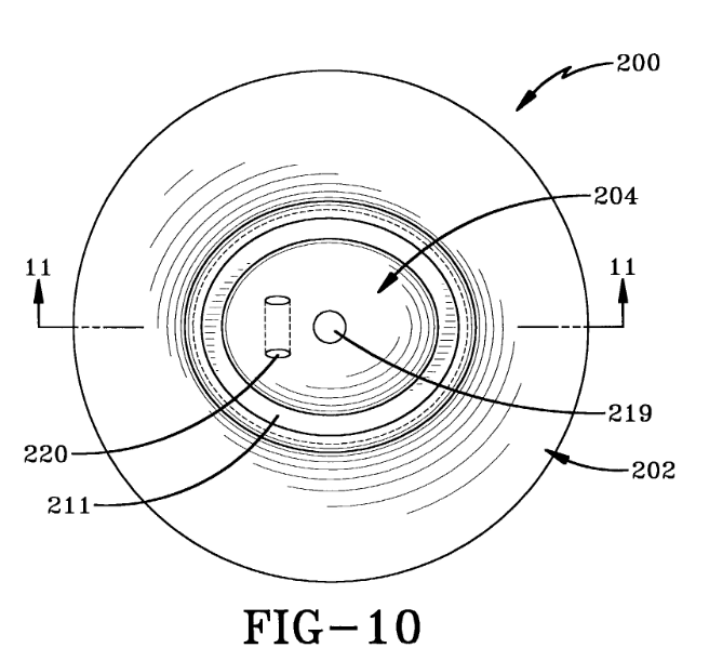
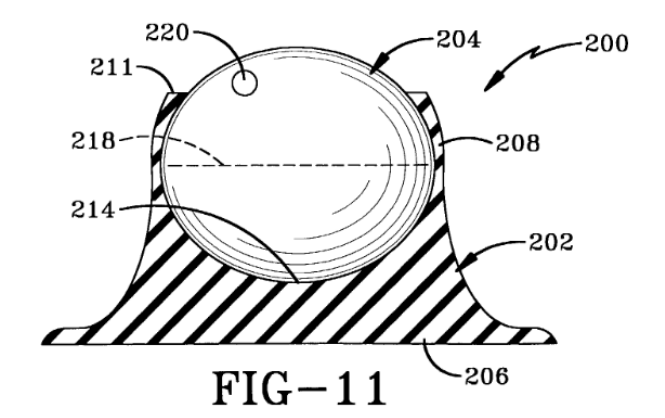
’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20 that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48) The proper alignment of monitoring device 204 is also important so that the breathing tube 219 for the pressure sensor remains positioned within opening 212. (Wilson-506, 8:11-13)
[1d] wherein the electrical sensor device is configured to	*Wilson-506 discloses, teaches, and/or suggests wherein the electrical sensor device is configured to sense, transmit and/or receive*

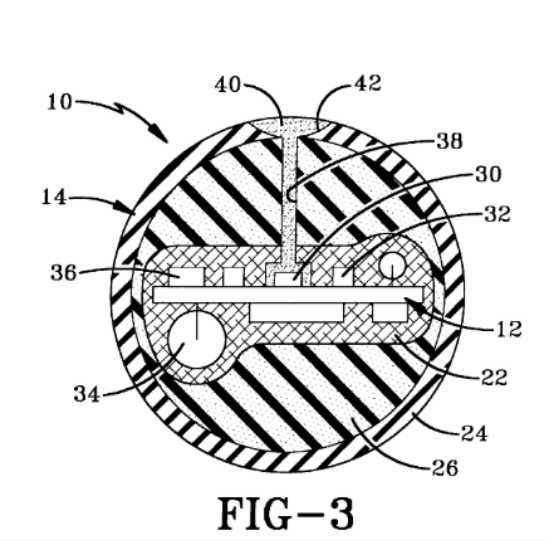
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use; and	*information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use. For example:* *See, e.g.*, **1[pre]**, above. **Abstract** A monitoring device and patch assembly includes a patch that removably and re-attachably holds the monitoring device. The patch is adapted to connect the monitoring device to a pneumatic tire when the monitoring device is held by the patch. The patch is configured to hold a monitoring device having a rounded outer surface. The patch holds the rounded monitoring device by having a resilient tube with an outlet having a diameter smaller than the diameter of the monitoring device. The monitoring device of the invention includes a feature that allows it to be removed from the patch. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG–6 The invention provides a monitoring device and patch assembly wherein the patch is configured to removably and re-attachably hold a monitoring device having a body that is outwardly curved. In one embodiment of the invention, the patch includes a tube that removably and re-attachably receives the monitoring device. (Wilson-506, 2:10-15) The tag assembly **70** may be of any configuration which allows it to fit within the contour of the cavity **16**, both of which are cylindrical in the embodiment shown in FIG. 1. In the preferred embodiment, tag assembly **70** is assembled into the cavity **16** as

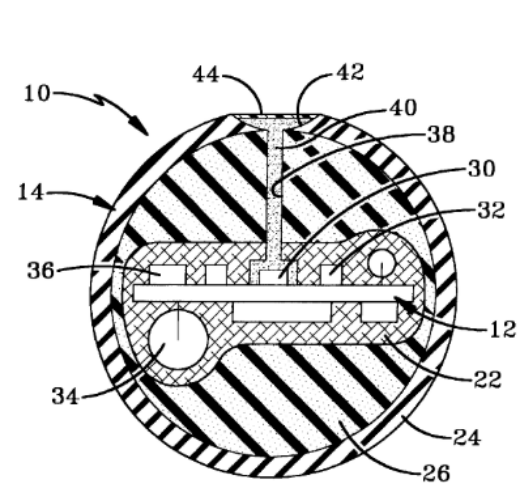
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	shown in FIG. 6. Since the rubber patch assembly can be attached to the tire using an air cure or low temperature cure, it is understood that the sequence of assembling the tag assembly into the rubber patch housing may be accomplished either before or after the rubber patch is attached to the tire innerliner. Tag assembly includes an optional antenna **72**. Housing **14** includes slots **74** to receive the antenna. After the tag assembly **70** is in place within the cavity, at least one lock pin **76** is inserted through a first aperture **78** in housing **80**. As shown in FIG. 6, lock pin **76** is positioned across at least a portion of the top of tag assembly **70**, preferably through a second aperture **82** on the opposite side of the housing. Alternatively, lock pin **76** could extend into the potting of tag assembly **70**. (Wilson-506, 5:7-24) FIG. 2 is a cross-sectional view of the patch of the present invention attached to the innerliner of a tire. (Wilson-506, 2:41-42)  FIG−2 FIG. 3 is a cross-sectional view of the electronic monitoring device embedded in potting material. (Wilson-506, 2:43-44)  FIG−3

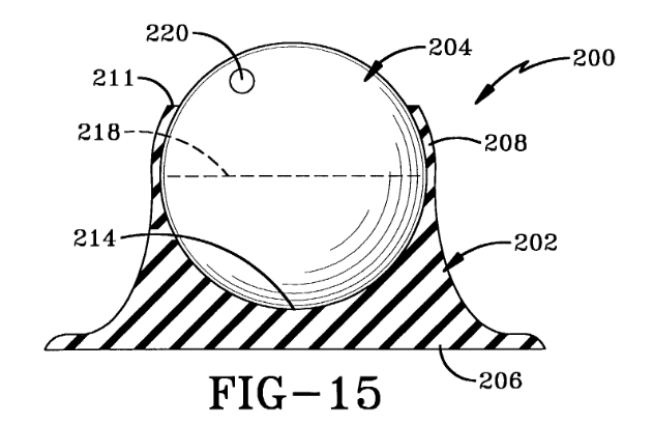
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) FIG. 5 is a cross-sectional view showing a battery attached to the tag; forming a tag assembly. (Wilson-506, 2:46-47)  FIG–5

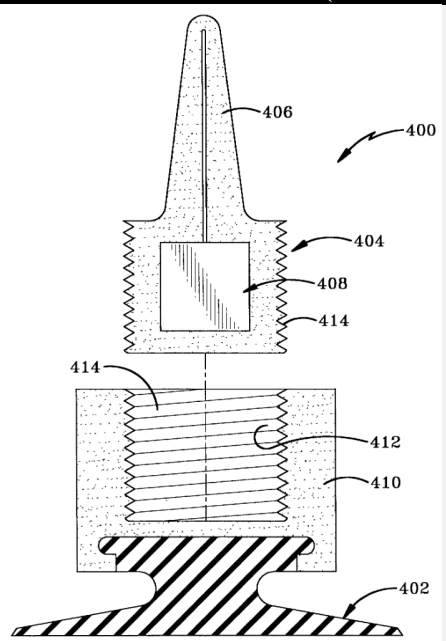
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)  FIG–10  FIG–11 The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54)

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)  FIG–3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24 and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation

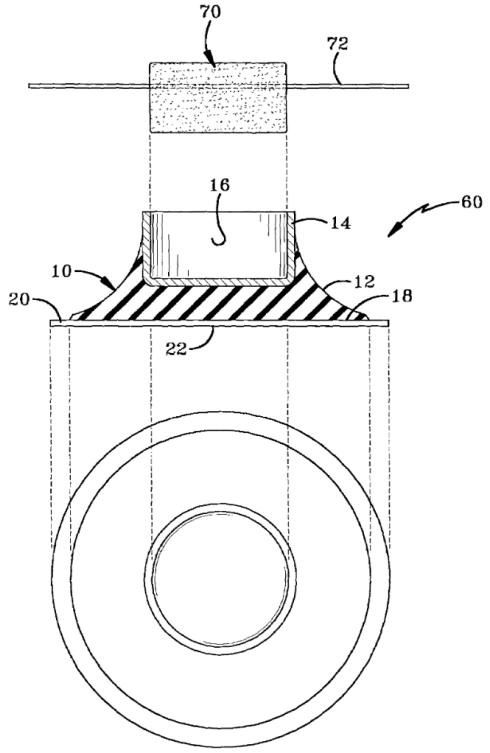
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15) Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)

’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20 that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48) A predictable proper alignment is important when monitoring device **204** has an antenna **218** that is tuned to function better when positioned in a specific direction. For example, antenna **218** may be aligned with the longest dimension of monitoring device **204** so that the user will known the

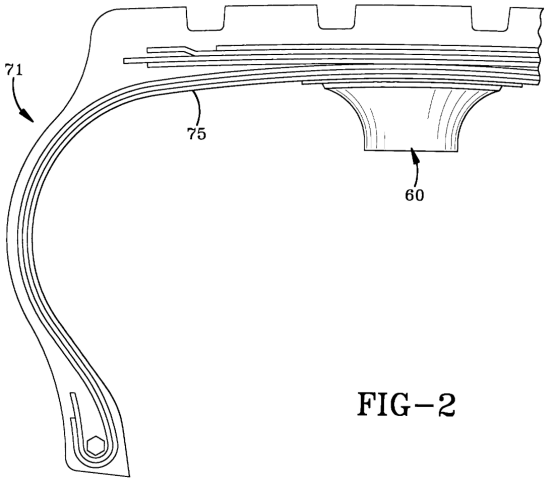
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	orientation and can orient antenna **218** with respect to tire **71**. (Wilson-506, 8:4-10) The proper alignment of monitoring device **204** is also important so that the breathing tube **219** for the pressure sensor remains positioned within opening **212**. (Wilson-506, 8:11-13) FIG. 15 is a section view of the patch taken along line **15**—**15** of FIG. 14 showing the patch in section with the tag assembly in elevation. (Wilson-506, 3:8-10)  FIG−15 FIG. 20 is a section view showing a tenth embodiment of the invention wherein an encapsulated monitoring device is threaded into a housing that is encapsulated around a portion of the patch. (Wilson-506, 3:22-25)

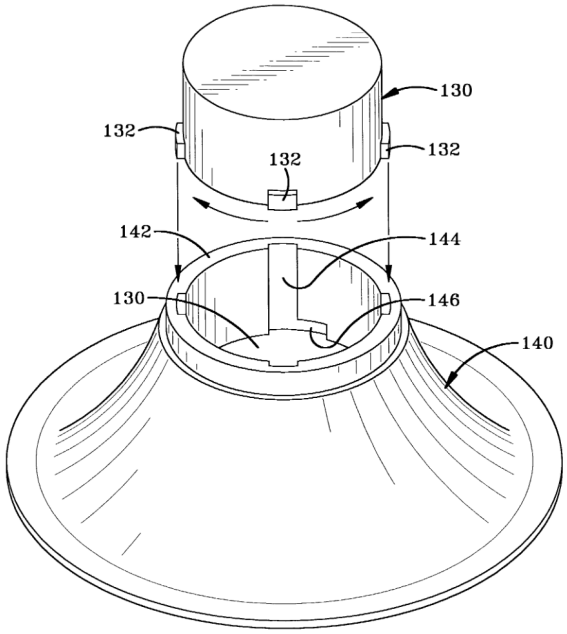
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−20 The tenth embodiment of the assembly is indicated generally by the numeral **400** in FIG. 20. Assembly **400** includes a patch **402** and a monitoring device **404** that includes a protective body **406** and a monitoring assembly **408**. Monitoring device **404** is the same as monitoring device **354** described above. In the tenth embodiment, monitoring device **404** is not directly connected to patch **402**. In this embodiment, assembly **400** includes an intermediate housing **410** that is attached to patch **402**. Monitoring device **404** is connected to housing **410** when it is mounted. (Wilson-506, 9:6-15)
[1e] a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.	*Wilson-506 discloses, teaches, and/or suggests a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.. For example:* *See, e.g.*, **1[pre]**, above. **Abstract** A monitoring device and patch assembly includes a patch that removably and re-attachably holds the monitoring device. The patch is adapted to connect the monitoring device to a pneumatic

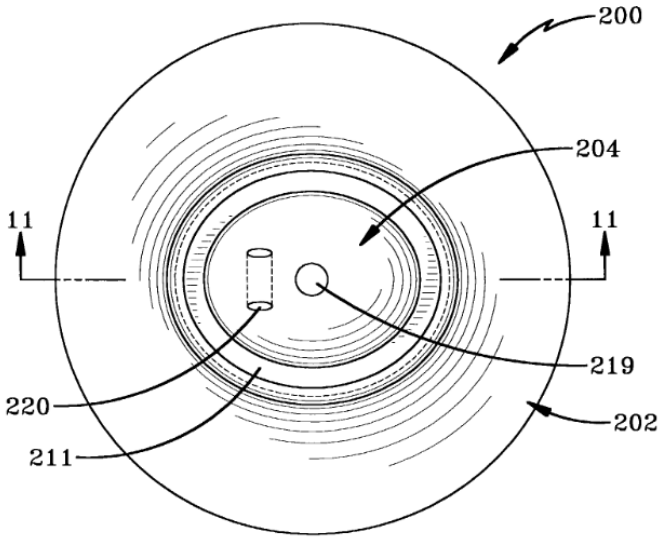
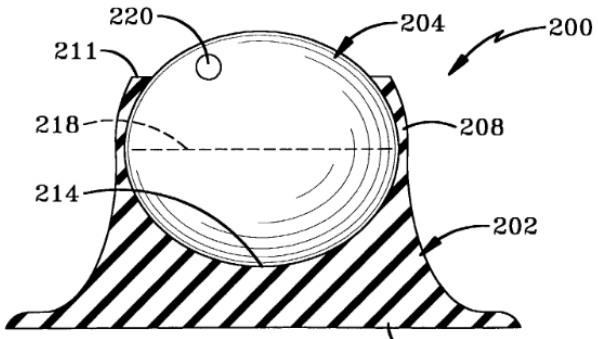
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	tire when the monitoring device is held by the patch. The patch is configured to hold a monitoring device having a rounded outer surface. The patch holds the rounded monitoring device by having a resilient tube with an outlet having a diameter smaller than the diameter of the monitoring device. The monitoring device of the invention includes a feature that allows it to be removed from the patch. The invention provides a monitoring device and patch assembly wherein the patch is configured to removably and re-attachably hold a monitoring device having a body that is outwardly curved. In one embodiment of the invention, the patch includes a tube that removably and re-attachably receives the monitoring device. (Wilson-506, 2:10-15) The invention also provides a monitoring device and patch combination that positions the monitoring device in a predictable orientation with respect to the tire so that the antenna of the monitoring device may be tuned for the orientation. The invention provides embodiments wherein the antenna is encapsulated and freely extending. (Wilson-506, 2:22-27) FIG. 1 is an exploded cross-sectional view of the first embodiment of the patch of the invention showing the housing and cavity for the tag assembly. (Wilson-506, 2:38-40)

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−1 FIG. 1 shows a rubber patch **10** of the present invention. The patch **10** has a first side **12** which includes a housing **14** with a cavity **16** of a preselected configuration. As shown in FIG. 1, the housing **14** has a cavity **16** which is cylindrical, although the cavity **16** may be of any convenient configuration, as will become apparent from the description which follows. The patch has a second opposite side **18** approximating the contour of an innerliner of a tire (not shown). In a preferred embodiment, the rubber patch is vulcanized and then assembled to the vulcanized tire. Although any method for assembling the vulcanized rubber patch to the vulcanized tire, one acceptable and preferred method is set forth in U.S. Pat. No. 5,971,046; the disclosures of which are incorporated herein by reference. In accordance with the referenced application, the patch may be a rubber selected from the group consisting of Ethylene Propylene Diene Monomer (EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about 150° C. and holding at this temperature for about 30 minutes. The

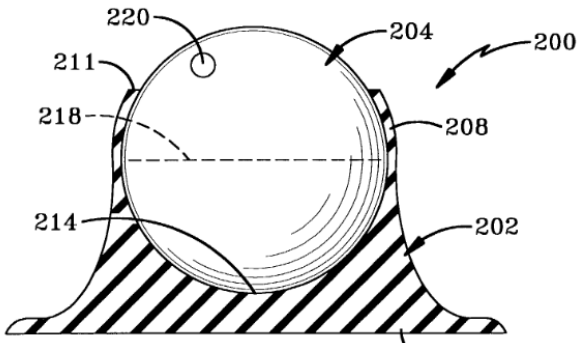
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. The second side **18** of the patch **10** approximates the contour of an innerliner of a tire. The contour of the second side **18** preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side is flat, having no contour. (Wilson-506, 3:35-67) Affixed to the second side **18** of the vulcanized tire patch is a dual cure bonding layer **20**, which has a first side (not shown) and a second side **22**. This dual cure bonding layer may be assembled to the patch at any time following vulcanization of the patch and prior to assembly of the patch assembly to the tire innerliner. The dual cure bonding layer is permanently assembled to the patch to form patch assembly **60**. A non-curing cement (not shown) is applied to side **18** of the patch in order to hold the dual cure bonding layer **20** onto the patch. Exemplary non-curing cement and an exemplary dual cure bonding layer are products of Patch Rubber Company. The important feature of the dual cure bonding layer is that it can be chemically activated and cured, without the need for heating to an elevated temperature. The process is diffusion controlled, however, and some minimal heating will speed the curing process. The dual cure bonding layer may be any material which can be activated and cured to the vulcanized rubber of the tire innerliner and the vulcanized patch. Preferably, however, the dual cure bonding rubber is natural rubber. The dual cure bonding rubber, after application of the activating cement, may cure at room temperature over a period of seventy-two (72) hours. However, if more rapid curing is desired, this may be accomplished by heating to 45° C. for at least twenty-four hours. (Wilson-506, 4:1-25) The tag assembly **70** may be of any configuration which allows it to fit within the contour of the cavity **16**, both of which are cylindrical in the embodiment shown in FIG. 1. In the preferred embodiment, tag assembly **70** is assembled into the cavity **16** as shown in FIG. 6. Since the rubber patch assembly can be attached to the tire using an air cure or low temperature cure, it is understood that the sequence of assembling the tag assembly into the rubber patch housing may be accomplished either before or after the rubber patch is attached to the tire innerliner. Tag assembly includes an optional antenna **72**. Housing **14** includes slots **74** to receive the antenna.

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	After the tag assembly **70** is in place within the cavity, at least one lock pin **76** is inserted through a first aperture **78** in housing **80**. As shown in FIG. 6, lock pin **76** is positioned across at least a portion of the top of tag assembly **70**, preferably through a second aperture **82** on the opposite side of the housing. Alternatively, lock pin **76** could extend into the potting of tag assembly **70**. (Wilson-506, 5:7-24) FIG. 2 is a cross-sectional view of the patch of the present invention attached to the innerliner of a tire. (Wilson-506, 2:41-42)  FIG−2 Referring now to FIG. 2, patch assembly **60** is then assembled to the innerliner **75** of tire **71**. Activating cement is first applied to second side **22** of dual cure bonding layer **20**. The patch assembly is then stitched to the innerliner of the vulcanized tire and the patch assembly/tire assembly is allowed to cure for a sufficient time and temperature to form a strong bond between the tire and the patch assembly. The times and temperatures utilized for this curing may be basically the same times and temperatures as previously discussed. To ensure a strong bond, the patch assembly optionally may be clamped to the tire innerliner **75**, until the curing cycle is completed. (Wilson-506, 2:26-37) FIG. 9 is a fourth embodiment of the present invention, shown in perspective, showing a slot and tab arrangement for locking a tag assembly to a rubber patch housing. (Wilson-506, 2:60-62)

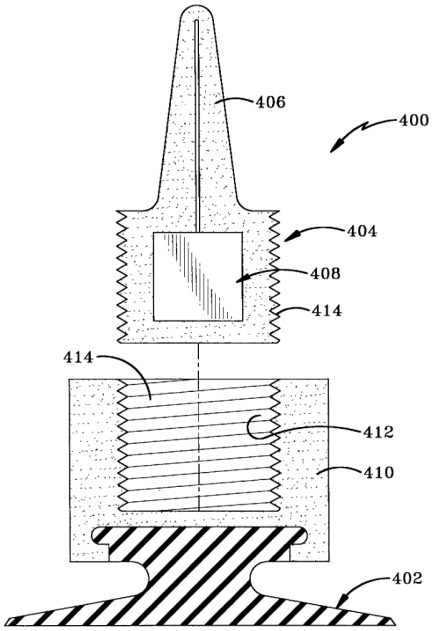
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−9 In yet another embodiment, depicted in FIG. 9, tag assembly **130** is formed with at least one tab **132**, while housing **142** of rubber patch **140** is formed with slots **144** corresponding to tabs on tag assembly **130**. At the bottom of the slots is a ring **146** having an internal diameter corresponding to the slot depth on the housing and extending from each slot at least partially around the housing bottom. Once tabs **132** of tag assembly **130** are mated with slots **144** of rubber patch and tag assembly **130** is inserted into housing **142**, tag assembly **130** is rotated sufficiently so that tabs **132** are rotated into ring **146** and no longer are aligned with slots **144**, locking the tag assembly to rubber patch **140**. An optional locking mechanism, such as discussed previously, may be added to lock tag assembly **130** to rubber patch **140** if there is a concern about rotation of tag assembly **130** with respect to rubber patch assembly. Another method of locking tag assembly **130** to rubber patch **140** is to insert a piece of material (not shown) into at least one slot **144**, for example by an interference fit between the slot and the material, so that in the event of rotation of the parts with respect to one another, even if the tabs **132** and slots become aligned, tabs **132** are prevented from moving axially in the slot. It is obvious that an equivalent structure can be achieved by reversing the arrangement of slots **144**, ring **146** and tabs **132** between tab assembly **130** and housing **142**. In this arrangement, at least one

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	tab is formed in the housing and at least one slot corresponding to tabs is formed in tab assembly. (Wilson-506, 6:17-44) FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)  FIG–10  FIG–11 The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring

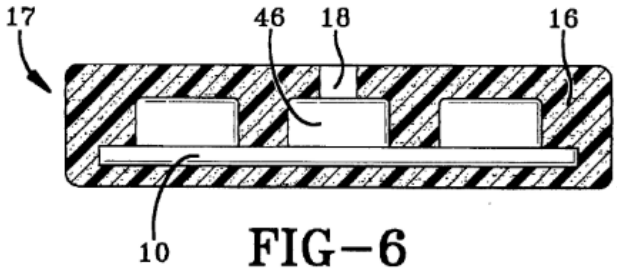
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54) Patch **202** includes a base **206** and a tube section **208** that projects up from base **206**. Patch **202** may include a bonding layer **20** as described above. Tube section **208** is annular and continuous and defines a cavity **210**. Tube section **208** includes a continuous lip **211** that defines an opening **212** that provides access to cavity **210**. Lip **211** and tube section **208** are free of interruptions, such as slits, that would allow lip **211** and tube section **208** to unintentionally open when used with the rounded monitoring devices of the invention. The continuity of lip **211** increases the retaining ability of patch **202** which is important when holding a spherical, oblong sphere, or teardrop shaped monitoring device. The continuity of lip **211** also reduces the risk that lip **211** will tear during extended use. Tube section **208** tapers closed toward lip **211**. (Wilson-506, 7:13-27) The resting position of lip **211** and opening **212** is smaller than the maximum width of monitoring device **204** such that opening **212** must be stretched wider to allow monitoring device **204** to be inserted into and removed from cavity **210**. Lip **211** thus has a closed resting position and an open stretched position. Cavity **210** has a depth that is greater than half of the height of monitoring device **204** such that tube section **208** will close around monitoring device **204** to hold it in place. The walls of tube section **208** have sufficient elasticity and extensibility such that opening **212** may be stretched open to accommodate monitoring device **204** to seat monitoring device **204** within patch **202** as depicted in FIG. 11. The elasticity of the walls allows them to return to their resting position to trap monitoring device **204** with an interference fit within patch **202**. The material of patch **202** is configured to retain these properties overtime in both hot and cold operating conditions. In exemplary embodiments, patch **202** may be fabricated from any of a variety of thermosets or thermoplastics that have desirable resiliency and aged properties. (Wilson-506, 7:28-47) The inner surface **214** that defines cavity **210** may be curved to substantially match the outer curvature of monitoring device **204** as shown in FIG. 11. In other embodiments of the invention, the inner surface **214** may be configured such that an

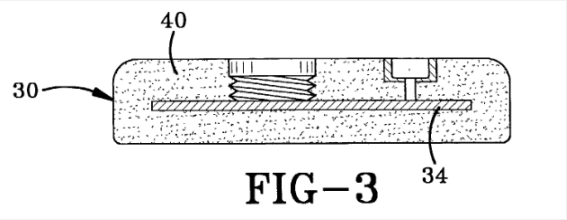
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	air pocket is disposed between base **206** and monitoring device **204**. (Wilson-506, 7:53-58) In the embodiment of the invention depicted in FIG. 11, monitoring device **204** is oblong and is positioned with its largest diameter substantially perpendicular to the longitudinal axis of patch **202**. Device **204** may be 3 to 5 percent out of round to achieve the benefits of an oblong device. The inventors also contemplate that patch **202** may be configured to receive monitoring device **204** with the smallest diameter of monitoring device **204** substantially perpendicular to the longitudinal axis of patch **202**. An oblong configuration helps properly align monitoring device **204** within patch **202** when vibration forces move monitoring device **204** with respect to patch **202**. (Wilson-506, 7:59-8:3) A predictable proper alignment is important when monitoring device **204** has an antenna **218** that is tuned to function better when positioned in a specific direction. For example, antenna **218** may be aligned with the longest dimension of monitoring device **204** so that the user will known the orientation and can orient antenna **218** with respect to tire **71**. (Wilson-506, 8:4-10) The proper alignment of monitoring device **204** is also important so that the breathing tube **219** for the pressure sensor remains positioned within opening **212**. (Wilson-506, 8:11-13) FIG. 15 is a section view of the patch taken along line **15**—**15** of FIG. 14 showing the patch in section with the tag assembly in elevation. (Wilson-506, 3:8-10)  FIG–15

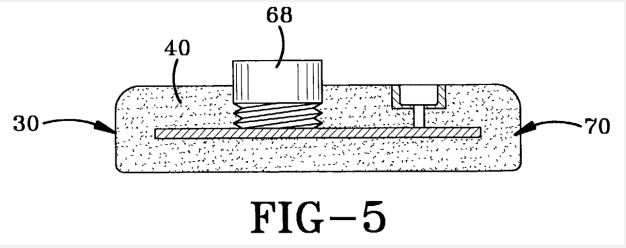
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	FIGS. 14 and 15 depict a sixth embodiment wherein monitoring device **204** is spherical. Another method of removing monitoring device **204** from patch **202** is to squeeze tube section **208** adjacent base **206** to force monitoring device **204** out of patch **202**. The squeezing force may be used in conjunction with tool **222**. (Wilson-506, 8:20-25) Patch **202** has rounded and curved walls and surfaces that lack points where stresses are concentrated. The lack of stress concentration increases the durability of patch **202**. Tube section **208** may also be configured to absorb vibrational forces. Assembly **200** also has the advantage that monitoring device **204** will not harm tire **71** if monitoring device **204** falls out of patch **202** because monitoring device is designed to be used loosely within tire **71** and includes no sharp edges that could damage tire **71**. (Wilson-506, 8:26-34) As described above, patch **202** is generally configured to hold monitoring device **304** in a manner that allows monitoring device **304** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **304** to patch **202**. (Wilson-506, 8:43-48) FIG. 20 is a section view showing a tenth embodiment of the invention wherein an encapsulated monitoring device is threaded into a housing that is encapsulated around a portion of the patch. (Wilson-506, 3:22-25)

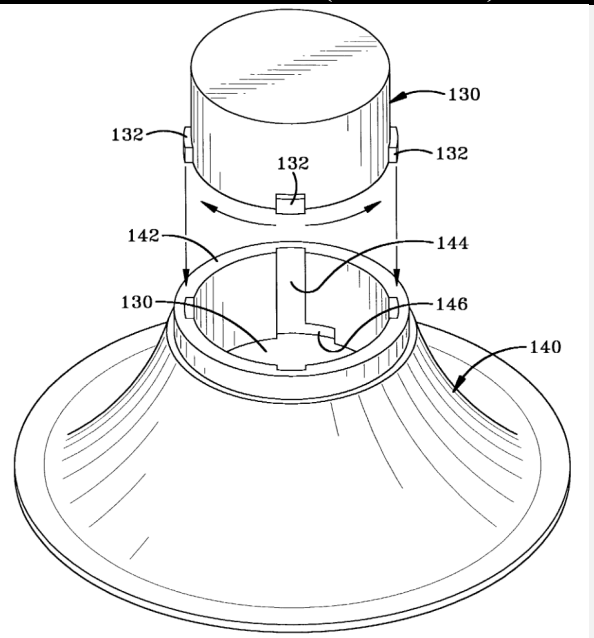
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−20 The tenth embodiment of the assembly is indicated generally by the numeral **400** in FIG. 20. Assembly **400** includes a patch **402** and a monitoring device **404** that includes a protective body **406** and a monitoring assembly **408**. Monitoring device **404** is the same as monitoring device **354** described above. In the tenth embodiment, monitoring device **404** is not directly connected to patch **402**. In this embodiment, assembly **400** includes an intermediate housing **410** that is attached to patch **402**. Monitoring device **404** is connected to housing **410** when it is mounted. (Wilson-506, 9:6-15) Housing **410** may be fabricated from the same material as protective body **406** or another material more rigid than the material of patch **402**. In one embodiment of the invention, housing **410** is encapsulated around the upper portion of patch **402**. In other embodiments, housing **410** may be adhesively connected or mechanically connected to patch **402**. (Wilson-506, 9:16-22) Housing **410** defines a cavity **412** adapted to receive all of, or a portion of, monitoring device **404**. Housing **410** and monitoring device **404** define cooperating threads **414** that allow monitoring device **404** to be selectively attached to and removed from housing **410**. In addition to threads **414**, any of the other

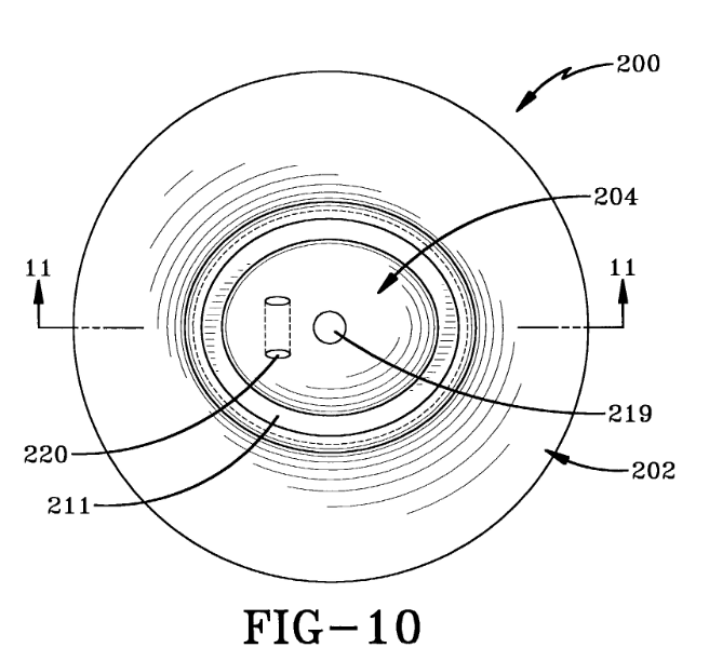
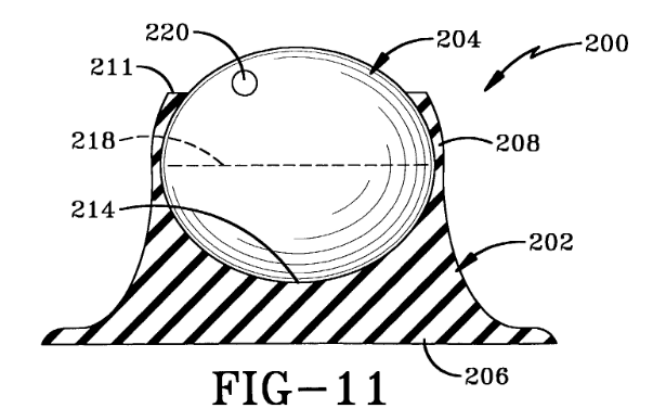
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	attachment arrangements described above may be used without departing from the concepts of the invention. (Wilson-506, 9:23-30)
2. The sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member assembly. For example:* *See, e.g.*, **1[pre]**, above. **Abstract** A monitoring device and patch assembly includes a patch that removably and re-attachably holds the monitoring device. The patch is adapted to connect the monitoring device to a pneumatic tire when the monitoring device is held by the patch. The patch is configured to hold a monitoring device having a rounded outer surface. The patch holds the rounded monitoring device by having a resilient tube with an outlet having a diameter smaller than the diameter of the monitoring device. The monitoring device of the invention includes a feature that allows it to be removed from the patch. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.)

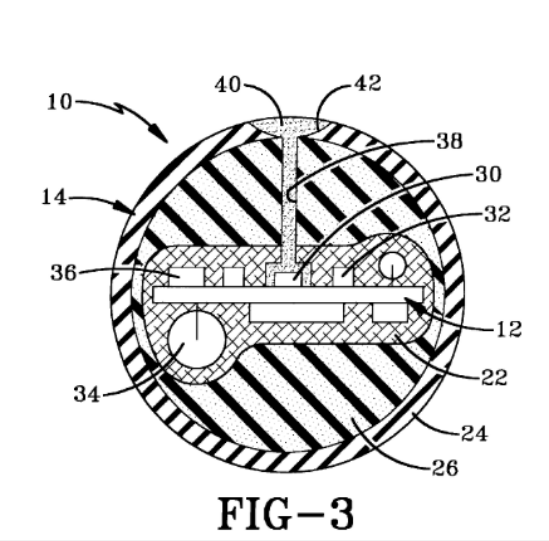
’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG–6 The invention provides a monitoring device and patch assembly wherein the patch is configured to removably and re-attachably hold a monitoring device having a body that is outwardly curved. In one embodiment of the invention, the patch includes a tube that

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	removably and re-attachably receives the monitoring device. (Wilson-506, 2:10-15) The invention also provides a monitoring device and patch combination that positions the monitoring device in a predictable orientation with respect to the tire so that the antenna of the monitoring device may be tuned for the orientation. The invention provides embodiments wherein the antenna is encapsulated and freely extending. (Wilson-506, 2:22-27) The tag assembly **70** may be of any configuration which allows it to fit within the contour of the cavity **16**, both of which are cylindrical in the embodiment shown in FIG. 1. In the preferred embodiment, tag assembly **70** is assembled into the cavity **16** as shown in FIG. 6. Since the rubber patch assembly can be attached to the tire using an air cure or low temperature cure, it is understood that the sequence of assembling the tag assembly into the rubber patch housing may be accomplished either before or after the rubber patch is attached to the tire innerliner. Tag assembly includes an optional antenna **72**. Housing **14** includes slots **74** to receive the antenna. After the tag assembly **70** is in place within the cavity, at least one lock pin **76** is inserted through a first aperture **78** in housing **80**. As shown in FIG. 6, lock pin **76** is positioned across at least a portion of the top of tag assembly **70**, preferably through a second aperture **82** on the opposite side of the housing. Alternatively, lock pin **76** could extend into the potting of tag assembly **70**. (Wilson-506, 5:7-24) FIG. 3 is a cross-sectional view of the electronic monitoring device embedded in potting material. (Wilson-506, 2:43-44)  FIG−3 The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring

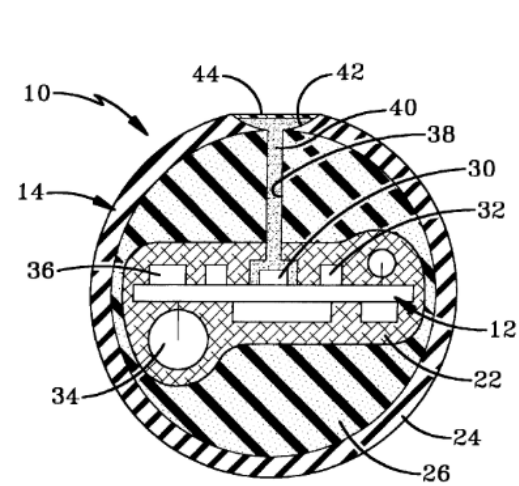
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) FIG. 5 is a cross-sectional view showing a battery attached to the tag; forming a tag assembly. (Wilson-506, 2:46-47)  FIG–5 FIG. 9 is a fourth embodiment of the present invention, shown in perspective, showing a slot and tab arrangement for locking a tag assembly to a rubber patch housing. (Wilson-506, 2:60-62)

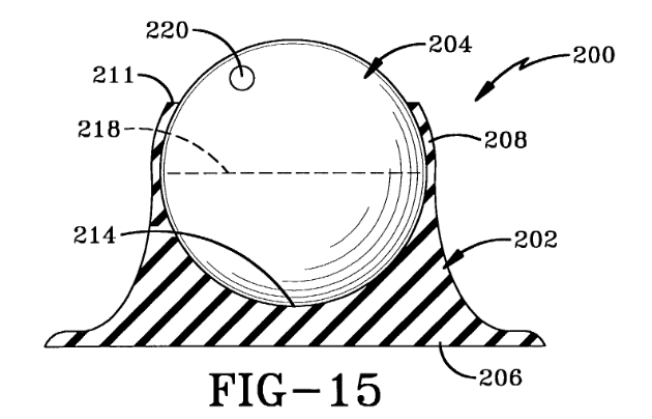
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−9 In yet another embodiment, depicted in FIG. 9, tag assembly **130** is formed with at least one tab **132**, while housing **142** of rubber patch **140** is formed with slots **144** corresponding to tabs on tag assembly **130**. At the bottom of the slots is a ring **146** having an internal diameter corresponding to the slot depth on the housing and extending from each slot at least partially around the housing bottom. Once tabs **132** of tag assembly **130** are mated with slots **144** of rubber patch and tag assembly **130** is inserted into housing **142**, tag assembly **130** is rotated sufficiently so that tabs **132** are rotated into ring **146** and no longer are aligned with slots **144**, locking the tag assembly to rubber patch **140**. An optional locking mechanism, such as discussed previously, may be added to lock tag assembly **130** to rubber patch **140** if there is a concern about rotation of tag assembly **130** with respect to rubber patch assembly. Another method of locking tag assembly **130** to rubber patch **140** is to insert a piece of material (not shown) into at least one slot **144**, for example by an interference fit between the slot and the material, so that in the event of rotation of the parts with respect to one another, even if the tabs **132** and slots become aligned, tabs **132** are prevented from moving axially in the slot. It is obvious that an equivalent structure can be achieved by reversing the arrangement of slots **144**, ring **146** and tabs **132** between tab assembly **130** and housing **142**. In this arrangement, at least one

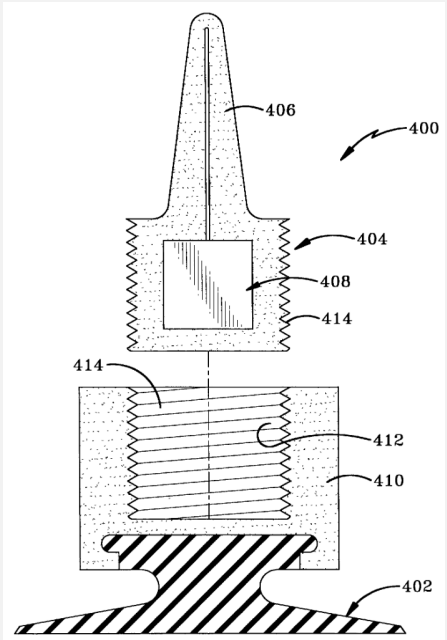
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	tab is formed in the housing and at least one slot corresponding to tabs is formed in tab assembly. (Wilson-506, 6:17-44) FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)  FIG–10  FIG–11 The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)  FIG–3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24

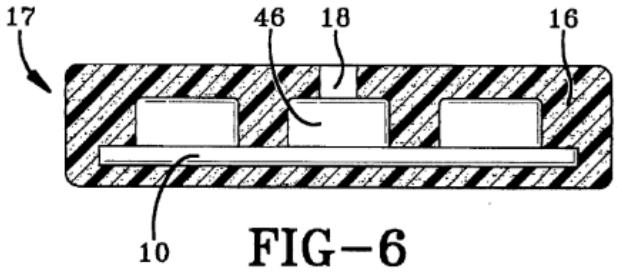
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15) Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)

’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20 that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48) In the embodiment of the invention depicted in FIG. 11, monitoring device **204** is oblong and is positioned with its largest diameter substantially perpendicular to the longitudinal axis of patch **202**. Device **204** may be 3 to 5 percent out of round to achieve the benefits of an oblong device. The inventors also contemplate that patch **202** may be configured to

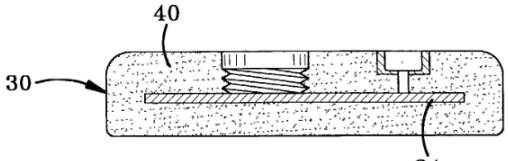
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	receive monitoring device **204** with the smallest diameter of monitoring device **204** substantially perpendicular to the longitudinal axis of patch **202**. An oblong configuration helps properly align monitoring device **204** within patch **202** when vibration forces move monitoring device **204** with respect to patch **202**. (Wilson-506, 7:59-8:3) A predictable proper alignment is important when monitoring device **204** has an antenna **218** that is tuned to function better when positioned in a specific direction. For example, antenna **218** may be aligned with the longest dimension of monitoring device **204** so that the user will known the orientation and can orient antenna **218** with respect to tire **71**. (Wilson-506, 8:4-10) The proper alignment of monitoring device **204** is also important so that the breathing tube **219** for the pressure sensor remains positioned within opening **212**. (Wilson-506, 8:11-13) FIG. 15 is a section view of the patch taken along line **15**—**15** of FIG. 14 showing the patch in section with the tag assembly in elevation. (Wilson-506, 3:8-10)  FIG−15 FIGS. 14 and 15 depict a sixth embodiment wherein monitoring device **204** is spherical. Another method of removing monitoring device **204** from patch **202** is to squeeze tube section **208** adjacent base **206** to force monitoring device **204** out of patch **202**. The squeezing force may be used in conjunction with tool **222**. (Wilson-506, 8:20-25) FIG. 20 is a section view showing a tenth embodiment of the invention wherein an encapsulated monitoring device is threaded

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	into a housing that is encapsulated around a portion of the patch. (Wilson-506, 3:22-25)  FIG−20 The tenth embodiment of the assembly is indicated generally by the numeral **400** in FIG. 20. Assembly **400** includes a patch **402** and a monitoring device **404** that includes a protective body **406** and a monitoring assembly **408**. Monitoring device **404** is the same as monitoring device **354** described above. In the tenth embodiment, monitoring device **404** is not directly connected to patch **402**. In this embodiment, assembly **400** includes an intermediate housing **410** that is attached to patch **402**. Monitoring device **404** is connected to housing **410** when it is mounted. (Wilson-506, 9:6-15) Housing **410** may be fabricated from the same material as protective body **406** or another material more rigid than the material of patch **402**. In one embodiment of the invention, housing **410** is encapsulated around the upper portion of patch **402**. In other embodiments, housing **410** may be adhesively connected or mechanically connected to patch **402**. (Wilson-506, 9:16-22) Housing **410** defines a cavity **412** adapted to receive all of, or a portion of, monitoring device **404**. Housing **410** and monitoring

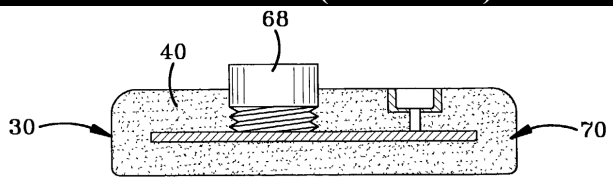
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device **404** define cooperating threads **414** that allow monitoring device **404** to be selectively attached to and removed from housing **410**. In addition to threads **414**, any of the other attachment arrangements described above may be used without departing from the concepts of the invention. (Wilson-506, 9:23-30)
5. The sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein. For example:* *See, e.g.*, **1[pre]**, above. **Abstract** A monitoring device and patch assembly includes a patch that removably and re-attachably holds the monitoring device. The patch is adapted to connect the monitoring device to a pneumatic tire when the monitoring device is held by the patch. The patch is configured to hold a monitoring device having a rounded outer surface. The patch holds the rounded monitoring device by having a resilient tube with an outlet having a diameter smaller than the diameter of the monitoring device. The monitoring device of the invention includes a feature that allows it to be removed from the patch. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG–6 The invention also provides a monitoring device and patch combination that positions the monitoring device in a predictable

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	orientation with respect to the tire so that the antenna of the monitoring device may be tuned for the orientation. The invention provides embodiments wherein the antenna is encapsulated and freely extending. (Wilson-506, 2:22-27) FIG. 1 shows a rubber patch **10** of the present invention. The patch **10** has a first side **12** which includes a housing **14** with a cavity **16** of a preselected configuration. As shown in FIG. 1, the housing **14** has a cavity **16** which is cylindrical, although the cavity **16** may be of any convenient configuration, as will become apparent from the description which follows. The patch has a second opposite side **18** approximating the contour of an innerliner of a tire (not shown). In a preferred embodiment, the rubber patch is vulcanized and then assembled to the vulcanized tire. Although any method for assembling the vulcanized rubber patch to the vulcanized tire, one acceptable and preferred method is set forth in U.S. Pat. No. 5,971,046; the disclosures of which are incorporated herein by reference. In accordance with the referenced application, the patch may be a rubber selected from the group consisting of Ethylene Propylene Diene Monomer (EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about 150° C. and holding at this temperature for about 30 minutes. The time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. The second side **18** of the patch **10** approximates the contour of an innerliner of a tire. The contour of the second side **18** preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side is flat, having no contour. (Wilson-506, 3:35-67) FIG. 3 is a cross-sectional view of the electronic monitoring device embedded in potting material. (Wilson-506, 2:43-44)

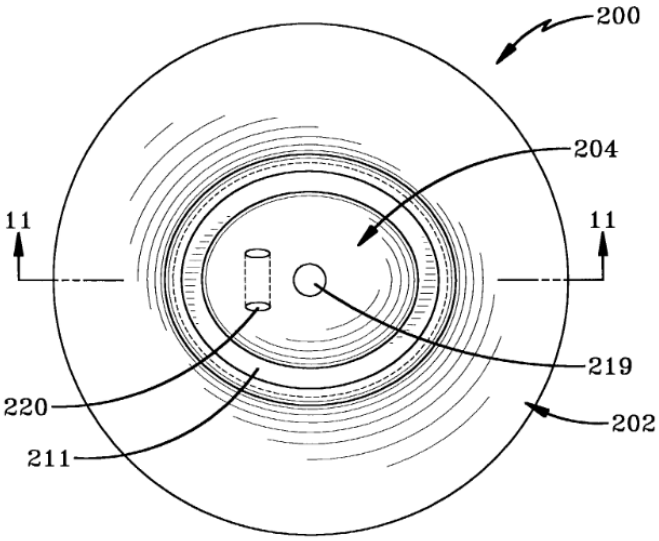
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG–3 The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) FIG. 5 is a cross-sectional view showing a battery attached to the tag; forming a tag assembly. (Wilson-506, 2:46-47)

'421 Claim Element	Disclosures from Prior Art (Wilson-506)

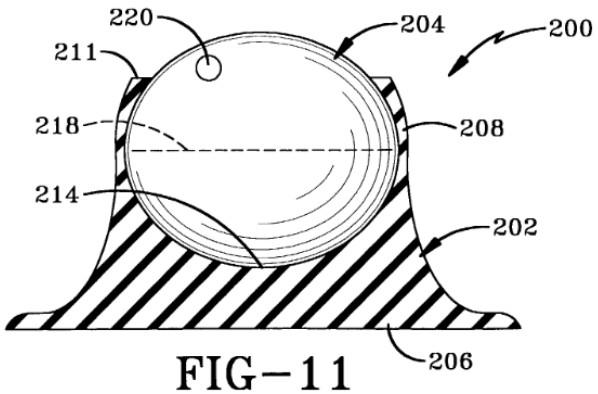


FIG–5

FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)

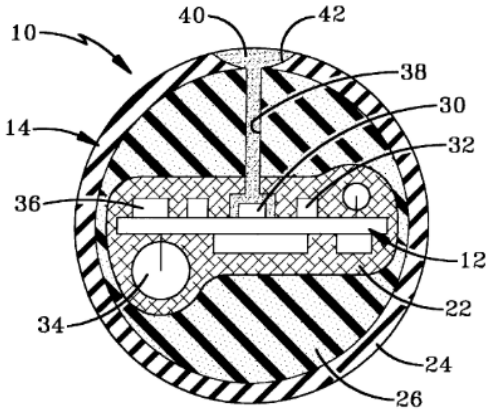


FIG–10

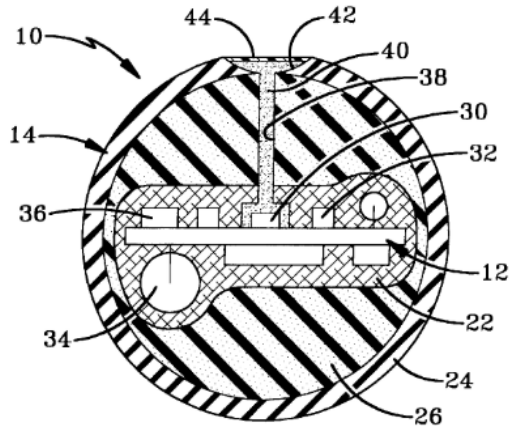


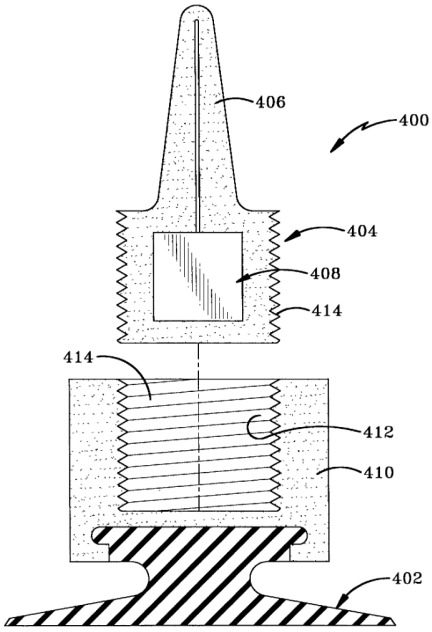
FIG–11

The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes

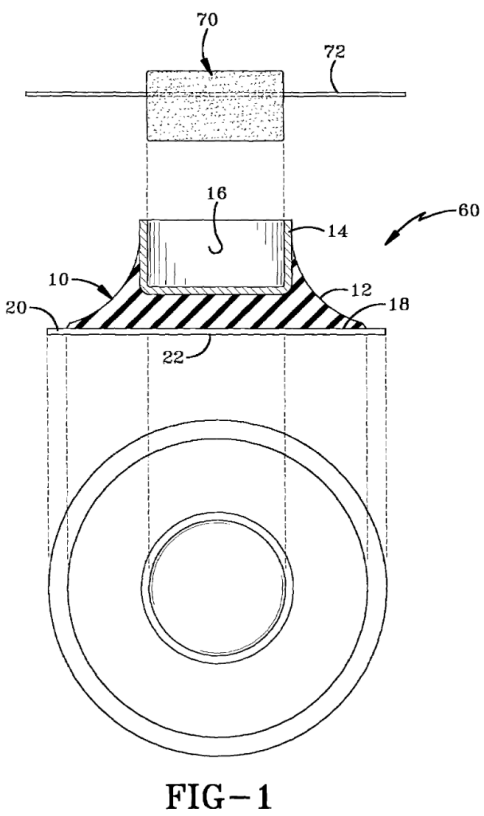
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)  FIG−3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24 and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15) Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)

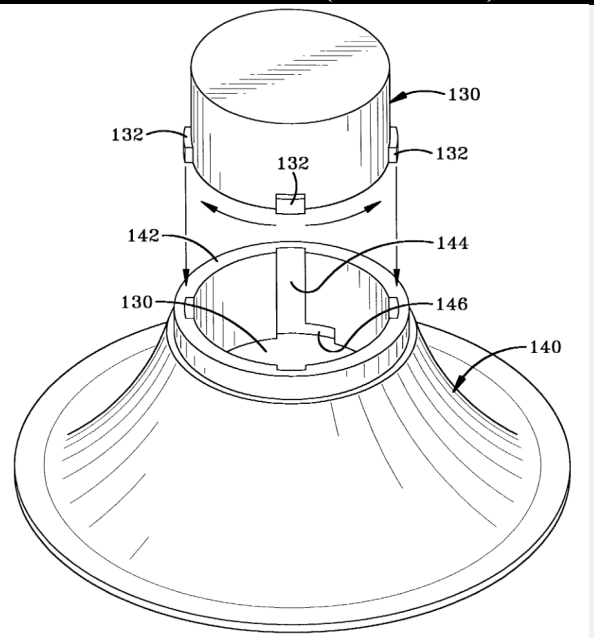
’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20 that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48) In the embodiment of the invention depicted in FIG. 11, monitoring device **204** is oblong and is positioned with its largest diameter substantially perpendicular to the longitudinal axis of patch **202**. Device **204** may be 3 to 5 percent out of round to achieve the benefits of an oblong device. The inventors also contemplate that patch **202** may be configured to

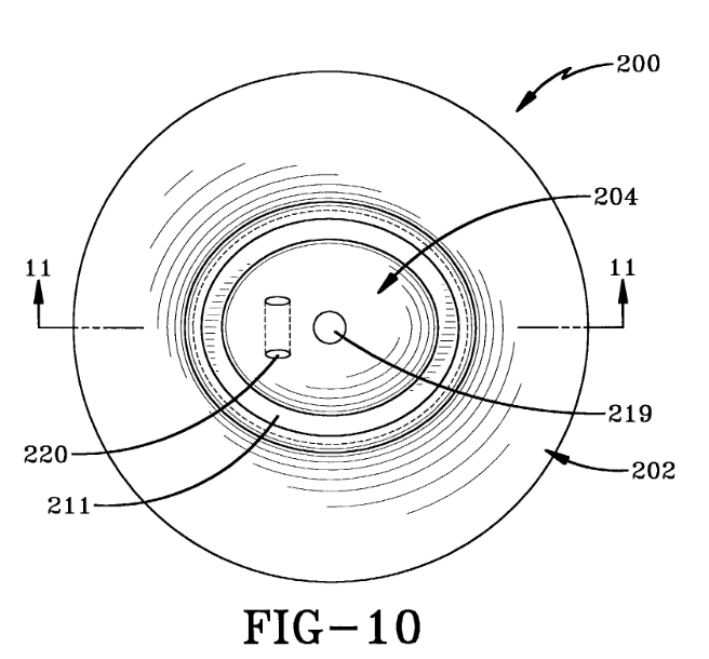
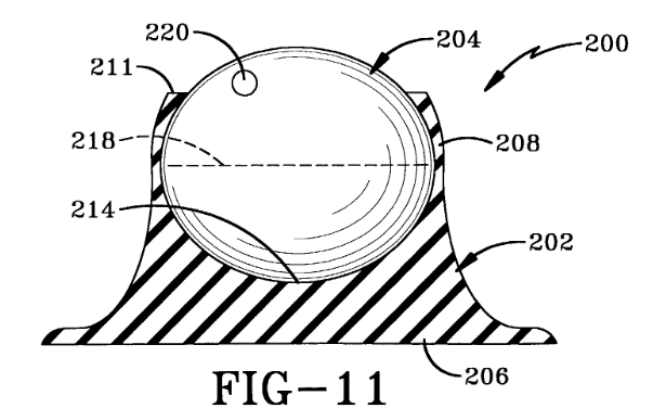
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	receive monitoring device **204** with the smallest diameter of monitoring device **204** substantially perpendicular to the longitudinal axis of patch **202**. An oblong configuration helps properly align monitoring device **204** within patch **202** when vibration forces move monitoring device **204** with respect to patch **202**. (Wilson-506, 7:59-8:3) A predictable proper alignment is important when monitoring device **204** has an antenna **218** that is tuned to function better when positioned in a specific direction. For example, antenna **218** may be aligned with the longest dimension of monitoring device **204** so that the user will known the orientation and can orient antenna **218** with respect to tire **71**. (Wilson-506, 8:4-10) The proper alignment of monitoring device **204** is also important so that the breathing tube **219** for the pressure sensor remains positioned within opening **212**. (Wilson-506, 8:11-13) FIG. 20 is a section view showing a tenth embodiment of the invention wherein an encapsulated monitoring device is threaded into a housing that is encapsulated around a portion of the patch. (Wilson-506, 3:22-25)  FIG−20

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	The tenth embodiment of the assembly is indicated generally by the numeral **400** in FIG. 20. Assembly **400** includes a patch **402** and a monitoring device **404** that includes a protective body **406** and a monitoring assembly **408**. Monitoring device **404** is the same as monitoring device **354** described above. In the tenth embodiment, monitoring device **404** is not directly connected to patch **402**. In this embodiment, assembly **400** includes an intermediate housing **410** that is attached to patch **402**. Monitoring device **404** is connected to housing **410** when it is mounted. (Wilson-506, 9:6-15) Housing **410** may be fabricated from the same material as protective body **406** or another material more rigid than the material of patch **402**. In one embodiment of the invention, housing **410** is encapsulated around the upper portion of patch **402**. In other embodiments, housing **410** may be adhesively connected or mechanically connected to patch **402**. (Wilson-506, 9:16-22) Housing **410** defines a cavity **412** adapted to receive all of, or a portion of, monitoring device **404**. Housing **410** and monitoring device **404** define cooperating threads **414** that allow monitoring device **404** to be selectively attached to and removed from housing **410**. In addition to threads **414**, any of the other attachment arrangements described above may be used without departing from the concepts of the invention. (Wilson-506, 9:23-30)
7. The sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member. For example:* *See, e.g.*, **1[pre]**, above. **Abstract** A monitoring device and patch assembly includes a patch that removably and re-attachably holds the monitoring device. The patch is adapted to connect the monitoring device to a pneumatic tire when the monitoring device is held by the patch. The patch is configured to hold a monitoring device having a rounded outer surface. The patch holds the rounded monitoring device by having a resilient tube with an outlet having a diameter smaller than the diameter of the monitoring device. The monitoring device of the

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	invention includes a feature that allows it to be removed from the patch. The invention also provides a monitoring device and patch combination that positions the monitoring device in a predictable orientation with respect to the tire so that the antenna of the monitoring device may be tuned for the orientation. The invention provides embodiments wherein the antenna is encapsulated and freely extending. (Wilson-506, 2:22-27) FIG. 1 is an exploded cross-sectional view of the first embodiment of the patch of the invention showing the housing and cavity for the tag assembly. (Wilson-506, 2:38-40)  FIG−1 FIG. 1 shows a rubber patch **10** of the present invention. The patch **10** has a first side **12** which includes a housing **14** with a cavity **16** of a preselected configuration. As shown in FIG. 1, the housing **14** has a cavity **16** which is cylindrical, although the cavity **16** may be of any convenient configuration, as will become apparent from the description which follows. The patch has a second opposite side **18** approximating the contour of an innerliner of a tire (not shown). In a preferred embodiment, the

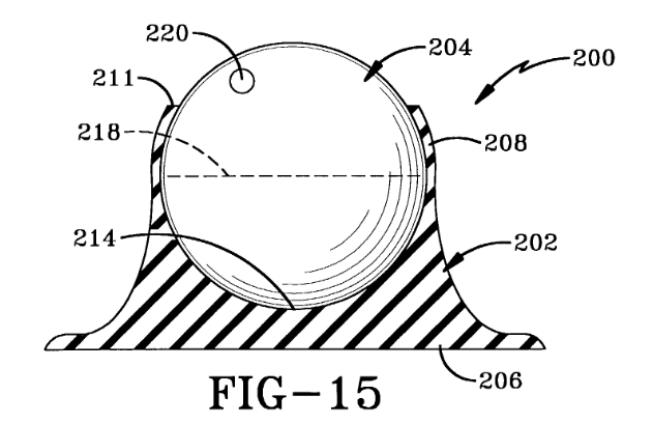
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	rubber patch is vulcanized and then assembled to the vulcanized tire. Although any method for assembling the vulcanized rubber patch to the vulcanized tire, one acceptable and preferred method is set forth in U.S. Pat. No. 5,971,046; the disclosures of which are incorporated herein by reference. In accordance with the referenced application, the patch may be a rubber selected from the group consisting of Ethylene Propylene Diene Monomer (EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about 150° C. and holding at this temperature for about 30 minutes. The time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. The second side **18** of the patch **10** approximates the contour of an innerliner of a tire. The contour of the second side **18** preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side is flat, having no contour. (Wilson-506, 3:35-67) FIG. 9 is a fourth embodiment of the present invention, shown in perspective, showing a slot and tab arrangement for locking a tag assembly to a rubber patch housing. (Wilson-506, 2:60-62)

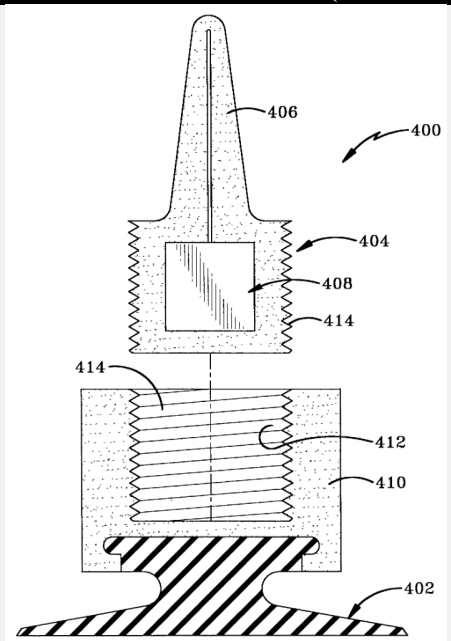
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−9 In yet another embodiment, depicted in FIG. 9, tag assembly **130** is formed with at least one tab **132**, while housing **142** of rubber patch **140** is formed with slots **144** corresponding to tabs on tag assembly **130**. At the bottom of the slots is a ring **146** having an internal diameter corresponding to the slot depth on the housing and extending from each slot at least partially around the housing bottom. Once tabs **132** of tag assembly **130** are mated with slots **144** of rubber patch and tag assembly **130** is inserted into housing **142**, tag assembly **130** is rotated sufficiently so that tabs **132** are rotated into ring **146** and no longer are aligned with slots **144**, locking the tag assembly to rubber patch **140**. An optional locking mechanism, such as discussed previously, may be added to lock tag assembly **130** to rubber patch **140** if there is a concern about rotation of tag assembly **130** with respect to rubber patch assembly. Another method of locking tag assembly **130** to rubber patch **140** is to insert a piece of material (not shown) into at least one slot **144**, for example by an interference fit between the slot and the material, so that in the event of rotation of the parts with respect to one another, even if the tabs **132** and slots become aligned, tabs **132** are prevented from moving axially in the slot. It is obvious that an equivalent structure can be achieved by reversing the arrangement of slots **144**, ring **146** and tabs **132** between tab assembly **130** and housing **142**. In this arrangement, at least one

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	tab is formed in the housing and at least one slot corresponding to tabs is formed in tab assembly. (Wilson-506, 6:17-44) FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)  FIG–10  FIG–11 The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring

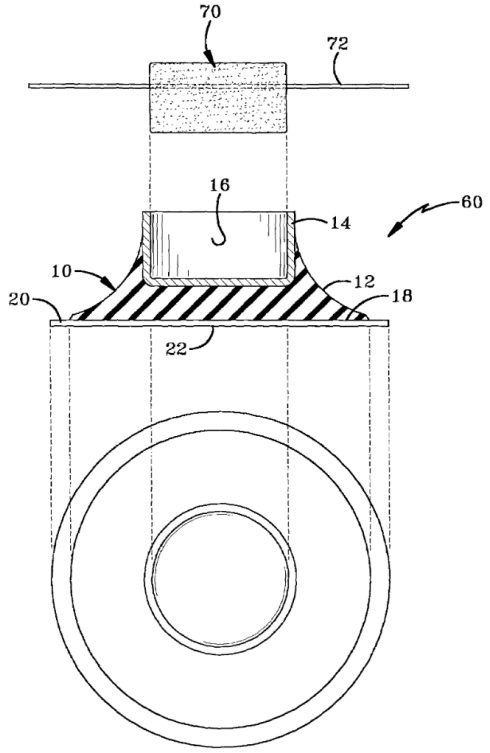
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) Patch **202** includes a base **206** and a tube section **208** that projects up from base **206**. Patch **202** may include a bonding layer **20** as described above. Tube section **208** is annular and continuous and defines a cavity **210**. Tube section **208** includes a continuous lip **211** that defines an opening **212** that provides access to cavity **210**. Lip **211** and tube section **208** are free of interruptions, such as slits, that would allow lip **211** and tube section **208** to unintentionally open when used with the rounded monitoring devices of the invention. The continuity of lip **211** increases the retaining ability of patch **202** which is important when holding a spherical, oblong sphere, or teardrop shaped monitoring device. The continuity of lip **211** also reduces the risk that lip **211** will tear during extended use. Tube section **208** tapers closed toward lip **211**. (Wilson-506, 7:13-27) The resting position of lip **211** and opening **212** is smaller than the maximum width of monitoring device **204** such that opening **212** must be stretched wider to allow monitoring device **204** to be inserted into and removed from cavity **210**. Lip **211** thus has a closed resting position and an open stretched position. Cavity **210** has a depth that is greater than half of the height of monitoring device **204** such that tube section **208** will close around monitoring device **204** to hold it in place. The walls of tube section **208** have sufficient elasticity and extensibility such that opening **212** may be stretched open to accommodate monitoring device **204** to seat monitoring device **204** within patch **202** as depicted in FIG. 11. The elasticity of the walls allows them to return to their resting position to trap monitoring device **204** with an interference fit

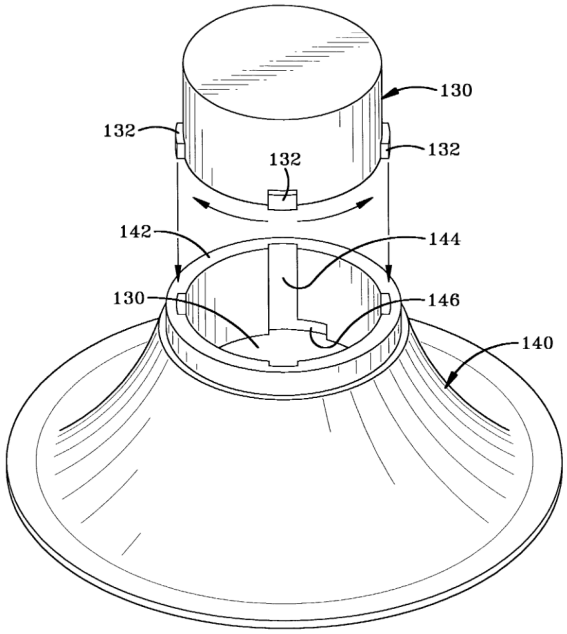
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	within patch **202**. The material of patch **202** is configured to retain these properties overtime in both hot and cold operating conditions. In exemplary embodiments, patch **202** may be fabricated from any of a variety of thermosets or thermoplastics that have desirable resiliency and aged properties. (Wilson-506, 7:28-47) The inner surface **214** that defines cavity **210** may be curved to substantially match the outer curvature of monitoring device **204** as shown in FIG. 11. In other embodiments of the invention, the inner surface **214** may be configured such that an air pocket is disposed between base **206** and monitoring device **204**. (Wilson-506, 7:53-58) In the embodiment of the invention depicted in FIG. 11, monitoring device **204** is oblong and is positioned with its largest diameter substantially perpendicular to the longitudinal axis of patch **202**. Device **204** may be 3 to 5 percent out of round to achieve the benefits of an oblong device. The inventors also contemplate that patch **202** may be configured to receive monitoring device **204** with the smallest diameter of monitoring device **204** substantially perpendicular to the longitudinal axis of patch **202**. An oblong configuration helps properly align monitoring device **204** within patch **202** when vibration forces move monitoring device **204** with respect to patch **202**. (Wilson-506, 7:59-8:3) A predictable proper alignment is important when monitoring device **204** has an antenna **218** that is tuned to function better when positioned in a specific direction. For example, antenna **218** may be aligned with the longest dimension of monitoring device **204** so that the user will known the orientation and can orient antenna **218** with respect to tire **71**. (Wilson-506, 8:4-10) The proper alignment of monitoring device **204** is also important so that the breathing tube **219** for the pressure sensor remains positioned within opening **212**. (Wilson-506, 8:11-13) FIG. 15 is a section view of the patch taken along line **15**—**15** of FIG. 14 showing the patch in section with the tag assembly in elevation. (Wilson-506, 3:8-10)

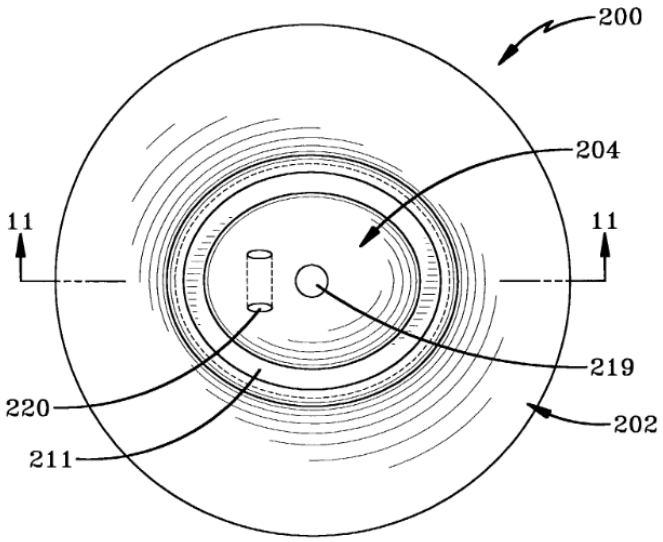
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−15 FIGS. 14 and 15 depict a sixth embodiment wherein monitoring device **204** is spherical. Another method of removing monitoring device **204** from patch **202** is to squeeze tube section **208** adjacent base **206** to force monitoring device **204** out of patch **202**. The squeezing force may be used in conjunction with tool **222**. (Wilson-506, 8:20-25) Patch **202** has rounded and curved walls and surfaces that lack points where stresses are concentrated. The lack of stress concentration increases the durability of patch **202**. Tube section **208** may also be configured to absorb vibrational forces. Assembly **200** also has the advantage that monitoring device **204** will not harm tire **71** if monitoring device **204** falls out of patch **202** because monitoring device is designed to be used loosely within tire **71** and includes no sharp edges that could damage tire **71**. (Wilson-506, 8:26-34) As described above, patch **202** is generally configured to hold monitoring device **304** in a manner that allows monitoring device **304** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **304** to patch **202**. (Wilson-506, 8:43-48) FIG. 20 is a section view showing a tenth embodiment of the invention wherein an encapsulated monitoring device is threaded into a housing that is encapsulated around a portion of the patch. (Wilson-506, 3:22-25)

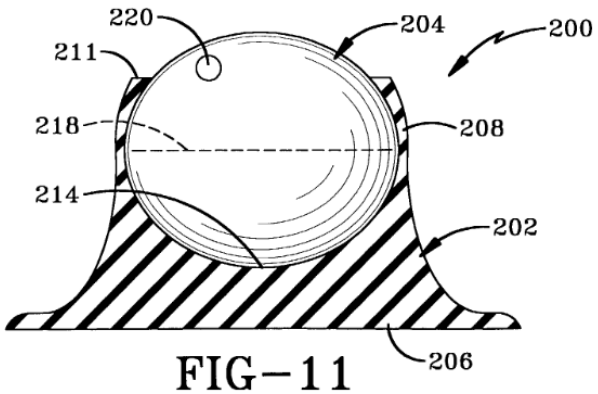
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−20 The tenth embodiment of the assembly is indicated generally by the numeral **400** in FIG. 20. Assembly **400** includes a patch **402** and a monitoring device **404** that includes a protective body **406** and a monitoring assembly **408**. Monitoring device **404** is the same as monitoring device **354** described above. In the tenth embodiment, monitoring device **404** is not directly connected to patch **402**. In this embodiment, assembly **400** includes an intermediate housing **410** that is attached to patch **402**. Monitoring device **404** is connected to housing **410** when it is mounted. (Wilson-506, 9:6-15) Housing **410** may be fabricated from the same material as protective body **406** or another material more rigid than the material of patch **402**. In one embodiment of the invention, housing **410** is encapsulated around the upper portion of patch **402**. In other embodiments, housing **410** may be adhesively connected or mechanically connected to patch **402**. (Wilson-506, 9:16-22) Housing **410** defines a cavity **412** adapted to receive all of, or a portion of, monitoring device **404**. Housing **410** and monitoring device **404** define cooperating threads **414** that allow monitoring device **404** to be selectively attached to and removed from housing **410**. In addition to threads **414**, any of the other

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	attachment arrangements described above may be used without departing from the concepts of the invention. (Wilson-506, 9:23-30)
8. The sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith. For example:* *See, e.g.*, **1[pre]**, above. **Abstract** A monitoring device and patch assembly includes a patch that removably and re-attachably holds the monitoring device. The patch is adapted to connect the monitoring device to a pneumatic tire when the monitoring device is held by the patch. The patch is configured to hold a monitoring device having a rounded outer surface. The patch holds the rounded monitoring device by having a resilient tube with an outlet having a diameter smaller than the diameter of the monitoring device. The monitoring device of the invention includes a feature that allows it to be removed from the patch. The invention also provides a monitoring device and patch combination that positions the monitoring device in a predictable orientation with respect to the tire so that the antenna of the monitoring device may be tuned for the orientation. The invention provides embodiments wherein the antenna is encapsulated and freely extending. (Wilson-506, 2:22-27) FIG. 1 is an exploded cross-sectional view of the first embodiment of the patch of the invention showing the housing and cavity for the tag assembly. (Wilson-506, 2:38-40)

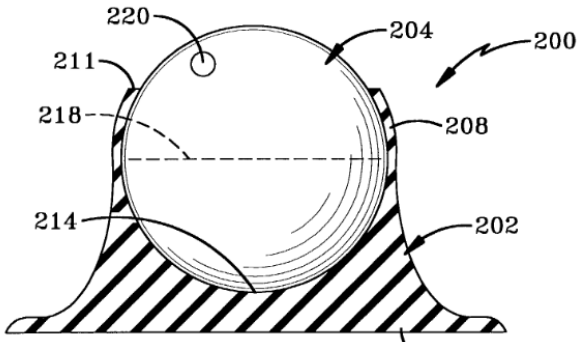
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−1 FIG. 1 shows a rubber patch **10** of the present invention. The patch **10** has a first side **12** which includes a housing **14** with a cavity **16** of a preselected configuration. As shown in FIG. 1, the housing **14** has a cavity **16** which is cylindrical, although the cavity **16** may be of any convenient configuration, as will become apparent from the description which follows. The patch has a second opposite side **18** approximating the contour of an innerliner of a tire (not shown). In a preferred embodiment, the rubber patch is vulcanized and then assembled to the vulcanized tire. Although any method for assembling the vulcanized rubber patch to the vulcanized tire, one acceptable and preferred method is set forth in U.S. Pat. No. 5,971,046; the disclosures of which are incorporated herein by reference. In accordance with the referenced application, the patch may be a rubber selected from the group consisting of Ethylene Propylene Diene Monomer (EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about 150° C. and holding at this temperature for about 30 minutes. The

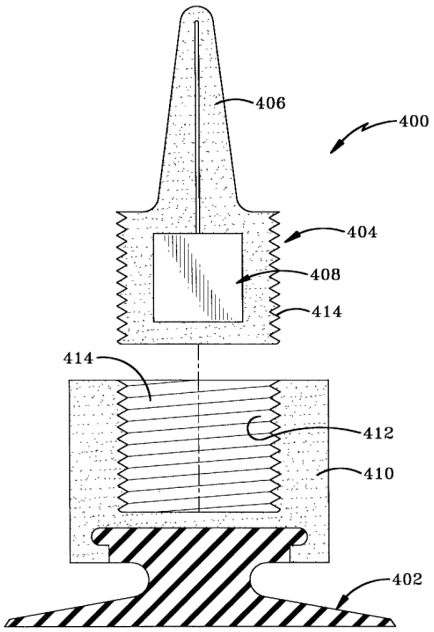
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. The second side **18** of the patch **10** approximates the contour of an innerliner of a tire. The contour of the second side **18** preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side is flat, having no contour. (Wilson-506, 3:35-67) FIG. 9 is a fourth embodiment of the present invention, shown in perspective, showing a slot and tab arrangement for locking a tag assembly to a rubber patch housing. (Wilson-506, 2:60-62)  FIG−9 In yet another embodiment, depicted in FIG. 9, tag assembly **130** is formed with at least one tab **132**, while housing **142** of rubber patch **140** is formed with slots **144** corresponding to tabs on tag assembly **130**. At the bottom of the slots is a ring **146** having an internal diameter corresponding to the slot depth on the housing and extending from each slot at least partially around the housing bottom. Once tabs **132** of tag assembly **130** are mated with slots **144** of rubber patch and tag assembly **130** is inserted into housing **142**, tag assembly **130** is rotated sufficiently so that tabs **132** are rotated into ring **146** and no longer are aligned with slots **144**, locking the tag assembly to rubber patch **140**. An

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	optional locking mechanism, such as discussed previously, may be added to lock tag assembly **130** to rubber patch **140** if there is a concern about rotation of tag assembly **130** with respect to rubber patch assembly. Another method of locking tag assembly **130** to rubber patch **140** is to insert a piece of material (not shown) into at least one slot **144**, for example by an interference fit between the slot and the material, so that in the event of rotation of the parts with respect to one another, even if the tabs **132** and slots become aligned, tabs **132** are prevented from moving axially in the slot. It is obvious that an equivalent structure can be achieved by reversing the arrangement of slots **144**, ring **146** and tabs **132** between tab assembly **130** and housing **142**. In this arrangement, at least one tab is formed in the housing and at least one slot corresponding to tabs is formed in tab assembly. (Wilson-506, 6:17-44) FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)  FIG–10

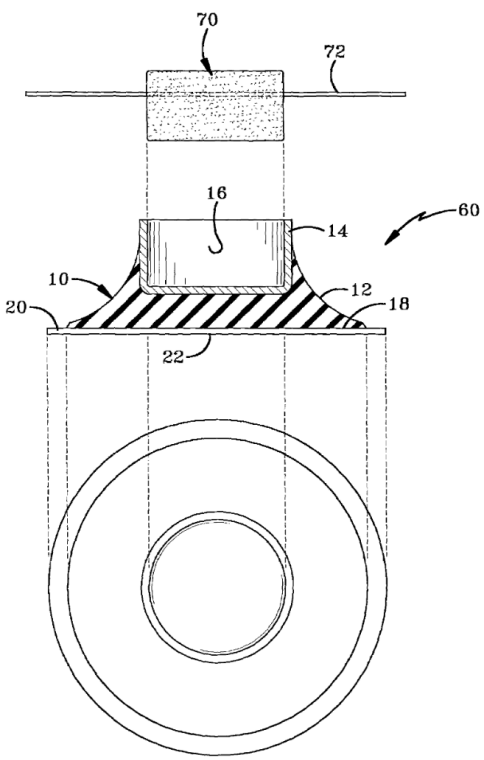
’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG–11 The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) Patch **202** includes a base **206** and a tube section **208** that projects up from base **206**. Patch **202** may include a bonding layer **20** as described above. Tube section **208** is annular and continuous and defines a cavity **210**. Tube section **208** includes a continuous lip **211** that defines an opening **212** that provides access to cavity **210**. Lip **211** and tube section **208** are free of interruptions, such as slits, that would allow lip **211** and tube section **208** to unintentionally open when used with the rounded monitoring devices of the invention. The continuity

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	of lip **211** increases the retaining ability of patch **202** which is important when holding a spherical, oblong sphere, or teardrop shaped monitoring device. The continuity of lip **211** also reduces the risk that lip **211** will tear during extended use. Tube section **208** tapers closed toward lip **211**. (Wilson-506, 7:13-27) The resting position of lip **211** and opening **212** is smaller than the maximum width of monitoring device **204** such that opening **212** must be stretched wider to allow monitoring device **204** to be inserted into and removed from cavity **210**. Lip **211** thus has a closed resting position and an open stretched position. Cavity **210** has a depth that is greater than half of the height of monitoring device **204** such that tube section **208** will close around monitoring device **204** to hold it in place. The walls of tube section **208** have sufficient elasticity and extensibility such that opening **212** may be stretched open to accommodate monitoring device **204** to seat monitoring device **204** within patch **202** as depicted in FIG. 11. The elasticity of the walls allows them to return to their resting position to trap monitoring device **204** with an interference fit within patch **202**. The material of patch **202** is configured to retain these properties overtime in both hot and cold operating conditions. In exemplary embodiments, patch **202** may be fabricated from any of a variety of thermosets or thermoplastics that have desirable resiliency and aged properties. (Wilson-506, 7:28-47) The inner surface **214** that defines cavity **210** may be curved to substantially match the outer curvature of monitoring device **204** as shown in FIG. 11. In other embodiments of the invention, the inner surface **214** may be configured such that an air pocket is disposed between base **206** and monitoring device **204**. (Wilson-506, 7:53-58) In the embodiment of the invention depicted in FIG. 11, monitoring device **204** is oblong and is positioned with its largest diameter substantially perpendicular to the longitudinal axis of patch **202**. Device **204** may be 3 to 5 percent out of round to achieve the benefits of an oblong device. The inventors also contemplate that patch **202** may be configured to receive monitoring device **204** with the smallest diameter of monitoring device **204** substantially perpendicular to the longitudinal axis of patch **202**. An oblong configuration helps properly align monitoring device **204** within patch **202** when

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	vibration forces move monitoring device **204** with respect to patch **202**. (Wilson-506, 7:59-8:3) A predictable proper alignment is important when monitoring device **204** has an antenna **218** that is tuned to function better when positioned in a specific direction. For example, antenna **218** may be aligned with the longest dimension of monitoring device **204** so that the user will known the orientation and can orient antenna **218** with respect to tire **71**. (Wilson-506, 8:4-10) The proper alignment of monitoring device **204** is also important so that the breathing tube **219** for the pressure sensor remains positioned within opening **212**. (Wilson-506, 8:11-13) FIG. 15 is a section view of the patch taken along line **15**—**15** of FIG. 14 showing the patch in section with the tag assembly in elevation. (Wilson-506, 3:8-10)  FIG−15 FIGS. 14 and 15 depict a sixth embodiment wherein monitoring device **204** is spherical. Another method of removing monitoring device **204** from patch **202** is to squeeze tube section **208** adjacent base **206** to force monitoring device **204** out of patch **202**. The squeezing force may be used in conjunction with tool **222**. (Wilson-506, 8:20-25) Patch **202** has rounded and curved walls and surfaces that lack points where stresses are concentrated. The lack of stress concentration increases the durability of patch **202**. Tube section **208** may also be configured to absorb vibrational forces. Assembly **200** also has the advantage that monitoring device **204** will not harm tire **71** if monitoring device **204** falls out of patch **202** because monitoring device is designed to be used

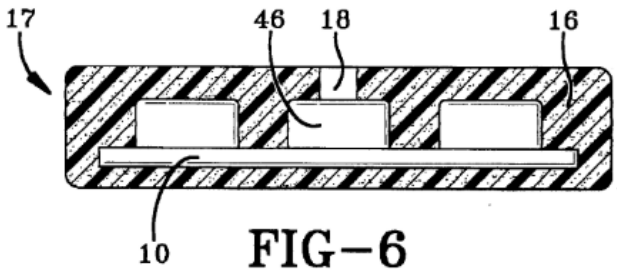
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	loosely within tire **71** and includes no sharp edges that could damage tire **71**. (Wilson-506, 8:26-34) As described above, patch **202** is generally configured to hold monitoring device **304** in a manner that allows monitoring device **304** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **304** to patch **202**. (Wilson-506, 8:43-48) FIG. 20 is a section view showing a tenth embodiment of the invention wherein an encapsulated monitoring device is threaded into a housing that is encapsulated around a portion of the patch. (Wilson-506, 3:22-25)  FIG−20 The tenth embodiment of the assembly is indicated generally by the numeral **400** in FIG. 20. Assembly **400** includes a patch **402** and a monitoring device **404** that includes a protective body **406** and a monitoring assembly **408**. Monitoring device **404** is the same as monitoring device **354** described above. In the tenth embodiment, monitoring device **404** is not directly connected to patch **402**. In this embodiment, assembly **400** includes an intermediate housing **410** that is attached to patch **402**. Monitoring

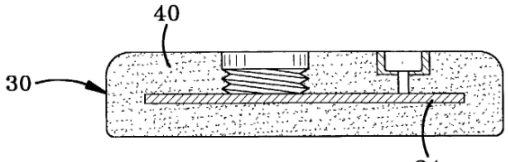
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device **404** is connected to housing **410** when it is mounted. (Wilson-506, 9:6-15) Housing **410** may be fabricated from the same material as protective body **406** or another material more rigid than the material of patch **402**. In one embodiment of the invention, housing **410** is encapsulated around the upper portion of patch **402**. In other embodiments, housing **410** may be adhesively connected or mechanically connected to patch **402**. (Wilson-506, 9:16-22) Housing **410** defines a cavity **412** adapted to receive all of, or a portion of, monitoring device **404**. Housing **410** and monitoring device **404** define cooperating threads **414** that allow monitoring device **404** to be selectively attached to and removed from housing **410**. In addition to threads **414**, any of the other attachment arrangements described above may be used without departing from the concepts of the invention. (Wilson-506, 9:23-30)
9. The sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member. For example:* *See, e.g.*, **1[pre]**, above. FIG. 1 is an exploded cross-sectional view of the first embodiment of the patch of the invention showing the housing and cavity for the tag assembly. (Wilson-506, 2:38-40)

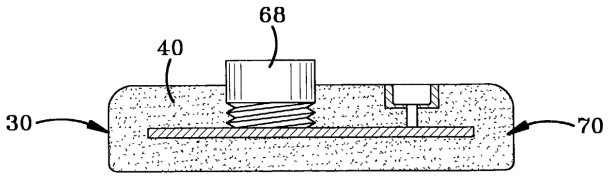
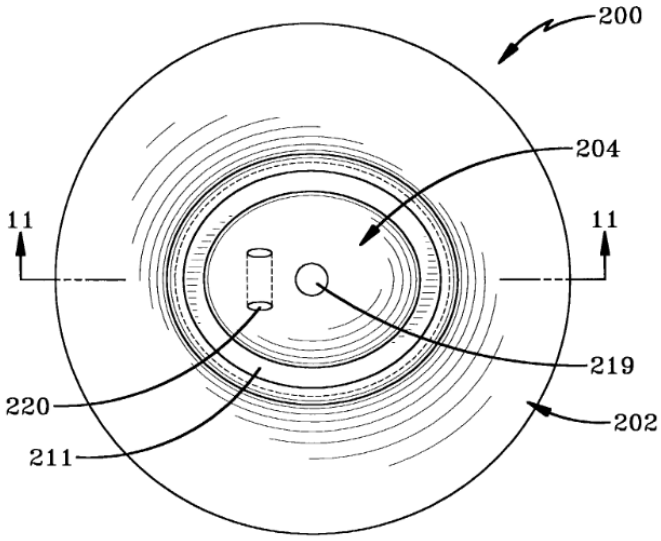
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−1 FIG. 1 shows a rubber patch **10** of the present invention. The patch **10** has a first side **12** which includes a housing **14** with a cavity **16** of a preselected configuration. As shown in FIG. 1, the housing **14** has a cavity **16** which is cylindrical, although the cavity **16** may be of any convenient configuration, as will become apparent from the description which follows. The patch has a second opposite side **18** approximating the contour of an innerliner of a tire (not shown). In a preferred embodiment, the rubber patch is vulcanized and then assembled to the vulcanized tire. Although any method for assembling the vulcanized rubber patch to the vulcanized tire, one acceptable and preferred method is set forth in U.S. Pat. No. 5,971,046; the disclosures of which are incorporated herein by reference. In accordance with the referenced application, the patch may be a rubber selected from the group consisting of Ethylene Propylene Diene Monomer (EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about 150° C. and holding at this temperature for about 30 minutes. The

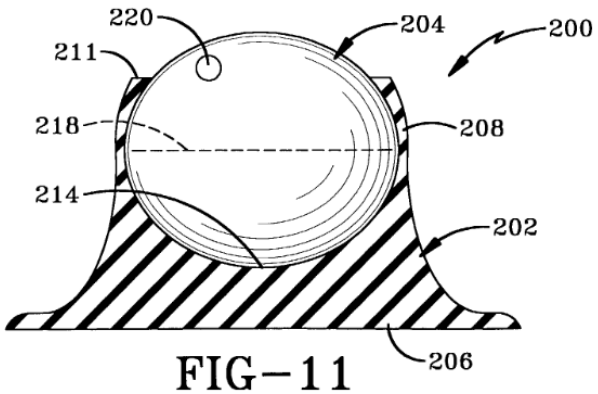
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. The second side **18** of the patch **10** approximates the contour of an innerliner of a tire. The contour of the second side **18** preferably is radiused to have about the same radius as the tire to which it is assembled, the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side is flat, having no contour. (Wilson-506, 3:35-67) Patch **202** has rounded and curved walls and surfaces that lack points where stresses are concentrated. The lack of stress concentration increases the durability of patch **202**. Tube section **208** may also be configured to absorb vibrational forces. Assembly **200** also has the advantage that monitoring device **204** will not harm tire **71** if monitoring device **204** falls out of patch **202** because monitoring device is designed to be used loosely within tire **71** and includes no sharp edges that could damage tire **71**. (Wilson-506, 8:26-34)
10. The sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device. For example:* *See, e.g.*, **1[pre]**, above. **Abstract** A monitoring device and patch assembly includes a patch that removably and re-attachably holds the monitoring device. The patch is adapted to connect the monitoring device to a pneumatic tire when the monitoring device is held by the patch. The patch is configured to hold a monitoring device having a rounded outer surface. The patch holds the rounded monitoring device by having a resilient tube with an outlet having a diameter smaller than the diameter of the monitoring device. The monitoring device of the invention includes a feature that allows it to be removed from the patch. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of

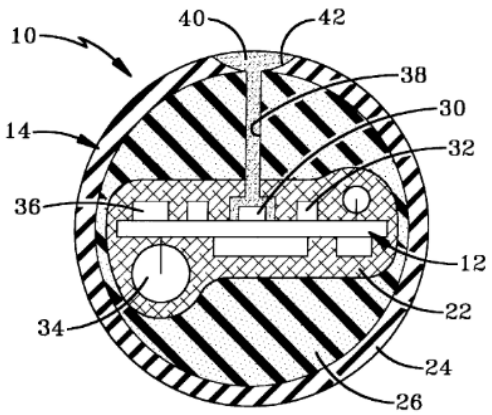
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)

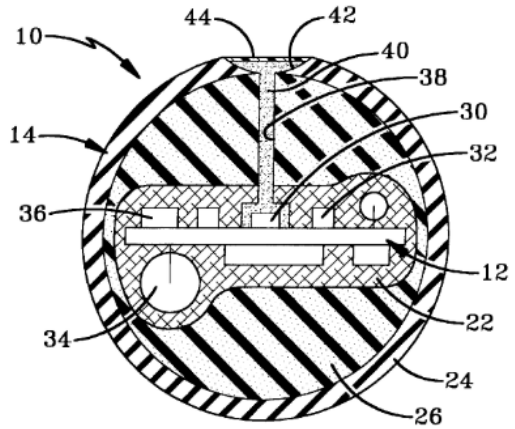
’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG–6 The invention also provides a monitoring device and patch combination that positions the monitoring device in a predictable orientation with respect to the tire so that the antenna of the monitoring device may be tuned for the orientation. The invention provides embodiments wherein the antenna is encapsulated and freely extending. (Wilson-506, 2:22-27) FIG. 1 shows a rubber patch **10** of the present invention. The patch **10** has a first side **12** which includes a housing **14** with a cavity **16** of a preselected configuration. As shown in FIG. 1, the housing **14** has a cavity **16** which is cylindrical, although the cavity **16** may be of any convenient configuration, as will become apparent from the description which follows. The patch has a second opposite side **18** approximating the contour of an innerliner of a tire (not shown). In a preferred embodiment, the rubber patch is vulcanized and then assembled to the vulcanized tire. Although any method for assembling the vulcanized rubber patch to the vulcanized tire, one acceptable and preferred method is set forth in U.S. Pat. No. 5,971,046; the disclosures of which are incorporated herein by reference. In accordance with the referenced application, the patch may be a rubber selected from the group consisting of Ethylene Propylene Diene Monomer (EPDM) rubber, butyl rubber, natural rubber, neoprene and mixtures thereof. One preferred embodiment is a mixture of chlorobutyl rubber and natural rubber. Another preferred embodiment is a mixture of Styrene-Butadiene rubber (SBR) and natural rubber. Typically, patches made of these rubber compositions may be cured by heating to a temperature of about 150° C. and holding at this temperature for about 30 minutes. The time and temperature may be modified as necessary to achieve sufficient curing of the patch for further assembly. The second side **18** of the patch **10** approximates the contour of an innerliner of a tire. The contour of the second side **18** preferably is radiused to have about the same radius as the tire to which it is assembled,

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	the radius being larger for larger tires. For very large tires, such as for off-the-road tires, the radius may be eliminated altogether, so that there is no contour and the opposite side is flat, having no contour. (Wilson-506, 3:35-67) FIG. 3 is a cross-sectional view of the electronic monitoring device embedded in potting material. (Wilson-506, 2:43-44)  FIG−3 The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the

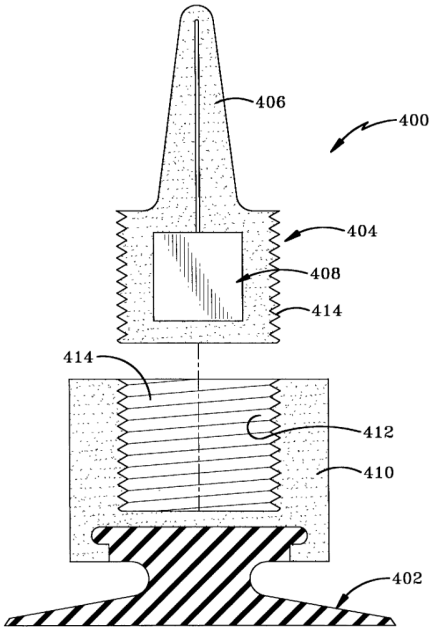
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) FIG. 5 is a cross-sectional view showing a battery attached to the tag; forming a tag assembly. (Wilson-506, 2:46-47)  FIG–5 FIG. 11 is a section view of the patch taken along line **11**—**11** of FIG. 10 showing the patch in section with the tag assembly in elevation. (Wilson-506, 2:65-67)  FIG–10

’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG–11 The fifth embodiment of the monitoring device (tag) and patch assembly of the invention is indicated generally by the numeral **200** in FIGS. 10–13. Assembly **200** generally includes a patch **202** and a monitoring device **204** that includes a protective body and a monitoring assembly. Patch **202** is generally configured to hold monitoring device **204** in a manner that allows monitoring device **204** to be repeatedly removed from patch **202** and reattached to patch **202** so that monitoring device **202** may be selectively mounted to tire **71** by selectively mounting monitoring device **204** to patch **202**. (Wilson-506, 6:45-54) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)

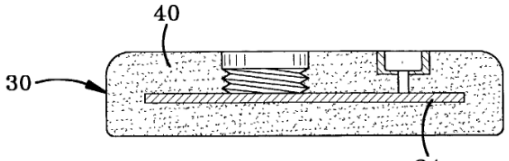
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG–3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24 and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15)

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)  FIG−9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48) In the embodiment of the invention depicted in FIG. 11, monitoring device **204** is oblong and is positioned with its largest diameter substantially perpendicular to the longitudinal axis of patch **202**. Device **204** may be 3 to 5 percent out of round to achieve the benefits of an oblong device. The inventors also contemplate that patch **202** may be configured to receive monitoring device **204** with the smallest diameter of monitoring device **204** substantially perpendicular to the longitudinal axis of patch **202**. An oblong configuration helps properly align monitoring device **204** within patch **202** when vibration forces move monitoring device **204** with respect to patch **202**. (Wilson-506, 7:59-8:3) A predictable proper alignment is important when monitoring device **204** has an antenna **218** that is tuned to function better when positioned in a specific direction. For example, antenna **218** may be aligned with the longest dimension of monitoring device **204** so that the user will known the orientation and can orient antenna **218** with respect to tire **71**. (Wilson-506, 8:4-10) The proper alignment of monitoring device **204** is also important so that the breathing tube **219** for the pressure sensor remains positioned within opening **212**. (Wilson-506, 8:11-13) FIG. 20 is a section view showing a tenth embodiment of the invention wherein an encapsulated monitoring device is threaded into a housing that is encapsulated around a portion of the patch. (Wilson-506, 3:22-25)

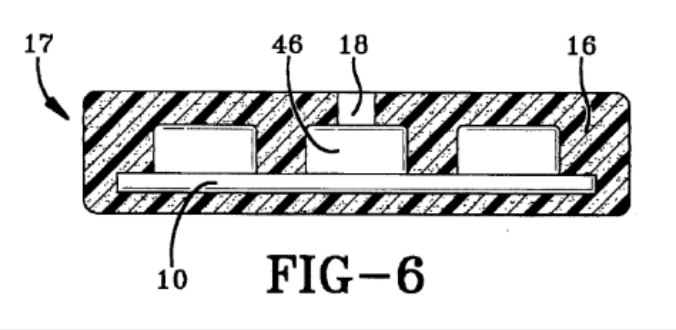
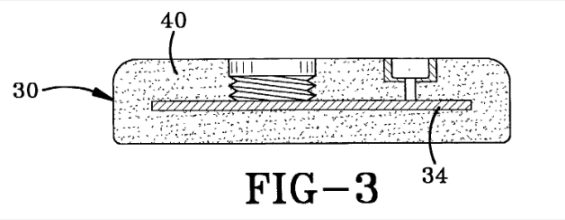
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG−20 The tenth embodiment of the assembly is indicated generally by the numeral **400** in FIG. 20. Assembly **400** includes a patch **402** and a monitoring device **404** that includes a protective body **406** and a monitoring assembly **408**. Monitoring device **404** is the same as monitoring device **354** described above. In the tenth embodiment, monitoring device **404** is not directly connected to patch **402**. In this embodiment, assembly **400** includes an intermediate housing **410** that is attached to patch **402**. Monitoring device **404** is connected to housing **410** when it is mounted. (Wilson-506, 9:6-15) Housing **410** may be fabricated from the same material as protective body **406** or another material more rigid than the material of patch **402**. In one embodiment of the invention, housing **410** is encapsulated around the upper portion of patch **402**. In other embodiments, housing **410** may be adhesively connected or mechanically connected to patch **402**. (Wilson-506, 9:16-22) Housing **410** defines a cavity **412** adapted to receive all of, or a portion of, monitoring device **404**. Housing **410** and monitoring device **404** define cooperating threads **414** that allow monitoring device **404** to be selectively attached to and removed from housing **410**. In addition to threads **414**, any of the other

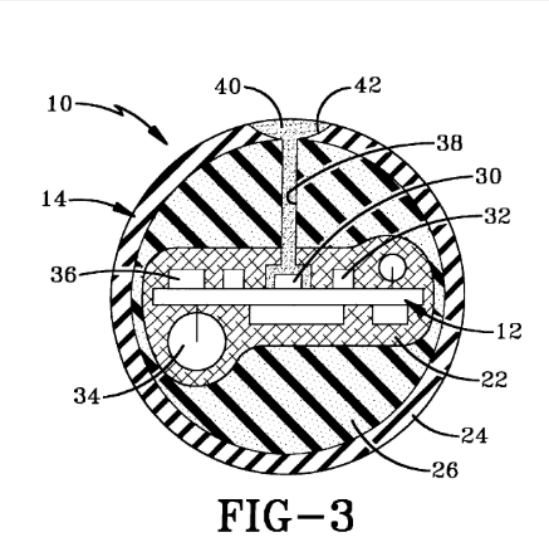
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	attachment arrangements described above may be used without departing from the concepts of the invention. (Wilson-506, 9:23-30)
11. A sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication.	*Wilson-506 discloses, teaches, and/or suggests a sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication. For example:* *See, e.g.*, **1[pre]**, above. "[INSERT]" (Wilson-506, cite.)
12. The sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*Wilson-506 discloses, teaches, and/or suggests the sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.*, **1[pre]**, above. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.)

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	The invention also provides a monitoring device and patch combination that positions the monitoring device in a predictable orientation with respect to the tire so that the antenna of the monitoring device may be tuned for the orientation. The invention provides embodiments wherein the antenna is encapsulated and freely extending. (Wilson-506, 2:22-27) The tag assembly **70** may be of any configuration which allows it to fit within the contour of the cavity **16**, both of which are cylindrical in the embodiment shown in FIG. 1. In the preferred embodiment, tag assembly **70** is assembled into the cavity **16** as shown in FIG. 6. Since the rubber patch assembly can be attached to the tire using an air cure or low temperature cure, it is understood that the sequence of assembling the tag assembly into the rubber patch housing may be accomplished either before or after the rubber patch is attached to the tire innerliner. Tag assembly includes an optional antenna **72**. Housing **14** includes slots **74** to receive the antenna. After the tag assembly **70** is in place within the cavity, at least one lock pin **76** is inserted through a first aperture **78** in housing **80**. As shown in FIG. 6, lock pin **76** is positioned across at least a portion of the top of tag assembly **70**, preferably through a second aperture **82** on the opposite side of the housing. Alternatively, lock pin **76** could extend into the potting of tag assembly **70**. (Wilson-506, 5:7-24) FIG. 3 is a cross-sectional view of the electronic monitoring device embedded in potting material. (Wilson-506, 2:43-44)  FIG−3 The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within

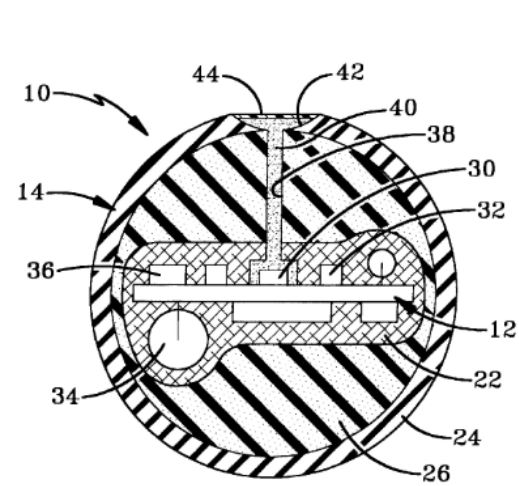
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) A predictable proper alignment is important when monitoring device **204** has an antenna **218** that is tuned to function better when positioned in a specific direction. For example, antenna **218** may be aligned with the longest dimension of monitoring device **204** so that the user will known the orientation and can orient antenna **218** with respect to tire **71**. (Wilson-506, 8:4-10)
20. The sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device. For example:* *See, e.g.*, **1[pre]**, above. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires.

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information from the electrical sensor device.	One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures

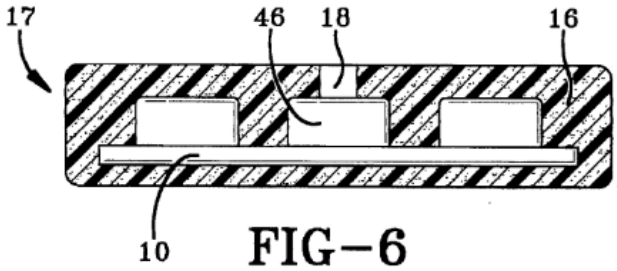
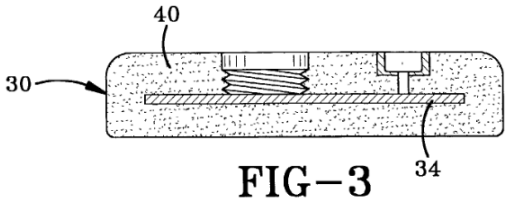
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG−6 FIG. 3 is a cross-sectional view of the electronic monitoring device embedded in potting material. (Wilson-506, 2:43-44)  FIG−3 The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the

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	temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)  FIG–3

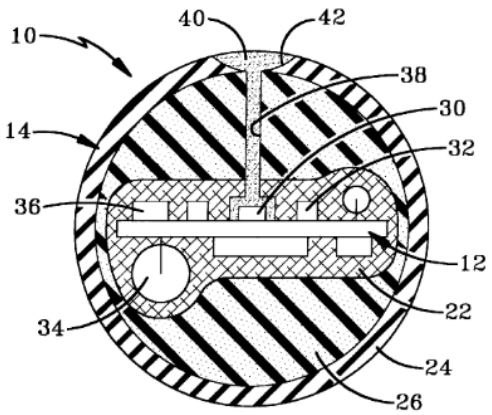
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24 and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15) Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)

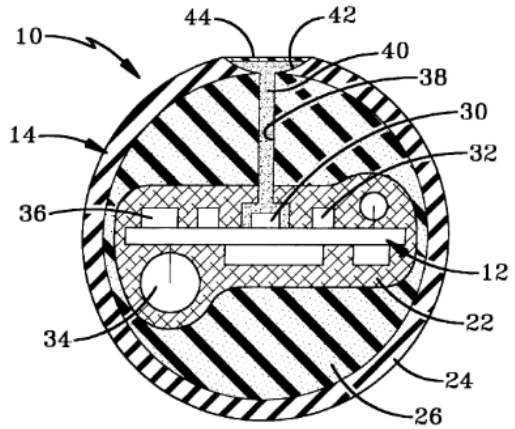
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG–9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20 that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48)
21. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor. For example:* *See, e.g.*, **1[pre]**, above.

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring

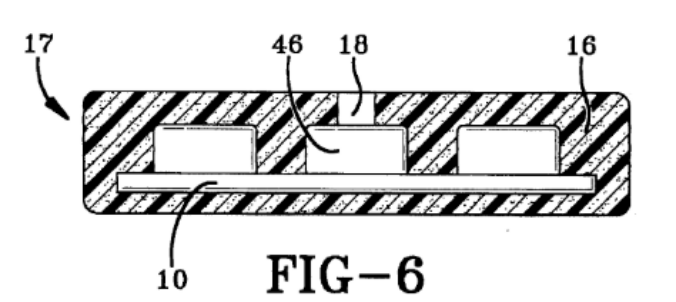
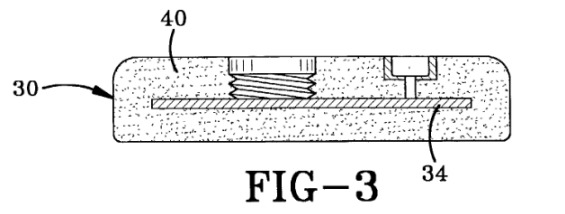
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG–6 FIG. 3 is a cross-sectional view of the electronic monitoring device embedded in potting material. (Wilson-506, 2:43-44)  FIG–3 The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)

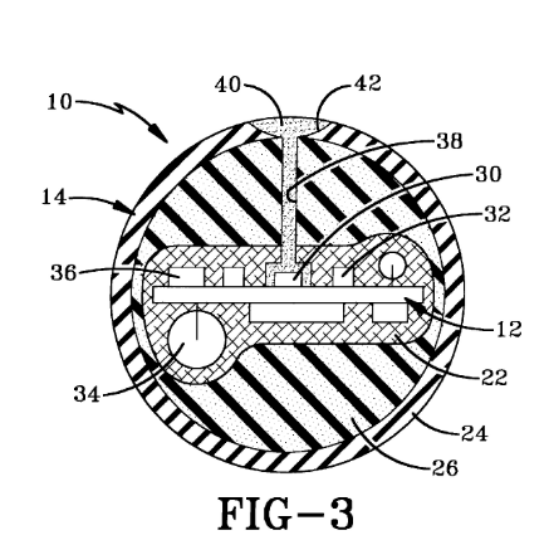
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	 FIG–3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24 and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15)

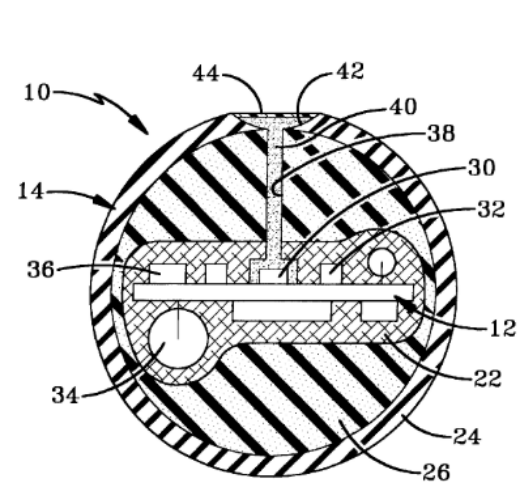
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)  FIG−9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48)
22. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device. For example:* *See, e.g.*, **1[pre]**, above. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.) While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard

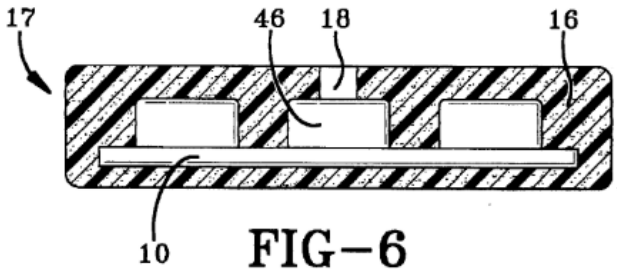
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG−6 FIG. 3 is a cross-sectional view of the electronic monitoring device embedded in potting material. (Wilson-506, 2:43-44)  FIG−3 The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring

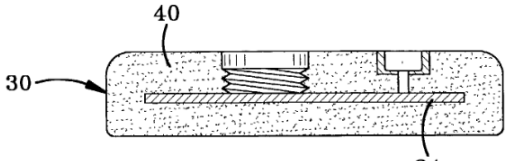
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12)

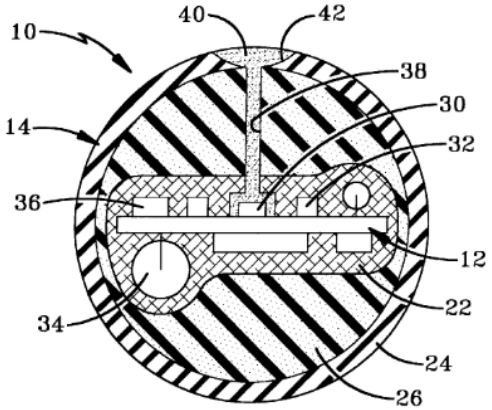
’421 Claim Element	Disclosures from Prior Art (Wilson-506)
	FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)  FIG−3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24 and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the

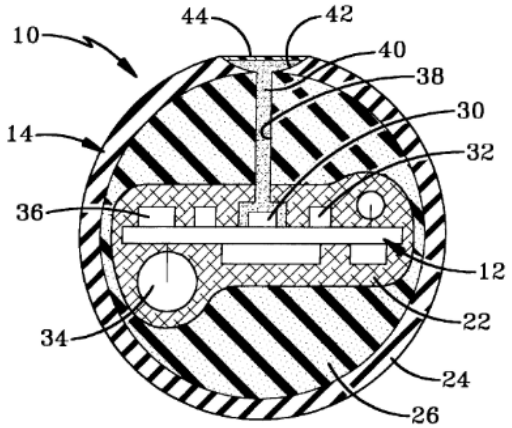
'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15) Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)  FIG–9 Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present

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	invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20 that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48)
23. The sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object. For example:* *See, e.g.*, **1[pre]**, above. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires. One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) The monitoring device 10 is comprised of a microchip 20, an antenna 30, an amplifier 42, a battery 44, a pressure sensor 46, and optional temperature and mileage/distance sensors (not shown), populating a circuit board 48 as depicted in FIG. 2. While not shown in the embodiment of FIG. 2, it is envisioned that the microchip 20 itself can contain all or some of the aforementioned components. (Koch-787, 4:26-33.)

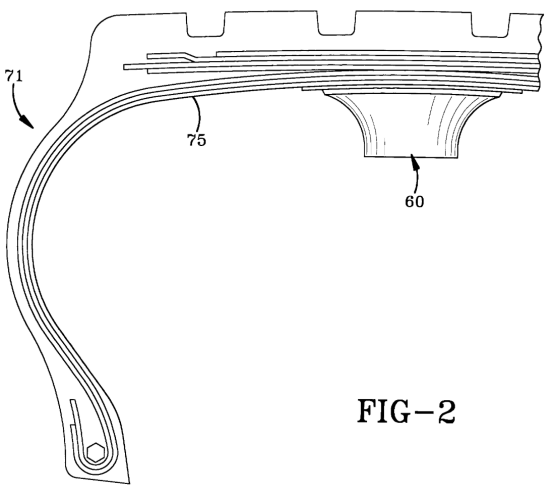
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	While optional, it is desirable that the monitoring device be contained in a rigid or semi-rigid encasement to enhance rigidity and inhibit straining of the device. This reinforcing encasement or encapsulation is a solid material, i.e., non-foam compounds, which is compatible with the tire rubber, such as various urethanes, epoxies, unsaturated polyester-styrene resins, and hard rubber compositions. Hard rubber compositions generally refer to any type of rubber or elastomer which is crosslinked and has a Shore A hardness of from about 50 to about 100, and desirably a Shore D hardness of from about 5 to about 80 and preferably a Shore D hardness from about 40 to about 80. We have found that the solid materials most suitable for use as reinforcement encasement or encapsulation of the device typically have an elastic modulus (Young's Modulus, E) in the range of about 100 ksi (100,000 pounds per square inch) to about 500 (500,000 pounds per square inch) ksi. The actual selected elastic modulus of the solid reinforcement encasement materials used to encase the device are a function of the stiffness of the monitoring device itself. (Koch-787, 34-53) An example of the monitoring device being encapsulated is shown in FIG. 6, wherein monitoring device 10 is encased within encasement or encapsulating material 16 o form monitoring device assembly 17. As shown in FIG. 6, it is an important aspect of the present invention that the sensor 46, which measures pressure, have an opening, aperture, etc., 18 to allow an air path to the sensor so it can measure the internal tire pressure. (Koch-787, 54-61)  FIG–6 FIG. 3 is a cross-sectional view of the electronic monitoring device embedded in potting material. (Wilson-506, 2:43-44)

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	 FIG–3 The electronic monitoring device is a circuit board which includes sensors and may include an antenna. The electronic monitoring device may include a power source or battery, although the battery may be attached to the electronic monitoring device at a later time. In the preferred embodiment, the battery is not included as part of the electronic monitoring device. The electronic monitoring device **34** is encapsulated in a potting material **40** which solidifies into a rigid material as shown in FIG. 3. Referring to FIGS. 3 and 4, the electronic monitoring device **34** is placed within a mold **42** having a first half **52** and a second half **54**. The mold is then filled with the potting material **40** in fluid form, which fills the mold and flows around the electronic monitoring device and allowed to cure, resulting in a rigid tag. Any potting material having a Young's Modulus of at least 30,000 psi and which is capable of being molded around the electronic monitoring device without damaging any of the components of the device. Preferably, the potting material has a Young's Modulus of at least about 100,000 psi. Two preferred potting materials include epoxy and urethane. If desired, the curing of the potting material around the electronic device may be accelerated by preheating the mold to an elevated temperature which is above ambient, but below the temperature at which damage to the electronic monitoring device will occur. A preferred temperature is about 80° C. After the epoxy has been cured, the mold halves **52**, **54** are separated, yielding a rigid, encapsulated tag **30**. In a preferred embodiment, FIG. 5, a battery **68** which provides power to the tag **30** is attached to the tag to form a tag assembly **70**. Although the battery is shown as held in position contacting the electronic monitoring device **34** by threading, any suitable means of attaching the battery to the circuit board so that the battery may be removed is acceptable. Alternate means of attaching the battery to the circuit board may include spring clips, lock pins or other hold down devices. (Wilson-506, 4:38-5:6) Monitoring device **204** may have the same structure as the monitoring device disclosed in U.S. Pat. No. 6,082,192; the disclosures of this patent are incorporated herein by reference. As such, monitoring device **204** and those having the same type of

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	configuration (a rounded outer surface) do not have any features that may be used to secure them to a patch. Patch **202** of the present invention is designed to hold monitoring device **204** in a fixed position with respect to tire **71** without requiring any special modification to monitoring device **204** that would prevent monitoring device **204** from being used in a tire in a loose, free rolling configuration. (Wilson-506, 7:2-12) FIG. 3 is a sectional view of the monitoring device of FIG. 2, the sectional view taken through a portion of the monitoring device assembly including the breathing tube; (Koch-192, 3:53-55)  FIG–3 Another objective of the present invention is to provide a monitoring assembly for a pneumatic tire that allows a pressure sensor to function while reducing the risk that the pressure sensor malfunctions by filling the breathing tube of the monitoring device with a transfer gel. (Koch-192, 2:63-67) In accordance with another objective of the present invention, protective body 14 includes an encapsulation layer 22, an outer skin 24, and a cushion 26 disposed between skin 24 and encapsulation layer 22 as shown in FIG. 3. Encapsulation layer 22 may be formed from a substantially rigid encapsulation material such as a hard plastic, epoxy, or rubber. Encapsulation layer 22 is configured to maintain the position of each of the elements of electronic monitoring device 12 when monitoring assembly 10 is loosely moving about chamber 20 while tire 16 is in use. Cushion 26 preferably is fabricated from a foam or a soft rubber and provides a shock absorber

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	to assembly 10. The foam is preferably resilient. As can be seen in FIG. 3, the thickness of cushion 26 varies so that the internal surface of cushion 26 matches the exterior surface of encapsulation layer 22, while the external surface of cushion 26 is substantially spherical. Skin 24 provides a durable, protective layer to monitoring assembly 10 and may be fabricated from a substantially durable rubber or plastic that is fixed to cushion 26 by a suitable adhesive or by curing the materials together. In one embodiment of the present invention, skin 24 has an external diameter of about 2 inches to about 21/2 inches. Obviously, other sizes of assembly 10 are contemplated by the present invention. (Koch-192, 4:59-5:15) Electronic monitoring device 12 preferably is an active monitoring device that includes at least one sensor such as a pressure sensor 30. Other sensors may include a thermometer 32 for measuring the internal temperature of tire 16. Electronic monitoring device 12 may further include a battery 34 that powers a central processing unit (CPU) 36 that both drives and monitors the other sensors of device 12. Numerous types of electronic monitoring devices are known in the art and the specific configuration described is not to limit the application of the present invention. (Koch-192, 5:16-25) FIG. 9 is a view similar to FIG. 3 showing an alternative embodiment of the breathing tube configuration. (Koch-192, 4:3-4)  FIG–9

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	Pressure sensor 30 must be exposed to the pressure of the surrounding atmosphere in chamber 20 for it to provide useful information. A breathing tube 38 thus is provided through encapsulation layer 22, cushion 26, and skin 24. Breathing tube 38 preferably is formed during the fabrication of monitoring assembly 10 or may be formed after assembly 10 has been fabricated. Breathing tube 38 may be empty to provide direct fluid communication between pressure sensor 30 and the surrounding atmosphere. In another embodiment of the present invention, breathing tube 38 is filled with a transfer gel 40 that has a one-to-one transfer ratio so that pressure sensor 30 senses the pressure change in transfer gel 40 which, in turn, senses and experiences pressure changes in the atmosphere of chamber 20 that surrounds monitoring assembly 10. Transfer gel 40 prevents breathing tube 38 from being clogged with debris such as dust, rubber shavings, or grease that may be present in chamber 30 or on rim 18. An indentation 42 is provided in skin 24 to give transfer gel 40 more surface area that is exposed to the atmosphere surrounding monitoring assembly 10. In another embodiment of the invention, a flexible diaphragm 44 (FIG. 9) covers breathing tube 38 to prevent transfer gel 40 from becoming contaminated. (Koch-192, 5:26-48)
24. The sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire. For example:* *See, e.g.*, **1[pre]**, above. **Abstract** A monitoring device and patch assembly includes a patch that removably and re-attachably holds the monitoring device. The patch is adapted to connect the monitoring device to a pneumatic tire when the monitoring device is held by the patch. The patch is configured to hold a monitoring device having a rounded outer surface. The patch holds the rounded monitoring device by having a resilient tube with an outlet having a diameter smaller than the diameter of the monitoring device. The monitoring device of the invention includes a feature that allows it to be removed from the patch. Recent engineering advances have permitted the installation of monitoring devices having active integrated circuits within tires.

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
	One such device is described in U.S. Pat. No. 5,562,787 to Koch et al. entitled Method of Monitoring Conditions of Vehicle Tires, incorporated herein by reference, and assigned to the assignee of the present invention. These devices include an active circuit powered by a dedicated long life, miniature battery and at least one sensor for detecting, optionally storing and transmitting real time engineering conditions within the tire. Such devices are capable of being programmed to remain in an active, but dormant condition, but will switch automatically to an "awakened" condition in response to an external signal or a condition which exceeds preset limits. (Wilson-506, 1:47-60) FIG. 2 is a cross-sectional view of the patch of the present invention attached to the innerliner of a tire. (Wilson-506, 2:41-42)  FIG−2 Referring now to FIG. 2, patch assembly **60** is then assembled to the innerliner **75** of tire **71**. Activating cement is first applied to second side **22** of dual cure bonding layer **20**. The patch assembly is then stitched to the innerliner of the vulcanized tire and the patch assembly/tire assembly is allowed to cure for a sufficient time and temperature to form a strong bond between the tire and the patch assembly. The times and temperatures utilized for this curing may be basically the same times and temperatures as previously discussed. To ensure a strong bond, the patch assembly optionally may be clamped to the tire innerliner **75**, until the curing cycle is completed. (Wilson-506, 2:26-37)
28[pre]. A sensor assembly and sensing system for use	*To the extent that the preamble is limiting, Wilson-506 discloses, teaches, and/or suggests a* sensor assembly and sensing system for use with an object that rotates in use comprising. *For example:*

'421 Claim Element	**Disclosures from Prior Art (Wilson-506)**
with an object that rotates in use comprising:	*See, e.g.*, **1[pre]**, **11**, above. *See also following limitations.*
[28a] a housing comprising an outer structure that defines an open internal cavity therein,	*Wilson-506 discloses, teaches, and/or suggests a housing comprising an outer structure that defines an open internal cavity therein. For example:* *See, e.g.*, **[1a]-[1c]**, **10**, above.
[28b] an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device,	*Wilson-506 discloses, teaches, and/or suggests an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device. For example:* *See, e.g.*, **[1a]-[1c]**, **5**, **10**, above.
[28c] wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location.	*Wilson-506 discloses, teaches, and/or suggests wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location. For example:* *See, e.g.*, **[1d]**, above.
[28d] wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor;	*Wilson-506 discloses, teaches, and/or suggests wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor. For example:* *See, e.g.*, **[1a]-[1c]**, **20**, above.
[28e] a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment	*Wilson-506 discloses, teaches, and/or suggests a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member. For example:* *See, e.g.*, **[1e]**, **7**, **8**, above.

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
between the housing and the retaining member; and	
[28f] a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly.	*Wilson-506 discloses, teaches, and/or suggests a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly. For example:* *See, e.g.*, **1**, **11**, above.
31. The sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity. For example:* *See, e.g.*, **[1c]**, above.
32. The sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member. For example:* *See, e.g.*, **[1e]**, **9**, above.
33. The sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.*, **[1b]**, **11** above.
34. The sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil	*Wilson-506 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data. For example:*

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data.	*See, e.g.,* **1[pre]**, **[1b]**, **[1d]**, **[1e]**, **11**, **12**, **20**, above.
41[pre] A method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of:	*To the extent that the preamble is limiting, Wilson-506 discloses, teaches, and/or suggests a method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of: vulcanized rubber tire comprising. For example:* *See, e.g.,* **1**, **11**, **12**, **20**, above. *See also following limitations.*
[41a] installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity, and	*Wilson-506 discloses, teaches, and/or suggests installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41b] wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry,	*Wilson-506 discloses, teaches, and/or suggests wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41c] wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity;	*Wilson-506 discloses, teaches, and/or suggests wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41d] attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the	*Wilson-506 discloses, teaches, and/or suggests attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object. For example:* *See, e.g.,* **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
retaining member is connected with the object before or after formation of the object; and	
[41e] monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly.	*Wilson-506 discloses, teaches, and/or suggests monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
43. The method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity.	*Wilson-506 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
44. The method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed.	*Wilson-506 discloses, teaches, and/or suggests the method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above
48. The method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire.	*Wilson-506 discloses, teaches, and/or suggests the method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
50. The method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to	*Wilson-506 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

'421 Claim Element	Disclosures from Prior Art (Wilson-506)
a display feature that is positioned on the housing.	
51. The method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device.	*Wilson-506 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
52. The method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor.	*Wilson-506 discloses, teaches, and/or suggests the method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
53. The method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly.	*Wilson-506 discloses, teaches, and/or suggests the method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

Invalidity Claim Chart Against U.S. Patent No. 11,835,421 ("'421 Patent")
Based on the VDO REDI-Sensor

The "VDO REDI-Sensor" was publicly available and on sale prior to the earliest effective filing date of the ''421 patent. VDO REDI-Sensor qualifies as prior art under at least 35 U.S.C. § 102(a), as reflected in at least the following:

- https://www.youtube.com/watch?v=VXrC8g3auVI (dated November 18, 2016)
- https://www.vdo.de/redi-montage/

1.5 Copyright

This reference manual is intended for express use with VDO REDI-Sensor installation and service, and may be freely copied and distributed with this intent. However, the material must not be used for any other purpose without the explicit and prior approval of Continental Aftermarket GmbH. © 2014 Continental Aftermarket GmbH.

- https://media.motoral.ee/productfiles/999029350/manual/WDO_REDI_SENSORI_PAIGALDUSJUHEND.pdf

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- https://www.vdo.com/media/182596/tu00-0780-6107100-manual-d-151221-en.pdf

1.4 Copyright

This document is provided for use during the installation and replacement of the VDO REDI-Sensors, and must be copied and circulated for this purpose only. The document must not be used for any other purpose unless explicit written approval has been granted by Continental Aftermarket GmbH in advance. © 2016 Continental Aftermarket GmbH.

- https://www.rema-tiptop.de/fileadmin/data/common/downloads/roundtable/2014/2014-03-20_Continental_Roundtable_Handout_FINAL.pdf



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S.Dötsch

www.vdo.com

VDO

- https://www.continental.com/en/press/press-releases/2014-09-16-vdo-redi-sensor/

Press Release September 16, 2014

VDO REDI-Sensor successfully launched on the market

- VDO REDI-Sensor available on the European market as of summer 2014
- The multi-application TPM sensor can be installed in a wide range of vehicles
- Extensive product benefits simplify TPMS servicing for workshops
- The VDO REDI-Sensor is the winner of the Automechanika Innovation Awards 2014 in the category "Parts & Components"

Frankfurt, 16th September 2014. As of 1st November 2014, every new car in the European Union will have to be fitted with a tire pressure monitoring system (TPMS). As a result, workshops will have to check that the TPM system is functioning correctly after every tire or wheel change. When direct TPM systems are used, the tire pressure is measured quickly and accurately by sensors in the tire. However, the associated monitoring systems require specific sensors depending on the manufacturer. With the VDO REDI-Sensor solution, Continental's VDO brand has developed sensors that are all suitable for use in a wide range of vehicles and therefore greatly simplify operations with these systems. VDO REDI-Sensors also offers a range of other advantages.

The VDO REDI-Sensor: All the advantages at a glance

Suitable for use with many different vehicles: At present, practically every TPMS-equipped vehicle that comes to a workshop requires a specific TPM sensor. In the future, however, all workshops will be able to cater to a wide range of different vehicles using just three VDO REDI-Sensor variants. This will greatly simplify storage and logistics for workshops and spare parts dealers alike.



VDO REDI-Sensor anticipates and/or renders obvious the Asserted Claims of the '421 Patent (at least as Revvo understands Plaintiff's application of the Asserted Claims in an effort to show infringement).

To the extent Plaintiff argues that any element below is not disclosed by VDO REDI-Sensor, a person of ordinary skill in the art would have found it obvious to combine the teachings of VDO REDI-Sensor with the background knowledge of a person of ordinary skill in the art and/or the additional references and exemplary teachings set forth in the chart below, to arrive at the claim limitation with a reasonable expectation of success. The chart below provides representative examples of where each element of each claim is found within VDO REDI-Sensor. Citations are meant to be exemplary, not exhaustive, and Revvo reserves the right to identify and discuss additional portions of the reference in support of its contentions and/or to rebut arguments made by Plaintiff. Citations to figures, drawings, tables, and the link include reference to any accompanying or related text. All internal cross-references are meant to incorporate the cross-referenced material as if fully set forth therein.

It is Revvo's position that Plaintiff's October 30, 2024 Infringement Contentions have not established that any accused product or service infringes any valid claim. Thus, Revvo's statements below should not be treated as an admission, implication, or suggestion that Revvo agrees with Plaintiff regarding either the scope, construction, or interpretation of any of the Asserted Claims or the infringement theories advanced by Plaintiff in its Infringement Contentions, including whether any Asserted Claim satisfies 35 U.S.C. §§ 101 or 112. In certain cases, Revvo has specified non-limiting examples of where its application of the prior art is based on Plaintiff's apparent application of the claim element. These statements are not intended to suggest that Revvo agrees with Plaintiff's application of any claim element, suggest a proposed construction at this stage of the case, or suggest that construction is needed, as the parties are not required to exchange terms for construction or propose claim constructions until a later date.

Plaintiff has yet to identify any limitation of the Asserted Claims that it contends is not anticipated and/or rendered obvious by VDO REDI-Sensor. Revvo therefore expressly reserves the right to respond to any such contention, including by identifying additional obviousness combinations, if Plaintiff makes any such contention.

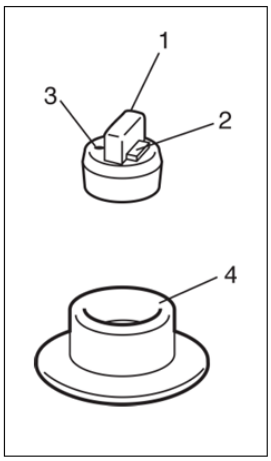
Where Revvo states that VDO REDI-Sensor "discloses" a limitation, that disclosure may be express, implicit, and/or inherent.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
1[pre]. A sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising:	*To the extent that the preamble is limiting, VDO REDI-Sensor discloses, teaches, and/or suggests a sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising. For example:*  https://www.vdo.com/media/182596/tu00-0780-6107100-manual-d-151221-en.pdf  2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

3.1 Components



1	RF (radio frequency) antenna
2	LF (low frequency) antenna
3	Pressure port
4	Rubber container

Fig. 1 Components

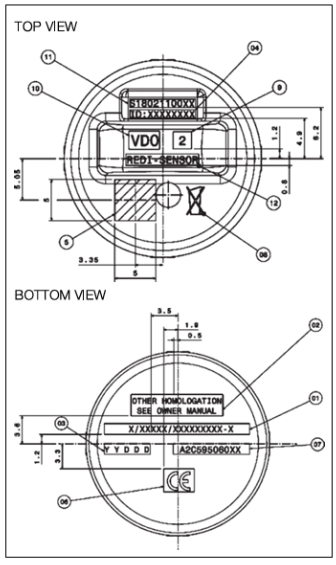
https://www.vdo.de/redi-montage/ at 32.

3.2 Marking

Marking of the VDO REDI-Sensor

The VDO REDI-Sensor is laser marked on the top and on the bottom side of the module. The bottom marking is not visible after installation in the container.

https://www.vdo.de/redi-montage/ at 32.



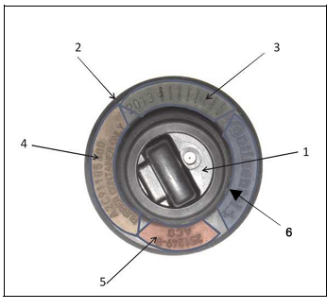
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

Marking of the rubber container



Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

https://www.vdo.de/redi-montage/ at 33.

Examples:

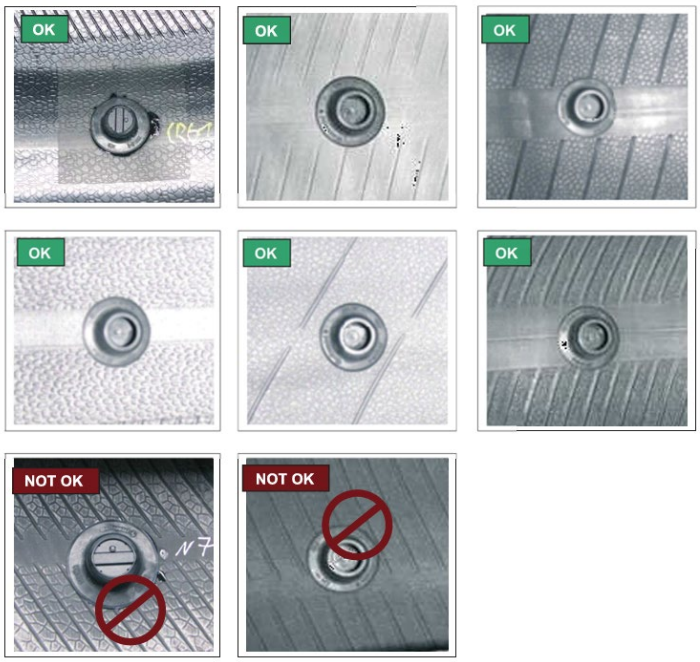


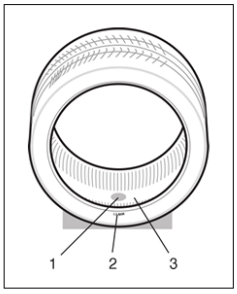
Fig. 5 Examples for bonding position of sensor

https://www.vdo.de/redi-montage/ at 37.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

4.4 Bonding position in the tyre

Look for a smooth area in the tyre without ridges or ribbing that will readily accept glue.



1 bonding position in the tyre
2 production date stamp on tyre sidewall
3 tyre inner liner

Fig. 6 Bonding position in the tyre

The correct position of the bonding surface is:

- In the middle of the tyre inner liner (see also Fig. 5 Examples for bonding position of sensor).
- To be mounted at the tyre production date stamp (week code), for ease in locating the sensor during future tyre service and for best communication between the sensor and the TPMS service tool.

https://www.vdo.de/redi-montage/ at 38.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

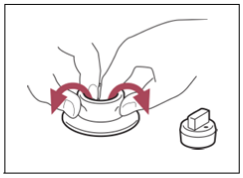
4.6 Installing the tyre sensor in the rubber container

The tyre sensor is normally supplied pre-assembled in the rubber container. In this case proceed with chapter 4.7.

In case of reusing a VDO REDI-Sensor, please make a battery check.

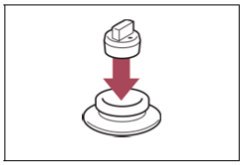
The tyre sensor may be inserted manually into the rubber container or using an optional spreader tool.

Manual installation of the tyre sensor



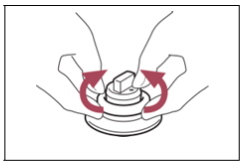
1 Fold over the sealing lip of the rubber container.

Keep the rubber container free of tyre mounting lubricants and other lubrication liquids..

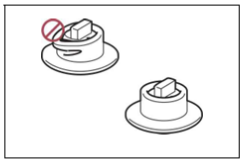


2 Place the VDO REDI-Sensor in the rubber container.

Take specifically care, that no air may be trapped below the sensor. Otherwise the sensor could be popped out.



3 Fold the sealing lip of the container up again.



4 The sealing lip of the container must lie uniformly on the top of the sensor around the circumference.

Fig. 8 Manual installation of the tyre sensor

https://www.vdo.de/redi-montage/ at 40.

4.10 Final inspection

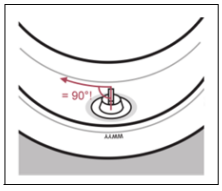


Fig. 13 Antenna orientation

1 Check that the sensor antenna is at right (90 degrees) angles to the rolling direction of the tyre.

If the antenna is not oriented properly it can be removed from the rubber container by folding down its lip and repositioning the sensor or use of the spreader tool after the glue has dried (see sections 5 and 4.6). Do not wrench the sensor within the rubber container (i.e. with pliers).

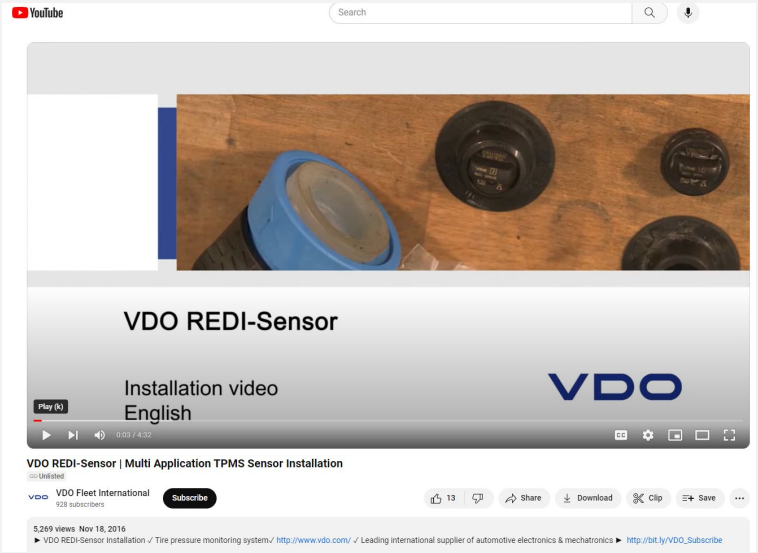
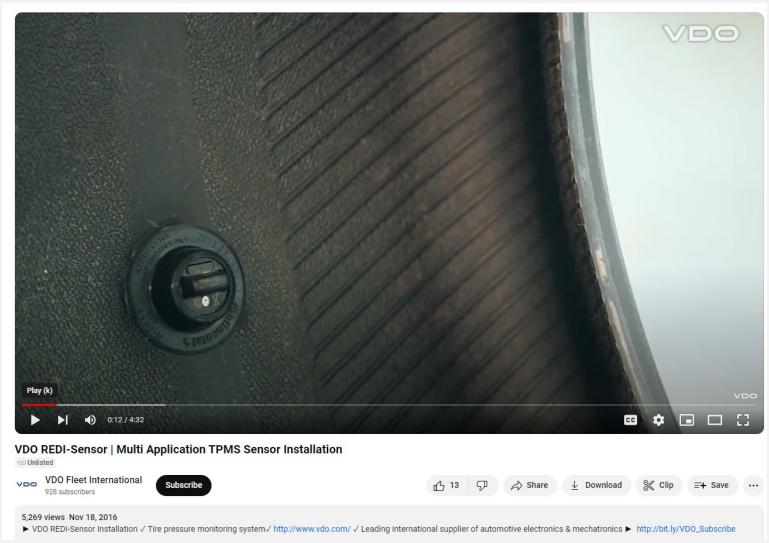
2 Inspect the bond visually. When bonded correctly, the rubber container with integral tyre sensor is in full, flush contact with the inner liner of the tyre.

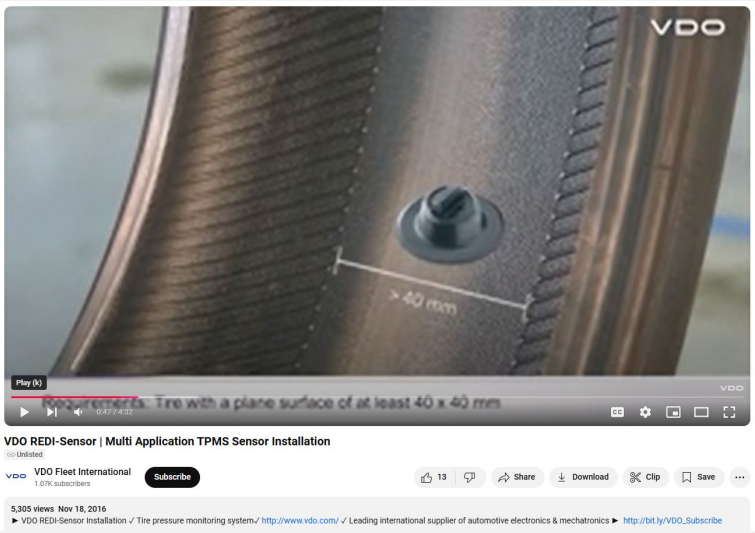
Minor amount of glue exceeding the rubber container edge can stay there and will dry quickly.

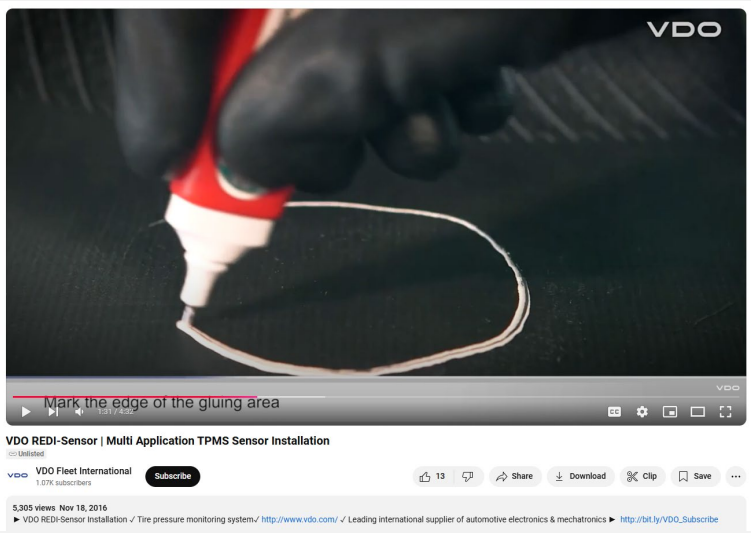
A larger amount of excessive glue can be carefully wiped away prior to the glue curing / setting by disposable paper towels, but note for future installations to adjust the amount of glue used.

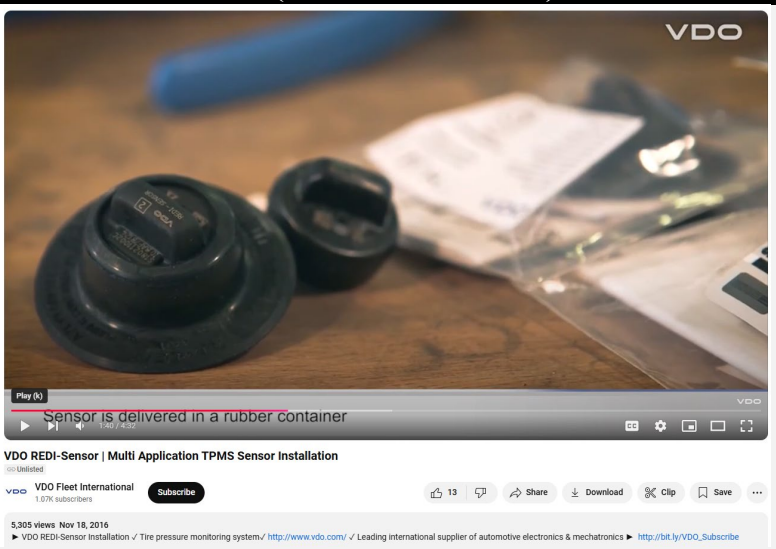
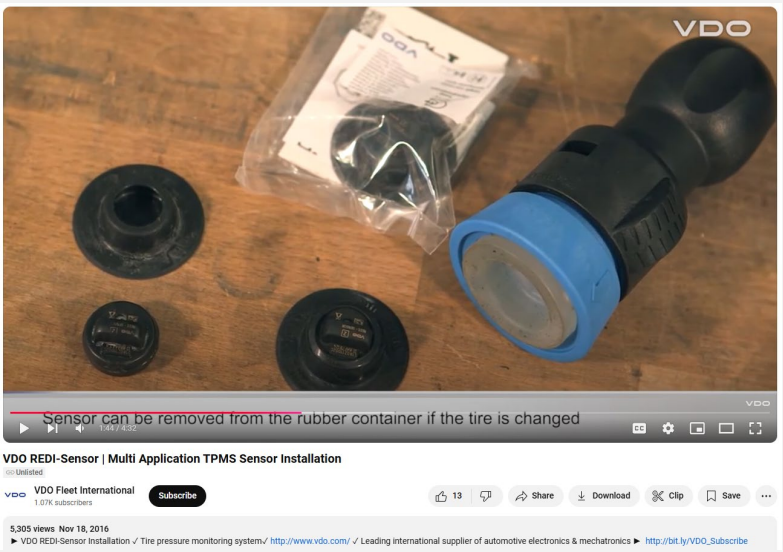
3 Check proper functioning of the sensor using a dedicated TPMS service tool / scan tool.

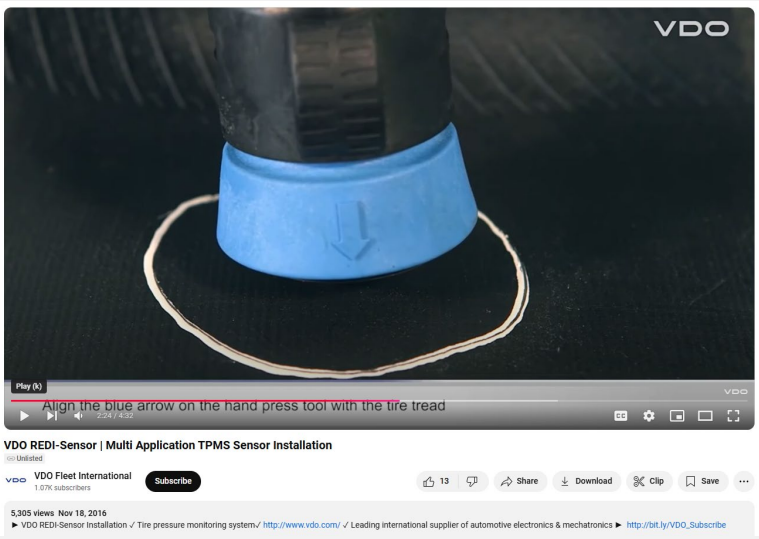
https://www.vdo.de/redi-montage/ at 46.

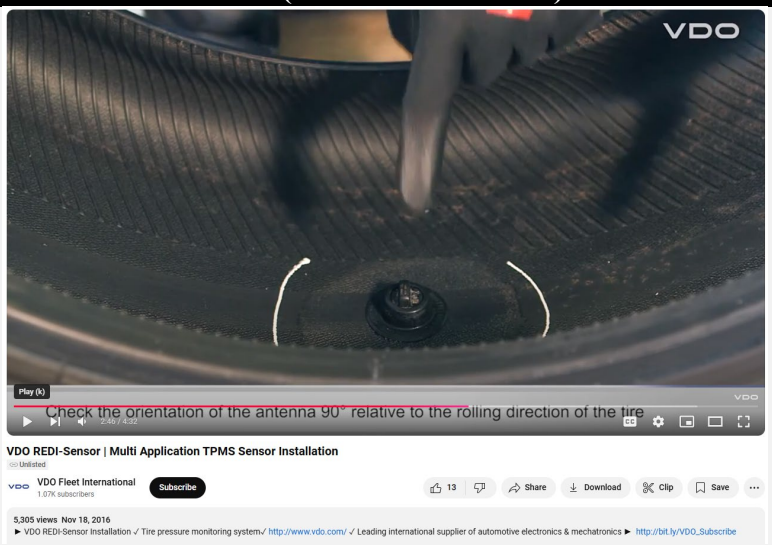
’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

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	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

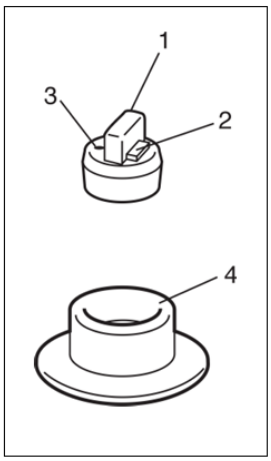
’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI *See also following limitations.*
[1a] a housing comprising an outer surface and an internal cavity that is enclosed within the housing;	*VDO REDI-Sensor discloses, teaches, and/or suggests a housing comprising an outer surface and an internal cavity that is enclosed within the housing. For example:* *See, e.g.*, **1[pre]**, above. 2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

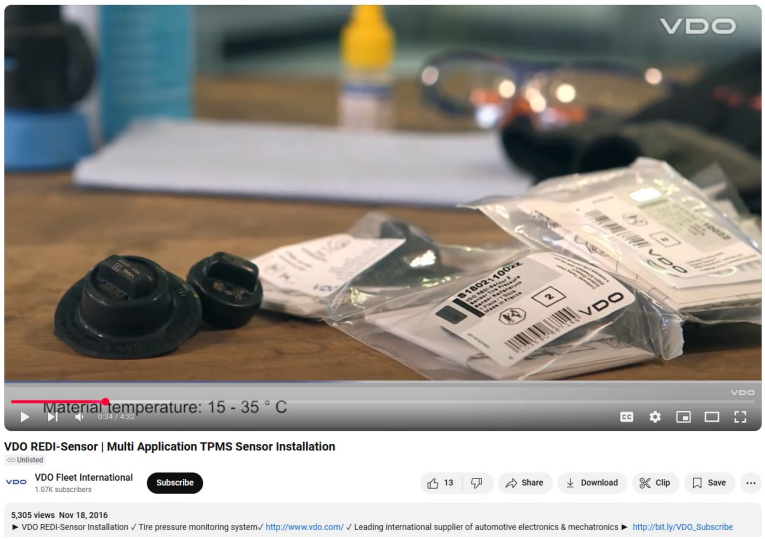
3.1 Components



1 RF (radio frequency) antenna
2 LF (low frequency) antenna
3 Pressure port
4 Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



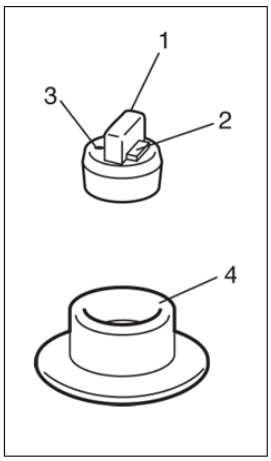
https://www.youtube.com/watch?v=VXrC8g3auVI

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
[1b] an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity,	*VDO REDI-Sensor discloses, teaches, and/or suggests an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity. For example:* *See, e.g.*, **1[pre]**, above. 2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

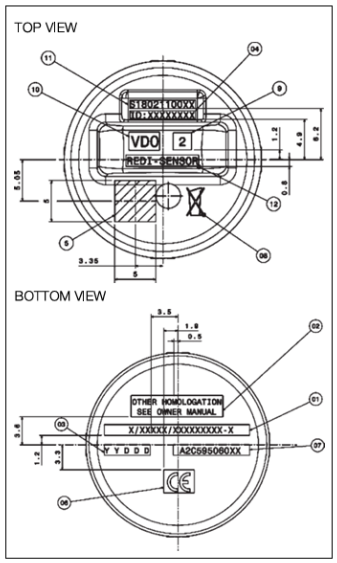
3.1 Components



1	RF (radio frequency) antenna
2	LF (low frequency) antenna
3	Pressure port
4	Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



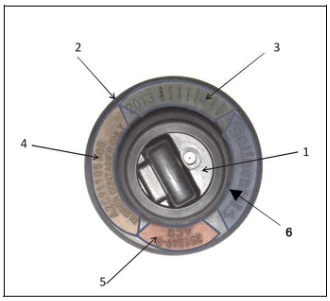
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

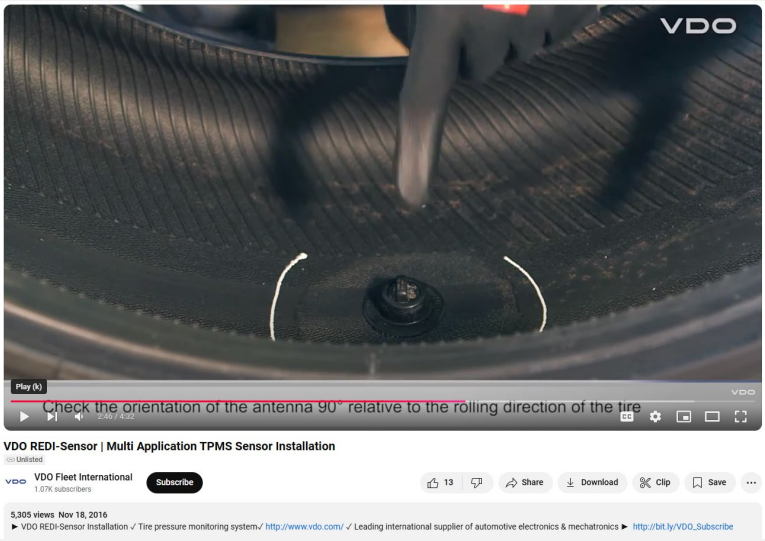
Marking of the rubber container



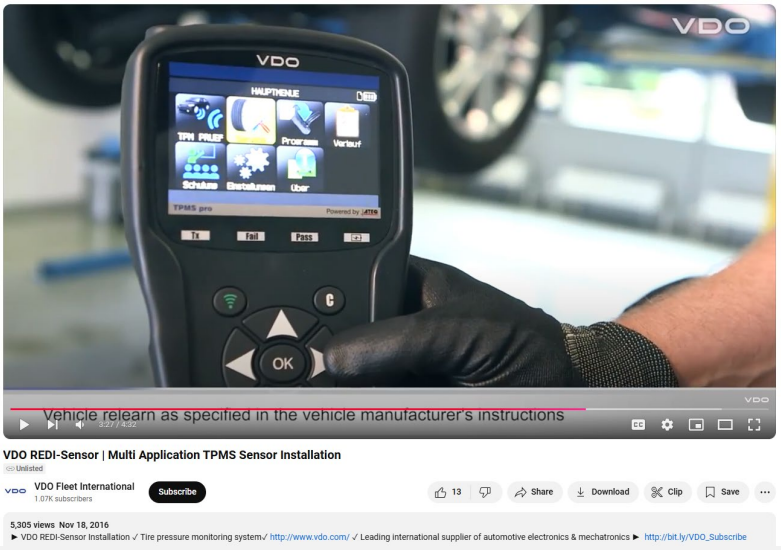
Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

https://www.vdo.de/redi-montage/ at 33.



https://www.youtube.com/watch?v=VXrC8g3auVI



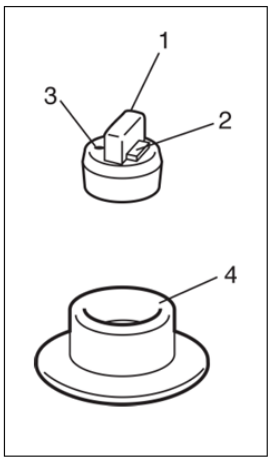
https://www.youtube.com/watch?v=VXrC8g3auVI

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
[1c] wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing,	*VDO REDI-Sensor discloses, teaches, and/or suggests wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing. For example:* *See, e.g.*, **1[pre]**, above. 2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

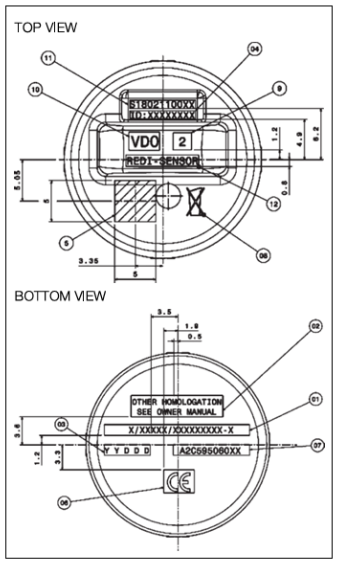
3.1 Components



1	RF (radio frequency) antenna
2	LF (low frequency) antenna
3	Pressure port
4	Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



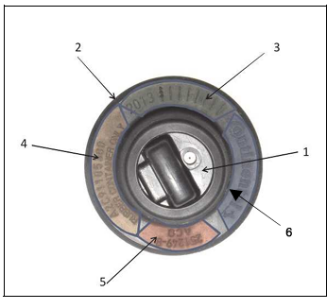
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

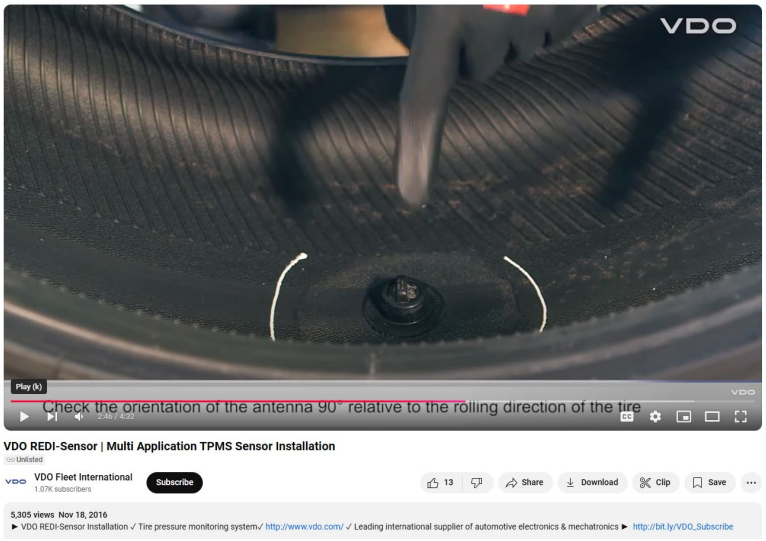
Marking of the rubber container



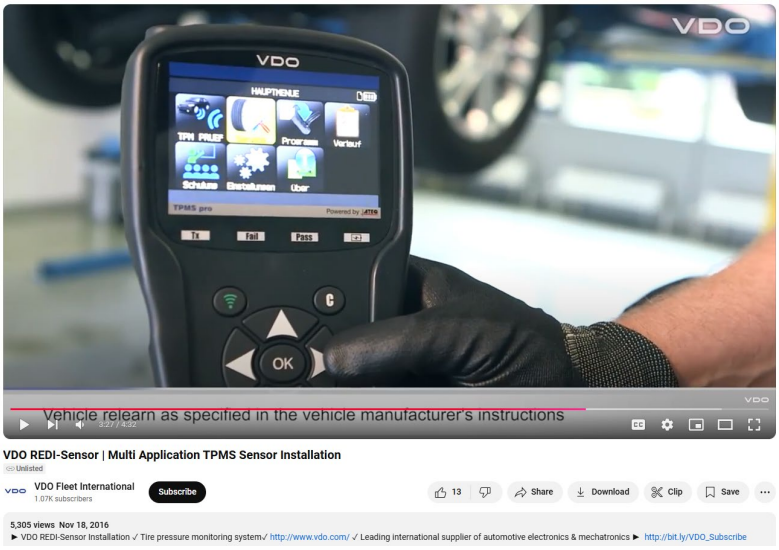
Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

https://www.vdo.de/redi-montage/ at 33.



https://www.youtube.com/watch?v=VXrC8g3auVI



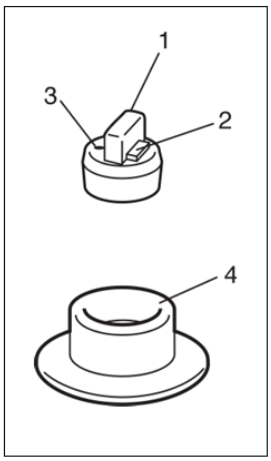
https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
[1d] wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use; and	*VDO REDI-Sensor discloses, teaches, and/or suggests wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use. For example:* *See, e.g.*, **1[pre]**, above. 2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

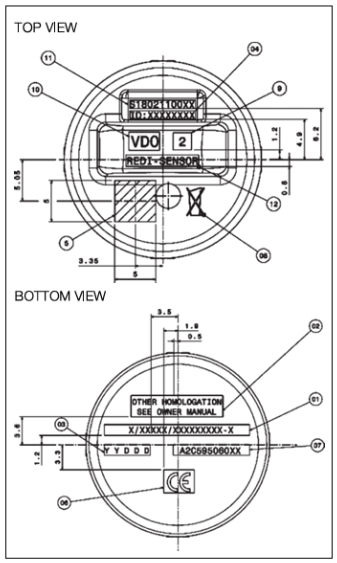
3.1 Components



1	RF (radio frequency) antenna
2	LF (low frequency) antenna
3	Pressure port
4	Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



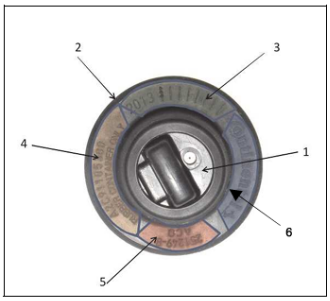
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

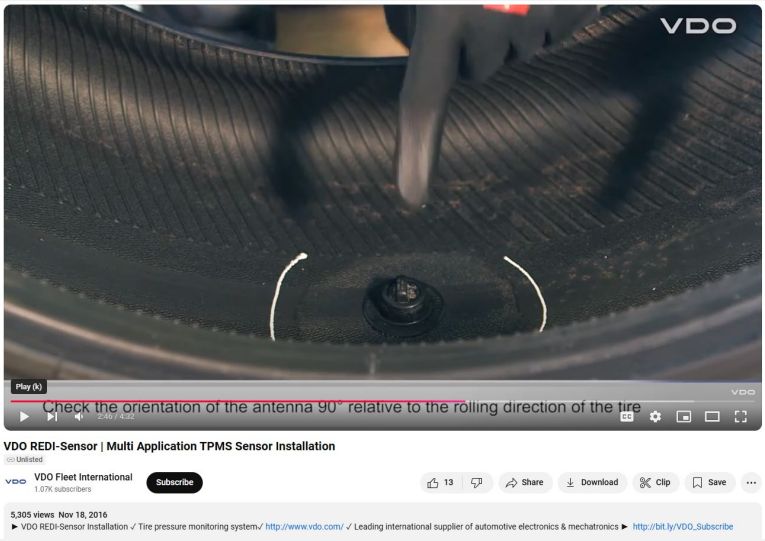
Marking of the rubber container



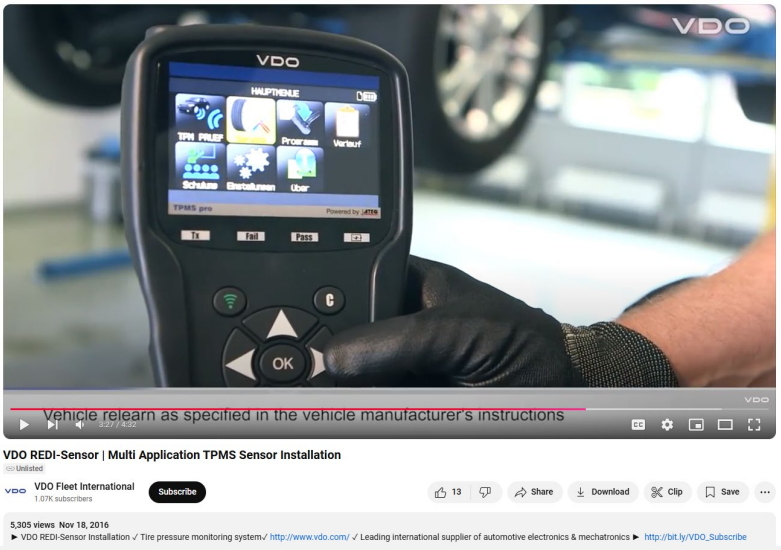
Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

https://www.vdo.de/redi-montage/ at 33.



https://www.youtube.com/watch?v=VXrC8g3auVI



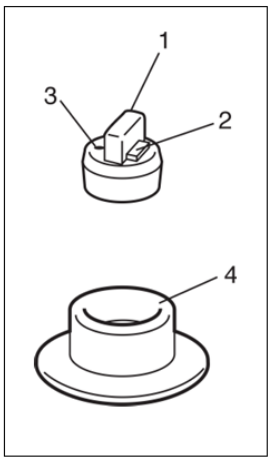
https://www.youtube.com/watch?v=VXrC8g3auVI

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
[1e] a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.	*VDO REDI-Sensor discloses, teaches, and/or suggests a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.. For example:* *See, e.g.*, **1[pre]**, above. 2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

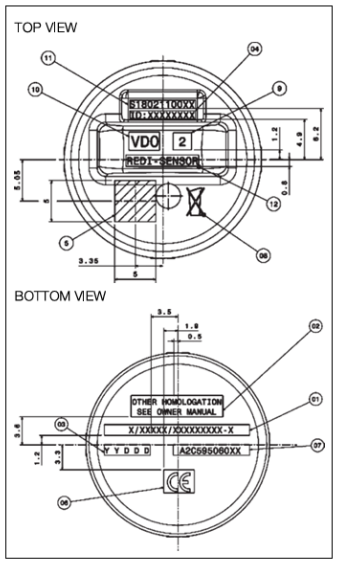
3.1 Components



1	RF (radio frequency) antenna
2	LF (low frequency) antenna
3	Pressure port
4	Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



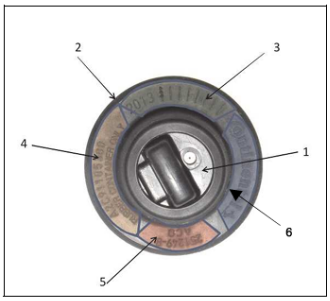
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

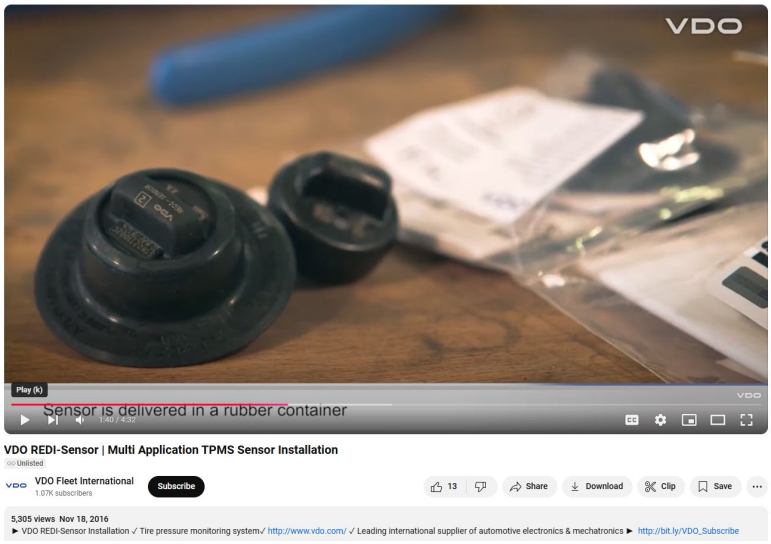
Marking of the rubber container



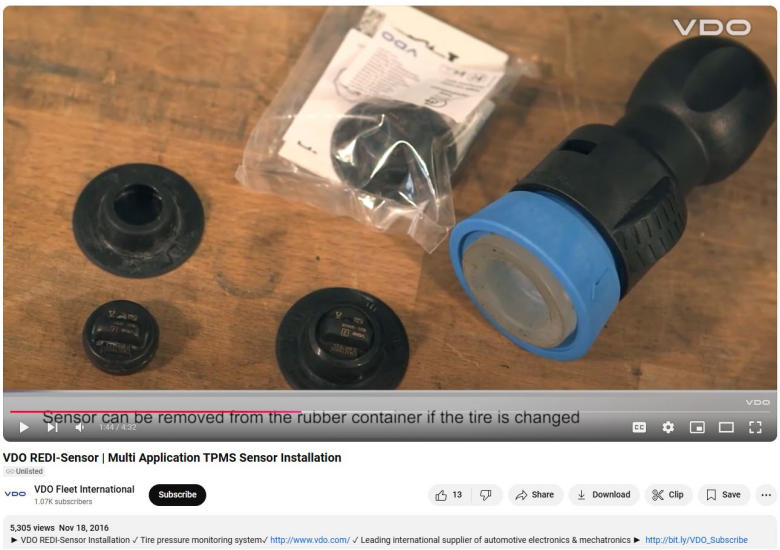
Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

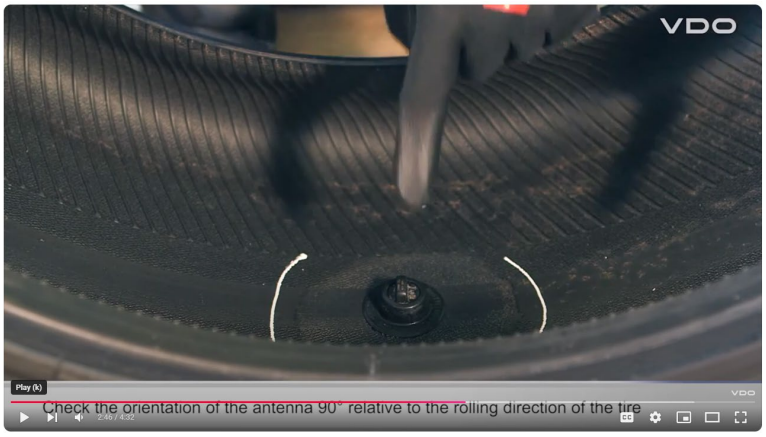
https://www.vdo.de/redi-montage/ at 33.

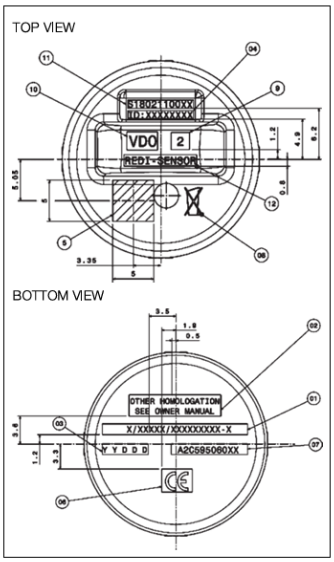


https://www.youtube.com/watch?v=VXrC8g3auVI

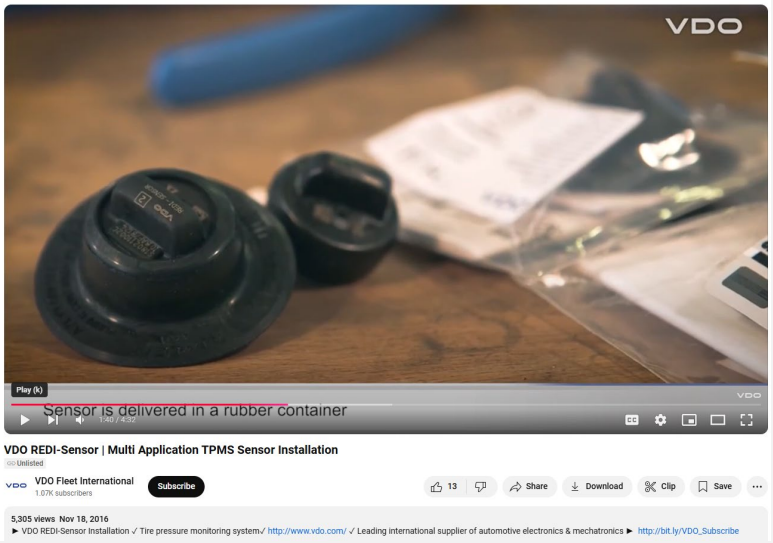


https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
2. The sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member. For example:* *See, e.g.*, **1[pre]**, above.  Fig. 2 Marking of VDO REDI-Sensor https://www.vdo.de/redi-montage/ at 33.

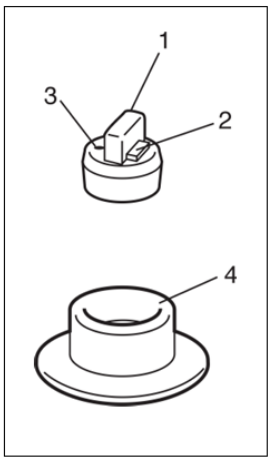
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
5. The sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein. For example:* *See, e.g.*, **1[pre]**, above. 2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

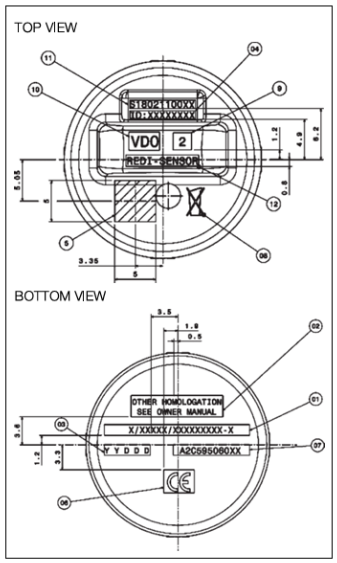
3.1 Components



1	RF (radio frequency) antenna
2	LF (low frequency) antenna
3	Pressure port
4	Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



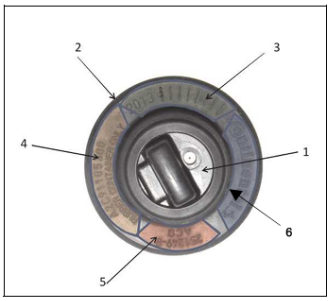
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

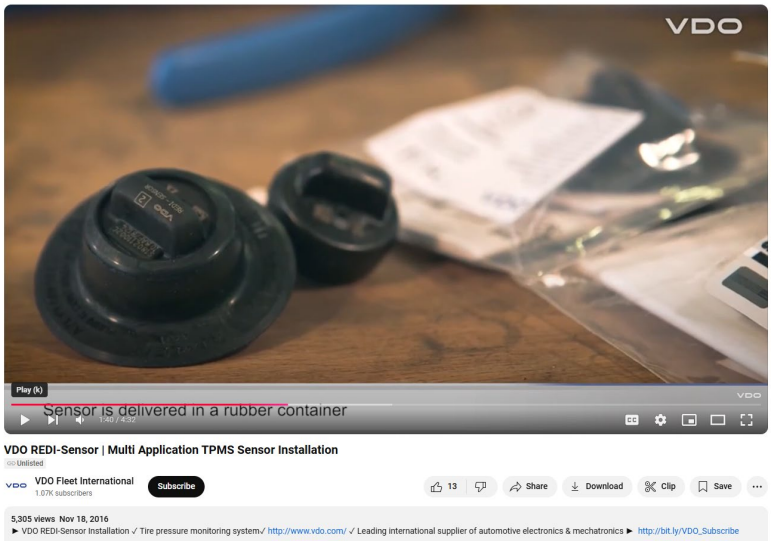
Marking of the rubber container



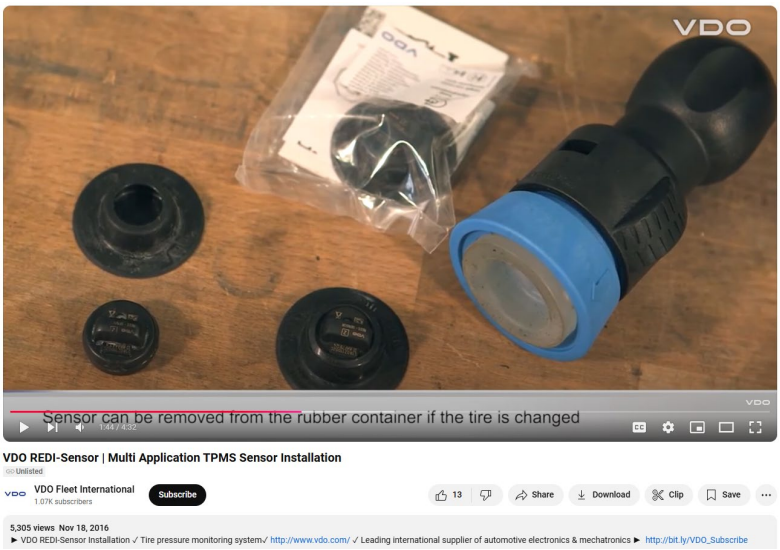
Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

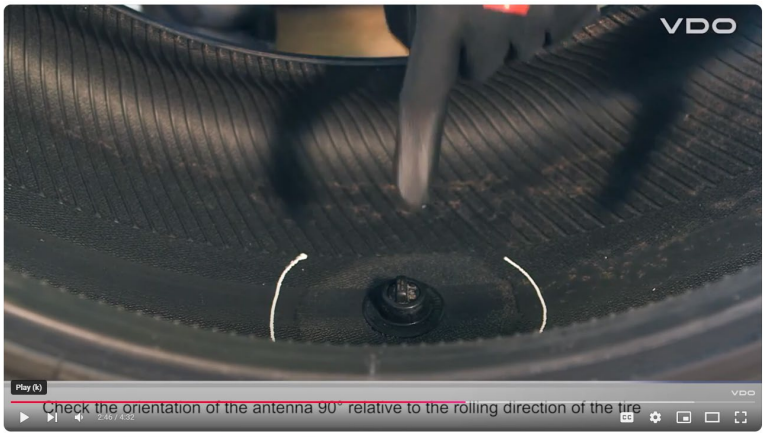
https://www.vdo.de/redi-montage/ at 33.

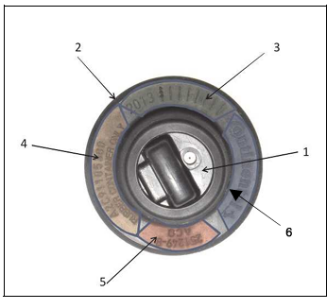


https://www.youtube.com/watch?v=VXrC8g3auVI



https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
7. The sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member. For example:* *See, e.g.*, **1[pre]**, above. **Marking of the rubber container**  Fig. 3 Marking of the rubber container | Area | Designation | |---|---| | 1 | Tyre Sensor | | 2 | Rubber container | | 3 | Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year) | | 4 | Article number of rubber container | | 5 | Production code | | 6 | Continental logo | https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

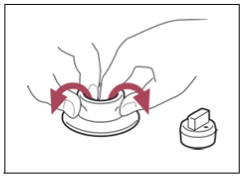
4.6 Installing the tyre sensor in the rubber container

The tyre sensor is normally supplied pre-assembled in the rubber container. In this case proceed with chapter 4.7.

In case of reusing a VDO REDI-Sensor, please make a battery check.

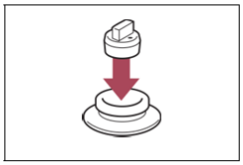
The tyre sensor may be inserted manually into the rubber container or using an optional spreader tool.

Manual installation of the tyre sensor



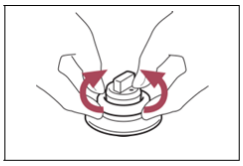
1 Fold over the sealing lip of the rubber container.

Keep the rubber container free of tyre mounting lubricants and other lubrication liquids..

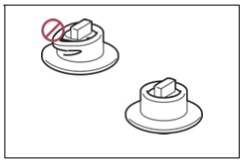


2 Place the VDO REDI-Sensor in the rubber container.

Take specifically care, that no air may be trapped below the sensor. Otherwise the sensor could be popped out.



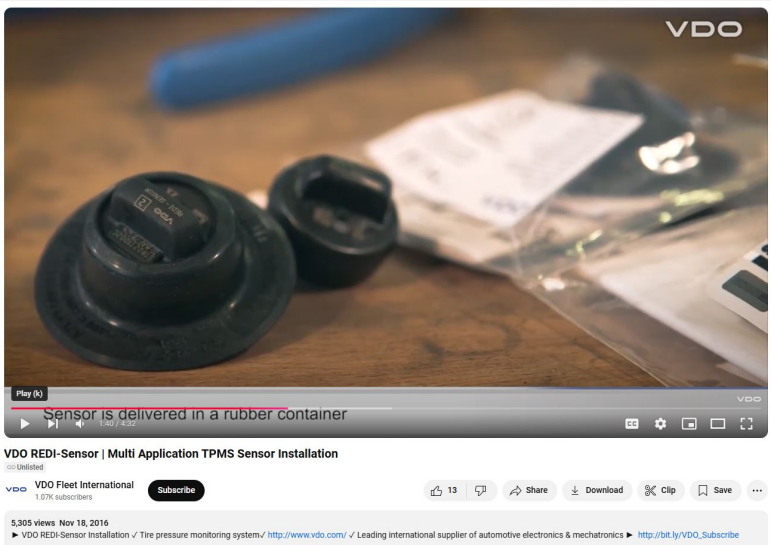
3 Fold the sealing lip of the container up again.



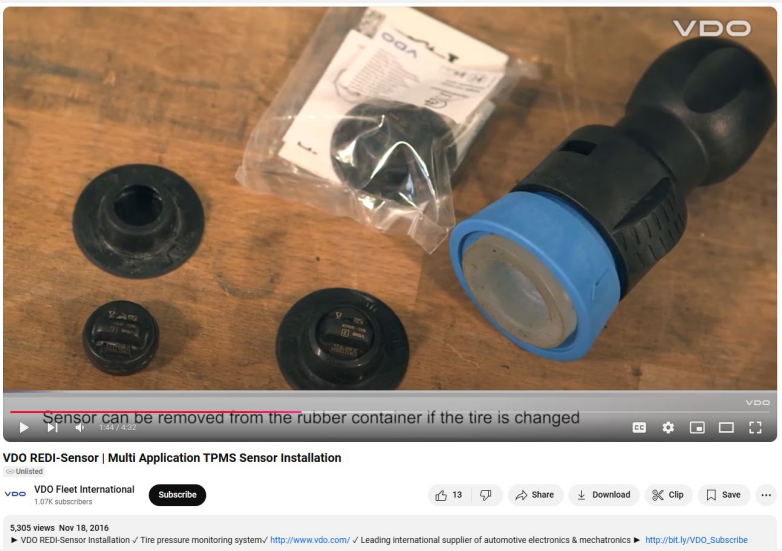
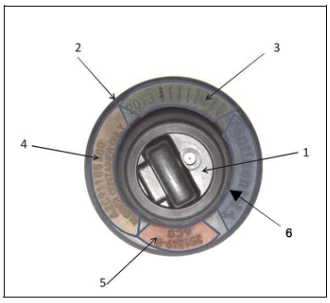
4 The sealing lip of the container must lie uniformly on the top of the sensor around the circumference.

Fig. 8 Manual installation of the tyre sensor

https://www.vdo.de/redi-montage/ at 40.



https://www.youtube.com/watch?v=VXrC8g3auVI

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
8. The sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith. For example:* *See, e.g.*, **1[pre]**, above. **Marking of the rubber container**  Fig. 3 Marking of the rubber container | Area | Designation | |---|---| | 1 | Tyre Sensor | | 2 | Rubber container | | 3 | Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year) | | 4 | Article number of rubber container | | 5 | Production code | | 6 | Continental logo | https://www.vdo.de/redi-montage/ at 33.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

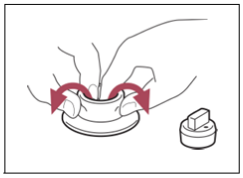
4.6 Installing the tyre sensor in the rubber container

The tyre sensor is normally supplied pre-assembled in the rubber container. In this case proceed with chapter 4.7.

In case of reusing a VDO REDI-Sensor, please make a battery check.

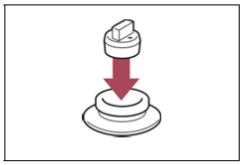
The tyre sensor may be inserted manually into the rubber container or using an optional spreader tool.

Manual installation of the tyre sensor



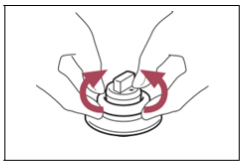
1 Fold over the sealing lip of the rubber container.

Keep the rubber container free of tyre mounting lubricants and other lubrication liquids..

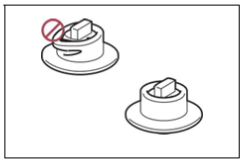


2 Place the VDO REDI-Sensor in the rubber container.

Take specifically care, that no air may be trapped below the sensor. Otherwise the sensor could be popped out.



3 Fold the sealing lip of the container up again.



4 The sealing lip of the container must lie uniformly on the top of the sensor around the circumference.

Fig. 8 Manual installation of the tyre sensor

https://www.vdo.de/redi-montage/ at 40.

4.10 Final inspection

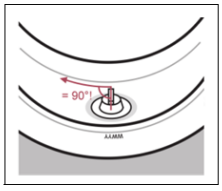


Fig. 13 Antenna orientation

1 Check that the sensor antenna is at right (90 degrees) angles to the rolling direction of the tyre.

If the antenna is not oriented properly it can be removed from the rubber container by folding down its lip and repositioning the sensor or use of the spreader tool after the glue has dried (see sections 5 and 4.6). Do not wrench the sensor within the rubber container (i.e. with pliers).

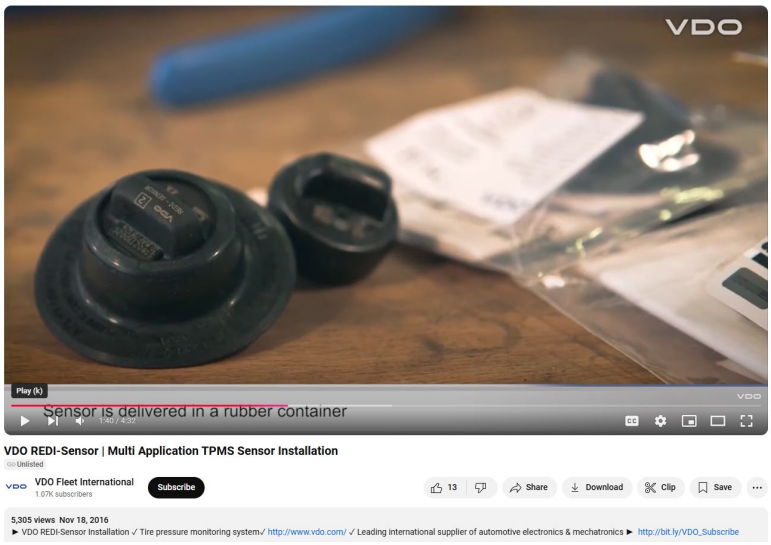
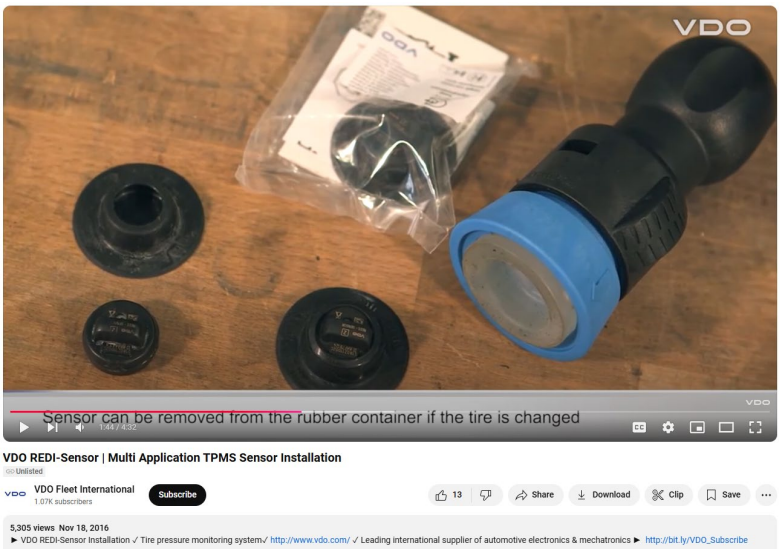
2 Inspect the bond visually. When bonded correctly, the rubber container with integral tyre sensor is in full, flush contact with the inner liner of the tyre.

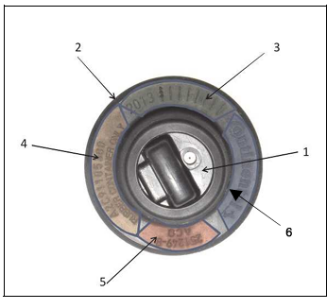
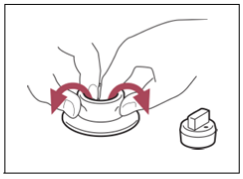
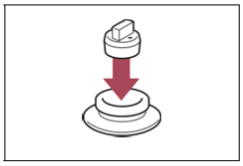
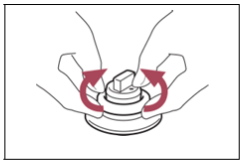
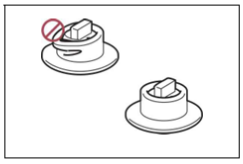
Minor amount of glue exceeding the rubber container edge can stay there and will dry quickly.

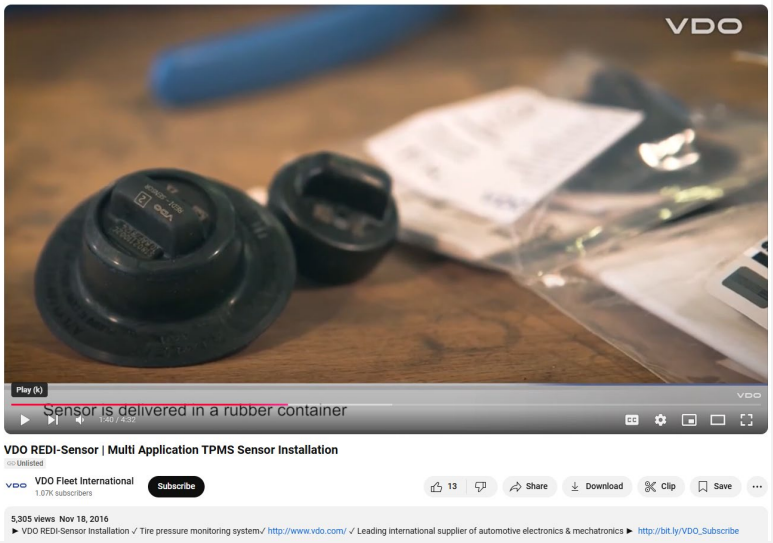
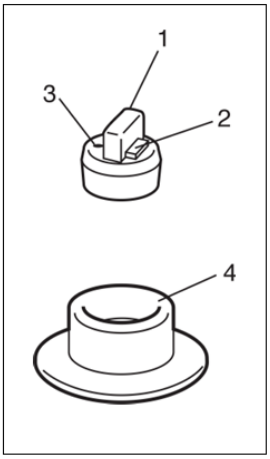
A larger amount of excessive glue can be carefully wiped away prior to the glue curing / setting by disposable paper towels, but note for future installations to adjust the amount of glue used.

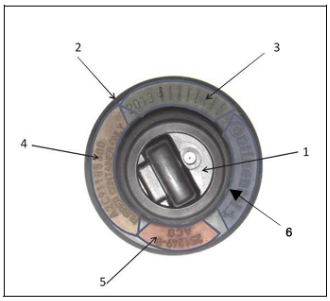
3 Check proper functioning of the sensor using a dedicated TPMS service tool / scan tool.

https://www.vdo.de/redi-montage/ at 46.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI
9. The sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member. For example:* *See, e.g.*, **1[pre]**, above.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
attached to the retaining member.	**Marking of the rubber container**  Fig. 3 Marking of the rubber container Area / Designation: 1 – Tyre Sensor 2 – Rubber container 3 – Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year) 4 – Article number of rubber container 5 – Production code 6 – Continental logo https://www.vdo.de/redi-montage/ at 33. 4.6 Installing the tyre sensor in the rubber container The tyre sensor is normally supplied pre-assembled in the rubber container. In this case proceed with chapter 4.7. In case of reusing a VDO REDI-Sensor, please make a battery check. The tyre sensor may be inserted manually into the rubber container or using an optional spreader tool. **Manual installation of the tyre sensor**  1 Fold over the sealing lip of the rubber container. Keep the rubber container free of tyre mounting lubricants and other lubrication liquids..  2 Place the VDO REDI-Sensor in the rubber container. Take specifically care, that no air may be trapped below the sensor. Otherwise the sensor could be popped out.  3 Fold the sealing lip of the container up again.  4 The sealing lip of the container must lie uniformly on the top of the sensor around the circumference. Fig. 8 Manual installation of the tyre sensor https://www.vdo.de/redi-montage/ at 40.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
10. The sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device. For example:* *See, e.g.*, **1[pre]**, above. 3 Design 3.1 Components  1 RF (radio frequency) antenna 2 LF (low frequency) antenna 3 Pressure port 4 Rubber container Fig. 1 Components https://www.vdo.de/redi-montage/ at 32.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	Marking of the rubber container  Fig. 3 Marking of the rubber container | Area | Designation | |---|---| | 1 | Tyre Sensor | | 2 | Rubber container | | 3 | Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year) | | 4 | Article number of rubber container | | 5 | Production code | | 6 | Continental logo | https://www.vdo.de/redi-montage/ at 33.  https://www.youtube.com/watch?v=VXrC8g3auVI
11. A sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication.	*VDO REDI-Sensor discloses, teaches, and/or suggests a sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication. For example:* *See, e.g.*, **1[pre]**, above. 4.12 Vehicle relearn procedure The VDO REDI-Sensor is designed to follow the OE vehicle relearn procedures. It is recommended to use a dedicated TPMS service tool / scan tool to complete the vehicle relearn procedure. Some vehicles require up to a 20 minute stationary wait period following replacement sensor installation before the replacement sensor can be learned to the vehicle. In case of the VDO REDI-Sensor, the tool shall be placed close to the production date stamp on the tyre side wall. If the sensor type is unknown (in case of an installed valve-type sensor), the tool has to be placed close to the valve instead. https://www.vdo.de/redi-montage/ at 47.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI
12. The sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.*, **1[pre]**, above.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

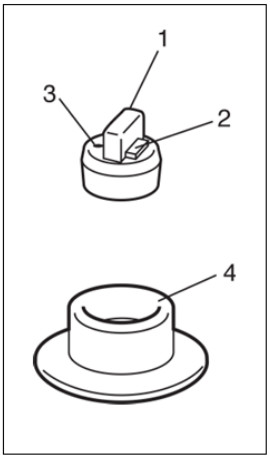
2.2 Intended use of the VDO REDI-Sensors

The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued.

https://www.vdo.de/redi-montage/ at 30.

3 Design

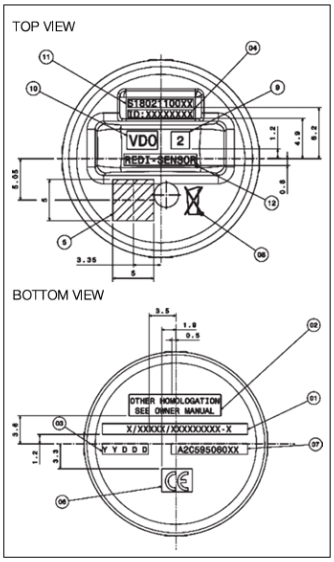
3.1 Components



1 RF (radio frequency) antenna
2 LF (low frequency) antenna
3 Pressure port
4 Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



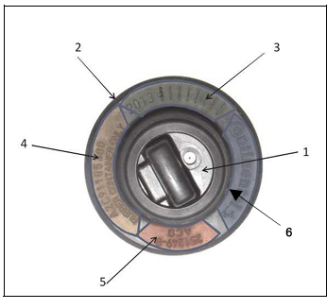
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

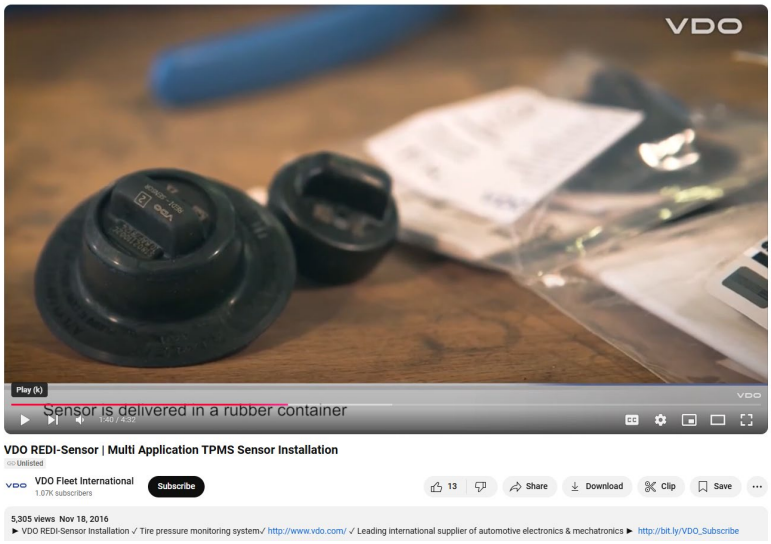
Marking of the rubber container



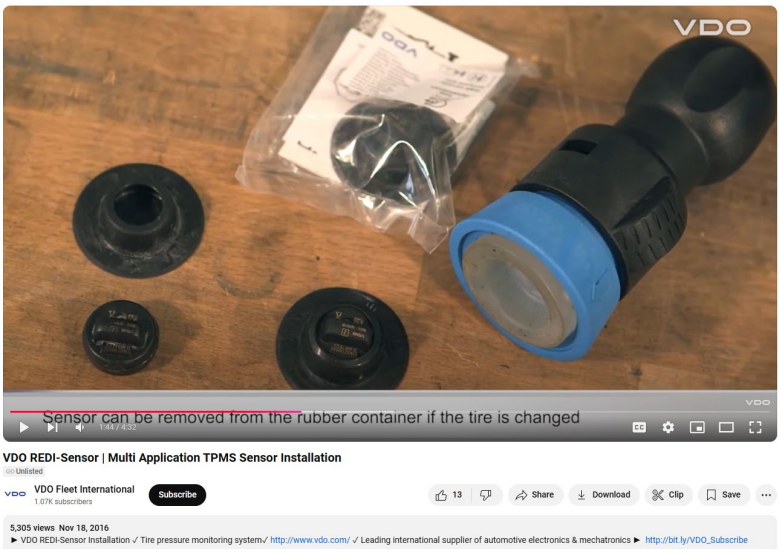
Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

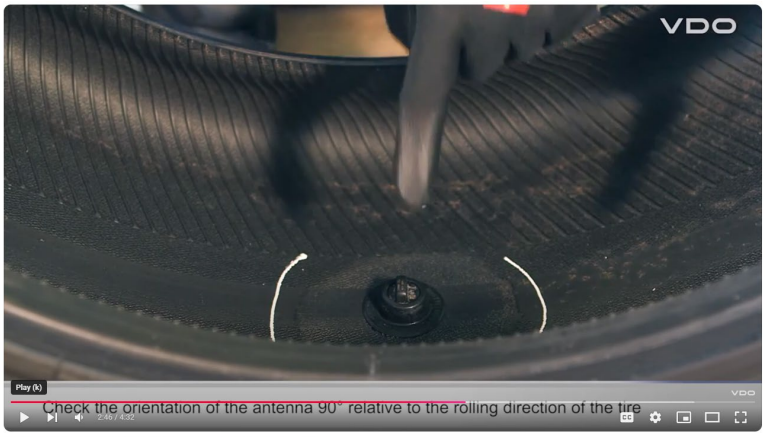
https://www.vdo.de/redi-montage/ at 33.



https://www.youtube.com/watch?v=VXrC8g3auVI



https://www.youtube.com/watch?v=VXrC8g3auVI

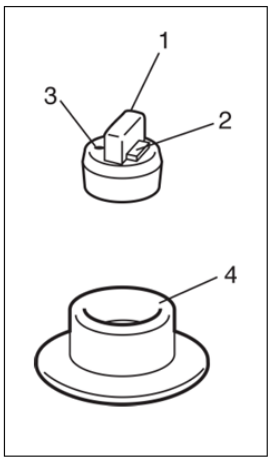
’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
20. The sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device. For example:* *See, e.g.*, **1[pre]**, above. 2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

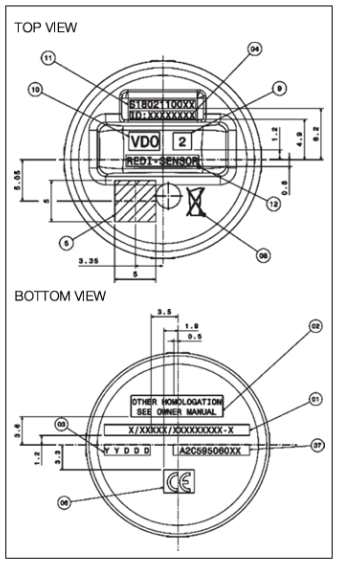
3.1 Components



1	RF (radio frequency) antenna
2	LF (low frequency) antenna
3	Pressure port
4	Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



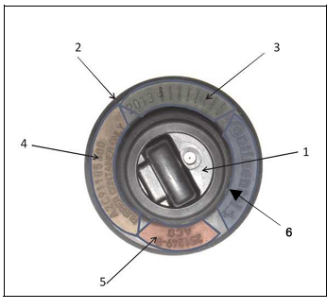
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

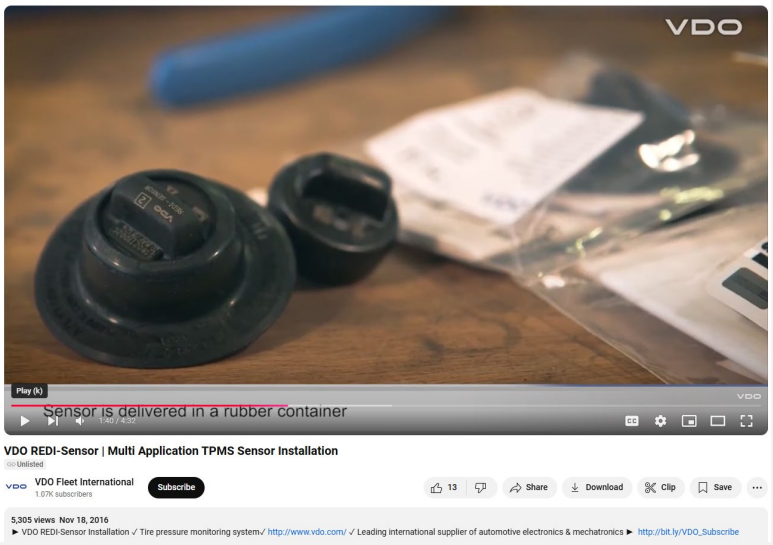
Marking of the rubber container



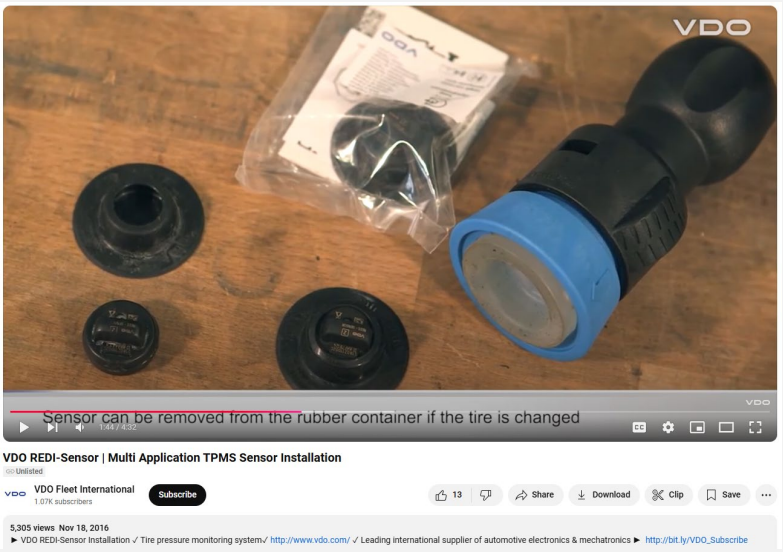
Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

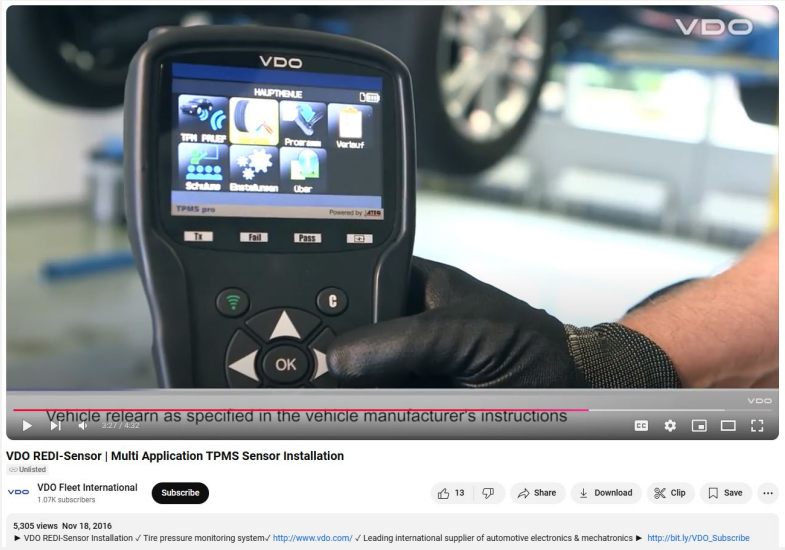
https://www.vdo.de/redi-montage/ at 33.



https://www.youtube.com/watch?v=VXrC8g3auVI



https://www.youtube.com/watch?v=VXrC8g3auVI

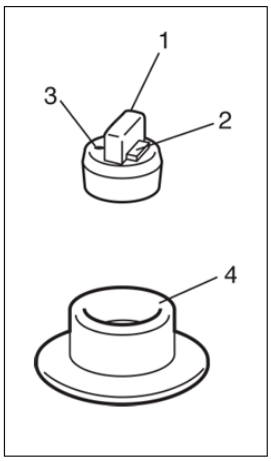
’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
21. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor. For example:* *See, e.g.*, **1[pre]**, above. 2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

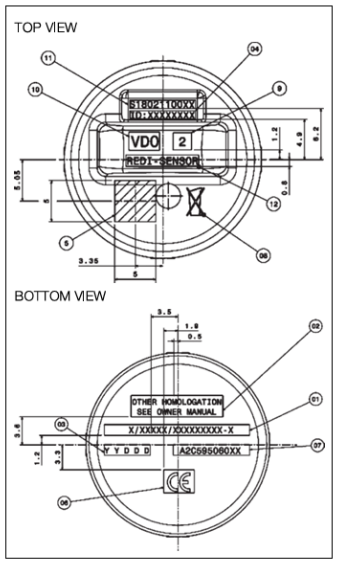
3.1 Components



1	RF (radio frequency) antenna
2	LF (low frequency) antenna
3	Pressure port
4	Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



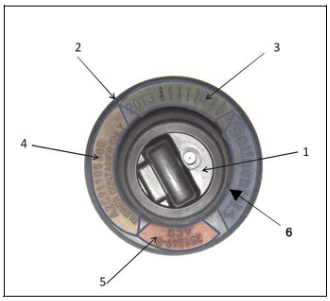
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

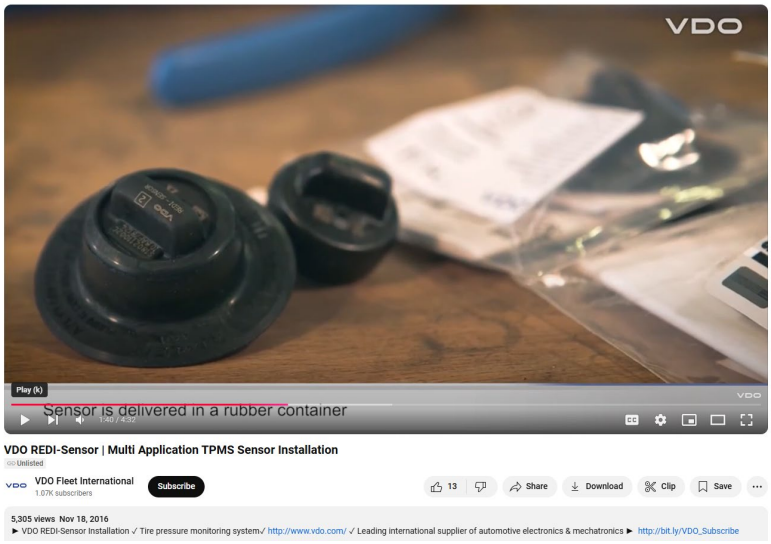
Marking of the rubber container



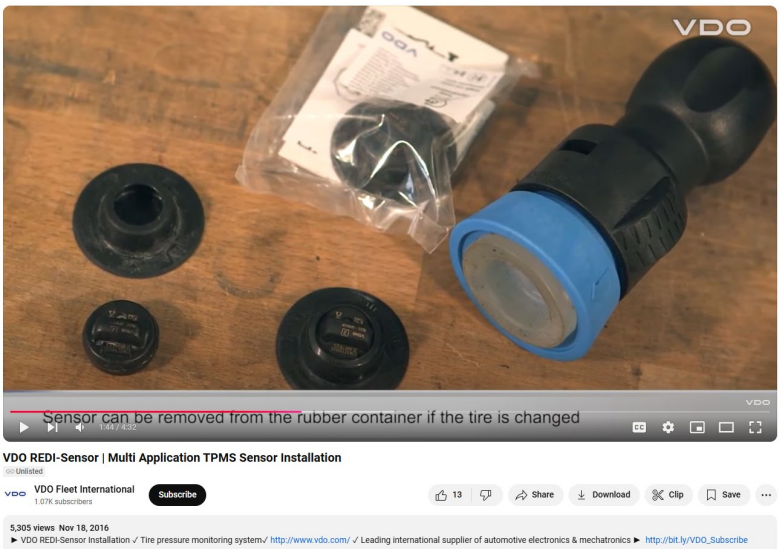
Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

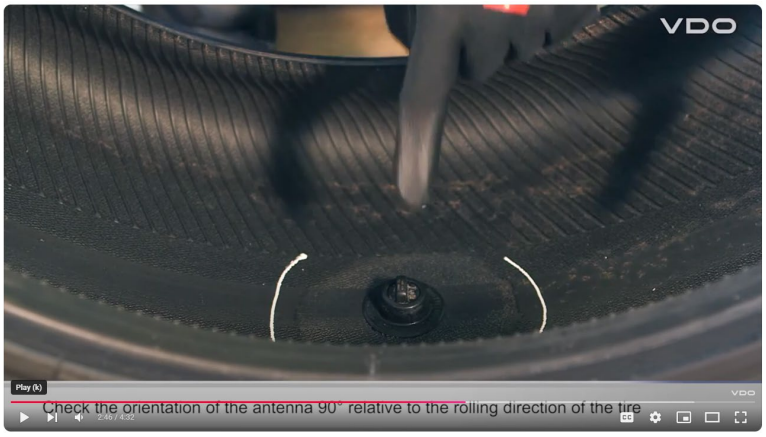
https://www.vdo.de/redi-montage/ at 33.



https://www.youtube.com/watch?v=VXrC8g3auVI



https://www.youtube.com/watch?v=VXrC8g3auVI

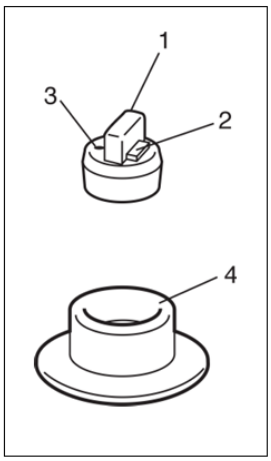
’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 VDO REDI-Sensor | Multi Application TPMS Sensor Installation Unlisted VDO Fleet International 1.07K subscribers Subscribe 13 Share Download Clip Save 5,305 views Nov 18, 2016 ► VDO REDI-Sensor Installation ✓ Tire pressure monitoring system✓ http://www.vdo.com/ ✓ Leading international supplier of automotive electronics & mechatronics ► http://bit.ly/VDO_Subscribe https://www.youtube.com/watch?v=VXrC8g3auVI
22. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device. For example:* *See, e.g.*, **1[pre]**, above. 2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

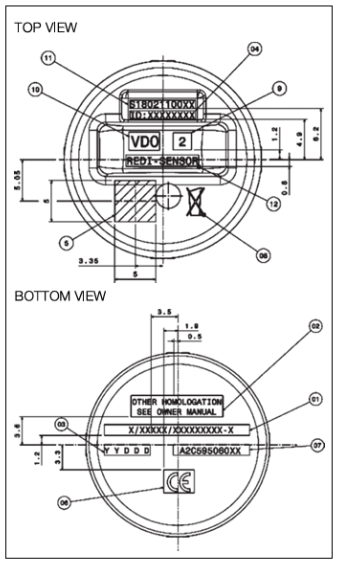
3.1 Components



1	RF (radio frequency) antenna
2	LF (low frequency) antenna
3	Pressure port
4	Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



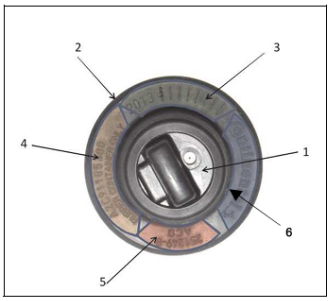
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

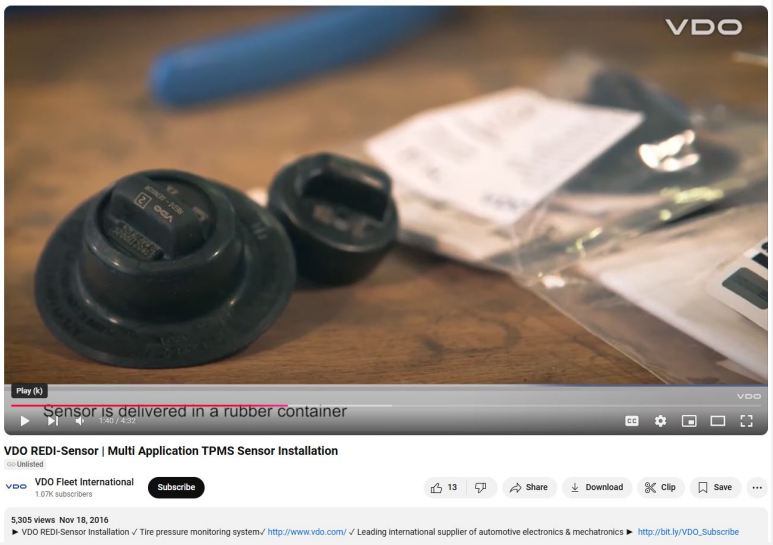
Marking of the rubber container



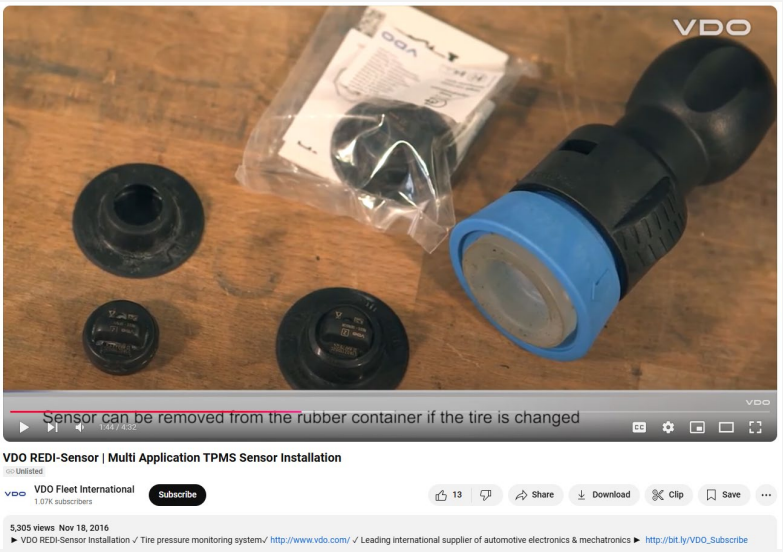
Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

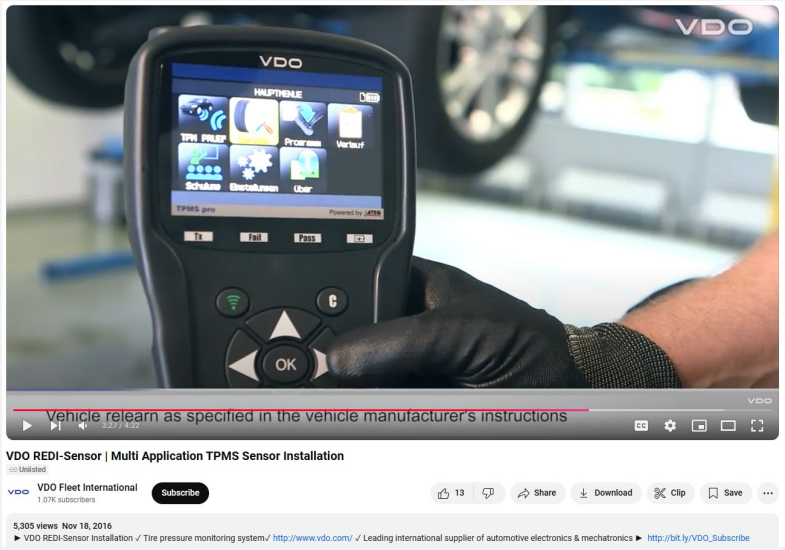
https://www.vdo.de/redi-montage/ at 33.



https://www.youtube.com/watch?v=VXrC8g3auVI



https://www.youtube.com/watch?v=VXrC8g3auVI

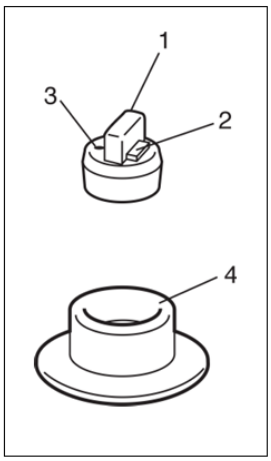
’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
23. The sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object. For example:* *See, e.g.*, **1[pre]**, above. 2.2 Intended use of the VDO REDI-Sensors The sensors are exclusively intended to measure air pressure and temperature in suitable tyres and to transfer the data to a corresponding original equipment (OE) vehicle tyre pressure monitoring system for which the specific VDO REDI-Sensor is catalogued. https://www.vdo.de/redi-montage/ at 30.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

3 Design

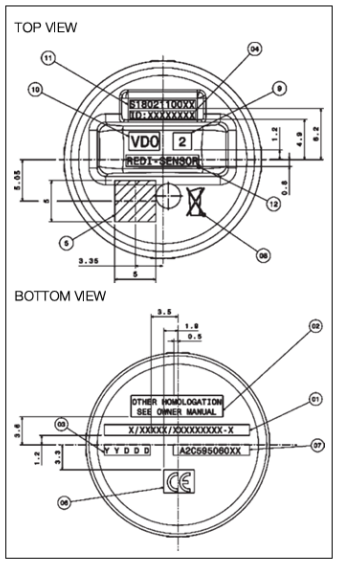
3.1 Components



1	RF (radio frequency) antenna
2	LF (low frequency) antenna
3	Pressure port
4	Rubber container

Fig. 1 Components

https://www.vdo.de/redi-montage/ at 32.



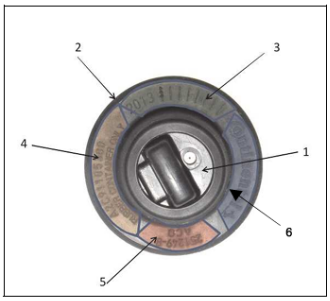
Area	Designation
01	Visual code
02	Homologation information
03	Date code
04	ID number
05	Data matrix code
06	CE logo
07	Customer reference (last two digits signify specific sensor variant number)
08	Recycling
09	Variant number
10	Product name 1
11	Continental reference (last two digits signify specific sensor variant number - rubber container included)
12	Product name 2

Fig. 2 Marking of VDO REDI-Sensor

https://www.vdo.de/redi-montage/ at 33.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

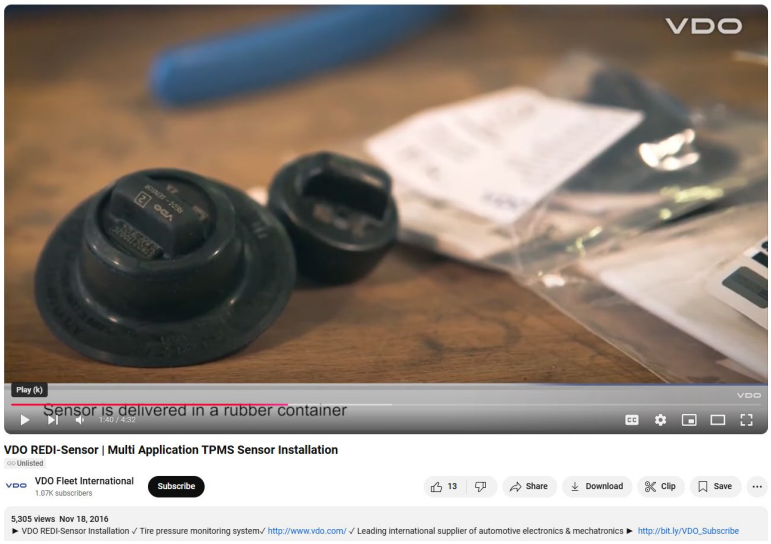
Marking of the rubber container



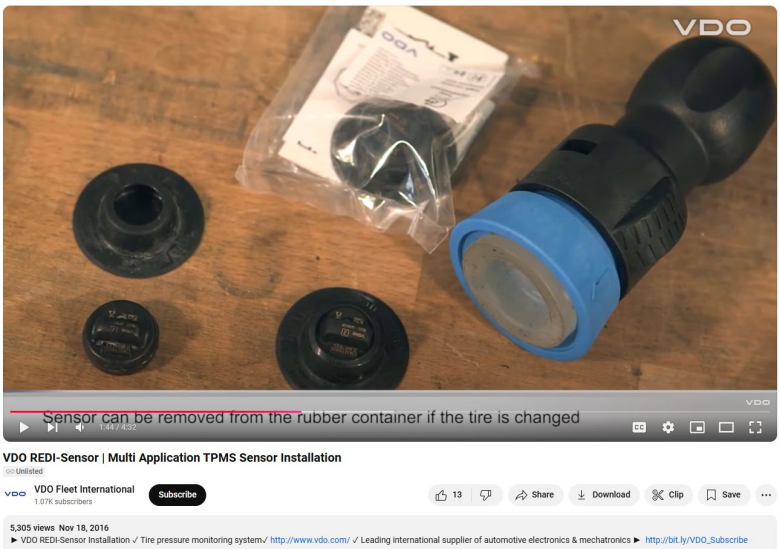
Area	Designation
1	Tyre Sensor
2	Rubber container
3	Quarter and year of production (each line is one year – starting with 2013 – and each dot is one quarter of a year)
4	Article number of rubber container
5	Production code
6	Continental logo

Fig. 3 Marking of the rubber container

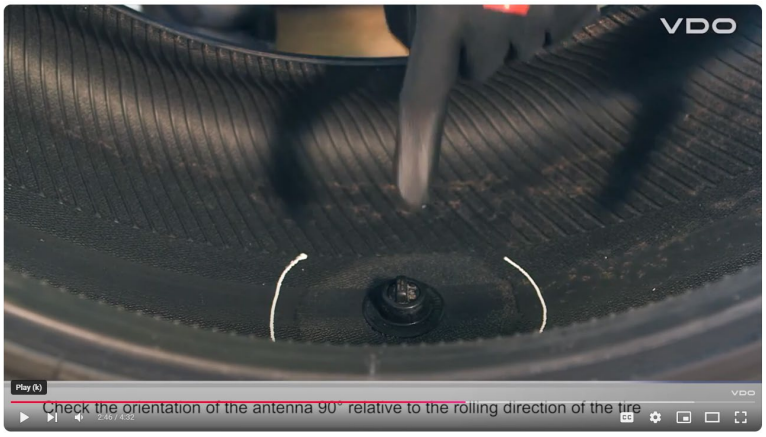
https://www.vdo.de/redi-montage/ at 33.

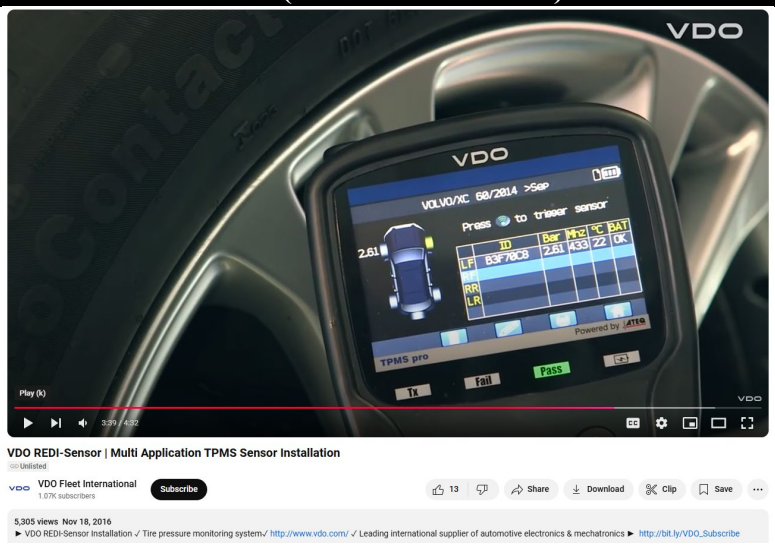
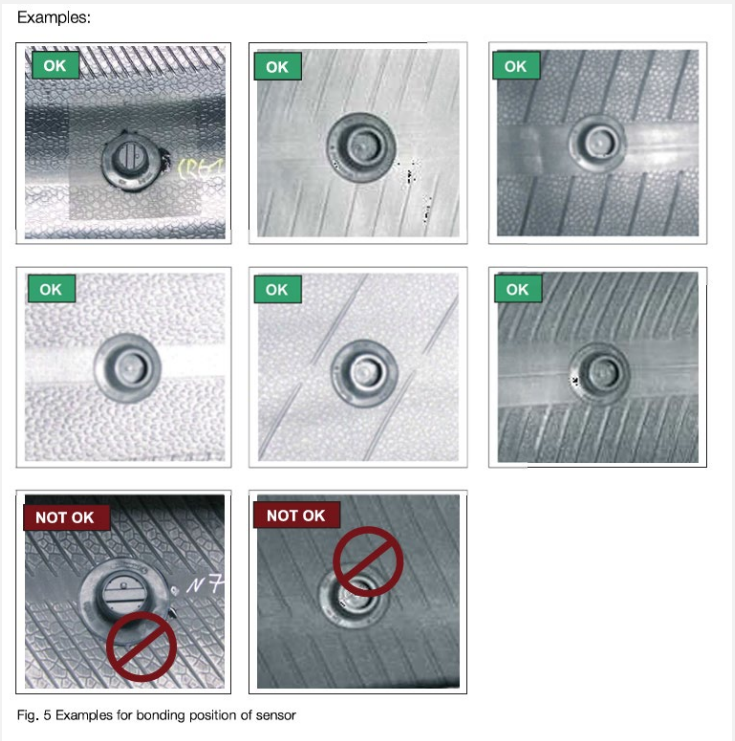


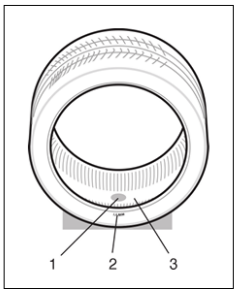
https://www.youtube.com/watch?v=VXrC8g3auVI



https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI
24. The sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire. For example:* *See, e.g.*, **1[pre]**, above.  Fig. 5 Examples for bonding position of sensor https://www.vdo.de/redi-montage/ at 37.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	4.4 Bonding position in the tyre Look for a smooth area in the tyre without ridges or ribbing that will readily accept glue.  1 bonding position in the tyre 2 production date stamp on tyre sidewall 3 tyre inner liner Fig. 6 Bonding position in the tyre The correct position of the bonding surface is: • In the middle of the tyre inner liner (see also Fig. 5 Examples for bonding position of sensor). • To be mounted at the tyre production date stamp (week code), for ease in locating the sensor during future tyre service and for best communication between the sensor and the TPMS service tool. https://www.vdo.de/redi-montage/ at 38.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)

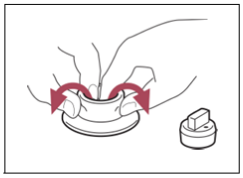
4.6 Installing the tyre sensor in the rubber container

The tyre sensor is normally supplied pre-assembled in the rubber container. In this case proceed with chapter 4.7.

In case of reusing a VDO REDI-Sensor, please make a battery check.

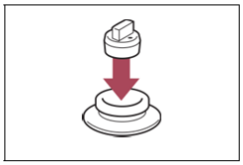
The tyre sensor may be inserted manually into the rubber container or using an optional spreader tool.

Manual installation of the tyre sensor



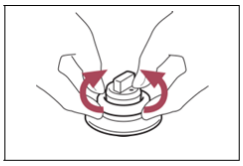
1 Fold over the sealing lip of the rubber container.

Keep the rubber container free of tyre mounting lubricants and other lubrication liquids..

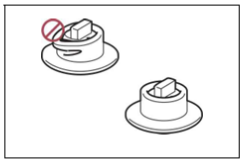


2 Place the VDO REDI-Sensor in the rubber container.

Take specifically care, that no air may be trapped below the sensor. Otherwise the sensor could be popped out.



3 Fold the sealing lip of the container up again.



4 The sealing lip of the container must lie uniformly on the top of the sensor around the circumference.

Fig. 8 Manual installation of the tyre sensor

https://www.vdo.de/redi-montage/ at 40.

4.10 Final inspection

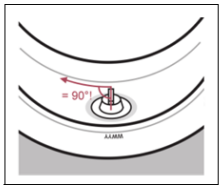


Fig. 13 Antenna orientation

1 Check that the sensor antenna is at right (90 degrees) angles to the rolling direction of the tyre.

If the antenna is not oriented properly it can be removed from the rubber container by folding down its lip and repositioning the sensor or use of the spreader tool after the glue has dried (see sections 5 and 4.6). Do not wrench the sensor within the rubber container (i.e. with pliers).

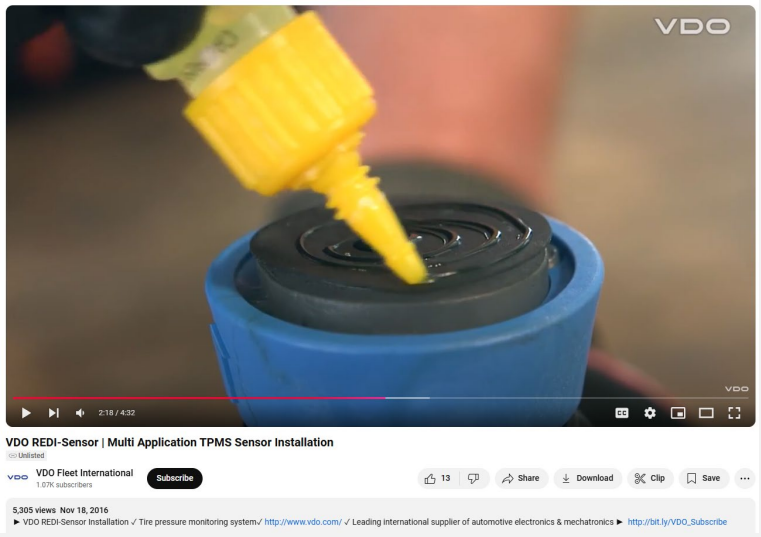
2 Inspect the bond visually. When bonded correctly, the rubber container with integral tyre sensor is in full, flush contact with the inner liner of the tyre.

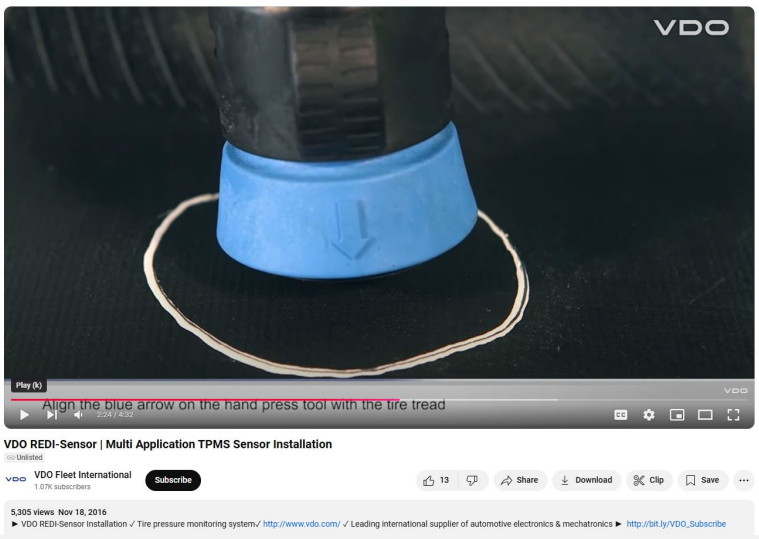
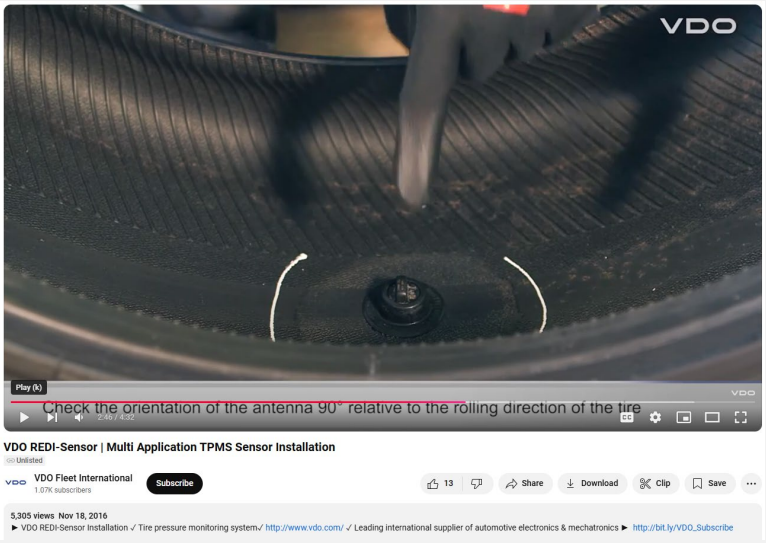
Minor amount of glue exceeding the rubber container edge can stay there and will dry quickly.

A larger amount of excessive glue can be carefully wiped away prior to the glue curing / setting by disposable paper towels, but note for future installations to adjust the amount of glue used.

3 Check proper functioning of the sensor using a dedicated TPMS service tool / scan tool.

https://www.vdo.de/redi-montage/ at 46.

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI

’421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
	 https://www.youtube.com/watch?v=VXrC8g3auVI  https://www.youtube.com/watch?v=VXrC8g3auVI
28[pre]. A sensor assembly and sensing system for use with an object that rotates in use comprising:	*To the extent that the preamble is limiting, VDO REDI-Sensor discloses, teaches, and/or suggests a* sensor assembly and sensing system for use with an object that rotates in use comprising. *For example:* *See, e.g.*, **1[pre]**, **11**, above. *See also following limitations.*
[28a] a housing comprising an outer structure that defines an	*VDO REDI-Sensor discloses, teaches, and/or suggests a housing comprising an outer structure that defines an open internal cavity therein. For example:*

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
open internal cavity therein,	*See, e.g.*, **[1a]-[1c]**, **10**, above.
[28b] an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device,	*VDO REDI-Sensor discloses, teaches, and/or suggests an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device. For example:* *See, e.g.*, **[1a]-[1c]**, **5**, **10**, above.
[28c] wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location.	*VDO REDI-Sensor discloses, teaches, and/or suggests wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location. For example:* *See, e.g.*, **[1d]**, above.
[28d] wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor;	*VDO REDI-Sensor discloses, teaches, and/or suggests wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor. For example:* *See, e.g.*, **[1a]-[1c]**, **20**, above.
[28e] a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member; and	*VDO REDI-Sensor discloses, teaches, and/or suggests a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member. For example:* *See, e.g.*, **[1e]**, **7**, **8**, above.

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
[28f] a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly.	*VDO REDI-Sensor discloses, teaches, and/or suggests a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly. For example:* *See, e.g.*, **1**, **11**, above.
31. The sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity. For example:* *See, e.g.*, **[1c]**, above.
32. The sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member. For example:* *See, e.g.*, **[1e]**, **9**, above.
33. The sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.*, **[1b]**, **11** above.
34. The sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine	*VDO REDI-Sensor discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data. For example:*

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data.	*See, e.g.,* **1[pre]**, **[1b]**, **[1d]**, **[1e]**, **11**, **12**, **20**, above.
41[pre] A method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of:	*To the extent that the preamble is limiting, VDO REDI-Sensor discloses, teaches, and/or suggests a method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of: vulcanized rubber tire comprising. For example:* *See, e.g.,* **1**, **11**, **12**, **20**, above. *See also following limitations.*
[41a] installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity, and	*VDO REDI-Sensor discloses, teaches, and/or suggests installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41b] wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry,	*VDO REDI-Sensor discloses, teaches, and/or suggests wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41c] wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity;	*VDO REDI-Sensor discloses, teaches, and/or suggests wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41d] attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment	*VDO REDI-Sensor discloses, teaches, and/or suggests attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object. For example:*

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object; and	*See, e.g.,* **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41e] monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly.	*VDO REDI-Sensor discloses, teaches, and/or suggests monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
43. The method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity.	*VDO REDI-Sensor discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
44. The method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed.	*VDO REDI-Sensor discloses, teaches, and/or suggests the method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above
48. The method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining	*VDO REDI-Sensor discloses, teaches, and/or suggests the method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire. For example:*

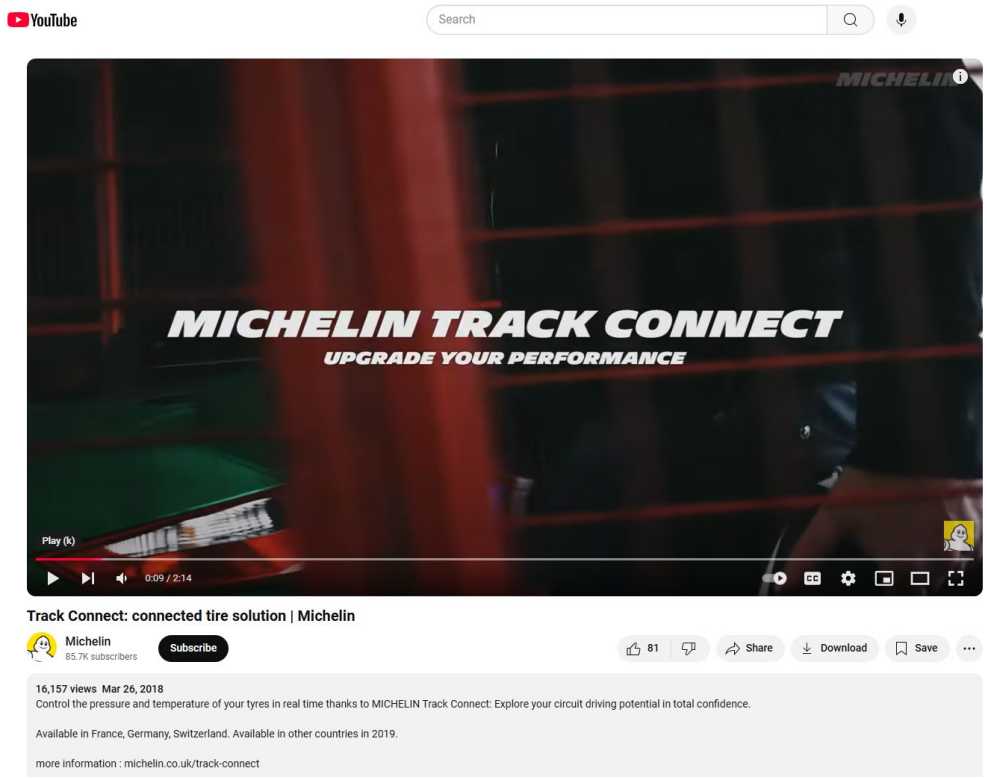
'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
member is attached to a surface that is inside of the vehicle tire.	*See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
50. The method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing.	*VDO REDI-Sensor discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
51. The method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device.	*VDO REDI-Sensor discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
52. The method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor.	*VDO REDI-Sensor discloses, teaches, and/or suggests the method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
53. The method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread	*VDO REDI-Sensor discloses, teaches, and/or suggests the method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly. For example:*

'421 Claim Element	Disclosures from Prior Art (VDO REDI-Sensor)
depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly.	*See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

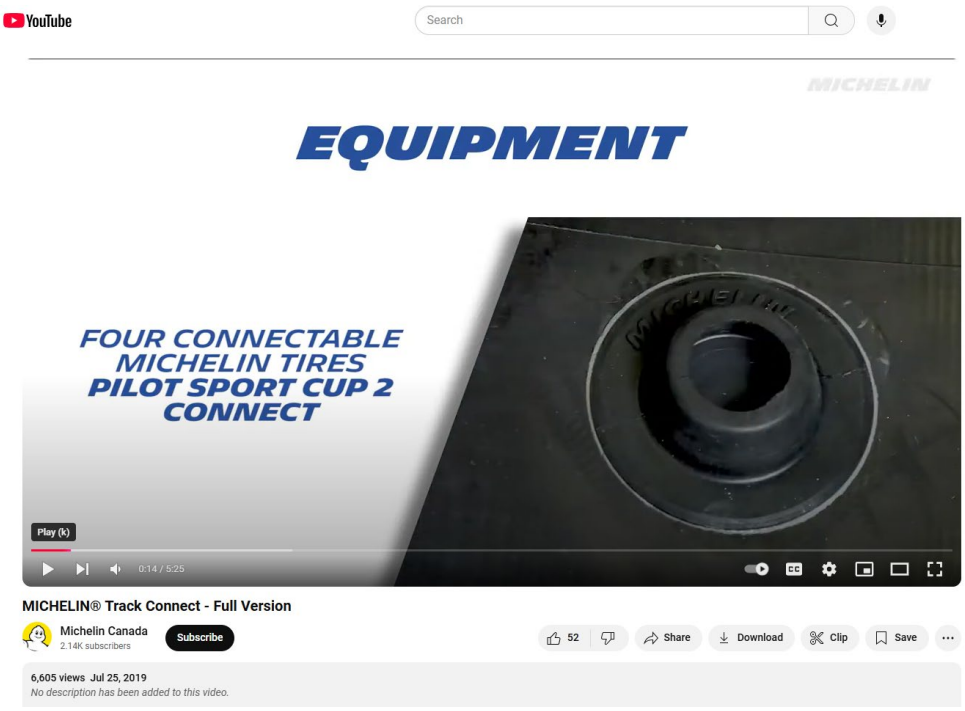
Invalidity Claim Chart Against U.S. Patent No. 11,835,421 ("'421 Patent")
Based on Michelin-Track Connect

The "Michelin-Track Connect" was publicly available and on sale prior to the earliest effective filing date of the '421 patent. Michelin-Track Connect qualifies as prior art under at least 35 U.S.C. § 102(a), as reflected in at least the following:

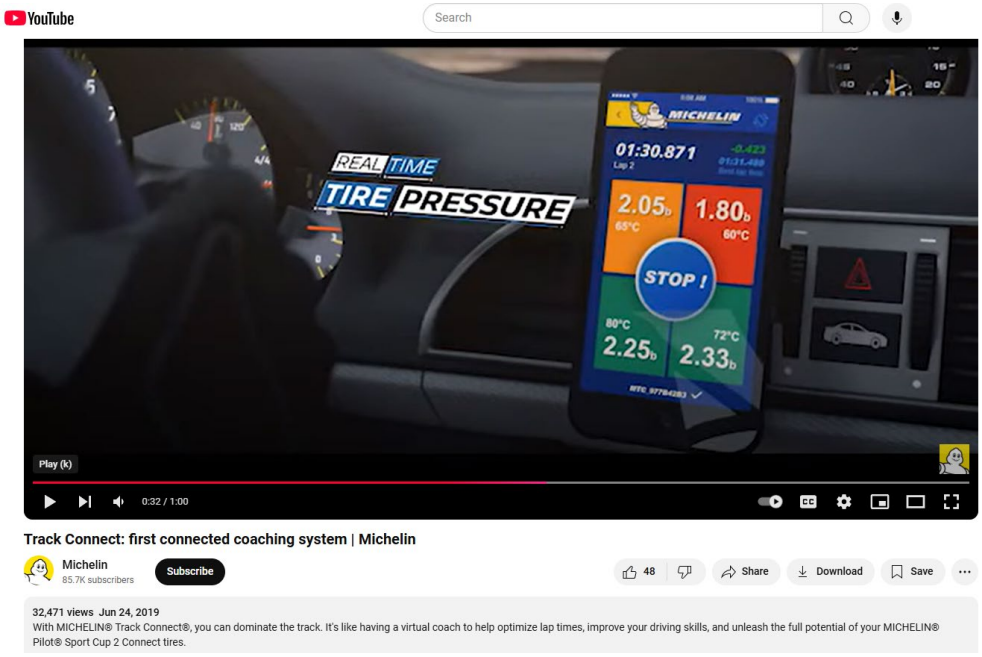
- https://www.youtube.com/watch?v=Cili2VJ7OXs (dated March 16, 2018)



- https://www.youtube.com/watch?v=arw108KcBCY (dated July 25, 2019)



- https://www.youtube.com/watch?v=ZrkpQX3mGl8 (dated June 24, 2019)



- https://www.youtube.com/watch?v=JHxZs0hHkjI (dated July 25, 2019)
- https://www.tirebusiness.com/news/michelin-courting-performance-customers-track-connect-tool
- https://fcc.report/FCC-ID/FI5-EX2-01/4287115.pdf

MICHELIN Track Connect User Manual

Version 04022019

Michelin, 23 Place des Carmes Dechaux, 63040 Clermont-Ferrand, France

With the phone in portrait mode…

The pressure and temperature information appears on the 4 dials representing your 4 tires. The color of the dials refers to the red / orange / green pressure ranges available before starting to drive.

In other words, if the dials are green it means that your tires are within the ideal pressure range for your car for the stated conditions and use.

While driving, your tires will warm up and the pressure will increase, so it is quite possible that you will see the colors change as the session continues.

If you have any doubts about how the tire pressures are changing, particularly if they go down, always ask a professional. A single inspection is often enough to prevent a puncture or any other problem that might cause a loss of pressure.



- https://dgaddcosprod.blob.core.windows.net/corporate-production/attachments/clktclei106at2fhhhpap25yr-pk-gims-19-salon-geneve-gb.pdf

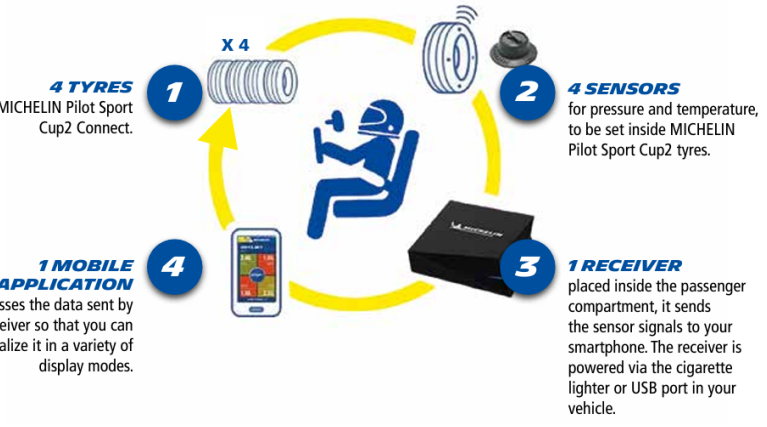


3 MICHELIN TRACK CONNECT

The first connected tyre on the market to enhance your circuit driving experience

In 2018, Michelin became the first manufacturer to market a connected tyre for amateur drivers wanting to improve their circuit driving and performance during track days.

Why: Following a few laps of a circuit, the individual pressure of each tyre will increase – how much depends on the circuit, the car and the type of driving. This pressure change can have the effect of severely degrading vehicle performance and tyre wear.



DURING

MICHELIN Track Connect gives the driver real-time information about the pressure and temperature of each of the vehicle's four tyres. The sensors inside the tyre can accurately measure the pressure and temperature of the tyres and will analyse any changes as the vehicle goes around the track. Based on these parameters, the smartphone application acts as an interface for the driver and formats the information to help the driver interpret it correctly, and will guide them as they optimise the calibration of the tyre pressure. For instance, with **MICHELIN Track Connect**, the driver is in a position to know whether their tyres are operating within the optimal limits according to the track driving conditions as defined by the driver (dry/damp/wet circuit). It is also possible for the driver to see how their vehicle is behaving (oversteering or understeering) according to the analysis of changes in the balance between front and rear tyre pressures.

Michelin-Track Connect anticipates and/or renders obvious the Asserted Claims of the '421 Patent (at least as Revvo understands Plaintiff's application of the Asserted Claims in an effort to show infringement).

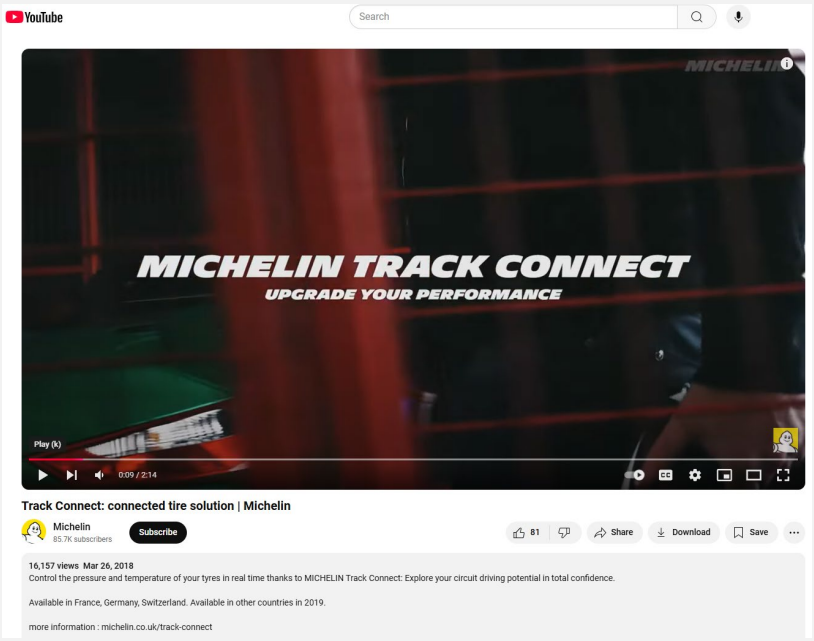
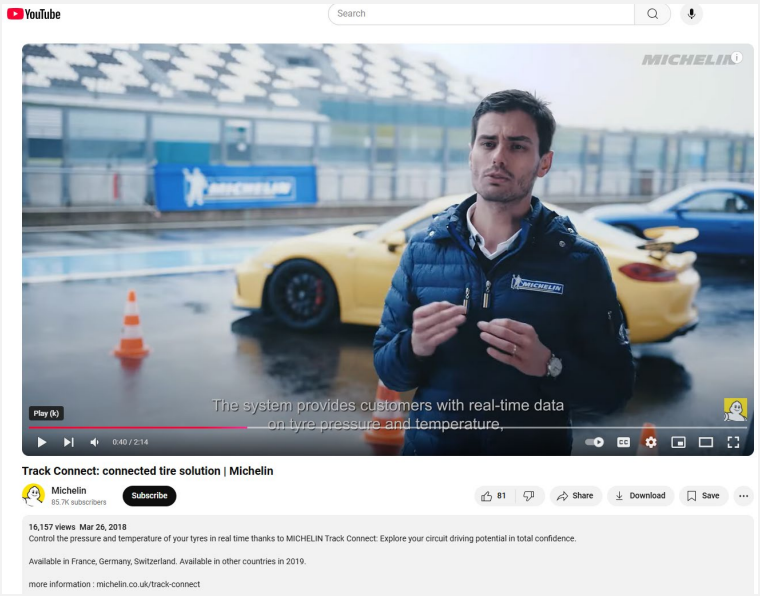
To the extent Plaintiff argues that any element below is not disclosed by Michelin-Track Connect, a person of ordinary skill in the art would have found it obvious to combine the teachings of Michelin-Track Connect with the background knowledge of a person of ordinary skill in the art and/or the additional references and exemplary teachings set forth in the chart below, to arrive at the claim limitation with a reasonable expectation of success. The chart below provides representative examples of where each element of each claim is found within Michelin-Track Connect. Citations are meant to be exemplary, not exhaustive, and Revvo reserves the right to identify and discuss additional portions of the reference in support of its contentions and/or to rebut arguments made by Plaintiff. Citations to figures, drawings, tables, and the link include reference to any accompanying or related text. All internal cross-references are meant to incorporate the cross-referenced material as if fully set forth therein.

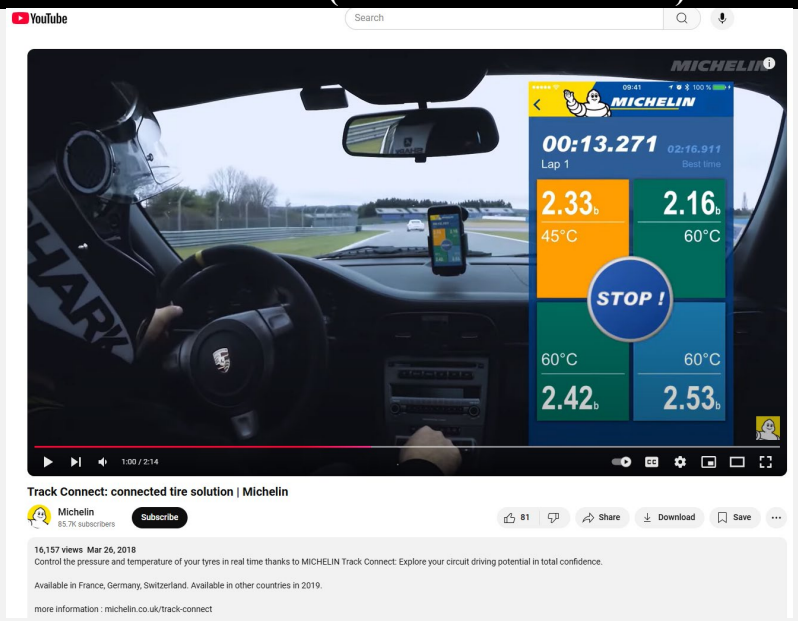
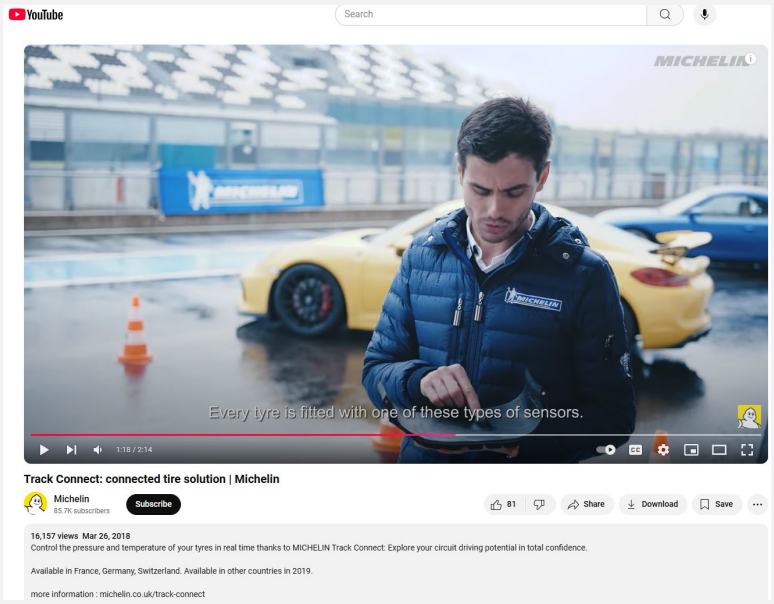
It is Revvo's position that Plaintiff's October 30, 2024 Infringement Contentions have not established that any accused product or service infringes any valid claim. Thus, Revvo's statements below should not be treated as an admission, implication, or suggestion that Revvo agrees with Plaintiff regarding either the scope, construction, or interpretation of any of the Asserted Claims or the infringement theories advanced by Plaintiff in its Infringement Contentions, including whether any Asserted Claim satisfies 35 U.S.C. §§ 101 or 112. In certain cases, Revvo has specified non-limiting examples of where its application of the prior art is based on Plaintiff's apparent application of the claim element. These statements are not intended to

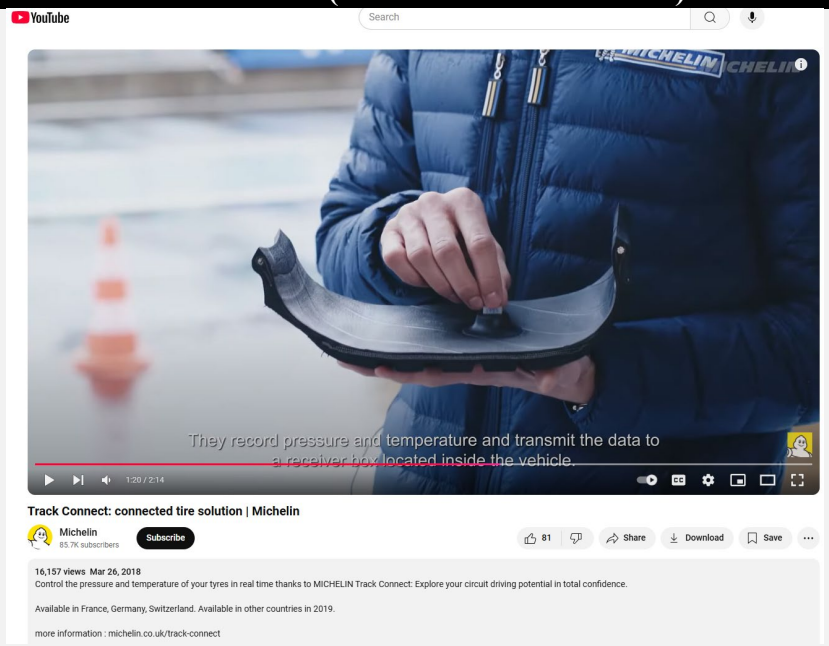
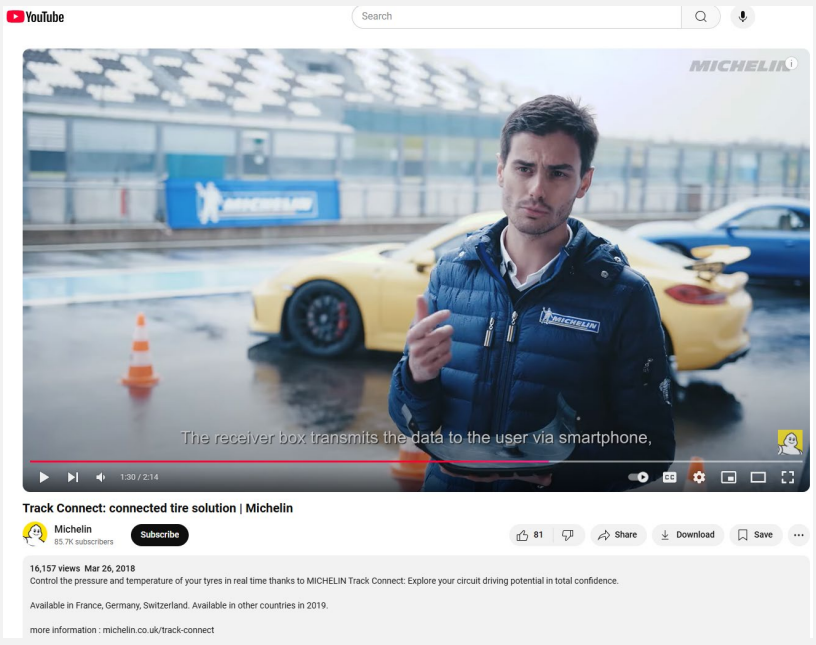
suggest that Revvo agrees with Plaintiff's application of any claim element, suggest a proposed construction at this stage of the case, or suggest that construction is needed, as the parties are not required to exchange terms for construction or propose claim constructions until a later date.

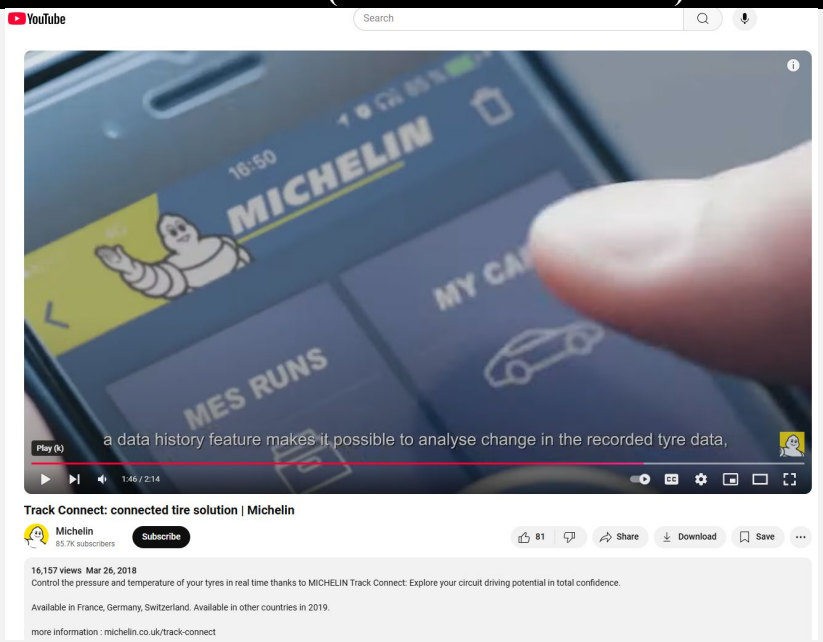
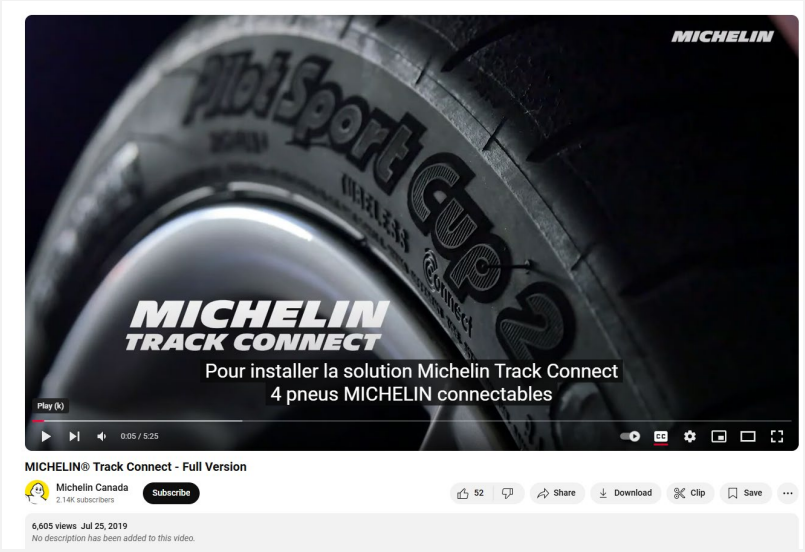
Plaintiff has yet to identify any limitation of the Asserted Claims that it contends is not anticipated and/or rendered obvious by Michelin-Track Connect. Revvo therefore expressly reserves the right to respond to any such contention, including by identifying additional obviousness combinations, if Plaintiff makes any such contention.

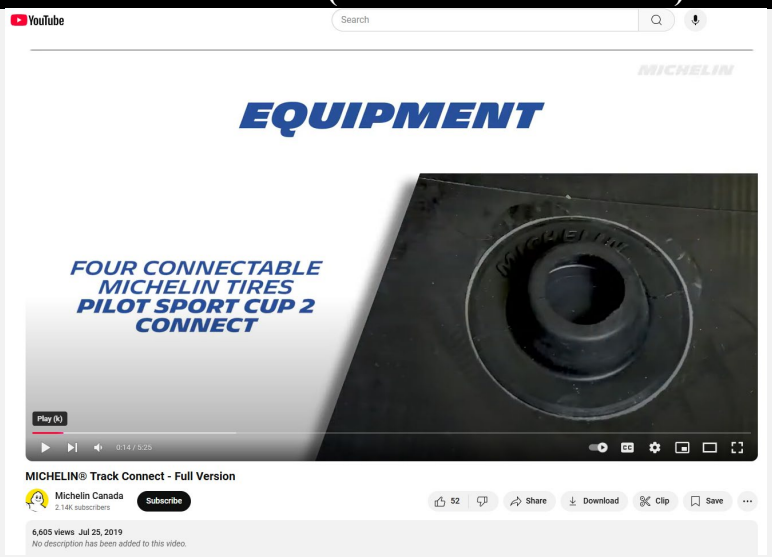
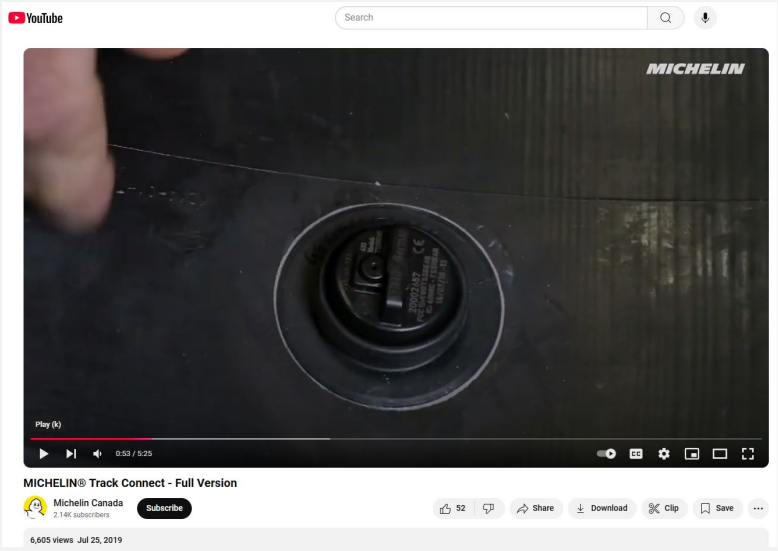
Where Revvo states that Michelin-Track Connect "discloses" a limitation, that disclosure may be express, implicit, and/or inherent.

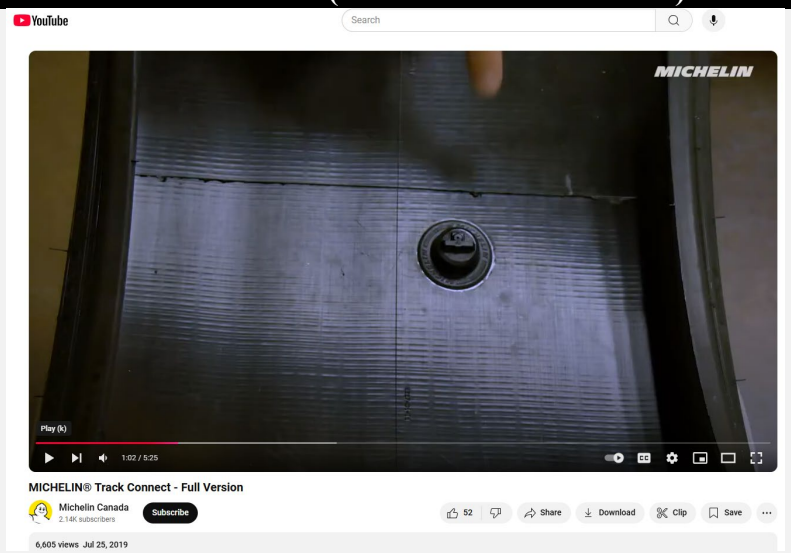
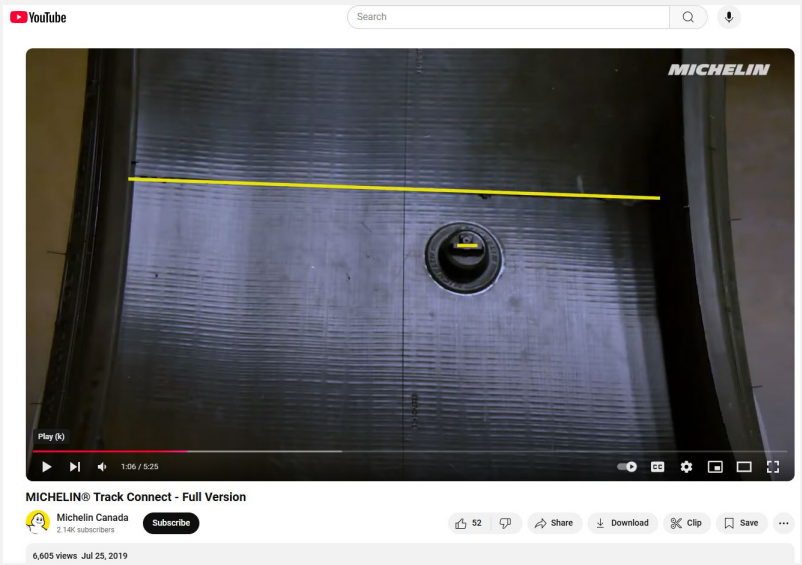
'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
1[pre]. A sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising:	*To the extent that the preamble is limiting, Michelin-Track Connect discloses, teaches, and/or suggests a sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising. For example:*  https://www.youtube.com/watch?v=Cili2VJ7OXs  https://www.youtube.com/watch?v=Cili2VJ7OXs

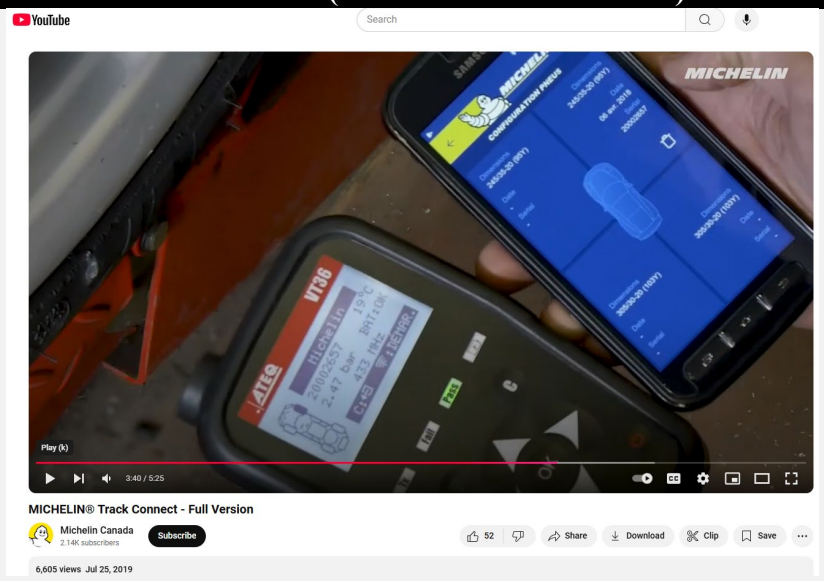
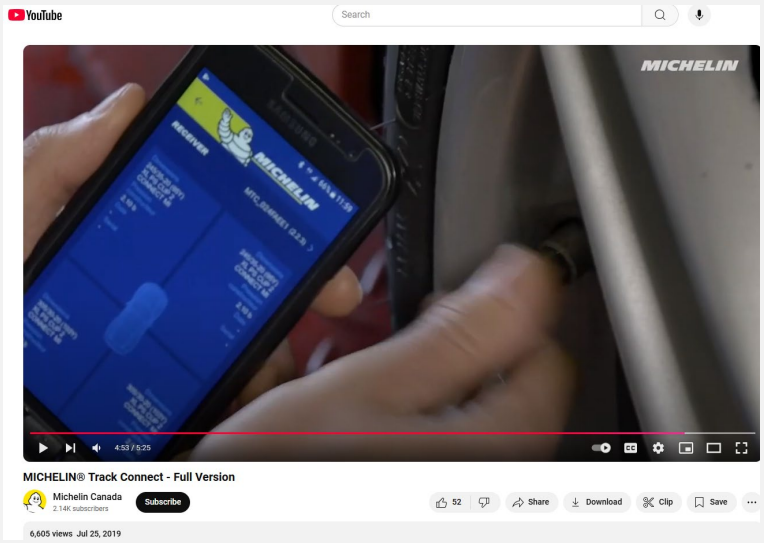
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=Cili2VJ7OXs  https://www.youtube.com/watch?v=Cili2VJ7OXs

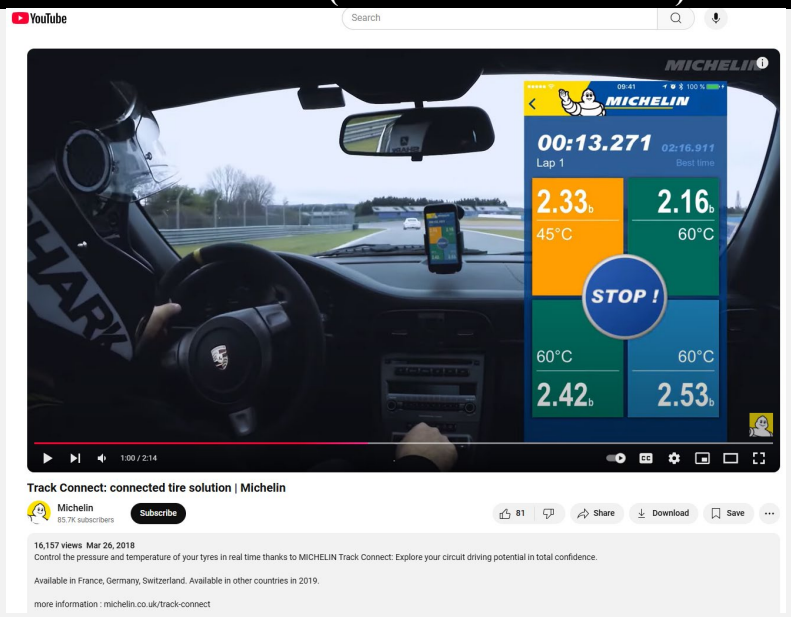
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=Cili2VJ7OXs  https://www.youtube.com/watch?v=Cili2VJ7OXs

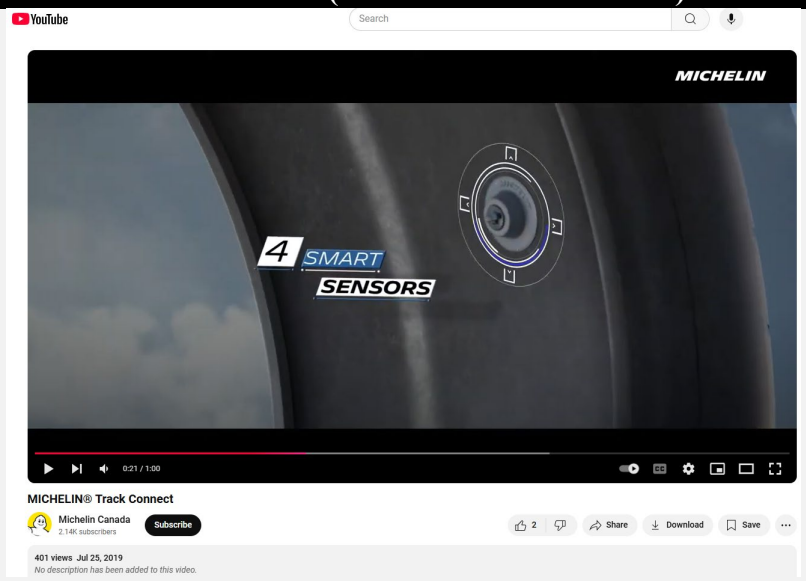
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
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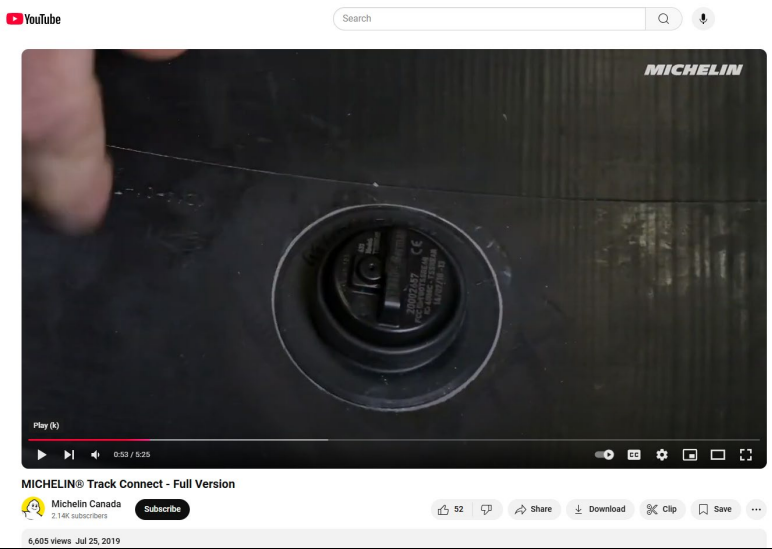
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=arw108KcBCY  https://www.youtube.com/watch?v=arw108KcBCY

’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=arw108KcBCY  https://www.youtube.com/watch?v=arw108KcBCY

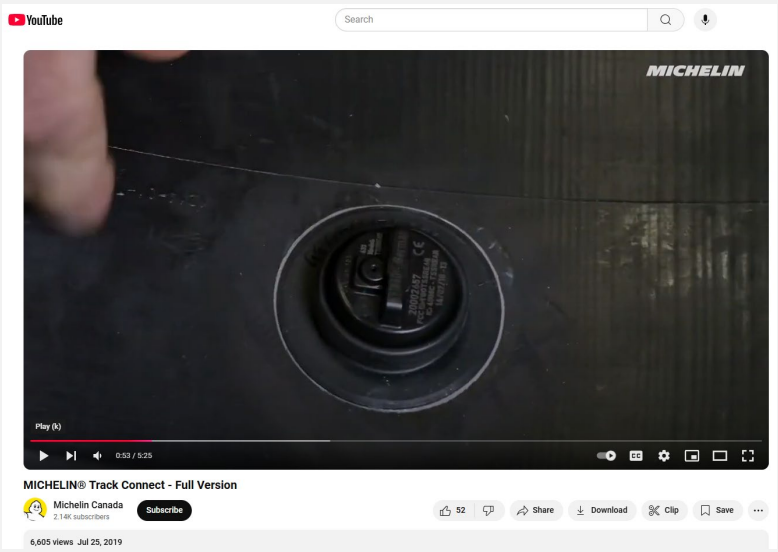
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=arw108KcBCY  https://www.youtube.com/watch?v=arw108KcBCY

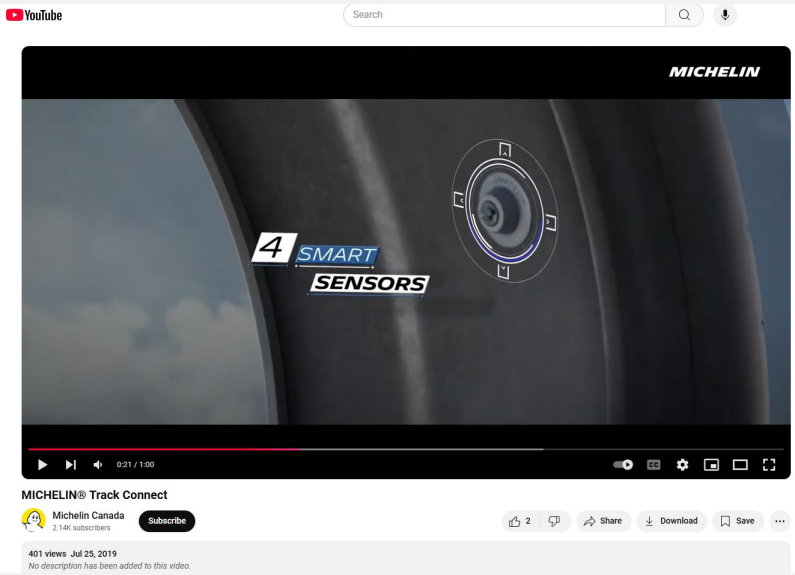
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=Cili2VJ7OXs  https://dgaddcosprod.blob.core.windows.net/corporate-production/attachments/clktclei106at2fhhhpap25yr-pk-gims-19-salon-geneve-gb.pdf

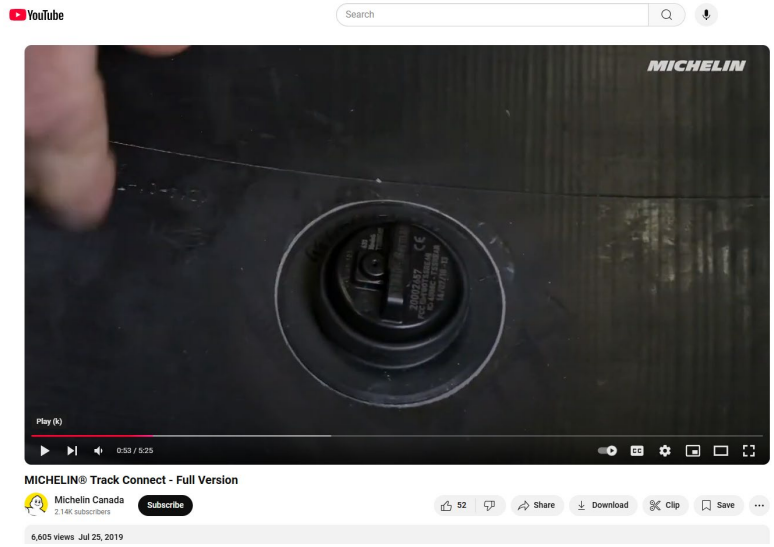
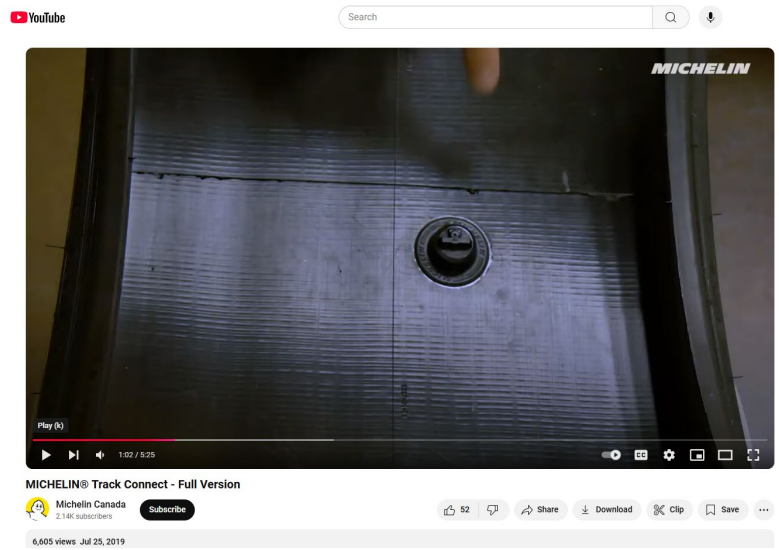
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=JHxZs0hHkjI  https://www.ceerta-pneus.com/capteur-michelin-track-connect-c2x32603583

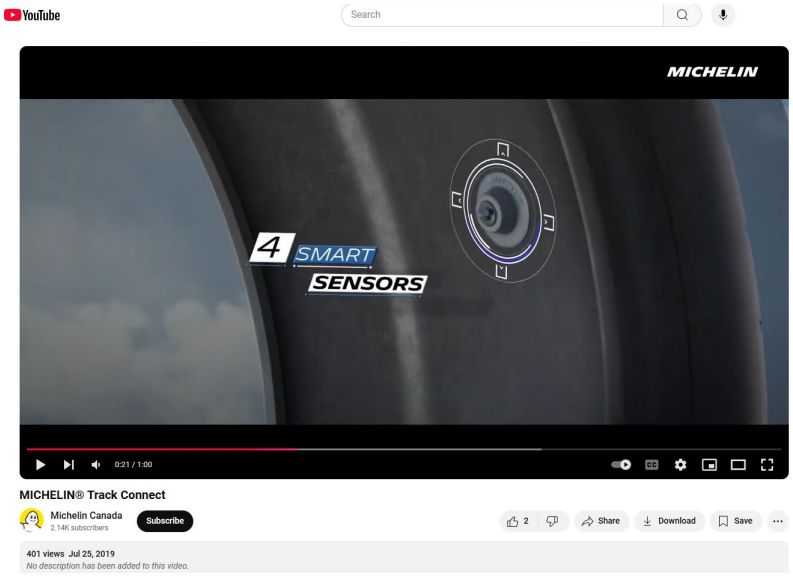
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://trackday.tires/raceware/michelin-track-connect-sensoren-4-stuks/ *See also following limitations.*
[1a] a housing comprising an outer surface and an internal cavity that is enclosed within the housing;	*Michelin-Track Connect discloses, teaches, and/or suggests a housing comprising an outer surface and an internal cavity that is enclosed within the housing. For example:* *See, e.g.*, **1[pre]**, above. 

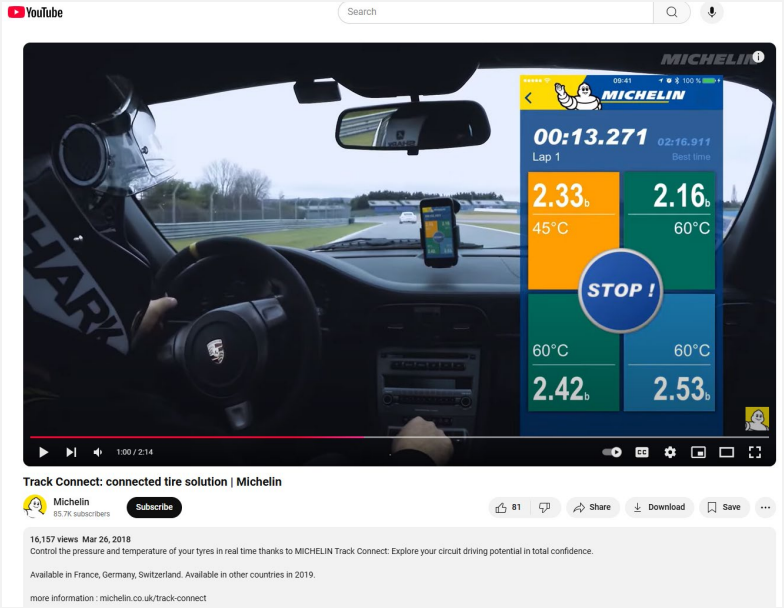
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	https://www.youtube.com/watch?v=arw108KcBCY  https://www.ceerta-pneus.com/capteur-michelin-track-connect-c2x32603583  https://trackday.tires/raceware/michelin-track-connect-sensoren-4-stuks/

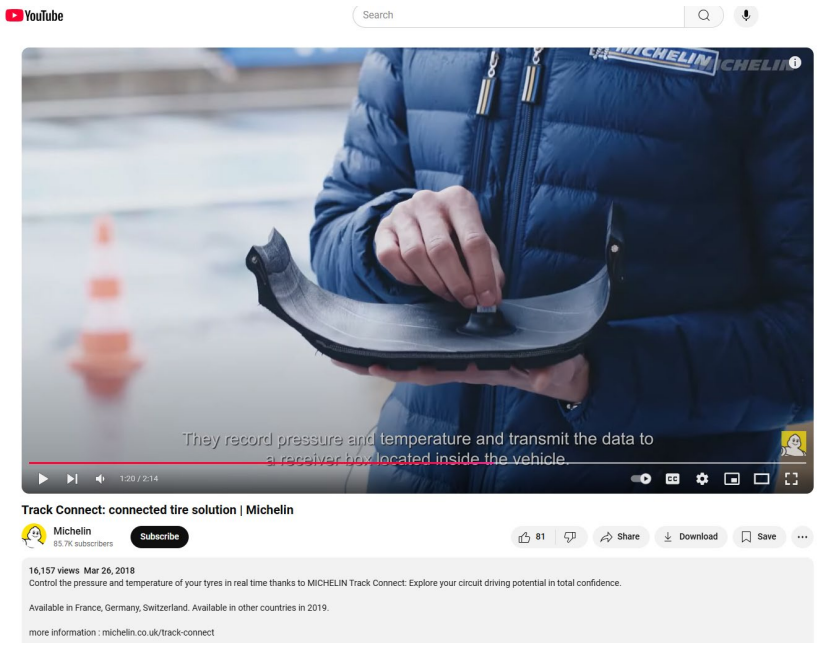
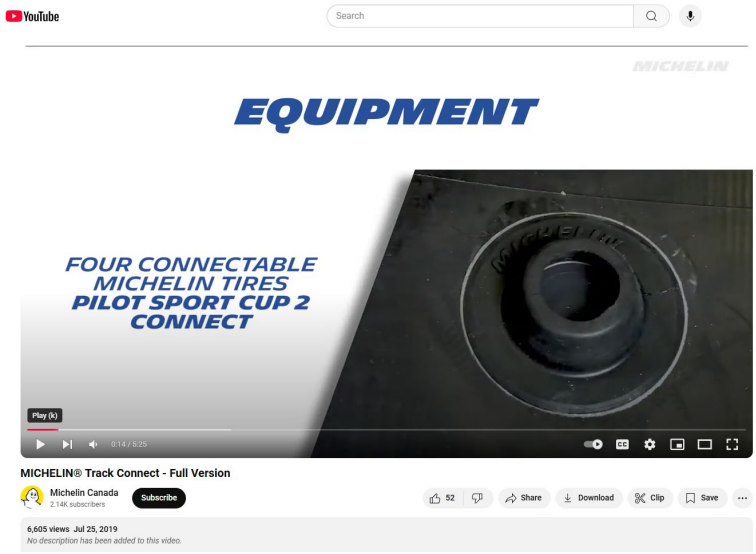
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
[1b] an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity,	*Michelin-Track Connect discloses, teaches, and/or suggests an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=arw108KcBCY  https://www.ceerta-pneus.com/capteur-michelin-track-connect-c2x32603583

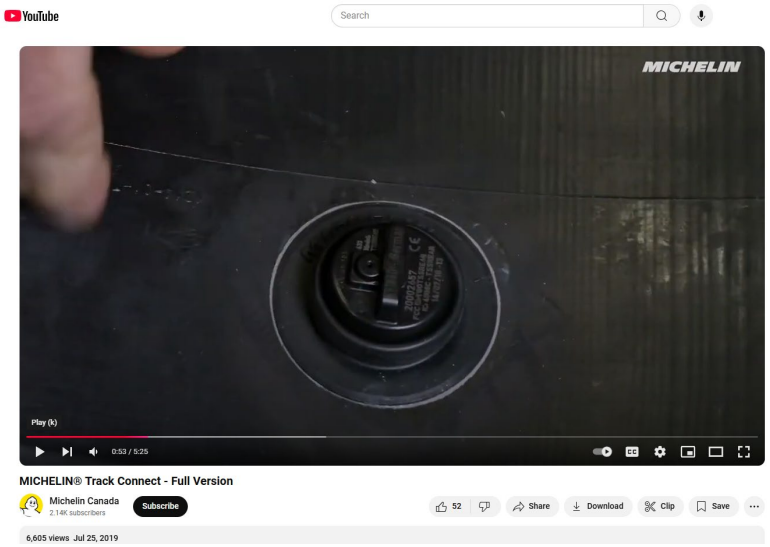
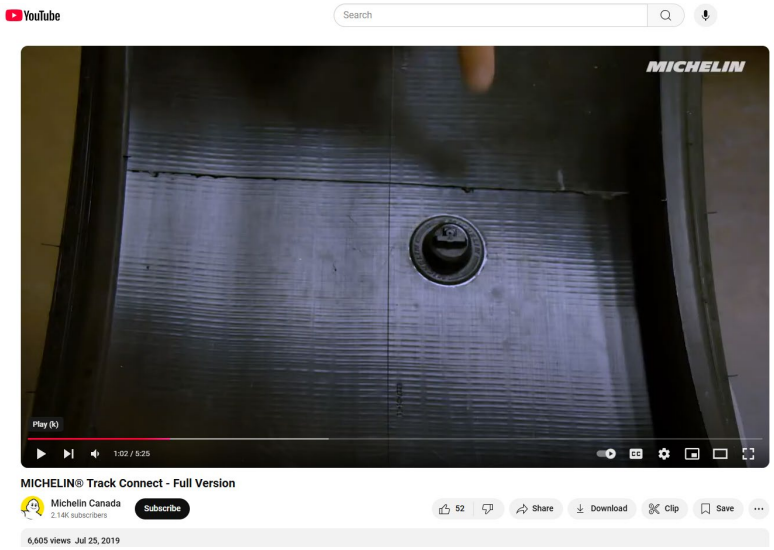
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://trackday.tires/raceware/michelin-track-connect-sensoren-4-stuks/  https://www.youtube.com/watch?v=JHxZs0hHkjI
[1c] wherein the internal cavity comprises an unfilled open space above or below the	*Michelin-Track Connect discloses, teaches, and/or suggests wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing. For example:*

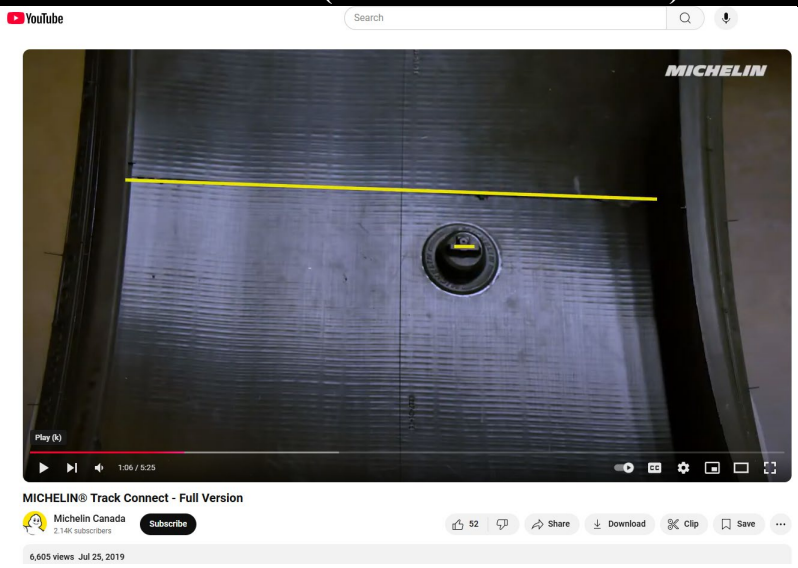
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
electrical sensor device in the housing,	*See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=arw108KcBCY  https://www.youtube.com/watch?v=arw108KcBCY

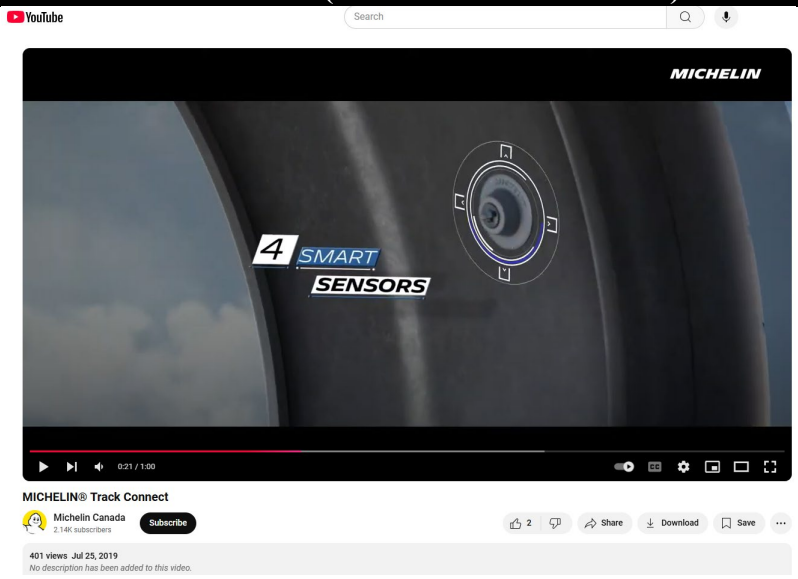
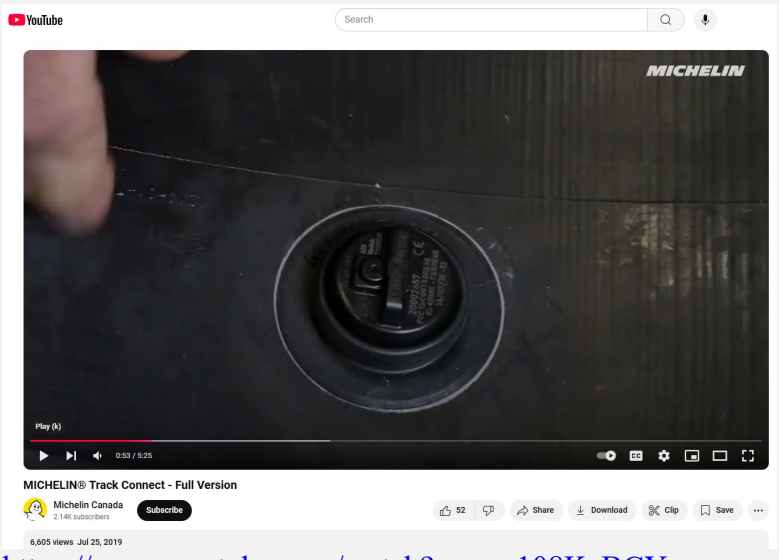
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://trackday.tires/raceware/michelin-track-connect-sensoren-4-stuks/  https://www.youtube.com/watch?v=JHxZs0hHkjI
[1d] wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions,	*Michelin-Track Connect discloses, teaches, and/or suggests wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use. For example:*

’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use; and	*See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=Cili2VJ7OXs  https://dgaddcosprod.blob.core.windows.net/corporate-production/attachments/clktclei106at2fhhhpap25yr-pk-gims-19-salon-geneve-gb.pdf
[1e] a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for	*Michelin-Track Connect discloses, teaches, and/or suggests a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.. For example:*

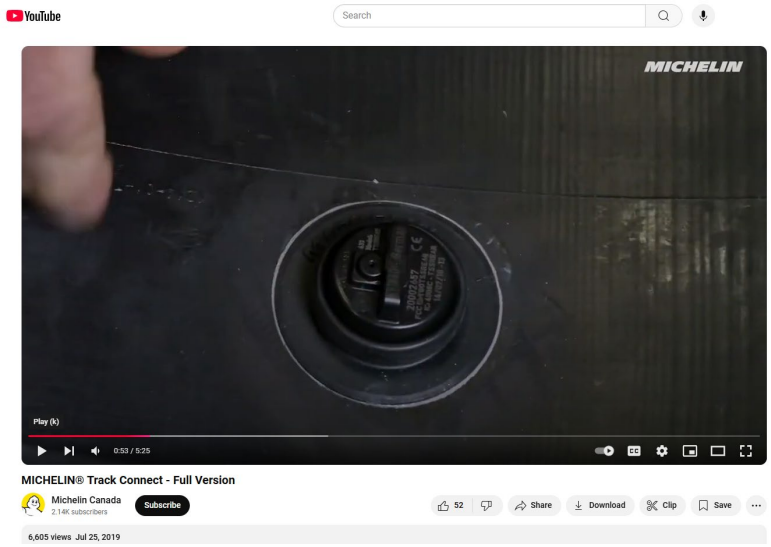
'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
attachment to rotate with the object when the object is rotated in use.	*See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=Cili2VJ7OXs  https://www.youtube.com/watch?v=arw108KcBCY

’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=arw108KcBCY  https://www.youtube.com/watch?v=arw108KcBCY

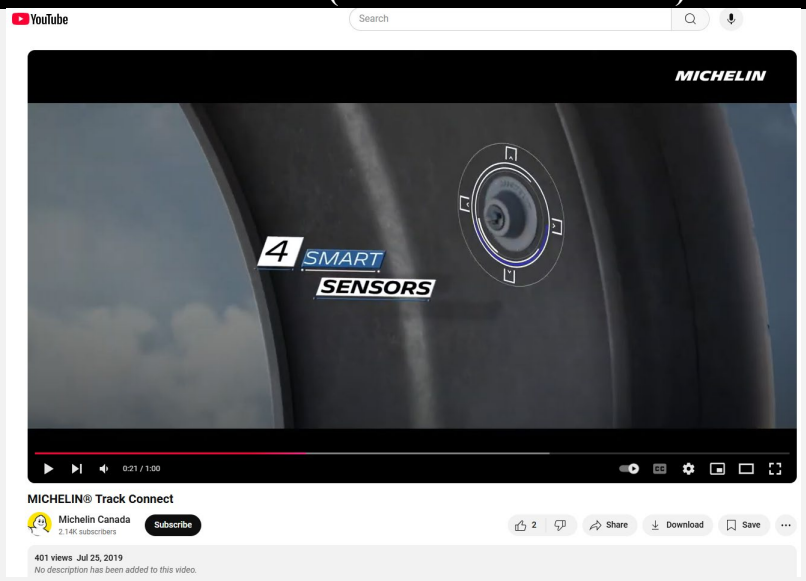
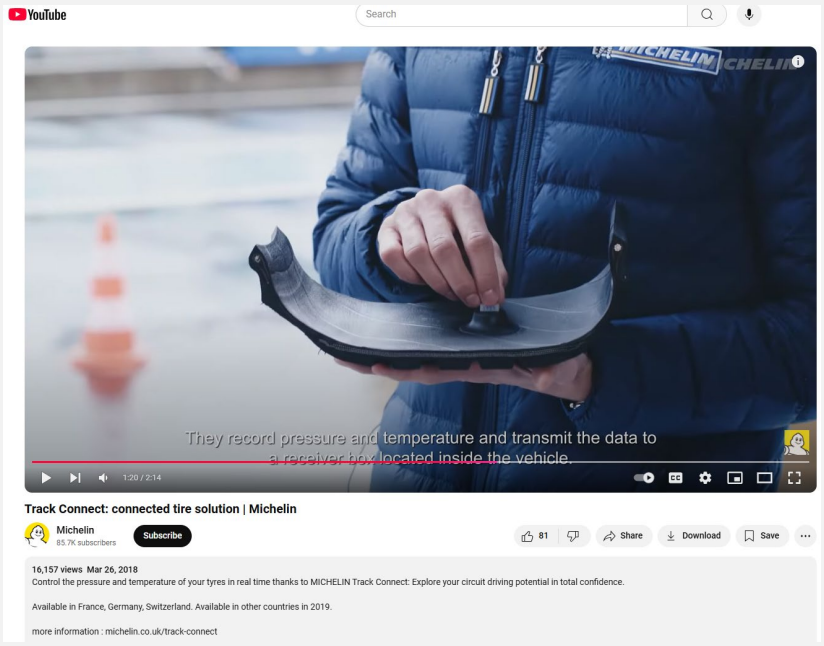
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=arw108KcBCY  https://dgaddcosprod.blob.core.windows.net/corporate-production/attachments/clktclei106at2fhhhpap25yr-pk-gims-19-salon-geneve-gb.pdf

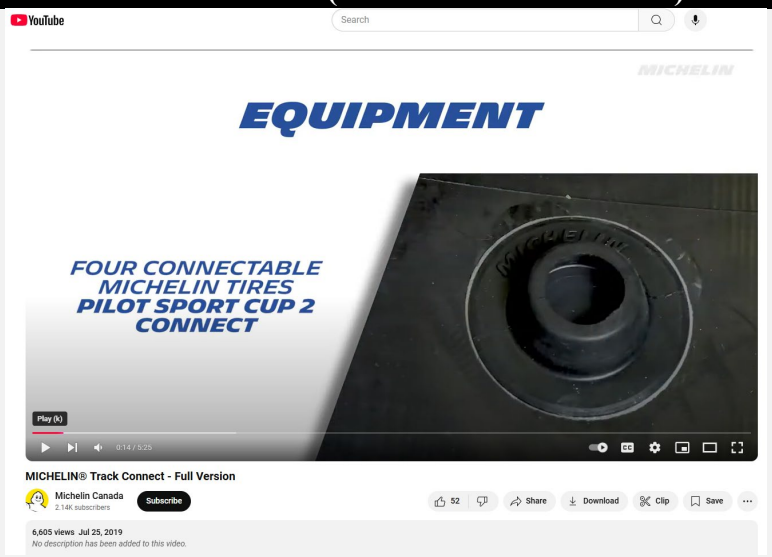
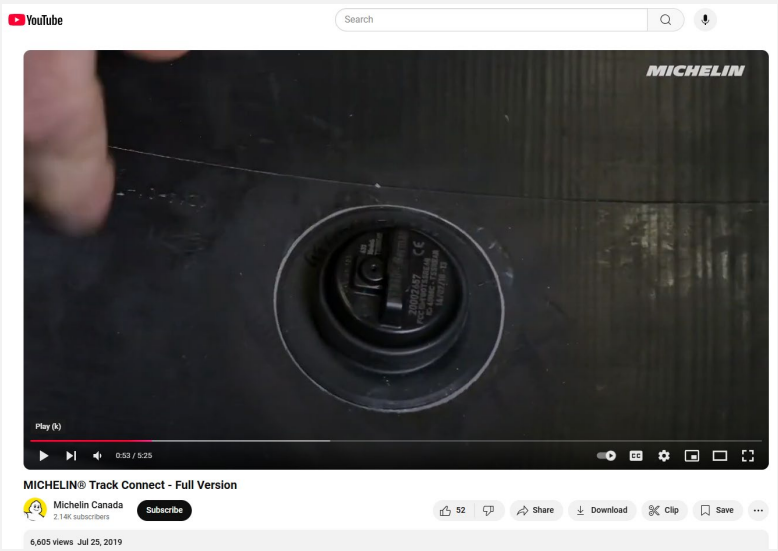
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=JHxZs0hHkjI
2. The sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member assembly. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=arw108KcBCY

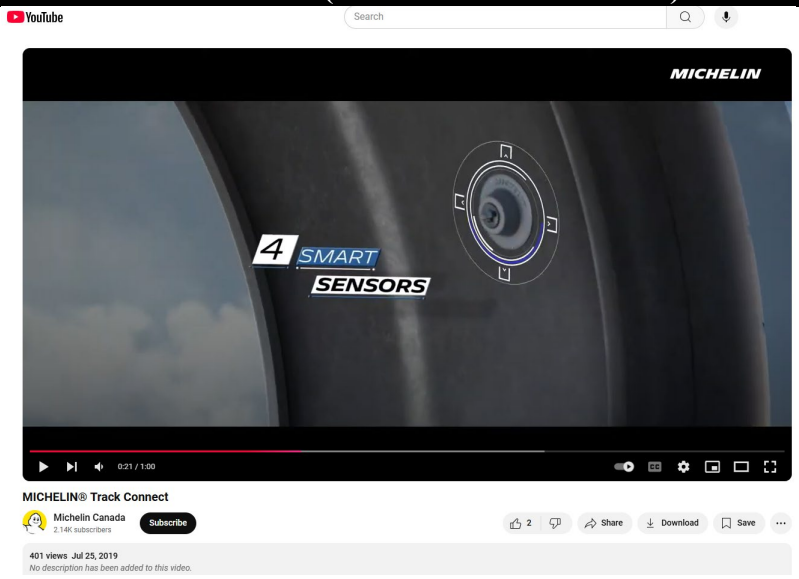
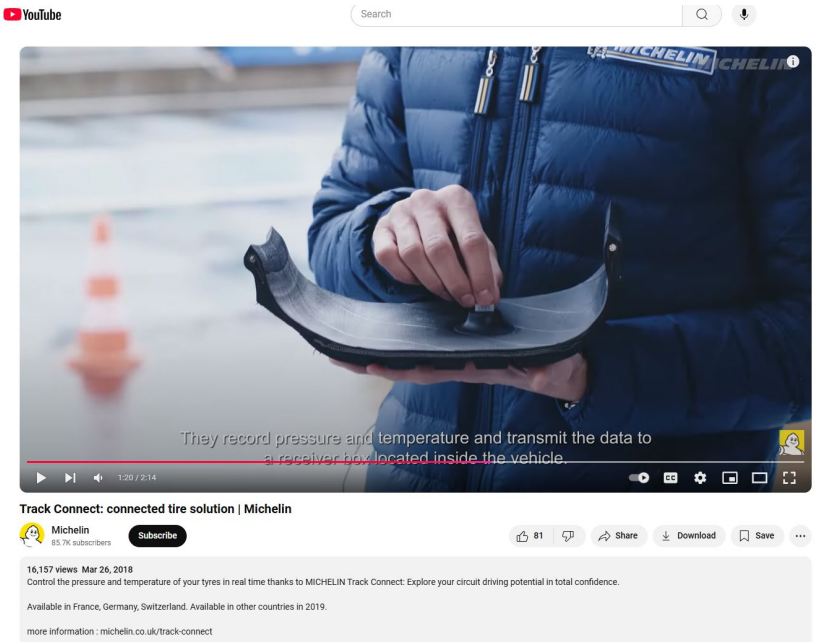
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.ceerta-pneus.com/capteur-michelin-track-connect-c2x32603583  https://trackday.tires/raceware/michelin-track-connect-sensoren-4-stuks/
5. The sensor assembly as recited in claim 1, wherein the electrical sensor device is	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface*

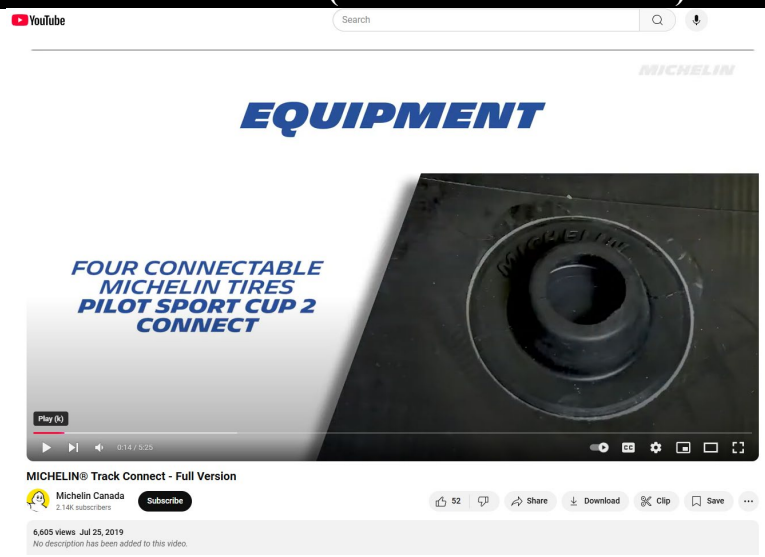
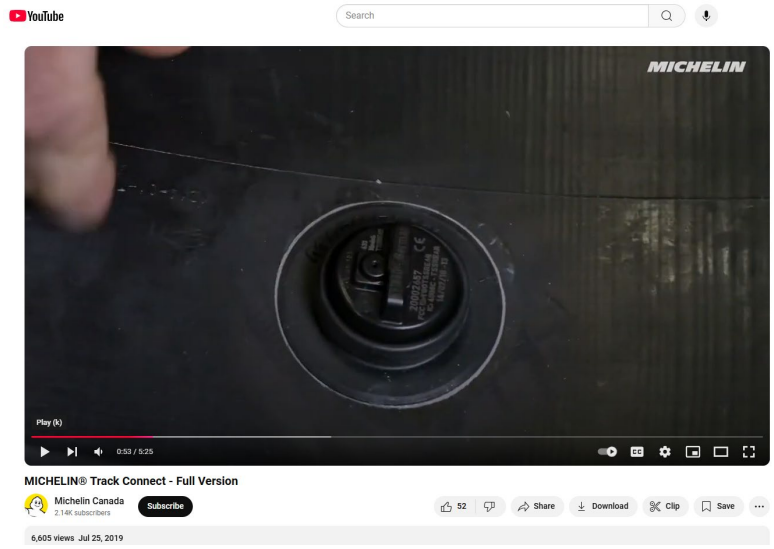
'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein.	*features within the cavity that contact the electrical sensor device to retain its position therein. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=arw108KcBCY  https://www.ceerta-pneus.com/capteur-michelin-track-connect-c2x32603583

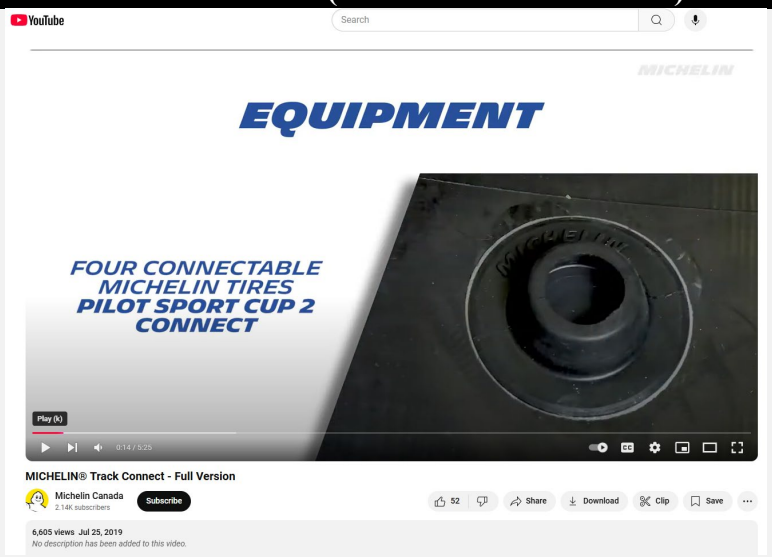
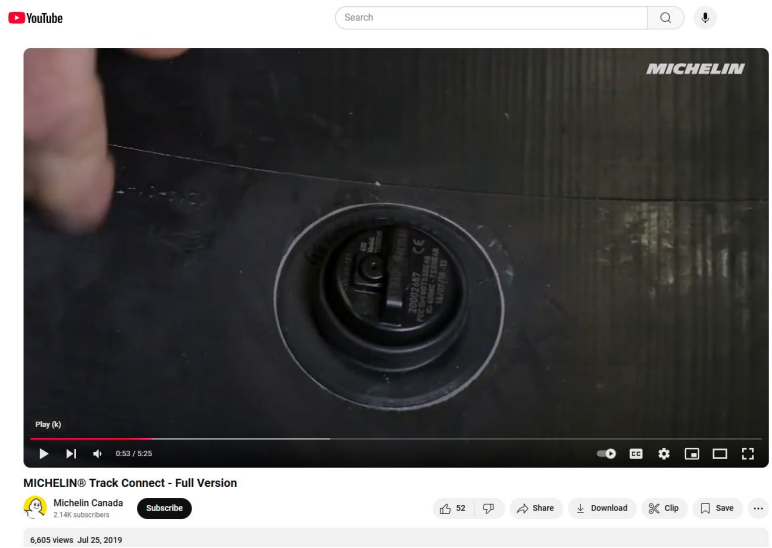
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://trackday.tires/raceware/michelin-track-connect-sensoren-4-stuks/
7. The sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member. For example:* *See, e.g.*, **1[pre]**, above.

’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=JHxZs0hHkjI  https://www.youtube.com/watch?v=Cili2VJ7OXs

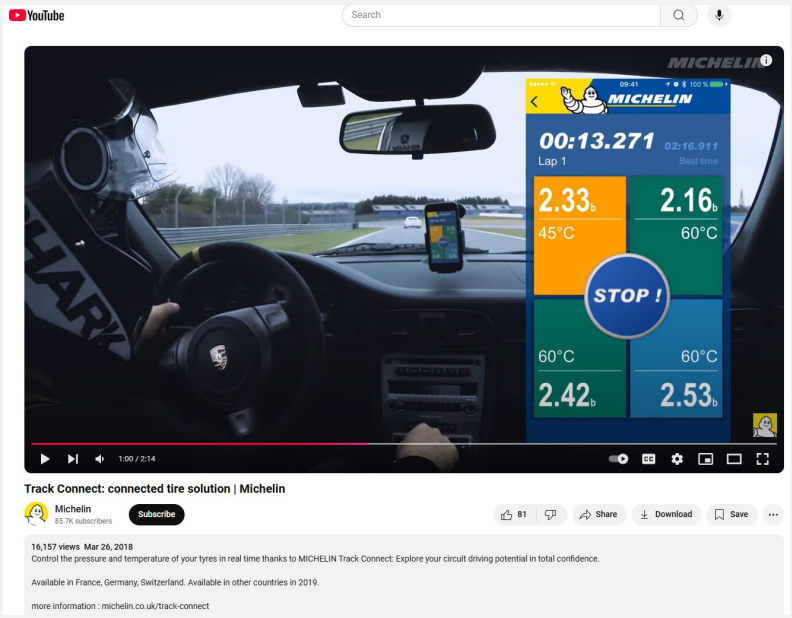
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=arw108KcBCY  https://www.youtube.com/watch?v=arw108KcBCY
8. The sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith. For example:* *See, e.g.*, **1[pre]**, above.

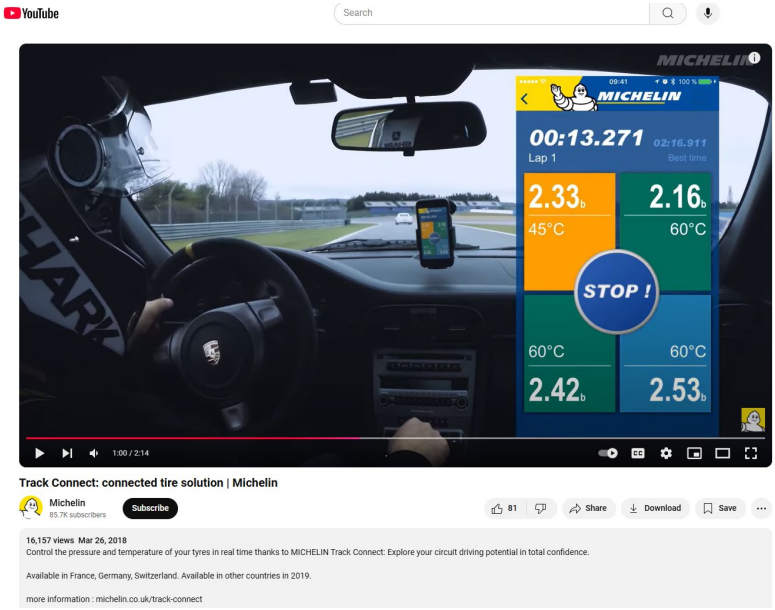
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=JHxZs0hHkjI  https://www.youtube.com/watch?v=Cili2VJ7OXs

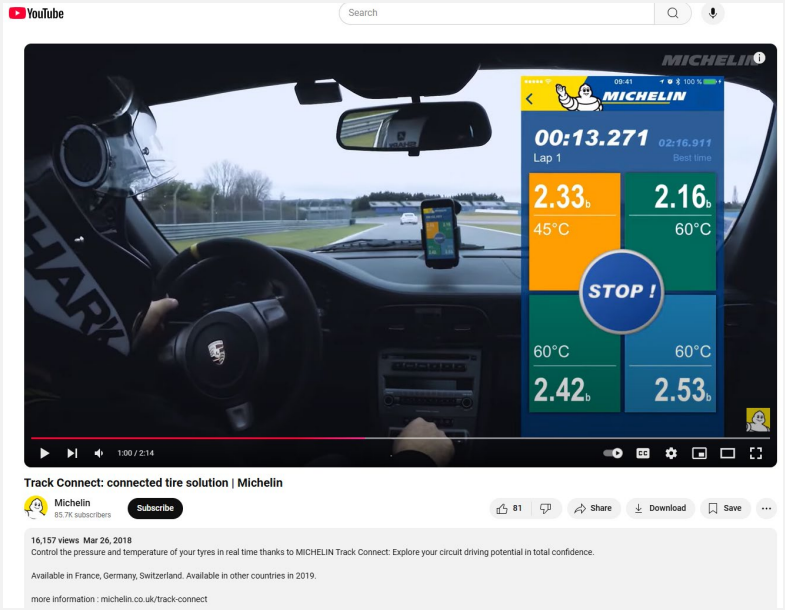
'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=arw108KcBCY  https://www.youtube.com/watch?v=arw108KcBCY
9. The sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member. For example:* *See, e.g.*, **1[pre]**, above.

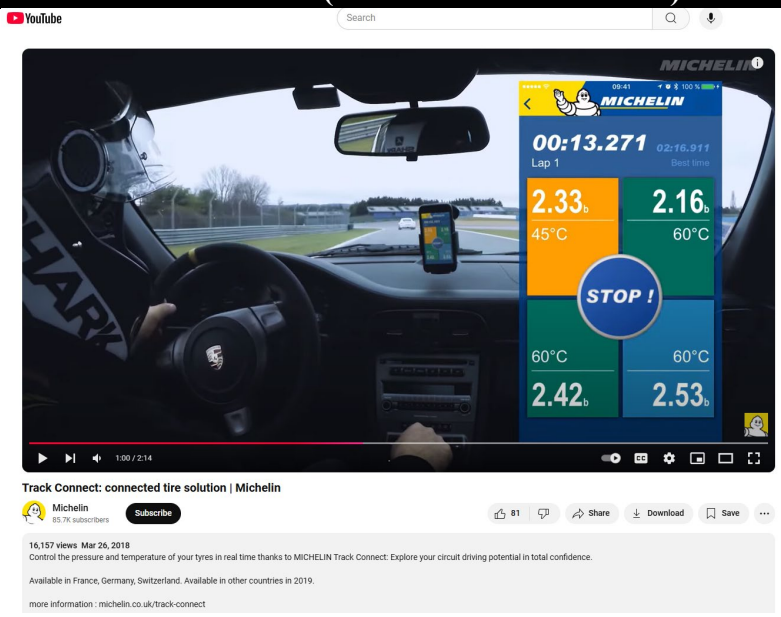
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=arw108KcBCY
10. The sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=arw108KcBCY

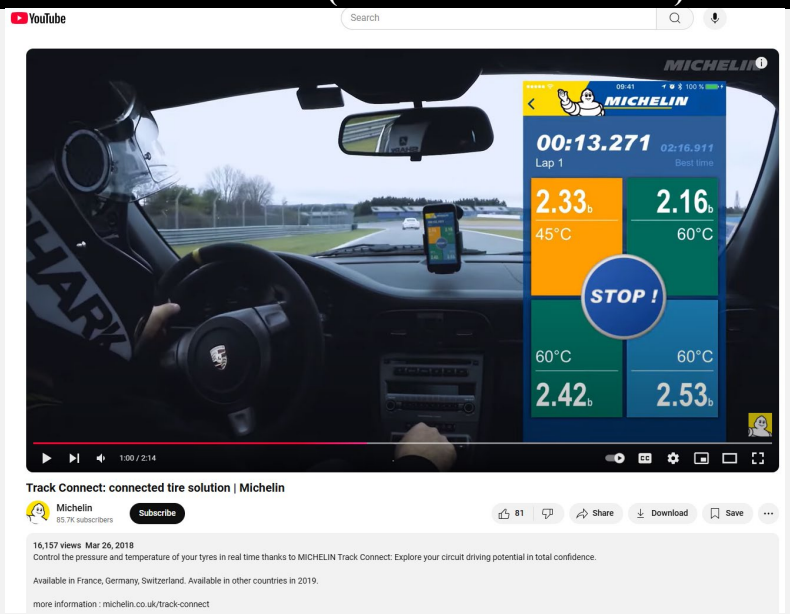
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.ceerta-pneus.com/capteur-michelin-track-connect-c2x32603583  https://trackday.tires/raceware/michelin-track-connect-sensoren-4-stuks/
11. A sensing system comprising the sensor assembly as recited in claim 1,	*Michelin-Track Connect discloses, teaches, and/or suggests a sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from*

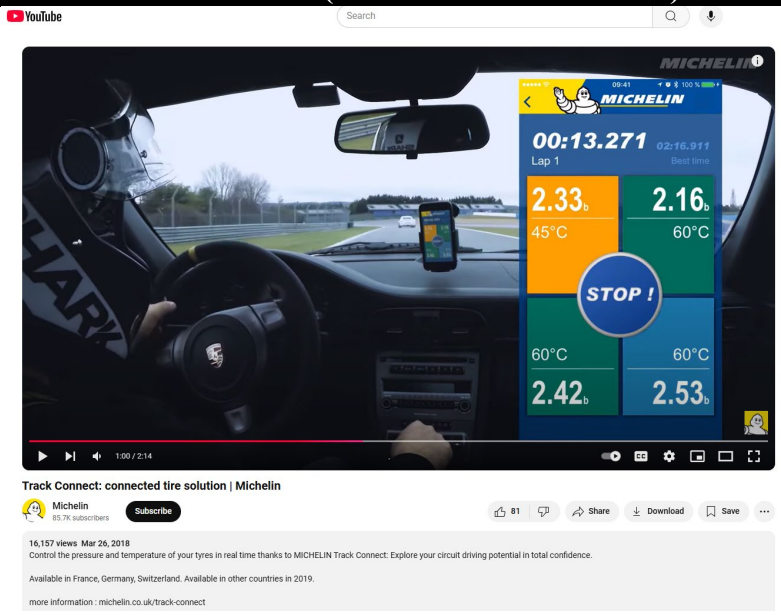
'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication.	*the object and that is configured to receive data from the electrical sensor device by wireless communication. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=Cili2VJ7OXs  https://dgaddcosprod.blob.core.windows.net/corporate-production/attachments/clktclei106at2fhhhpap25yr-pk-gims-19-salon-geneve-gb.pdf
12. The sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor	*Michelin-Track Connect discloses, teaches, and/or suggests the sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.*, **1[pre]**, above.

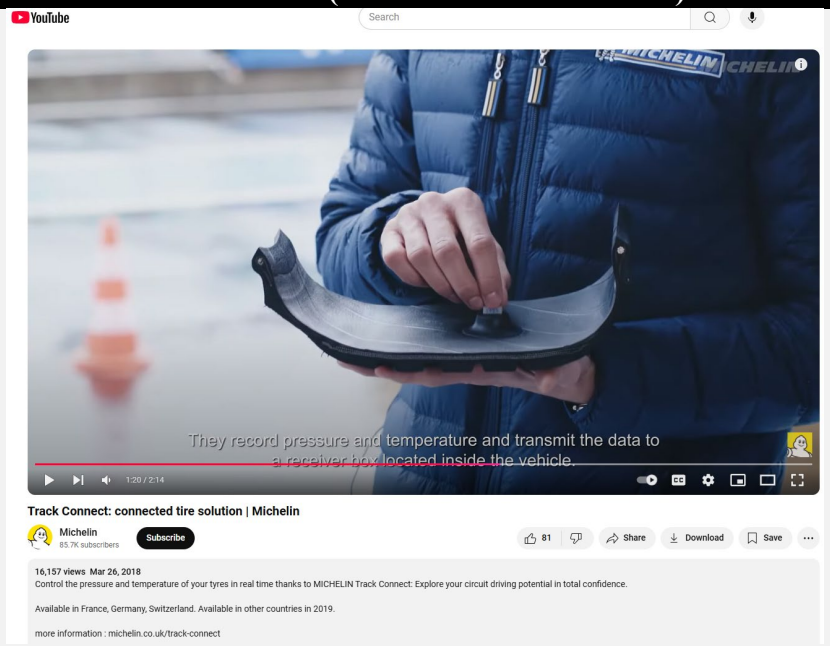
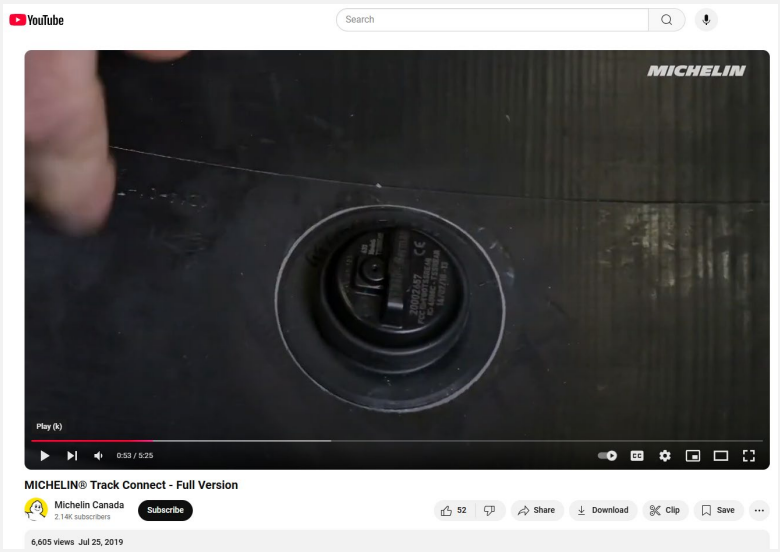
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
wirelessly to the external receiver.	 https://www.youtube.com/watch?v=Cili2VJ7OXs  https://dgaddcosprod.blob.core.windows.net/corporate-production/attachments/clktclei106at2fhhhpap25yr-pk-gims-19-salon-geneve-gb.pdf
20. The sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device. For example:* *See, e.g.*, **1[pre]**, above.

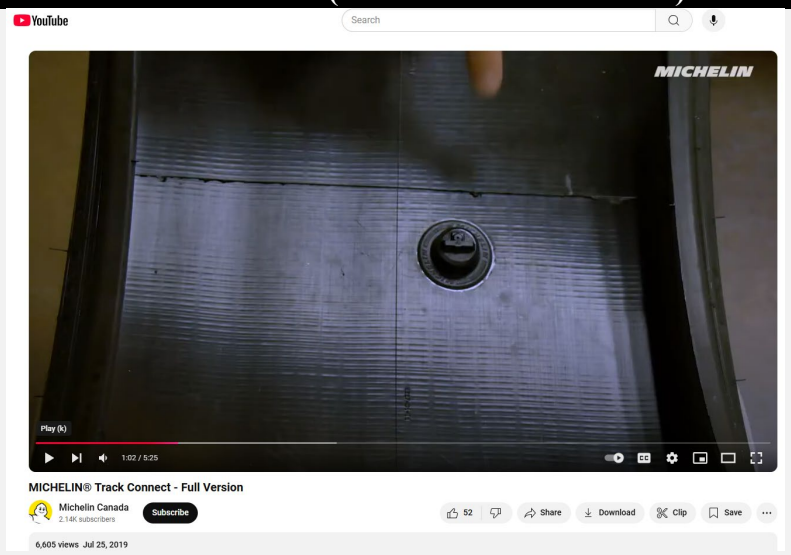
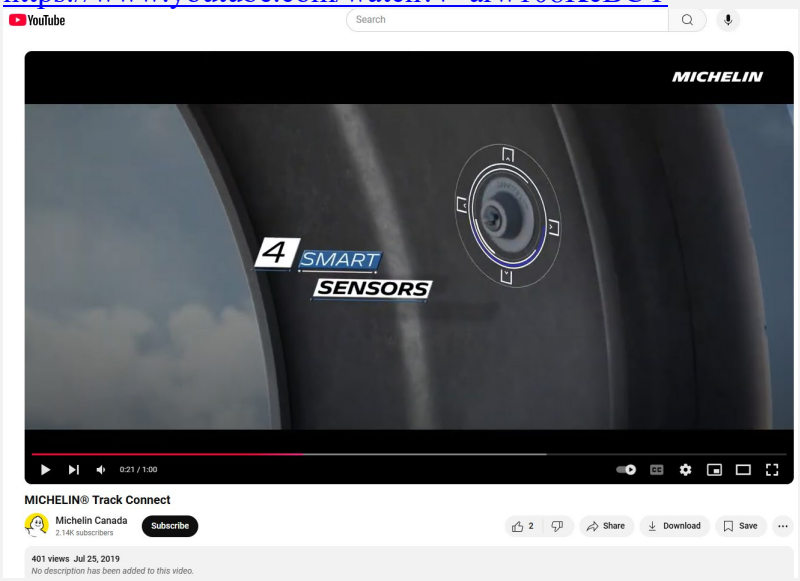
’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
an antenna for receiving and/or transmitting information from the electrical sensor device.	 https://www.youtube.com/watch?v=Cili2VJ7OXs  https://dgaddcosprod.blob.core.windows.net/corporate-production/attachments/clktclei106at2fhhhpap25yr-pk-gims-19-salon-geneve-gb.pdf
21. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor. For example:* *See, e.g.*, **1[pre]**, above.

’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=Cili2VJ7OXs  https://dgaddcosprod.blob.core.windows.net/corporate-production/attachments/clktclei106at2fhhhpap25yr-pk-gims-19-salon-geneve-gb.pdf
22. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device. For example:* *See, e.g.*, **1[pre]**, above.

’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=Cili2VJ7OXs  https://dgaddcosprod.blob.core.windows.net/corporate-production/attachments/clktclei106at2fhhhpap25yr-pk-gims-19-salon-geneve-gb.pdf
23. The sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object. For example:* *See, e.g.*, **1[pre]**, above.

'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
environment, the sensor assembly, or the object.	 https://www.youtube.com/watch?v=Cili2VJ7OXs  https://dgaddcosprod.blob.core.windows.net/corporate-production/attachments/clktclei106at2fhhhpap25yr-pk-gims-19-salon-geneve-gb.pdf
24. The sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire. For example:* *See, e.g.*, **1[pre]**, above.

’421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=Cili2VJ7OXs  https://www.youtube.com/watch?v=arw108KcBCY

'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
	 https://www.youtube.com/watch?v=arw108KcBCY  https://www.youtube.com/watch?v=JHxZs0hHkjI
28[pre]. A sensor assembly and sensing system for use with an object that rotates in use comprising:	*To the extent that the preamble is limiting, Michelin-Track Connect discloses, teaches, and/or suggests a* sensor assembly and sensing system for use with an object that rotates in use comprising. *For example:* *See, e.g.*, **1[pre]**, **11**, above. *See also following limitations.*
[28a] a housing comprising an outer structure that defines	*Michelin-Track Connect discloses, teaches, and/or suggests a housing comprising an outer structure that defines an open internal cavity therein. For example:*

'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
an open internal cavity therein,	*See, e.g.*, **[1a]-[1c]**, **10**, above.
[28b] an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device,	*Michelin-Track Connect discloses, teaches, and/or suggests an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device. For example:* *See, e.g.*, **[1a]-[1c]**, **5**, **10**, above.
[28c] wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location.	*Michelin-Track Connect discloses, teaches, and/or suggests wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location. For example:* *See, e.g.*, **[1d]**, above.
[28d] wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor;	*Michelin-Track Connect discloses, teaches, and/or suggests wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor. For example:* *See, e.g.*, **[1a]-[1c]**, **20**, above.
[28e] a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member; and	*Michelin-Track Connect discloses, teaches, and/or suggests a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member. For example:* *See, e.g.*, **[1e]**, **7**, **8**, above.
[28f] a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly.	*Michelin-Track Connect discloses, teaches, and/or suggests a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly. For example:* *See, e.g.*, **1**, **11**, above.

'421 Claim Element	**Disclosures from Prior Art (Michelin-Track Connect)**
31. The sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity. For example:* *See, e.g.*, **[1c]**, above.
32. The sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member. For example:* *See, e.g.*, **[1e]**, **9**, above.
33. The sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.*, **[1b]**, **11** above.
34. The sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data.	*Michelin-Track Connect discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data. For example:* *See, e.g.,* **1[pre]**, **[1b]**, **[1d]**, **[1e]**, **11**, **12**, **20**, above.
41[pre] A method for using a sensor assembly and sensing	*To the extent that the preamble is limiting, Michelin-Track Connect discloses, teaches, and/or suggests a method for using a sensor*

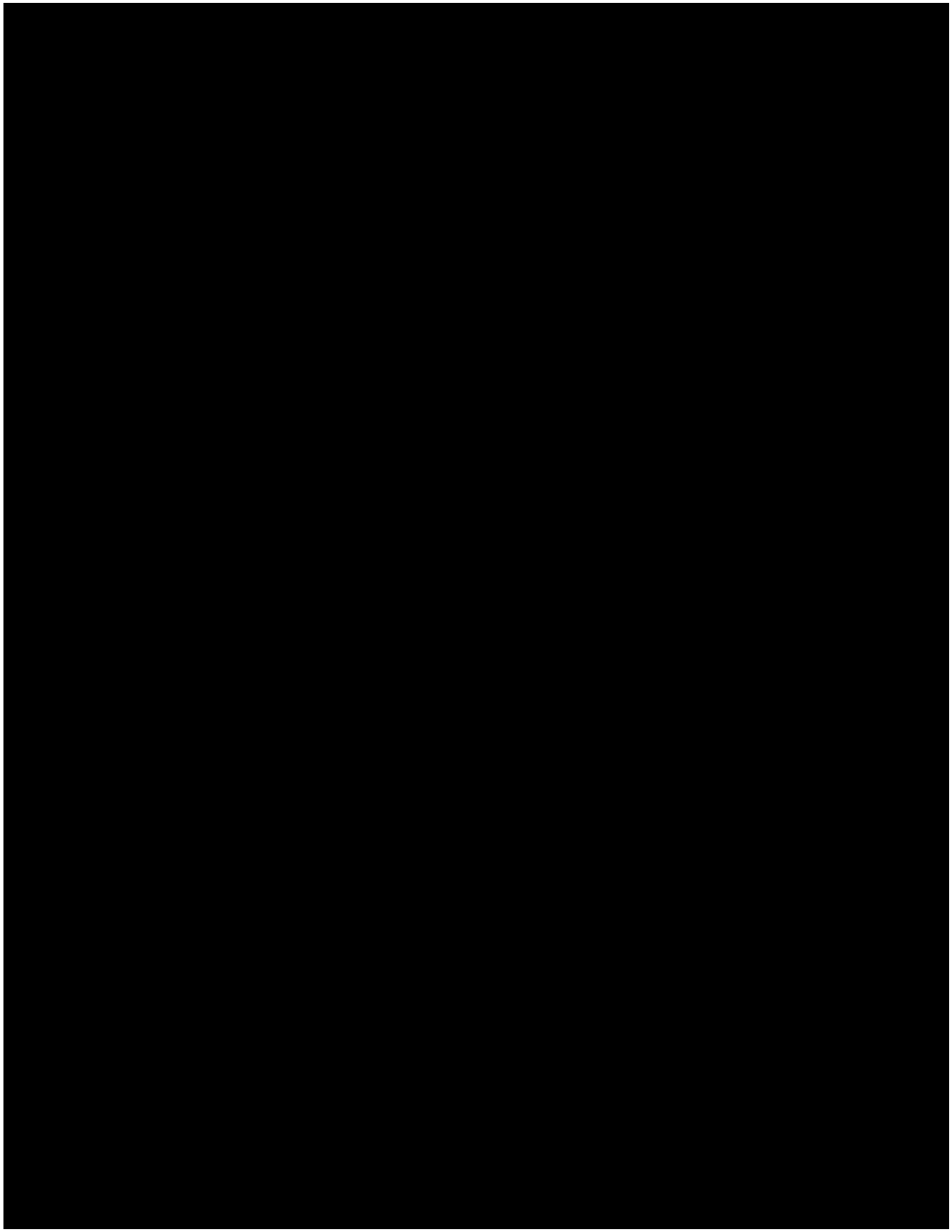
'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
system with an object that rotates in use comprising the steps of:	*assembly and sensing system with an object that rotates in use comprising the steps of: vulcanized rubber tire comprising. For example:* *See, e.g.,* **1**, **11**, **12**, **20**, above. *See also following limitations.*
[41a] installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity, and	*Michelin-Track Connect discloses, teaches, and/or suggests installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41b] wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry,	*Michelin-Track Connect discloses, teaches, and/or suggests wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41c] wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity;	*Michelin-Track Connect discloses, teaches, and/or suggests wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41d] attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object; and	*Michelin-Track Connect discloses, teaches, and/or suggests attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object. For example:* *See, e.g.,* **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41e] monitoring an operating parameter of the object through the use of the	*Michelin-Track Connect discloses, teaches, and/or suggests monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the*

'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly.	*operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
43. The method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity.	*Michelin-Track Connect discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
44. The method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed.	*Michelin-Track Connect discloses, teaches, and/or suggests the method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above
48. The method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire.	*Michelin-Track Connect discloses, teaches, and/or suggests the method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
50. The method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing.	*Michelin-Track Connect discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
51. The method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of	*Michelin-Track Connect discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating*

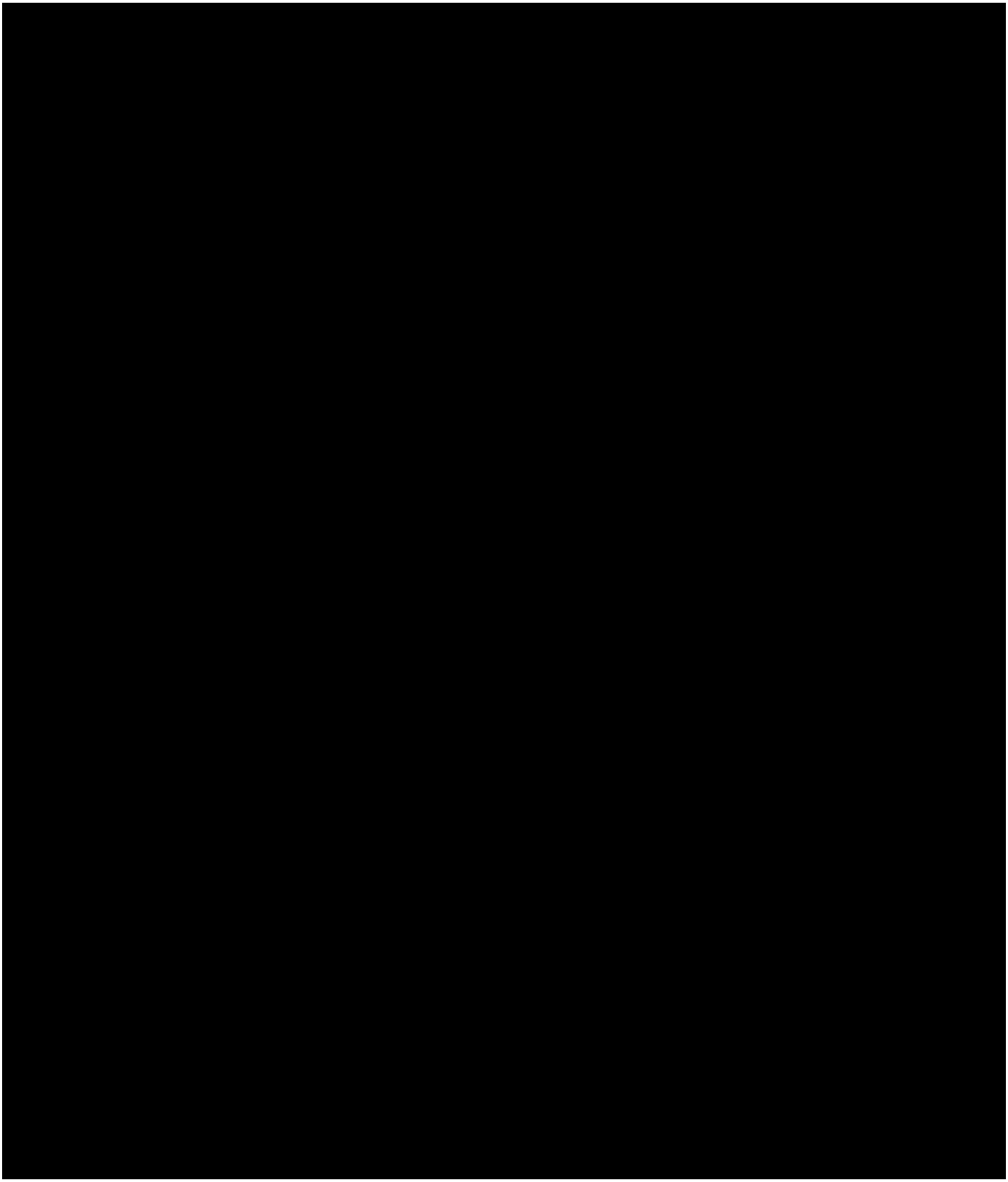
'421 Claim Element	Disclosures from Prior Art (Michelin-Track Connect)
operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device.	*parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
52. The method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor.	*Michelin-Track Connect discloses, teaches, and/or suggests the method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
53. The method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly.	*Michelin-Track Connect discloses, teaches, and/or suggests the method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

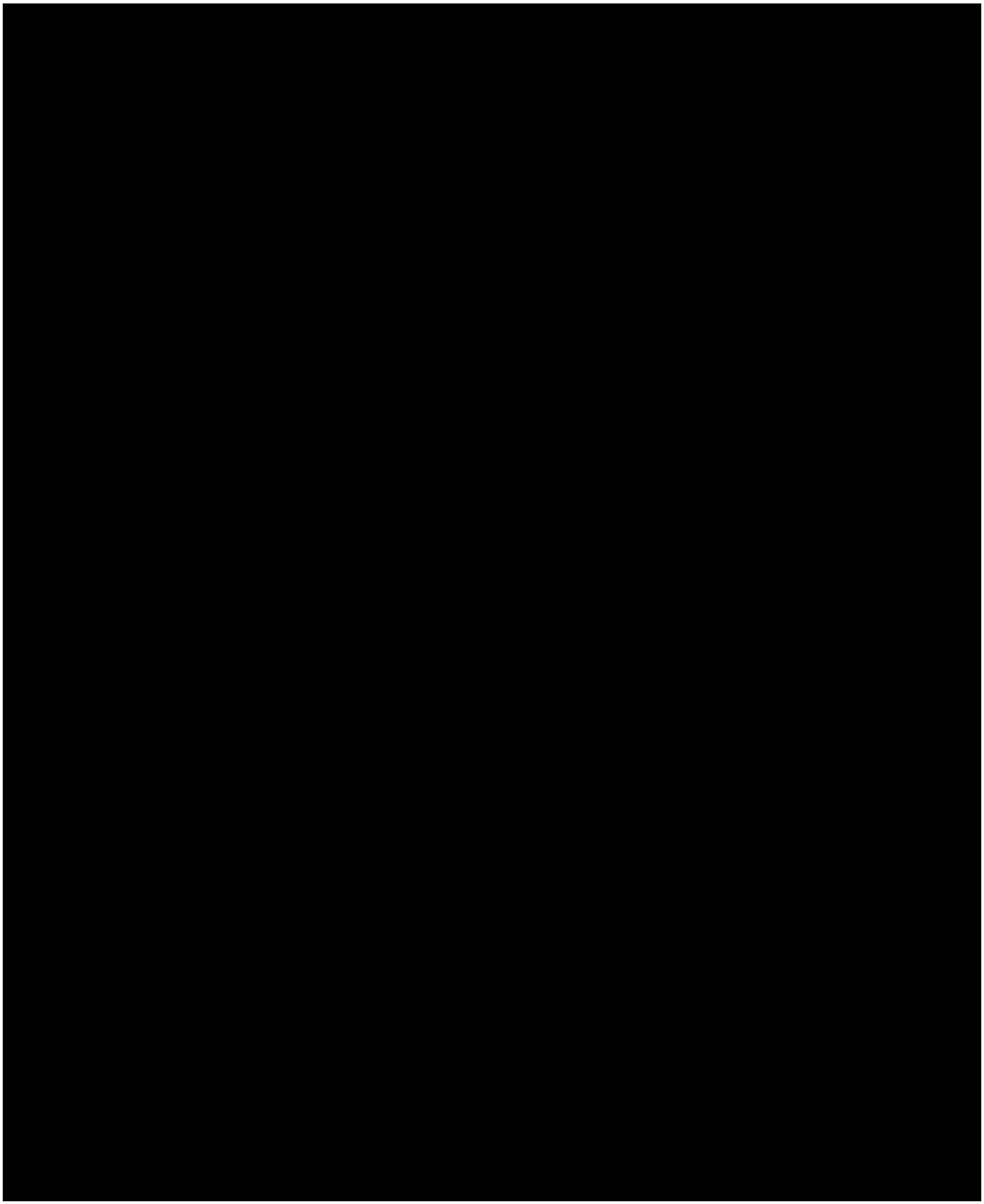
Invalidity Claim Chart Against U.S. Patent No. 11,835,421 ("'421 Patent")
Based on the Revvo-Nuro Sensor

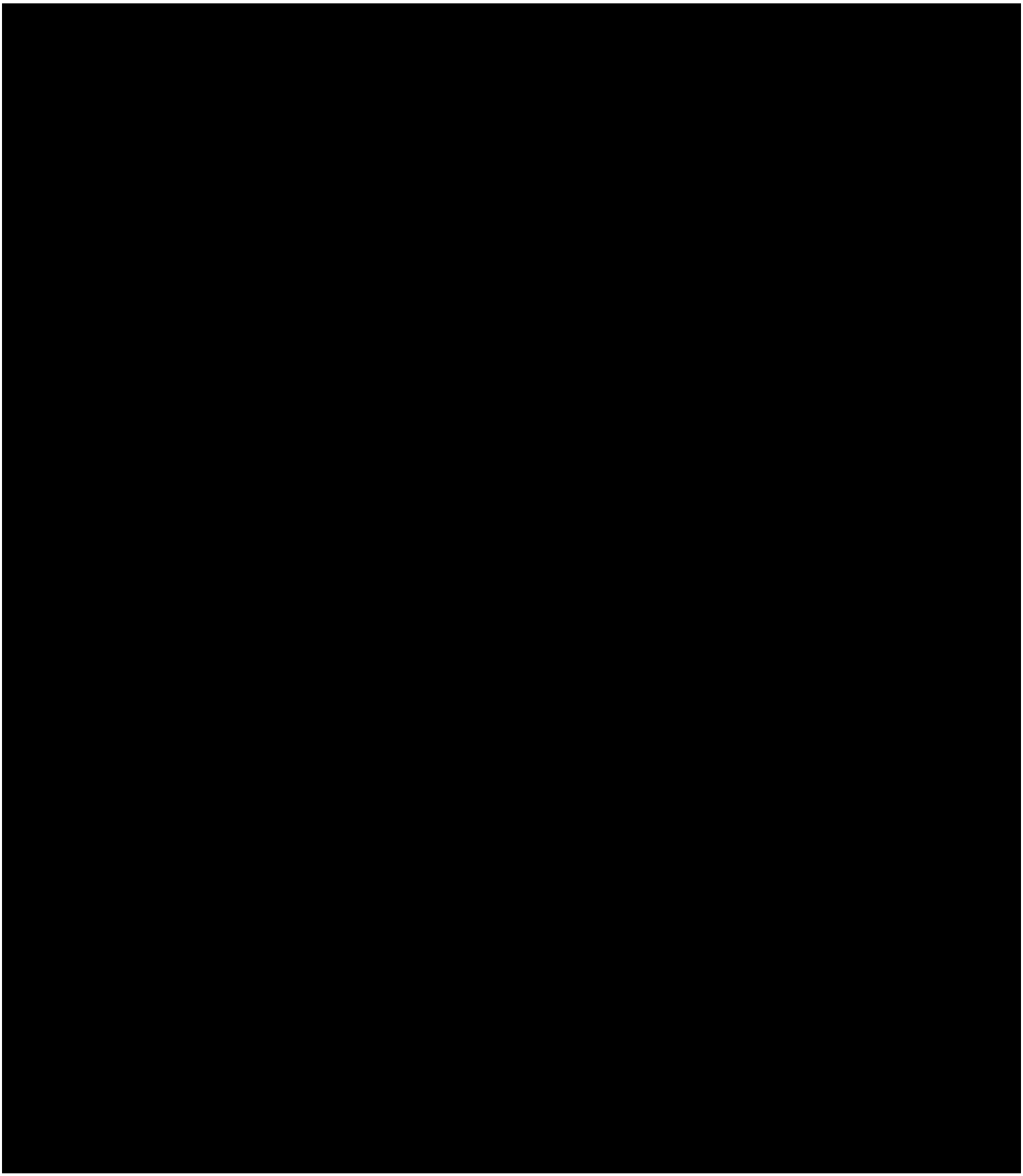


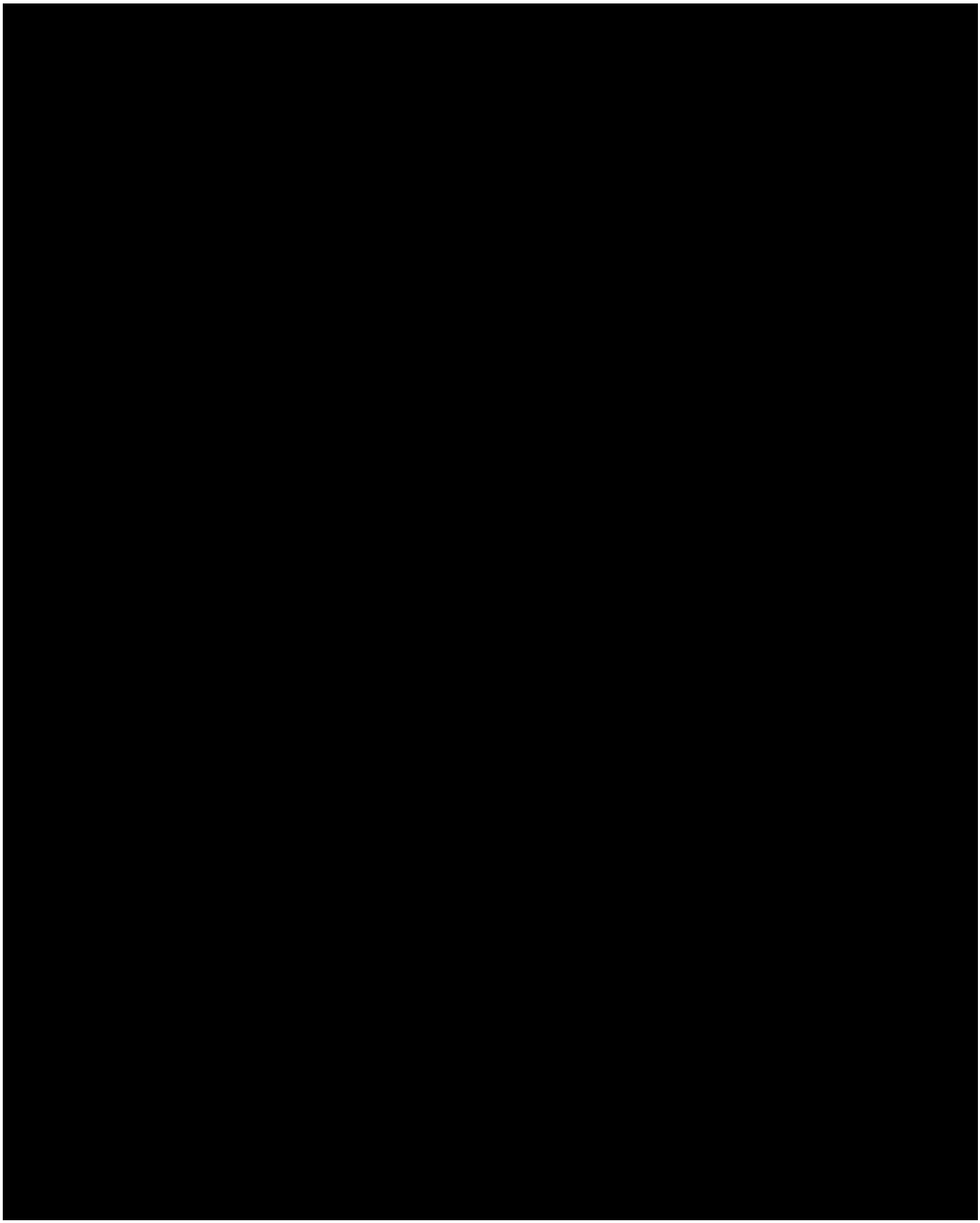


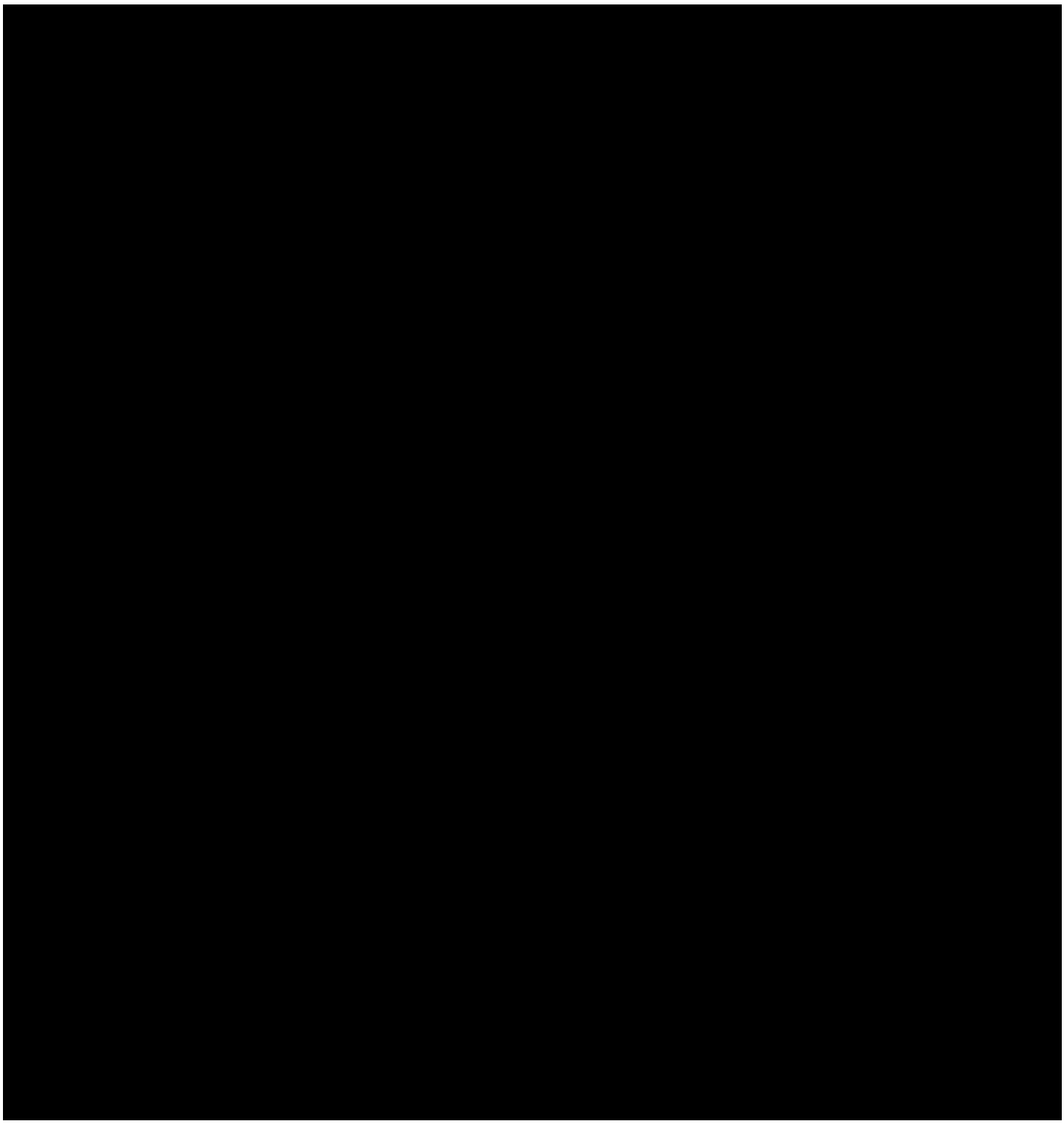


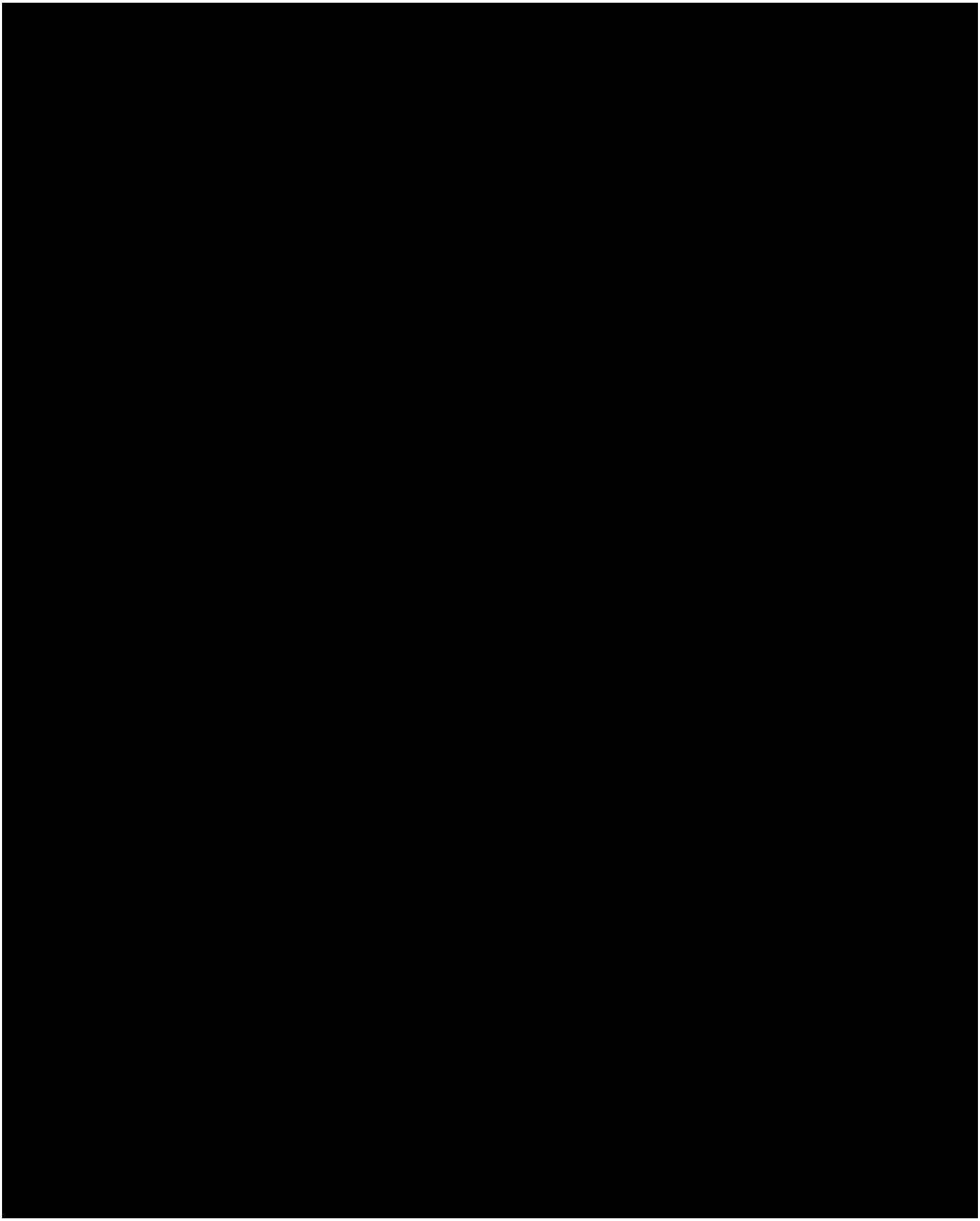


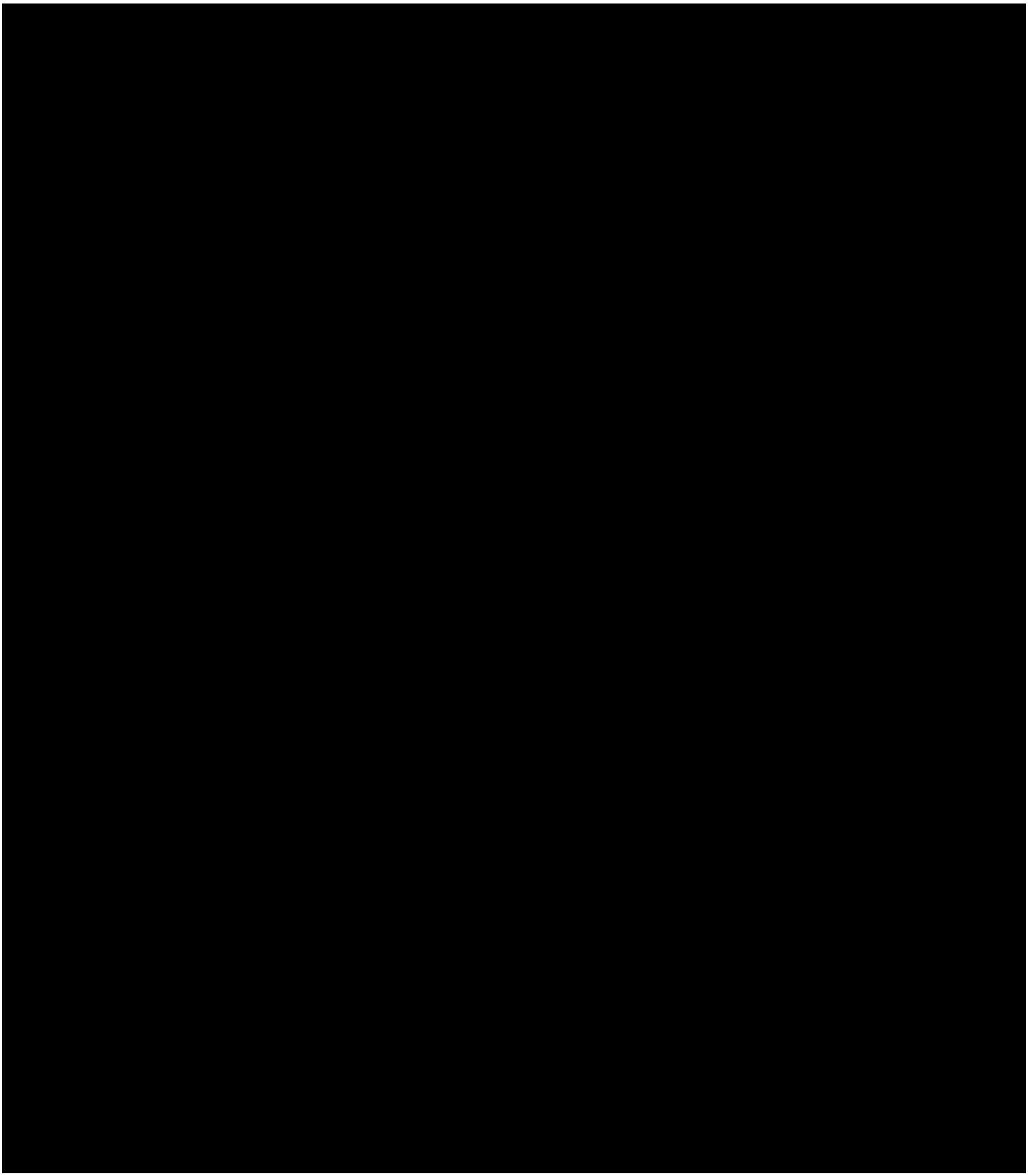


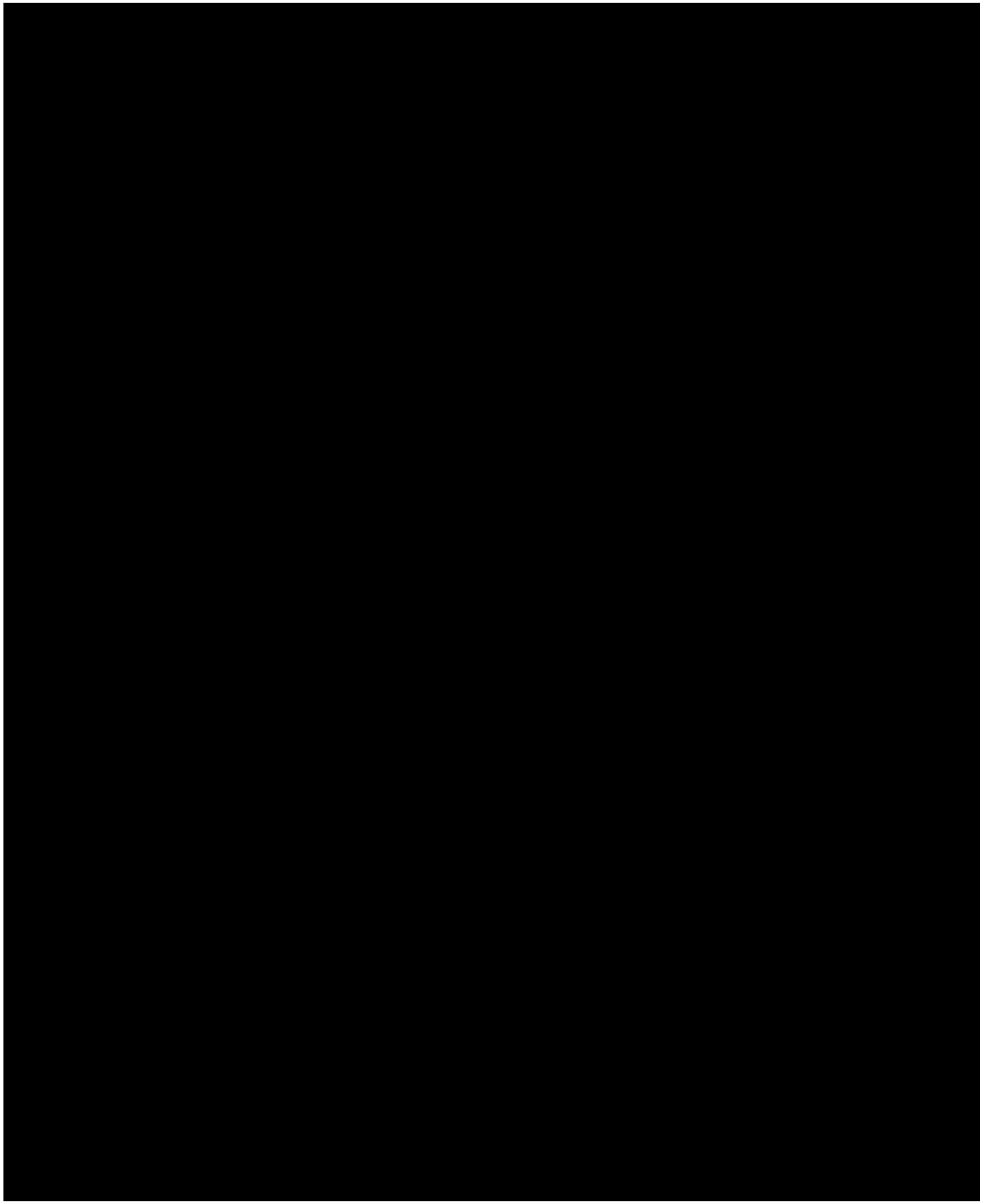


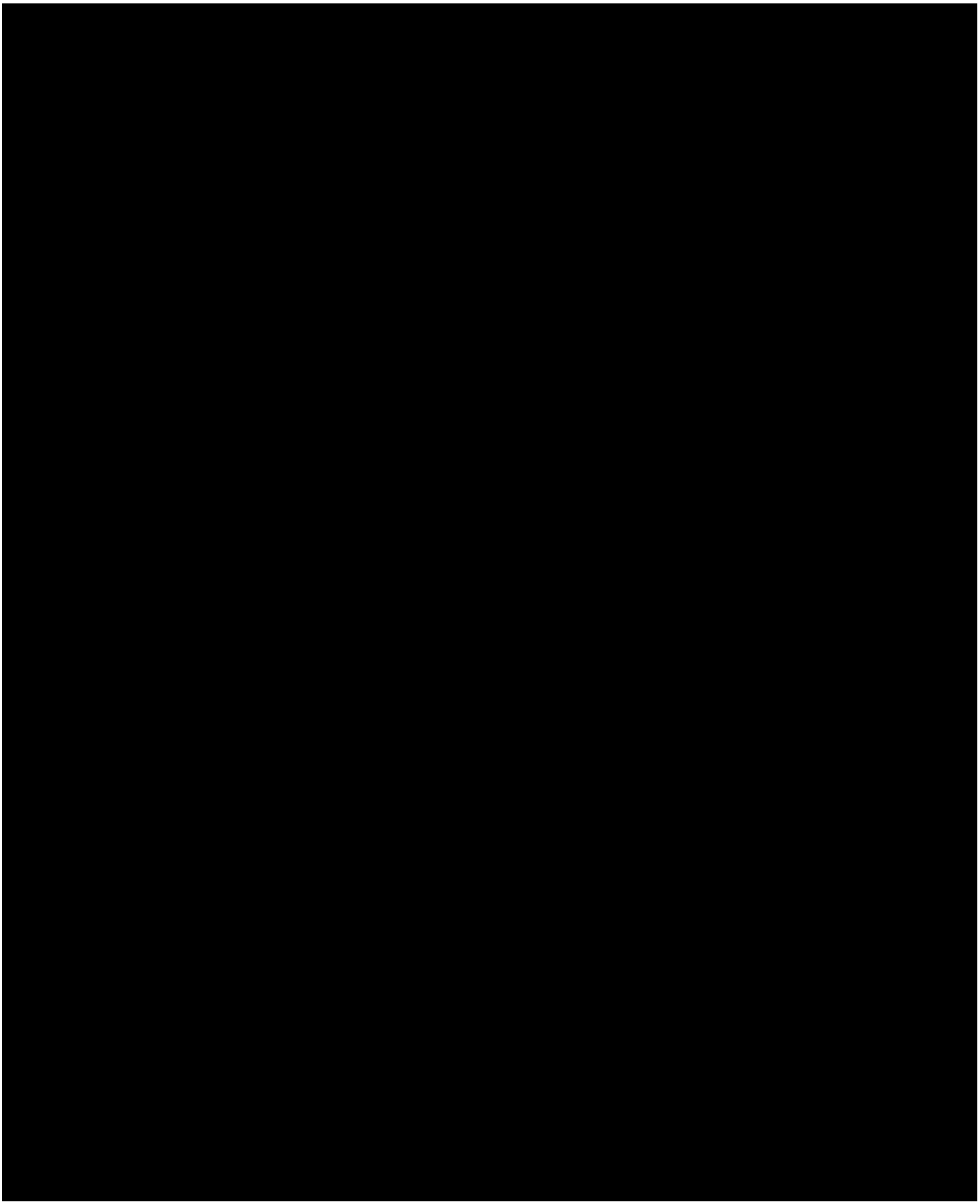


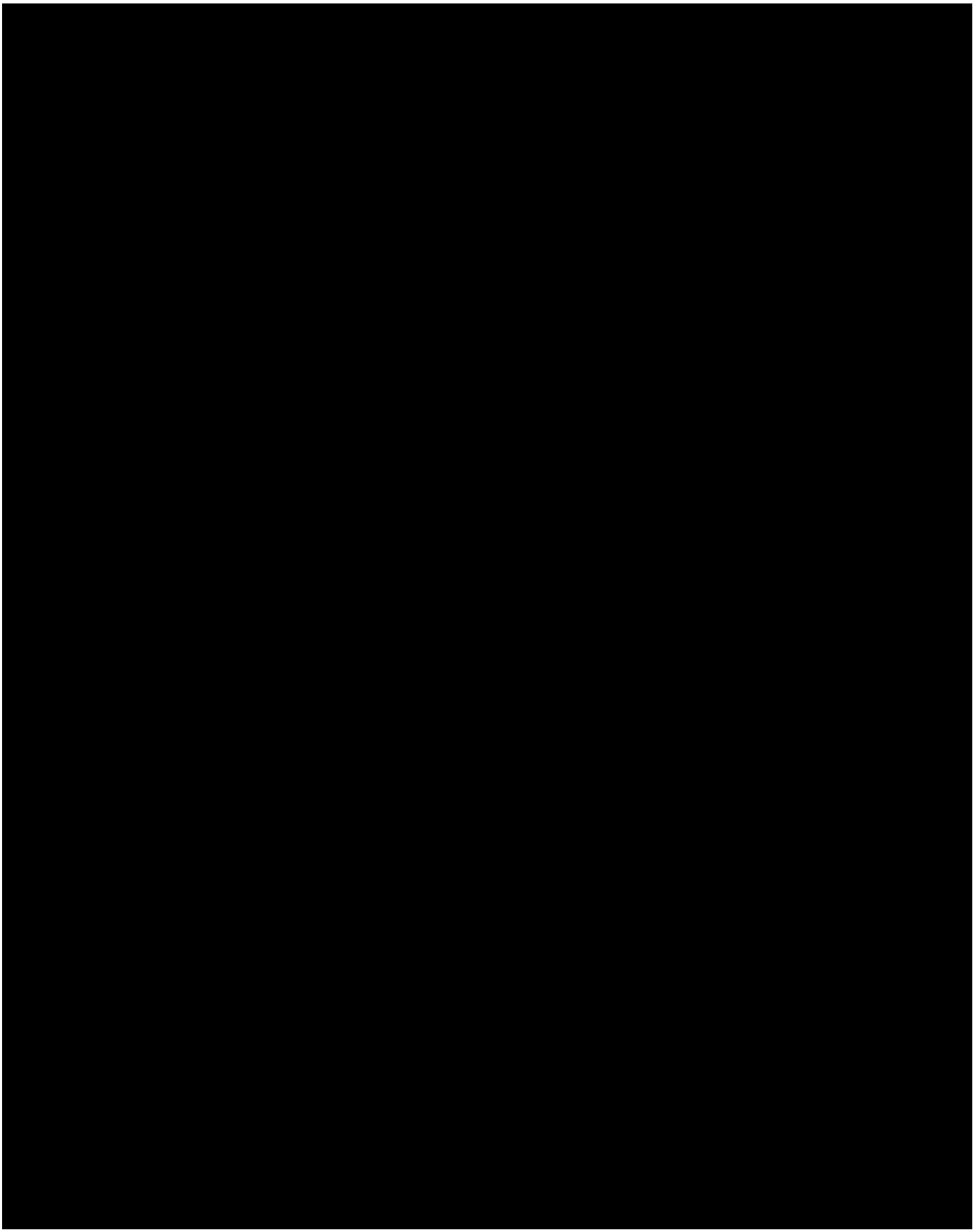


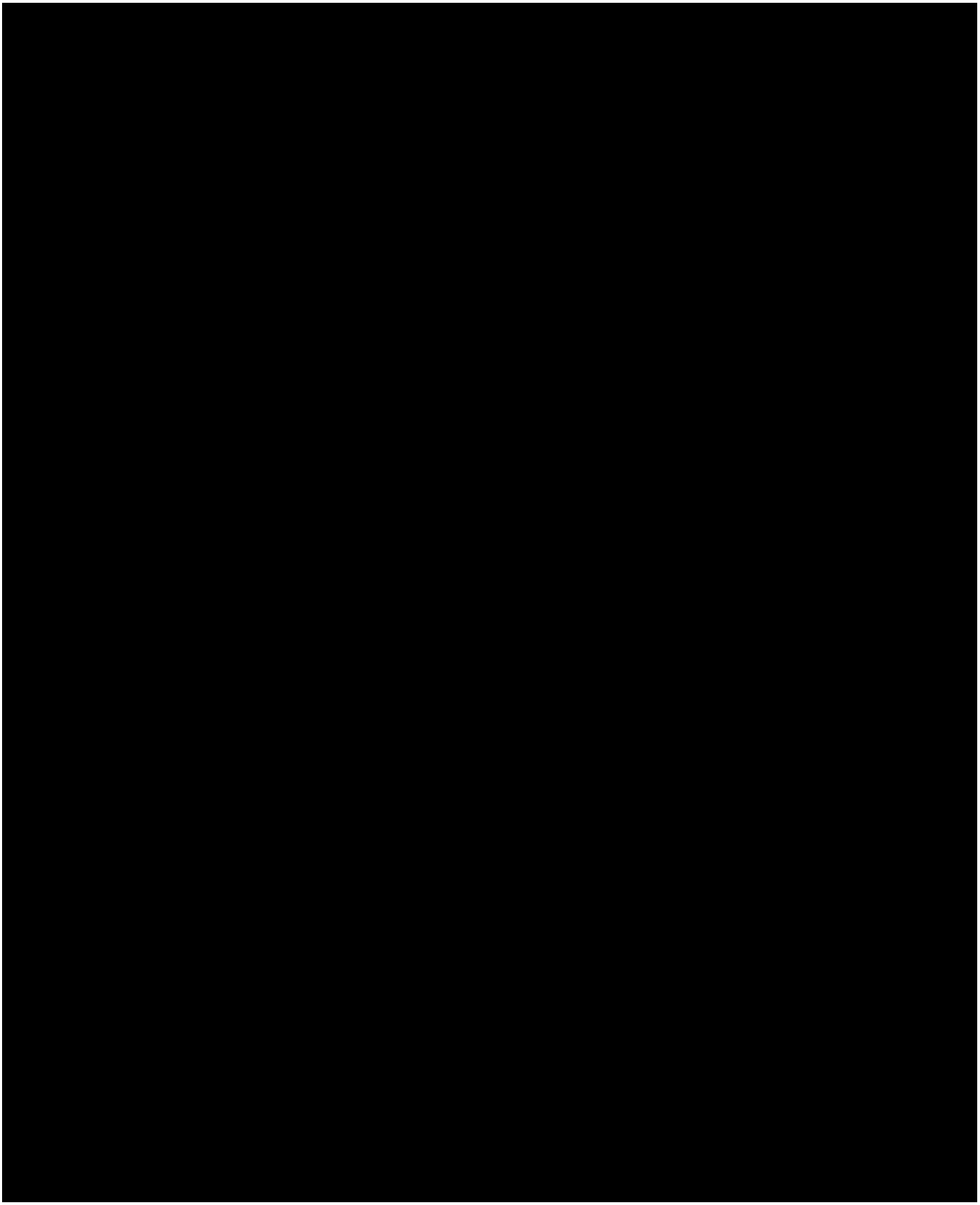


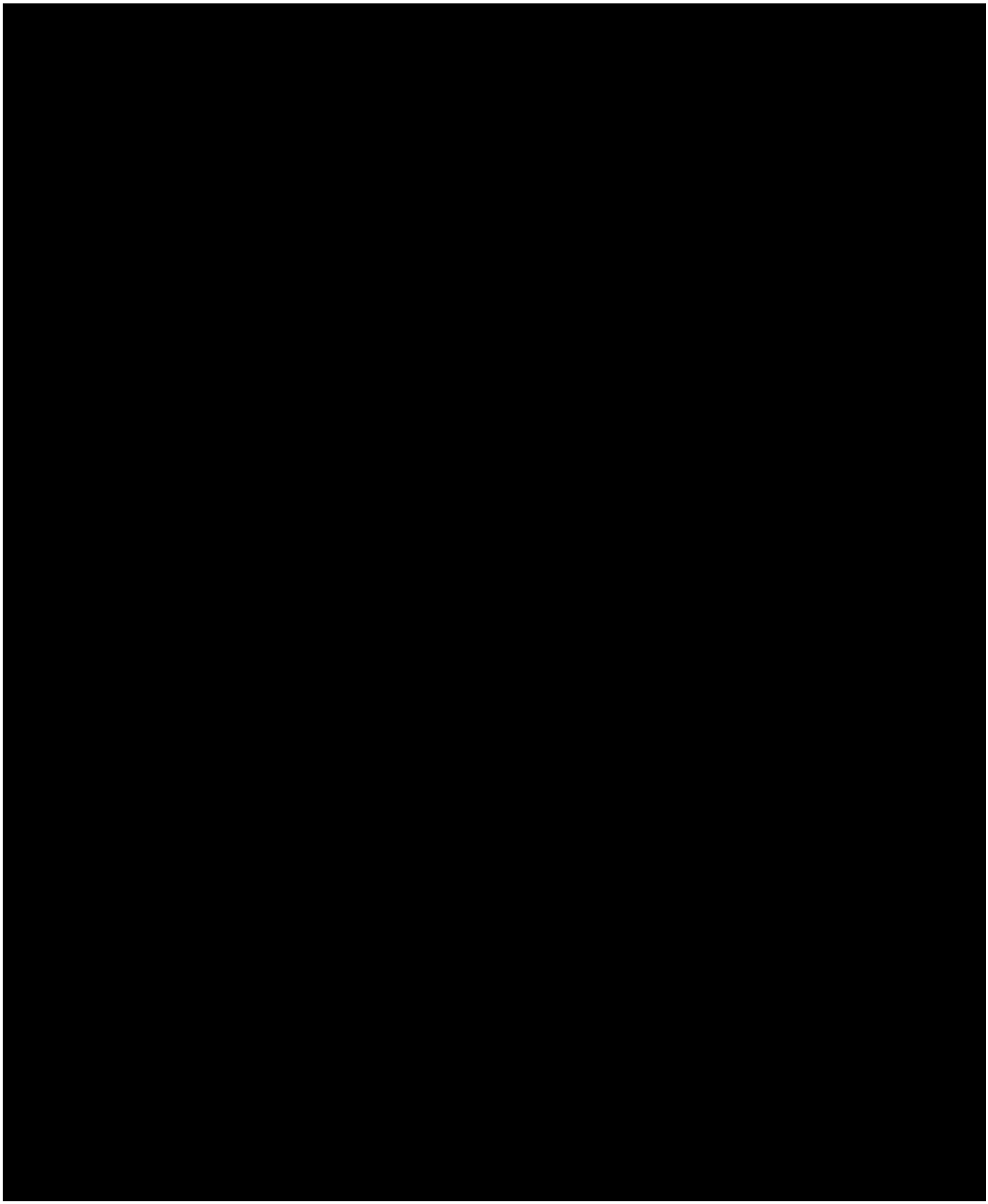


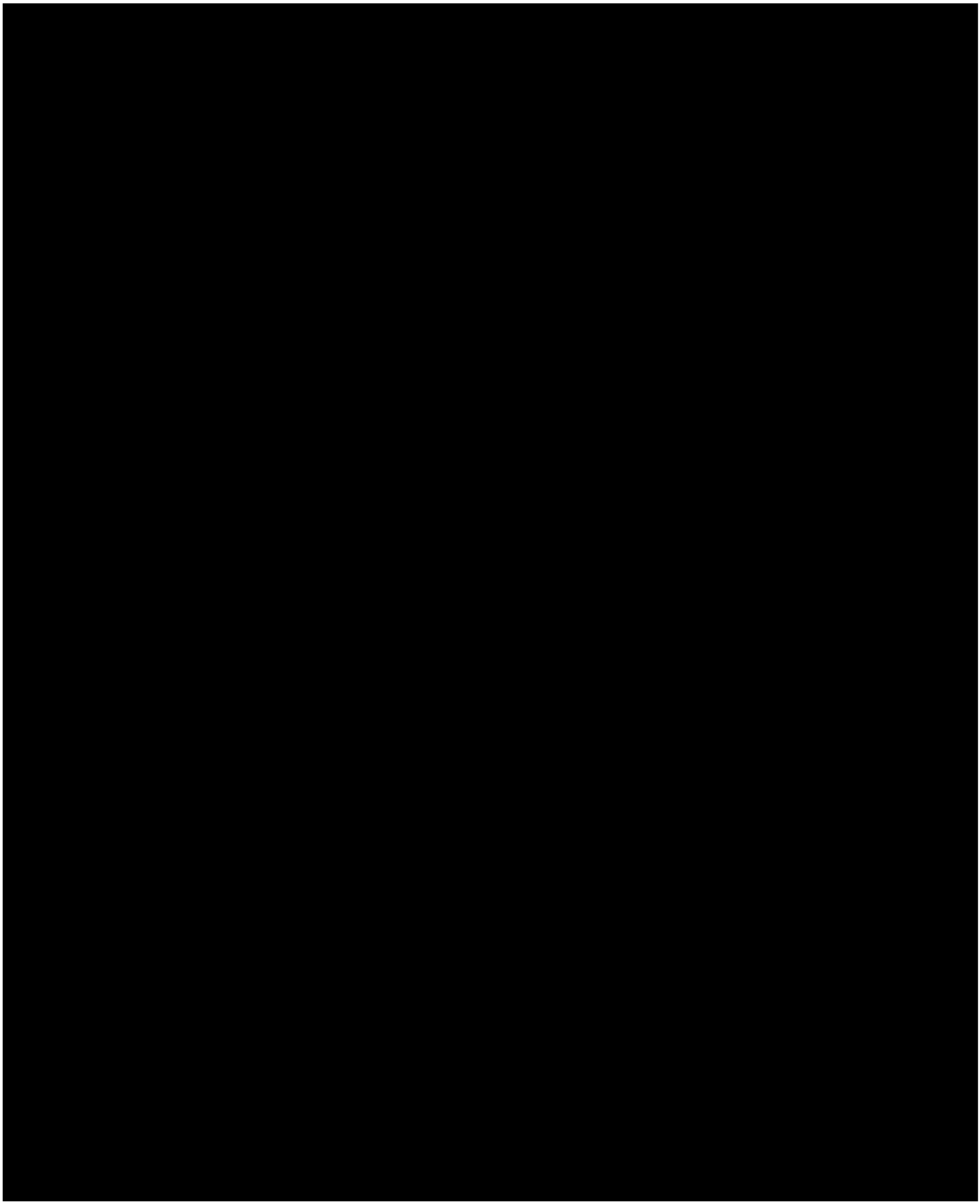


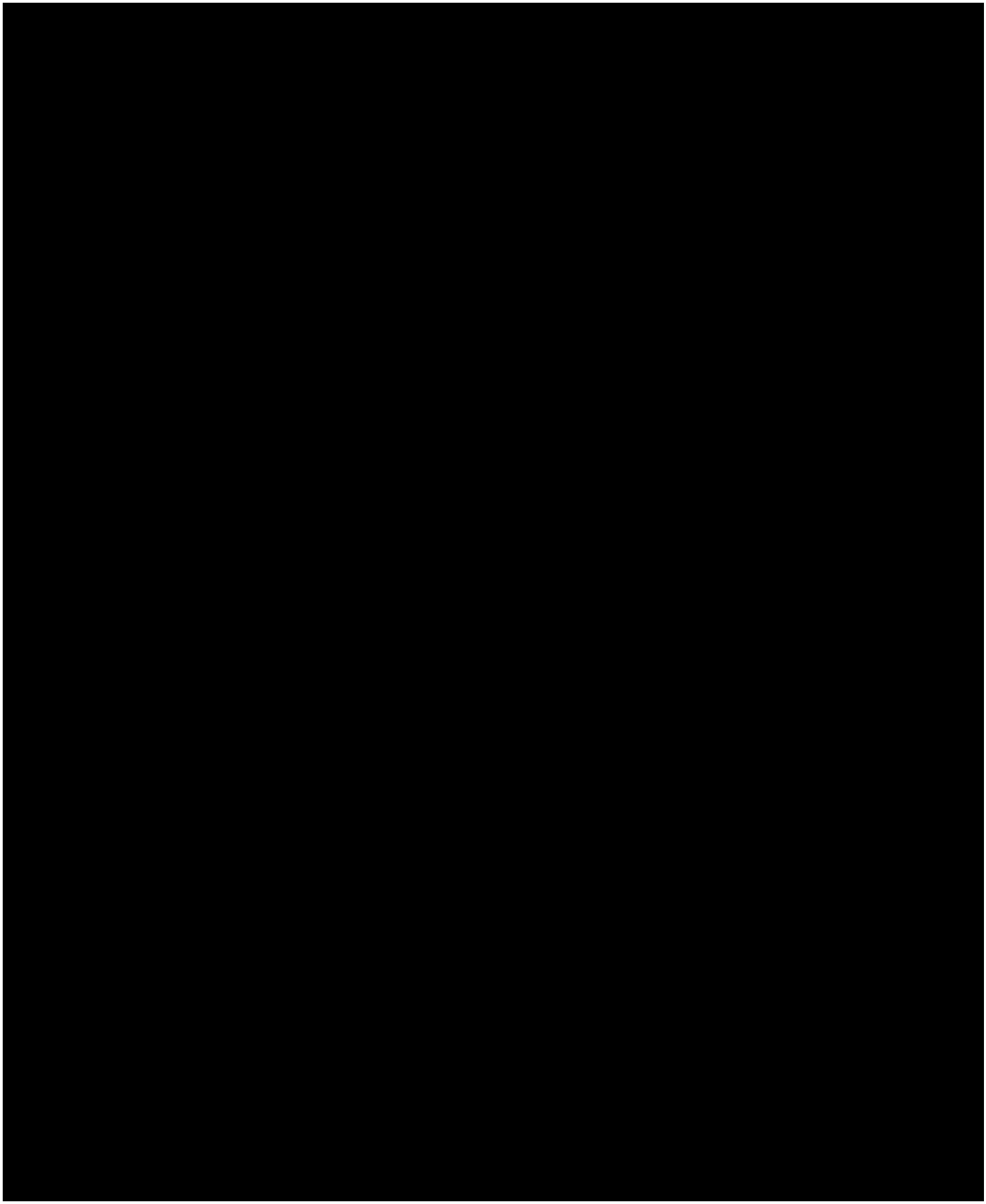


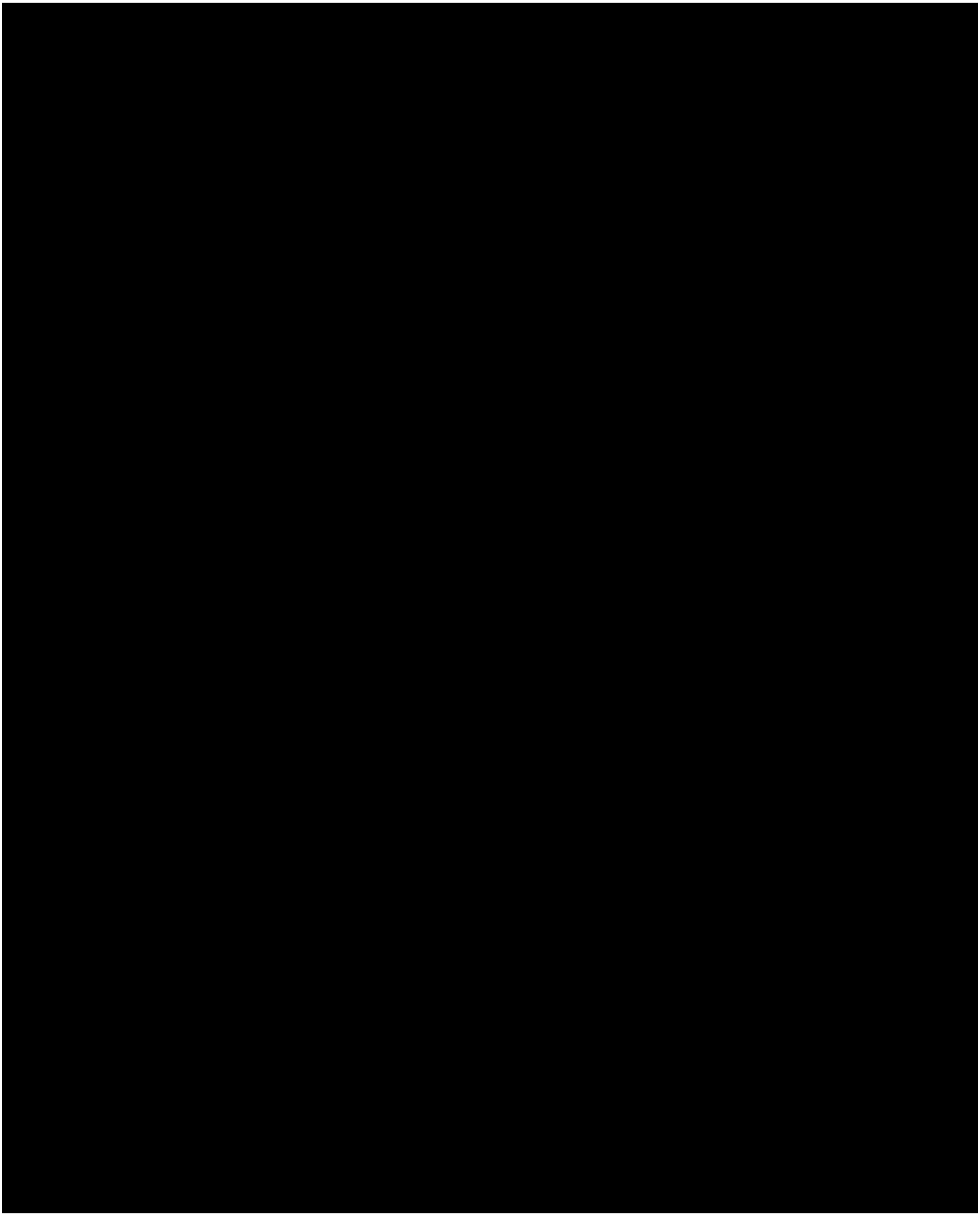


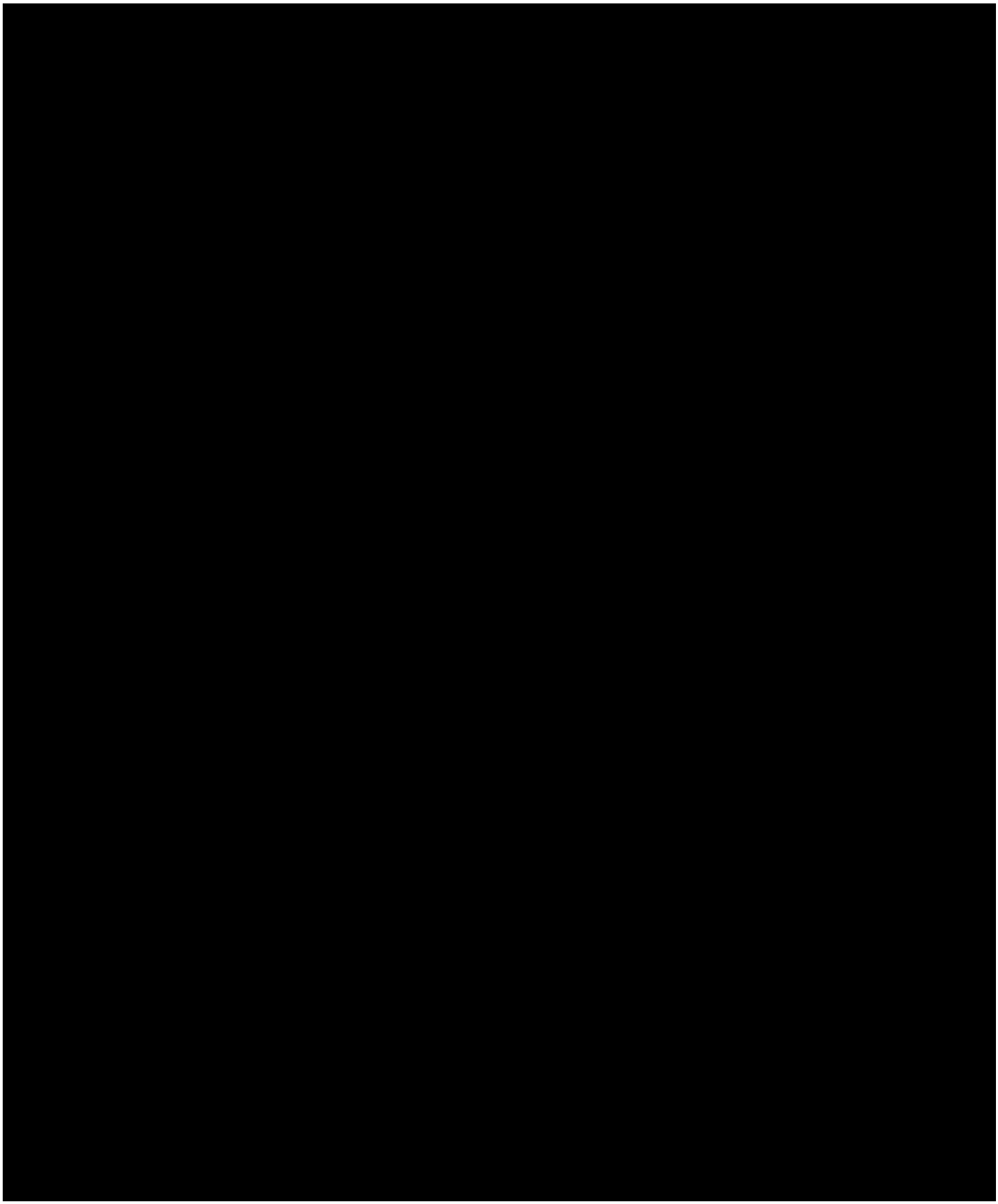


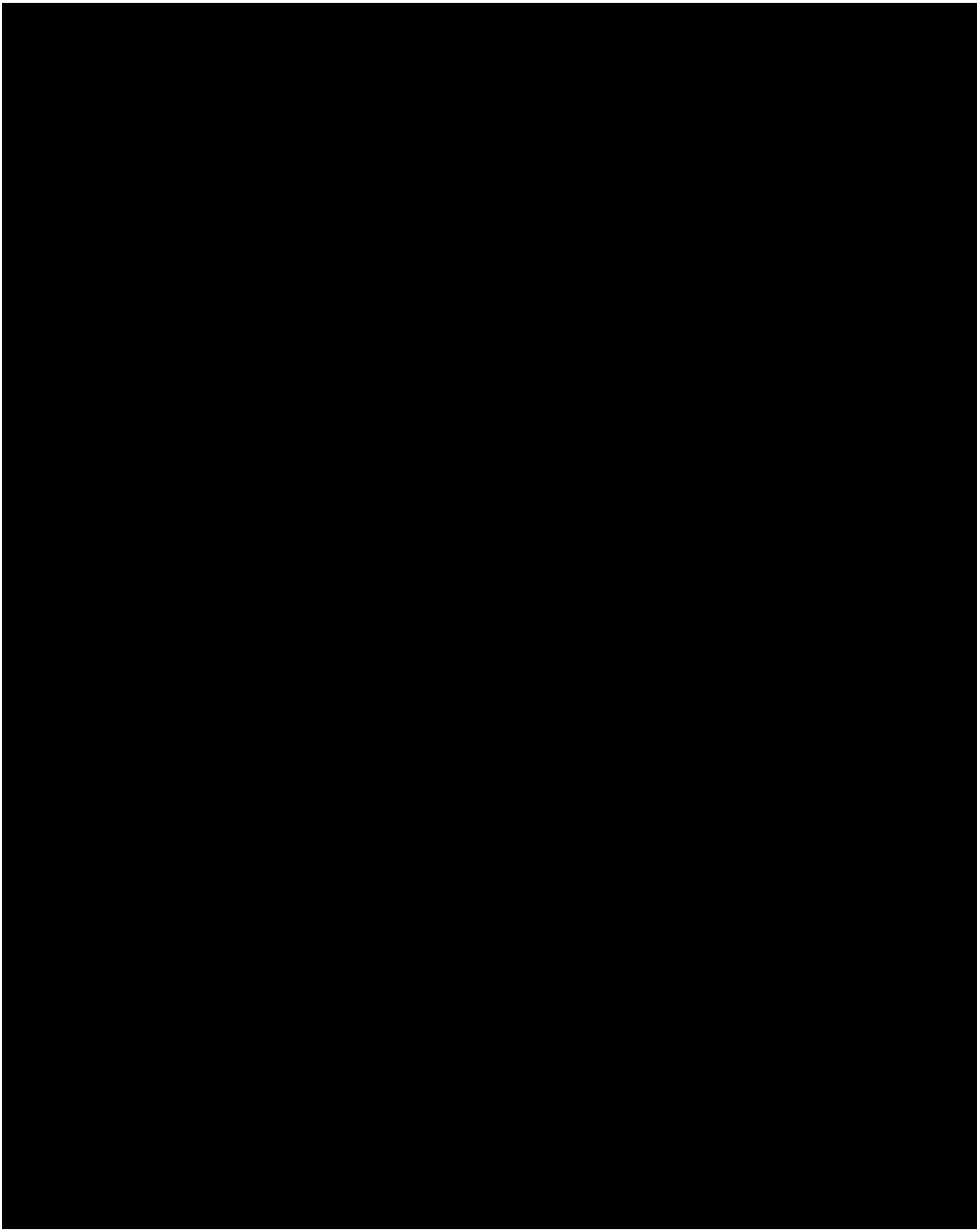


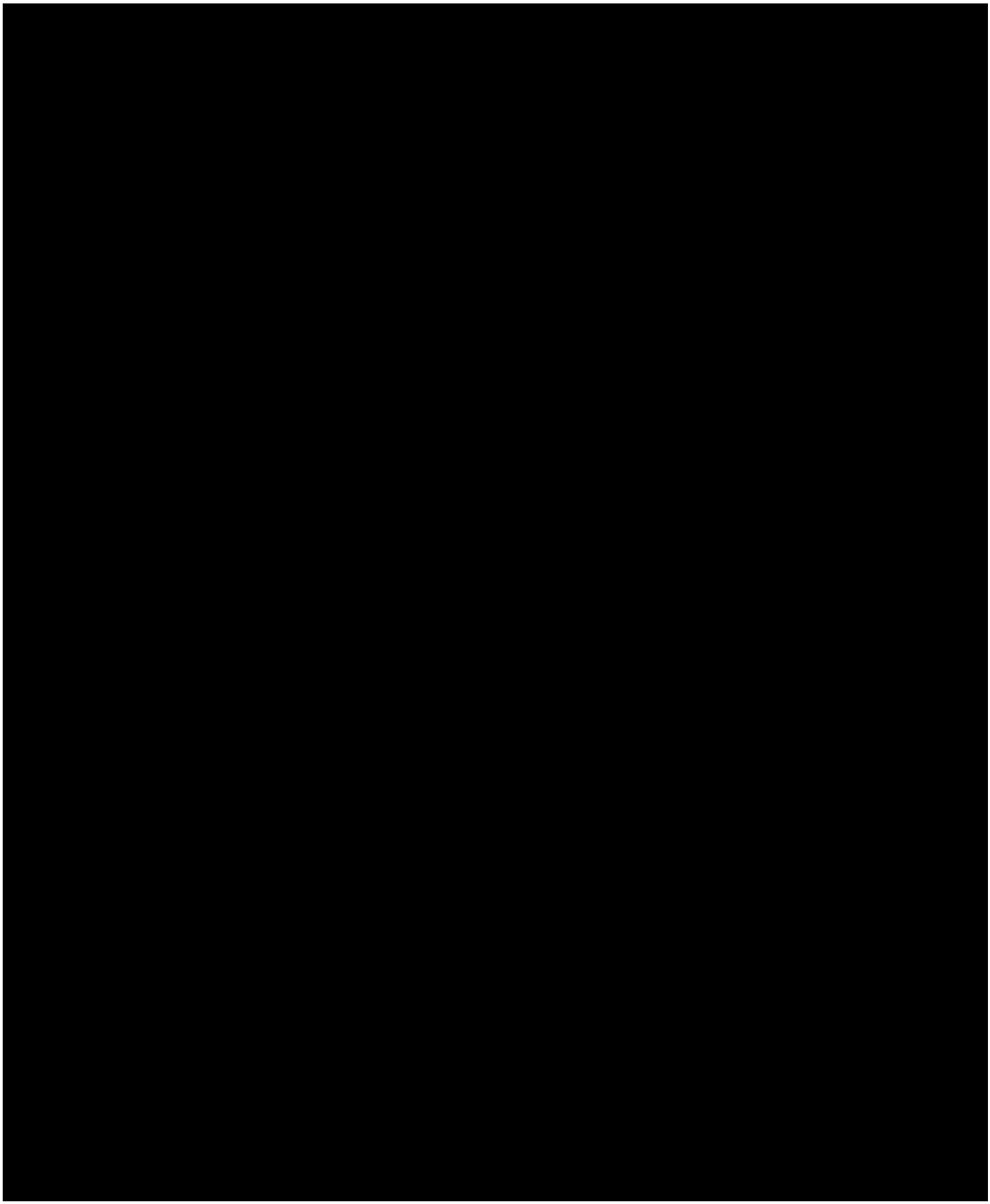


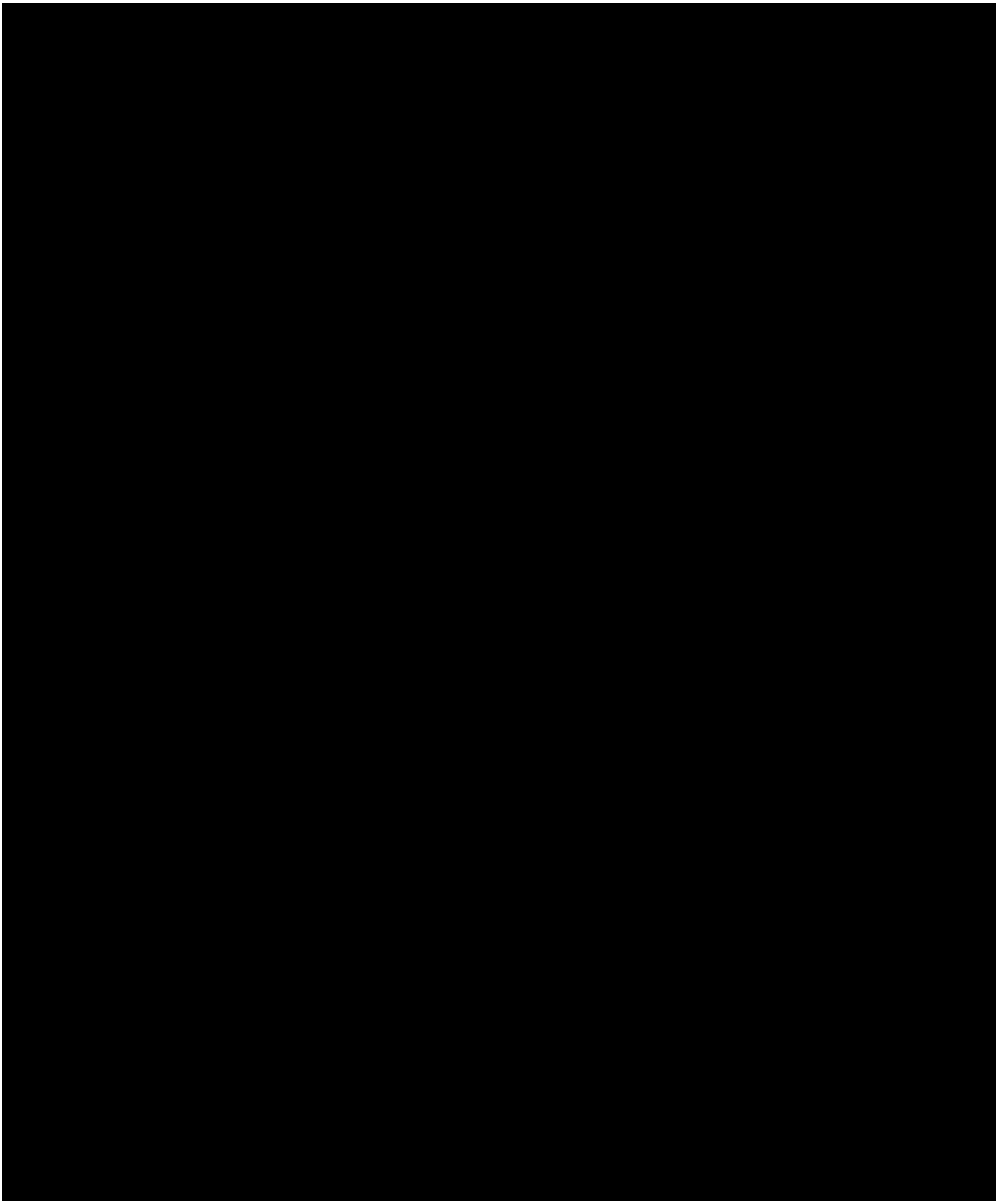


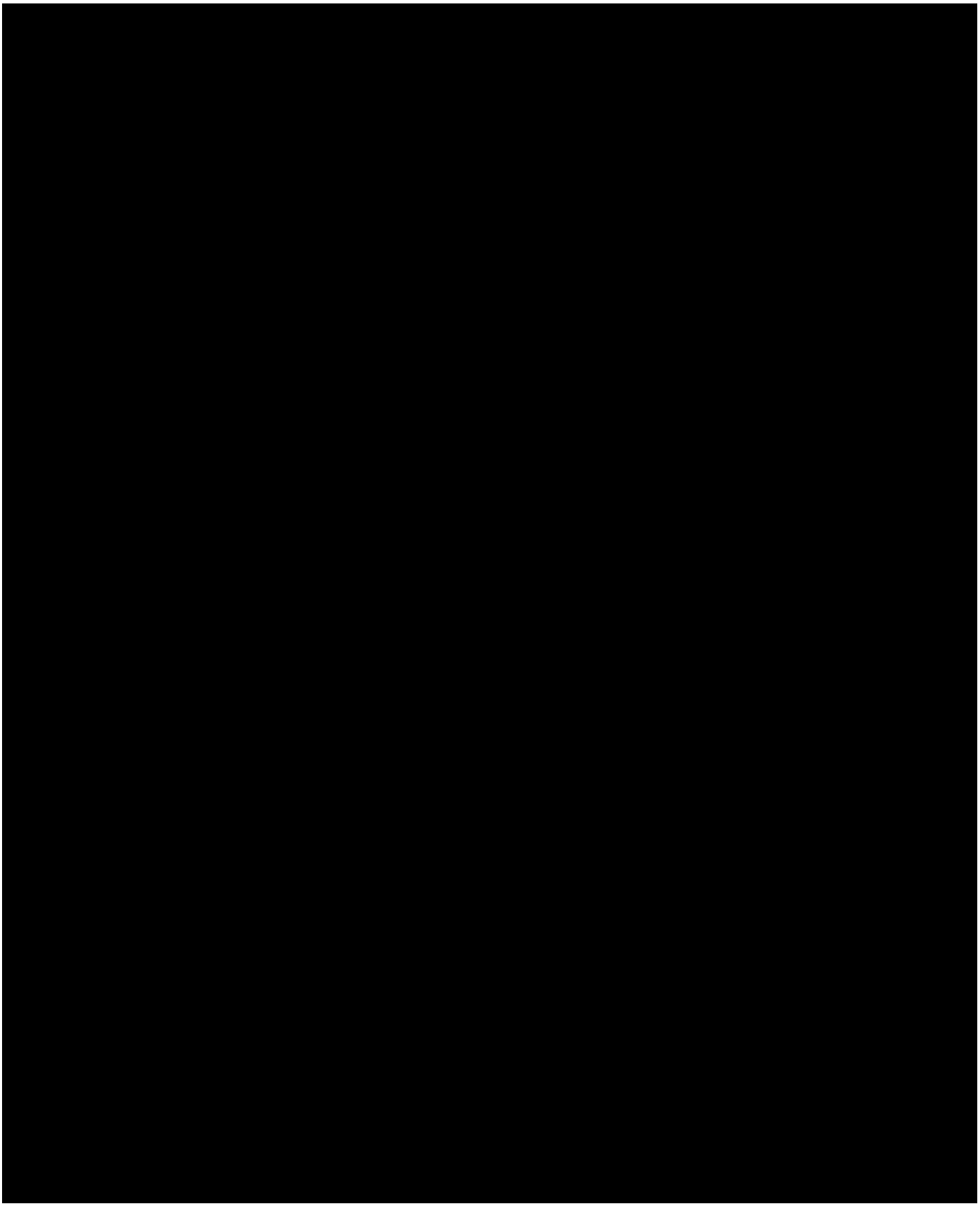














Invalidity Claim Chart Against U.S. Patent No. 11,835,421 ("'421 Patent")
Based on U.S. Patent Publ. No. 2021/0181063 ("Dodani-063")

U.S. Patent Publ. No. 2021/0181063 ("Dodani-063") was a national stage entry of PCT/US2019/046133, which was filed on August 12, 2019 and further derives priority to provisional application No. 62/717,887, filed on August 12, 2018. Dodani-063 qualifies as prior art under at least 35 U.S.C. § 102. Dodani-063 anticipates and/or renders obvious the Asserted Claims of the '421 Patent (at least as Revvo understands Plaintiff's application of the Asserted Claims in an effort to show infringement).

To the extent Plaintiff argues that any element below is not disclosed by Dodani-063, a person of ordinary skill in the art would have found it obvious to combine the teachings of Dodani-063 with the background knowledge of a person of ordinary skill in the art and/or the additional references and exemplary teachings set forth in the chart below, to arrive at the claim limitation with a reasonable expectation of success. The chart below provides representative examples of where each element of each claim is found within Dodani-063. Citations are meant to be exemplary, not exhaustive, and Revvo reserves the right to identify and discuss additional portions of the reference in support of its contentions and/or to rebut arguments made by Plaintiff. Citations to figures, drawings, tables, and the link include reference to any accompanying or related text. All internal cross-references are meant to incorporate the cross-referenced material as if fully set forth therein.

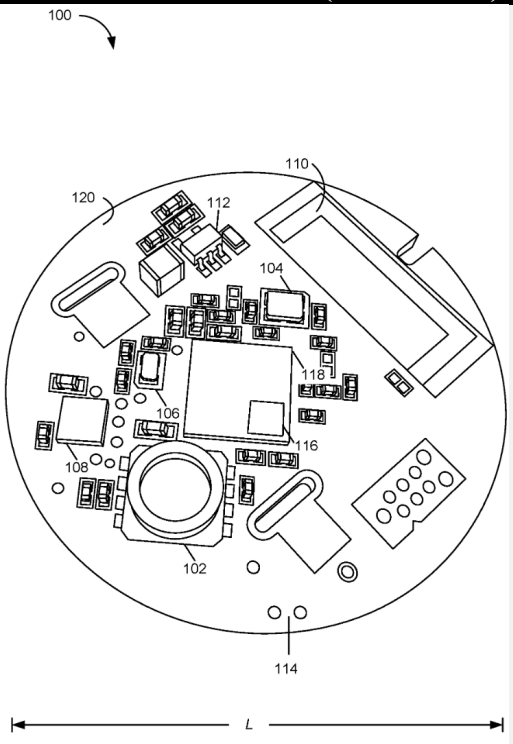
It is Revvo's position that Plaintiff's October 30, 2024 Infringement Contentions have not established that any accused product or service infringes any valid claim. Thus, Revvo's statements below should not be treated as an admission, implication, or suggestion that Revvo agrees with Plaintiff regarding either the scope, construction, or interpretation of any of the Asserted Claims or the infringement theories advanced by Plaintiff in its Infringement Contentions, including whether any Asserted Claim satisfies 35 U.S.C. §§ 101 or 112. In certain cases, Revvo has specified non-limiting examples of where its application of the prior art is based on Plaintiff's apparent application of the claim element. These statements are not intended to suggest that Revvo agrees with Plaintiff's application of any claim element, suggest a proposed construction at this stage of the case, or suggest that construction is needed, as the parties are not required to exchange terms for construction or propose claim constructions until a later date.

Plaintiff has yet to identify any limitation of the Asserted Claims that it contends is not anticipated and/or rendered obvious by Dodani-063. Revvo therefore expressly reserves the right to respond to any such contention, including by identifying additional obviousness combinations, if Plaintiff makes any such contention.

Where Revvo states that Dodani-063 "discloses" a limitation, that disclosure may be express, implicit, and/or inherent.

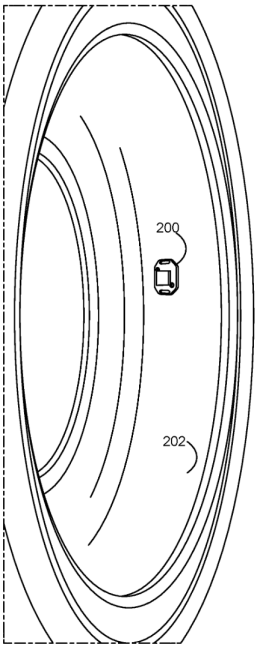
'421 Claim Element	Disclosures from Prior Art (Dodani-063)
1[pre]. A sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising:	*To the extent that the preamble is limiting, Dodani-063 discloses, teaches, and/or suggests a sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising. For example:* **Abstract** A tire sensor device for monitoring a condition of a tire includes a plurality of sensors including a temperature sensor and an accelerometer. The tire sensing device further includes memory configured to store data received by the plurality of sensors and one or more processors coupled with the memory. The one or more processors are configured to perform one or more initial processing operations on the data received by the plurality of sensors. The tire sensor device further includes an antenna, coupled with the one or more processors, configured to wirelessly communicate with one or more external devices. **[0002]** The disclosed embodiments relate generally to a tire sensor device for determining driving conditions and tire degradation, and more specifically to a tire sensor device adapted to be disposed on the inner surface of a tire tread. **[0005]** The present disclosure provides a tire sensor device for monitoring a condition of a tire. The tire sensor device includes a plurality of sensors including, optionally, a microphone, a temperature sensor, and an accelerometer. The tire sensor device further includes memory configured to store data (e.g., measurements) received by the plurality of sensors. The tire sensor device further includes a microprocessor coupled with the memory. The microprocessor is configured to perform one or more initial processing operations on the data received by the plurality of sensors. The one or more initial processing operations include determining one or more tire characteristics using data from the plurality of sensors acquired at a frequency greater than a frequency of rotation of the tire. The tire sensor device further includes an antenna, coupled with the microprocessor, configured to wirelessly communicate with one or more external devices (note, however, that the antenna may be separate from and communicatively coupled with the tire sensor device). The tire sensor device has dimensions less than 5 cm×5 cm×2 cm. **[0007]** Further, the present disclosure provides a method of alerting a user to changes in tire characteristics. The method includes receiving data from a plurality of sensors disposed within a tire. The plurality of sensors include, optionally, a microphone,

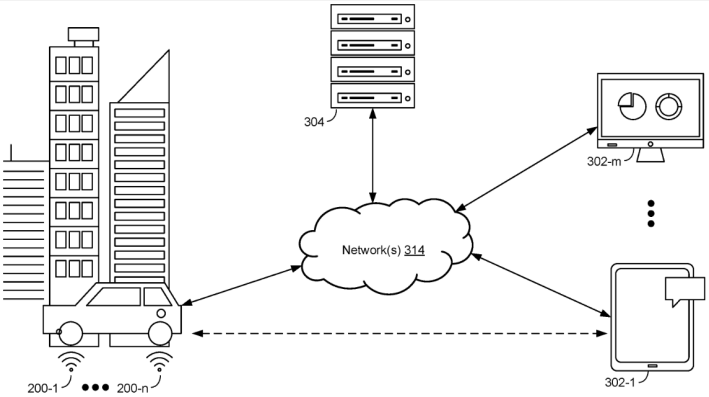
’421 Claim Element	Disclosures from Prior Art (Dodani-063)
	a temperature sensor, and an accelerometer. The data from the plurality of sensors are acquired at a frequency greater than a frequency of rotation of the tire. The method includes determining one or more characteristics of the tire using the data from the plurality of sensors acquired at a frequency greater than a frequency of rotation of the tire, the one or more characteristics of the tire selected from the group consisting of: a wheel misalignment; a slow leak; a puncture; rubber decay; low tread depth; excessive load; and a mileage limit exceeded. The method further includes providing a user alert indicating the one or more characteristics of the tire. **[00082]** Further, the present disclosure provides a method of monitoring tire conditions for a plurality of vehicles (e.g., a fleet of vehicles). The method includes receiving information from the plurality of vehicles indicating presence or absence of a plurality of tire conditions, including one or more tire conditions selected from the group consisting of: wheel misalignment; a slow leak; a puncture; rubber decay; low tread depth; excessive load; and a mileage limit exceeded. The method further includes displaying a dashboard summary of the one or more tire conditions for the plurality of vehicles. **[0012]** FIG. 1 is an illustration of a sensor board of a tire sensor device, in accordance with some embodiments.

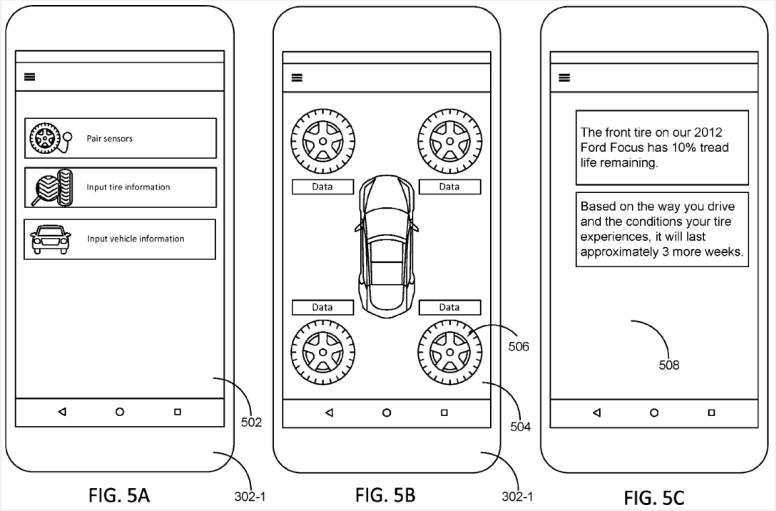
'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	 FIG. 1 **[0028]** FIG. 1 is an illustration of a sensor board **100** of a tire sensor device, in accordance with some embodiments. The sensor board **100** has several components, including but not limited to a pressure sensor **102**, a microphone **104**, a temperature sensor **106**, an accelerometer **108**, an antenna **110**, a voltage regulator **112**, an analog input **114**, memory **116**, and one or more processors **118**. The various sensors are configured to collect data and supply the data to the memory **116** and/or one or more processors **118**. In some embodiments, the several components including the various sensors are affixed to a common (i.e., the same) polychlorinated biphenyl (PCB) board **120** (e.g., the various sensors have a fixed position with respect to one another). In some embodiments, the PCB board **120** has printed thereon wires to connect the several components to one another. Note that, in various embodiments, any of the aforementioned sensors may be omitted. For example, in some embodiments, sensor board **100**, or a tire sensor device that includes sensor board **100**, does not include a microphone, does not includes a temperature sensors, and/or does not include an accelerometer. **[0031]** In some embodiments, the pressure sensor **102** is adapted to capture and/or measure the pressure of a tire to which the sensor board **100** is affixed. For example, the pressure sensor **102** may

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	be part number MS580305BA01-00 (MS5803-05BA), manufactured by TE CONNECTIVITY. **[0033]** In some embodiments, the temperature sensor **106** is adapted to measure temperature variation within and/or proximate to the tire, for example, as the tire is driven on a road surface. For example, the temperature sensor **106** may be part number TMP102-Q1, manufactured by TEXAS INSTRUMENTS. **[0034]** In some embodiments, the accelerometer **108** is adapted to detect and/or measure changes in the motion of the tire, for example, as the tire is driven on a road surface. For example, the accelerometer **108** may be part number ADXL372, manufactured by ANALOG DEVICES. In some embodiments, the accelerometer has a sampling rate of at least 3000 Hertz (Hz) (or 4000 Hz or 5000 Hz). In some embodiments, the accelerometer **108** has a sampling rate of 6400 Hz. In some embodiments, the accelerometer **108** has a sampling rate sufficient to acquire data (e.g., measurements) at a frequency greater than a frequency of rotation of the tire (e.g., at a predefined speed and for a predefined tire size and/or predefined circumference). For example, in some embodiments, the tire sensor device is adapted to operate (e.g., acquire multiple samples per wheel rotation) at speeds up to 120 miles per hour (mph) in a P215/60R16 tire. **[0035]** In some embodiments, the antenna **110** (e.g., a radio frequency (RF) antenna) is adapted to transmit data from the sensor board. For example, the antenna may be a printed on-board antenna. In some embodiments, the antenna **110** is adapted to communicate in an industrial, scientific and medical (ISM) radio band. In some embodiments, as described in greater detail with reference to FIGS. 7A-7C and FIG. 8, the antenna **110** is adapted to communicate over a plurality of bands (e.g., the antenna **110** is a multi-mode antenna). In some embodiments, the antenna **110** is adapted to communicate over BLUETOOTH (e.g., in a 2.4 GHz band). In some embodiments, antenna **110** is adapted to communicate over a 900 MHz Global System for Mobile Communications (GSM) band. In some embodiments, antenna **110** is adapted to communicate over a 415 MHz ISM band. In some embodiments, antenna **110** is an integral part of the tire sensor devices described herein (e.g., tire sensor device **200**, FIG. 2). In some embodiments, an antenna is separate from and communicatively coupled to the tire sensor devices described herein.

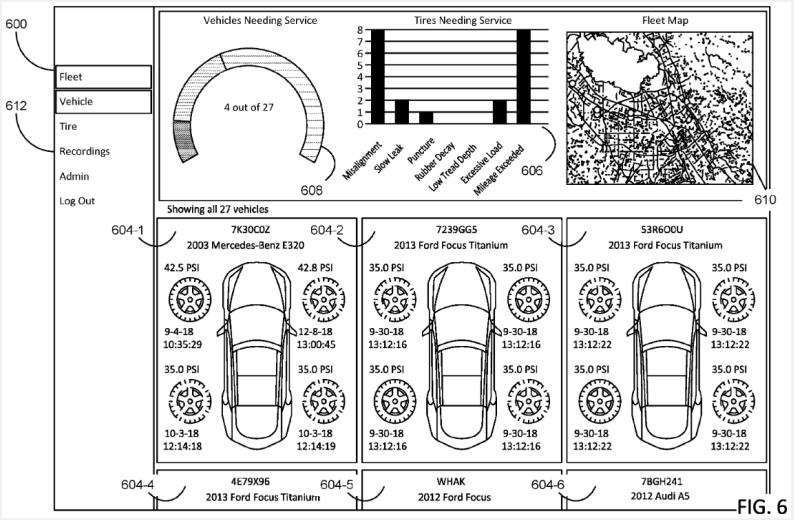
'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	[0038] In some embodiments, the one or more processors **118** are adapted to analyze data stored in the memory **116** and/or received from one or more of the sensors on the sensor board. In some embodiments, the one or more processors **118** comprise one or more microprocessors (e.g., the microprocessor comprises one or more central processing units (CPUs) and/or general processing units (GPUs)). In some embodiments, the one or more processors **118** comprise one or more field programmable gate arrays (FPGAs). In some embodiments, the one or more processors **118** comprise one or more application specific integrated circuits (ASICs). In some embodiments, the one or more processors **118** are embodied as a system-on-chip (SoC) (e.g., part number nRF52832, or a similar part such as nRF52840, manufactured by NORDIC SEMICONDUCTOR). The nRF52832 is an ultra-low power multiprotocol SoC with hardware support on-chip for BLUETOOTH® 5. The nRF52832 may further includes near-field communication (NFC) capabilities. **[0039]** In some embodiments, memory **116** is adapted to store data captured and/or generated by one or more sensors on the sensor board **100**. In some embodiments, memory **116** includes high-speed random access memory, such as DRAM, SRAM, DDR RAM, or other random access solid-state memory devices; and may include non-volatile memory, such as one or more flash memory devices, or other non-volatile solid-state storage devices. Memory **116** optionally includes one or more storage devices remotely located from one or more processors **118**. Memory **116**, or, alternatively, the non-volatile solid-state memory device(s) within memory **116**, includes a non-transitory computer-readable storage medium. In some embodiments, memory **116** comprises flash memory. For example, the flash memory may be part number W25N01GVZEIG TR (W25N01GV), manufactured by WINBOND ELECTRONICS. In some embodiments, memory **116** is packaged with the one or more processors **118** (e.g., as a single microprocessor). **[0013]** FIGS. 2A-2B illustrate a tire sensor device disposed on an inner surface of a tire opposite a tread, in accordance with some embodiments.

’421 Claim Element	Disclosures from Prior Art (Dodani-063)
	 FIG. 2A **[0041]** FIGS. 2A-2B illustrate a tire sensor device **200** disposed on an inner surface of a tire **202** opposite a tread, in accordance with some embodiments. In some embodiments, the tire sensor device **200** has dimensions less than 5 cm (e.g., in width W)×5 cm (e.g., in length L)×2 cm (e.g., in height H above the inner surface of the tire **202**). In some embodiments, the tire sensor device **200** has dimensions less than 10 cm×10 cm×4 cm. In some embodiments, tire sensor device **200** incudes a plurality of sensors including a microphone, a temperature sensor, and an accelerometer (e.g., includes sensor board **100**, FIG. 1). In some embodiments, tire sensor device **200** is configured to operate (e.g., obtain measurements from the plurality of sensors) while tire **202** is in use (e.g., while the vehicle is moving and the tire is pressurized to a pressure above 30 pounds per square inch (psi)). **[0042]** As illustrated, the tire sensor device **200** is affixed to the inner surface of the tire. For example, the sensor may be affixed to the inner surface of the tire using an industrial strength epoxy. As a result, there is no need to modify the manufacturing process of the tire and no damage results from affixing the sensor module to the tire. The sensor module may be affixed to the tire in any other suitable, non-invasive manner. In some circumstances, the tire sensor device **200** is installed at the time of manufacture, although the tire sensor device **200** may also be installed at a later time. In some circumstances, the tire sensor device **200** is

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	mounted at a midline of the inner surface of the tire, opposite the tread, although tire sensor device **200** may be installed elsewhere. In addition, two or more tire sensor devices **200** may be installed on a single tire. In some embodiments, the tire sensor device **200** is installed with a particular alignment relative to the tire (e.g., a first predetermined axis of the tire sensor device **200** is installed in a direction aligned with a circumference of the tire, such that the tire sensor device **200**'s accelerometers are aligned along a known axis with respect to the tire). **[0043]** In some embodiments, the tire sensor device **200** is affixed to the inner surface of the tire through a tire sensor dock (e.g., tire sensor dock **1100**, FIGS. 11A-11B) **[0014]** FIG. 3 is a block diagram illustrating a tire monitoring system, in accordance with some embodiments.  FIG. 3 **[0047]** In some embodiments, electronic device **302-1** communicates directly with one or more tire sensor devices **200** (as illustrated by the dotted line connecting tire sensor devices **200** and electronic device **302-1**). For example, electronic device **302-1** is able to communicate directly (e.g., through a wired connection (e.g., analog input **114**, FIG. 1) and/or through a short-range wireless signal (e.g., using antenna **110**. FIG. 1), such as those associated with personal-area-network (e.g., BLUETOOTH/BLE) communication technologies, radio-frequency-based near-field communication technologies, infrared communication technologies, etc.) with a tire sensor device **200**. In some embodiments, electronic device **302-1** communicates with the tire sensor device **200** through network(s) **314**. In some embodiments,

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	electronic device **302-1** uses the direct connection with tire sensor device **200** to receive data from the plurality of sensors on the tire sensor device **200**. For example, electronic device **302-1** acts as a transceiver for data from the plurality of sensors on tire sensor device **200** and uploads the data to a tire monitoring server **304**. Alternatively, the tire sensor device may communicate with an onboard diagnostic (OBD) dongle (e.g., an OBD-II data dongle) on a vehicle or a vehicle modem, which acts as a transceiver for data from the plurality of sensors on tire sensor device **200** and uploads the data to a tire monitoring server **304**. **[0051]** In some embodiments, the electronic device **302** includes a location-detection device **440**, such as a global navigation satellite system (GNSS) (e.g., GPS (global positioning system), GLONASS, Galileo, BeiDou) or other geo-location receiver, and/or location-detection software for determining the location of the electronic device **302** (e.g., module for finding a position of the electronic device **302** using trilateration of measured signal strengths for nearby devices). **[0017]** FIGS. 5A-5C illustrate example user interfaces for providing information (e.g., user alerts) about tire characteristics and/or tire conditions for one or more vehicles, in accordance with some embodiments.  FIG. 5A FIG. 5B FIG. 5C **[0075]** FIGS. 5A-5C illustrate example user interfaces for providing information (e.g., user alerts) about tire characteristics and/or tire conditions for one or more vehicles, in accordance with some embodiments. In some embodiments, the user interfaces shown in FIGS. 5A-5C are displayed on a client device (e.g., a

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	client, such as electronic device **302-1**, of tire monitoring server **304**, FIG. 3). **[0078]** FIG. 5B illustrates a user interface **504** for providing information and user alerts indicating characteristics of tires on a vehicle, as determined from tire sensor devices in each tire on the vehicle. In some embodiments, the user interface **504** indicates required service on a per tire basis for a respective vehicle. For example, user interface **504** may provide, for each tire on the vehicle (e.g., for each tire in which a tire sensor device is mounted), a user alert in response to determining a wheel misalignment; a slow leak; a puncture; rubber decay; low tread depth; excessive load; and a mileage limit exceeded. In addition, user interface **504** may provide, for each tire on the vehicle (e.g., for each tire in which a tire sensor device is mounted), information (e.g., data) such as the tire's pressure, remaining life (e.g., a projected remaining lifetime based on the driver's driving habits and the conditions experienced by the tire (e.g., road conditions, temperature conditions, etc.), as determined by the tire sensor device mounted on the tire). In some embodiments, user interface **504** includes, for a respective vehicle, a plurality of visual representations **506** of tires (e.g., a visual representation **506** of a tire for each tire in which a tire sensor device is mounted). In some embodiments, visual representations **506** of tires having a corresponding alert condition are visually distinguished from representations of tires that do not have an alert condition. In some embodiments, a visual representation **506** of a respective tire having a corresponding alert condition is visually distinguished from visual representations **506** of tires that do not have an alert condition by color coding (e.g., tires shown in red have an alert indicating an issue that requires attention, such as a slow leak or a mileage limit exceeded, whereas tires shown in green do not have an alert condition). **[0079]** FIG. 5C illustrates another user interface **508** for providing information and user alerts indicating characteristics of tires on a vehicle. In some embodiments, when updated information is received (e.g., by tire monitoring server **304**) from the vehicle (e.g., from a tire sensor device **200** on the vehicle) indicating that an alert condition for tire on the vehicle is met, an alert is automatically provided indicating that the tire on the respective vehicle requires service (e.g., a text message is provided as shown in FIG. 5C). For example, a text message is provided to the user (e.g., in real-time, without the user's

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	intervention), when a change in characteristics of a tire prompt an alert. As a more specific example, when tire monitoring server **304** determines that a tire has a predefined amount of tread life remaining (e.g., 25%, 10%, 0%), the tire monitoring server **304** sends a text message to the user informing the user of the remaining tread life. In some embodiments, analogous user alerts are provided based on other tire conditions, characteristics, and/or changes in characteristics discussed herein (e.g., detection of a slow leak or a puncture, excessive load, wheel misalignment, etc.). **[0018]** FIG. 6 illustrates an example of a user interface that includes a dashboard summary of tire characteristics and/or tire conditions for a plurality of vehicles (e.g., a fleet of vehicles), in accordance with some embodiments.  FIG. 6 **[0080]** FIG. 6 illustrates an example of a user interface **600** that includes a dashboard summary of tire characteristics and/or tire conditions for a plurality of vehicles (e.g., a fleet of vehicles), in accordance with some embodiments. In some embodiments, user interface **600** is displayed on a client device (e.g., a client, such as electronic device **302**-*m*, of tire monitoring server **304**, FIG. 3). **[0021]** FIG. 9 is a flow diagram of a method for providing a user alert indicating one or more characteristics of a tire, in accordance with some embodiments.

'421 Claim Element	Disclosures from Prior Art (Dodani-063)

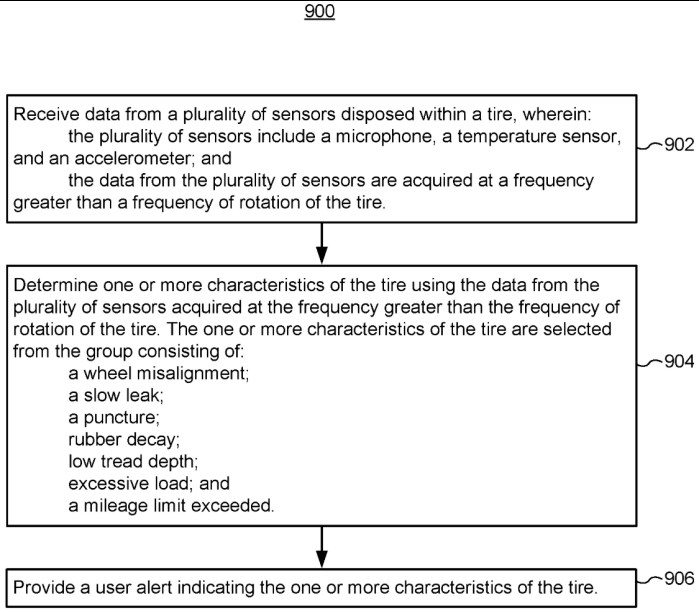


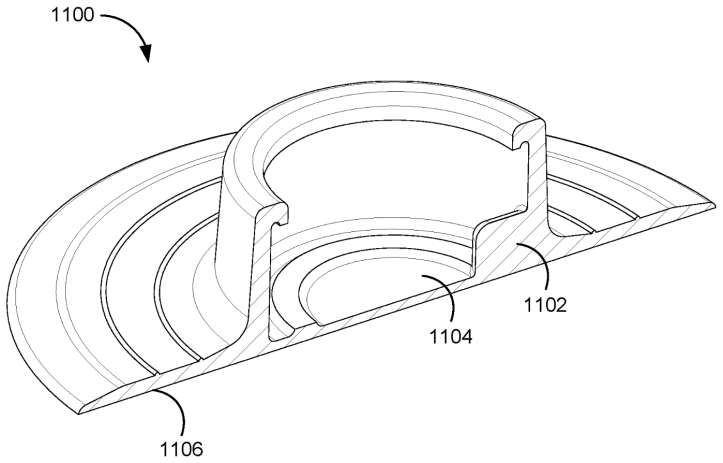
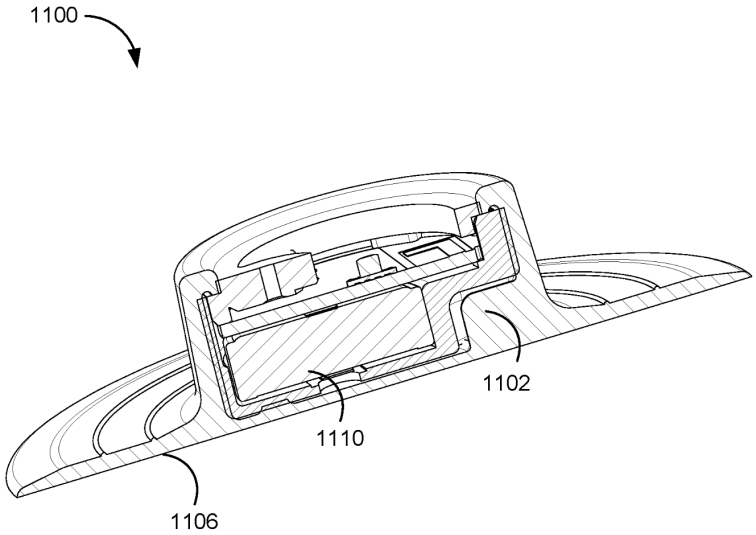
FIG. 9

[0090] FIG. 9 is a flow diagram of a method **900** for providing a user alert indicating one or more characteristics of a tire, in accordance with some embodiments. In some embodiments, various operations of method **900** are performed by a tire sensor device (e.g., tire sensor device **200**, FIG. 2). In some embodiments, various operations of method **900** are performed by a tire monitoring server (e.g., tire monitoring server **304**, FIG. 3) that receives data from a tire sensor device. In some embodiments, various operations of method **900** are performed by an electronic device (e.g., electronic device **302-1** and/or electronic device **302-2**, FIG. 3) communicatively-coupled with a tire sensor device and/or communicatively-coupled with a tire monitoring server.

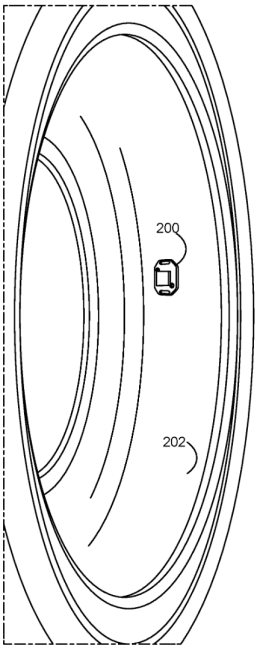
[0097] In some embodiments, determining that the tire is mounted to a misaligned wheel includes analyzing motion (e.g., wobble) of the tire as determined by data from the accelerometer and other sensors (e.g., the microphone). For example, the accelerometer is a three-axis accelerometer and determining that the tire is mounted to a misaligned wheel includes detecting that data from the accelerometer include periodic motion of the tire along an axis of rotation of the tire (e.g., at the frequency of rotation of the tire).

[0098] In some embodiments, the plurality of sensors includes a pressure sensor and determining that the tire has a slow leak includes detecting that the data from the pressure sensor has

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	decreased below a predefined rate (e.g., has decreased slowly). In some embodiments, determining that the tire has a slow leak includes determining that the decrease in pressure is not due to changes in ambient temperature. **[0099]** In some embodiments, the plurality of sensors includes a pressure sensor and determining that the tire has a puncture includes detecting that the data from the pressure sensor has decreased above a predefined rate (e.g., has decreased quickly). **[0100]** In some embodiments, determining that the tire has an excessive load includes correlating two or more of pressure, vehicle speed, and footprint length. In some embodiments, determining that the tire has an excessive load includes comparing footprint lengths between tires. [0108] In some embodiments, method **1000** include mounting (**1002**) a tire sensor device (e.g., tire sensor device **200**) on a respective tire of each vehicle of a plurality of vehicles. The tire sensor device includes: a plurality of sensors including a microphone, a temperature sensor, and an accelerometer; and memory configured to store data received by the plurality of sensors. The one or more processors are coupled with the memory and configured to perform one or more initial processing operations on the data received by the plurality of sensors. The tire sensor device optionally includes an antenna, coupled with the one or more processors, configured to wirelessly communicate with one or more external devices. **[0109]** Method **1000** further includes receiving (**1004**) information (e.g., data from tire sensor devices) from the plurality of vehicles indicating presence or absence of a plurality of tire conditions, including one or more tire conditions selected from the group consisting of: wheel misalignment; a slow leak; a puncture; rubber decay; low tread depth; excessive load; and a mileage limit exceeded. In some embodiments, the information indicating the presence or absence of a plurality of tire conditions is received from a plurality of sensors disposed within a respective tire from the plurality of vehicles, the plurality of sensors including a microphone, a temperature sensor, and an accelerometer. Various embodiments for determining and/or detecting the presence or absence of such tire conditions are described above with reference to method **900**, FIG. 9. For brevity, those details are not repeated here.

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	[0023] FIGS. 11A-11B show a tire sensor dock, in accordance with some embodiments.  FIG. 11A  FIG. 11B **[0116]** FIGS. 11A-11B shows a tire sensor dock 1100, in accordance with some embodiments. In some embodiments, tire sensor dock 1100 is adapted to receive a tire sensor device 1110 (FIG. 11B) (e.g., which may be functionally analogous to tire sensor device 200, FIG. 2). For example, tire sensor dock 1100 includes an opening 1104 that provides a snug fit with the tire sensor device 1110. In some embodiments, tire sensor dock 1100 is adapted to receive (e.g., mate with) a tire

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	sensor device 1110 such that the tire sensor device 1110 is non-rotatably positioned within the sensor dock. For example, tire sensor dock 1100 includes or has formed therein a boss 1102 which abuts the tire sensor device 1110 and prevents rotation (e.g., the tire sensor device 1110 has formed therein a complementary feature that receives the boss 1102 and prevents rotation). Alternatively, tire sensor dock 1100 is adapted to receive a boss formed on the tire sensor device 1110. **[0117]** A bottom surface **1106** of the tire sensor dock **1100** is further adapted to be affixed to the inner surface of a tire. In some embodiments, the tire sensor dock **1100** is made of natural rubber. The tire sensor dock **1100** is affixed and chemically bonded to the tire using a gum (e.g., a rubber vulcanizing cement) that cross-links with inner surface of the tire (e.g., thus, the tire sensor dock **1100** is permanently affixed to the tire). The durometer of the rubber of the tire sensor dock **1100** is similar to that of a tire after vulcanization (e.g., ranges between 40-80 depending on the stiffness required). In some embodiments, the tire sensor dock **1100** has a similar stiffness (e.g., within 5% or within 10%) to that of the tire so that the tire sensor dock **1100** flexes in a similar manner as the tire as it is rolling on the ground. Having a similar stiffness as the tire reduces shear stresses between the tire and the sensor dock caused by vibrations while in use and increases the lifespan of the tire sensor dock **1100** (e.g., the tire sensor dock **1100** can withstand speeds up to 300 mph and is designed to last at least 5 years). **[0024]** Some embodiments of the present disclosure provide a tire sensor device (e.g., a sensor board and/or a packaged) that is adapted to be mounted to a tire without invasive mounting requirements. The tire sensor device includes a plurality of sensors beyond a TPMS, including, optionally, a high-frequency accelerometer, a microphone, and/or a temperature sensor. The tire sensor device is further adapted to capture, measure, and analyze data from the tire using the plurality of sensors. The data may be transmitted to a server, which may analyze the data to quantify and characterize the effects of various external factors. These factors include, but are not limited to, road conditions, driver behavior, and environmental changes. By using a high-frequency accelerometer, for example, characteristics of individual rotations of each tire (e.g., the tires "footprint") can be determined. Tire conditions and degradation, such as rubber decay and/or low tread, can be identified by quantifying, characterizing,

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	and removing the effects of external factors (e.g., road conditions). **[0026]** Thus, systems are provided with improved methods for detecting and reporting tire degradation in one or more vehicles. These systems and methods use an unconventional combination of measurement apparatuses (e.g., sensors) to improve safety, performance, and efficiency (e.g., fuel and/or energy economy) of vehicles by improving tire maintenance. *See also following limitations.*
[1a] a housing comprising an outer surface and an internal cavity that is enclosed within the housing;	*Dodani-063 discloses, teaches, and/or suggests a housing comprising an outer surface and an internal cavity that is enclosed within the housing. For example:* *See, e.g.*, **1[pre]**, above. **[0013]** FIGS. 2A-2B illustrate a tire sensor device disposed on an inner surface of a tire opposite a tread, in accordance with some embodiments.  FIG. 2A **[0041]** FIGS. 2A-2B illustrate a tire sensor device **200** disposed on an inner surface of a tire **202** opposite a tread, in accordance with some embodiments. In some embodiments, the tire sensor

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	device **200** has dimensions less than 5 cm (e.g., in width W)×5 cm (e.g., in length L)×2 cm (e.g., in height H above the inner surface of the tire **202**). In some embodiments, the tire sensor device **200** has dimensions less than 10 cm×10 cm×4 cm. In some embodiments, tire sensor device **200** incudes a plurality of sensors including a microphone, a temperature sensor, and an accelerometer (e.g., includes sensor board **100**, FIG. 1). In some embodiments, tire sensor device **200** is configured to operate (e.g., obtain measurements from the plurality of sensors) while tire **202** is in use (e.g., while the vehicle is moving and the tire is pressurized to a pressure above 30 pounds per square inch (psi)). **[0042]** As illustrated, the tire sensor device **200** is affixed to the inner surface of the tire. For example, the sensor may be affixed to the inner surface of the tire using an industrial strength epoxy. As a result, there is no need to modify the manufacturing process of the tire and no damage results from affixing the sensor module to the tire. The sensor module may be affixed to the tire in any other suitable, non-invasive manner. In some circumstances, the tire sensor device **200** is installed at the time of manufacture, although the tire sensor device **200** may also be installed at a later time. In some circumstances, the tire sensor device **200** is mounted at a midline of the inner surface of the tire, opposite the tread, although tire sensor device **200** may be installed elsewhere. In addition, two or more tire sensor devices **200** may be installed on a single tire. In some embodiments, the tire sensor device **200** is installed with a particular alignment relative to the tire (e.g., a first predetermined axis of the tire sensor device **200** is installed in a direction aligned with a circumference of the tire, such that the tire sensor device **200**'s accelerometers are aligned along a known axis with respect to the tire). **[0043]** In some embodiments, the tire sensor device **200** is affixed to the inner surface of the tire through a tire sensor dock (e.g., tire sensor dock **1100**, FIGS. 11A-11B) **[0023]** FIGS. 11A-11B show a tire sensor dock, in accordance with some embodiments.

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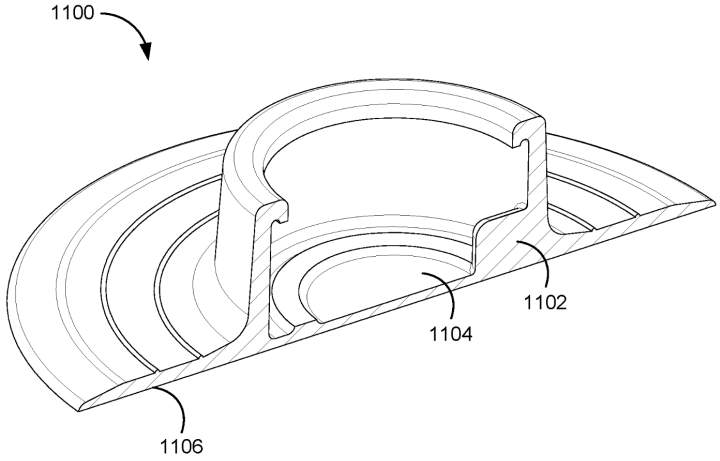


FIG. 11A

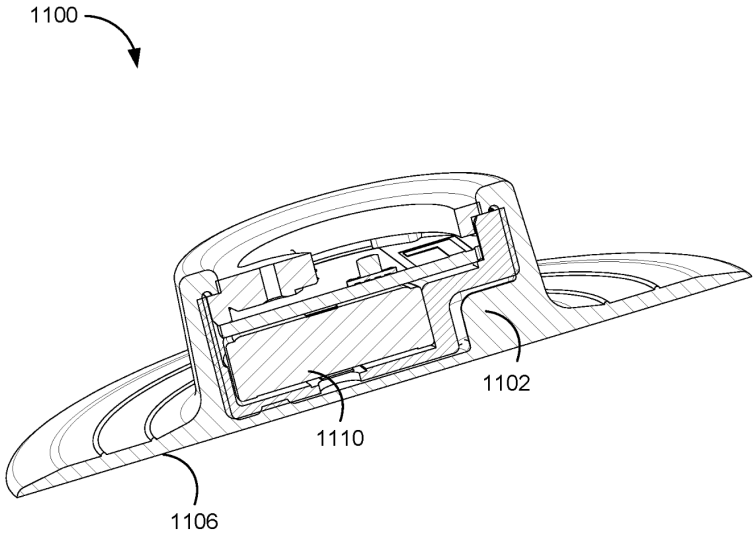
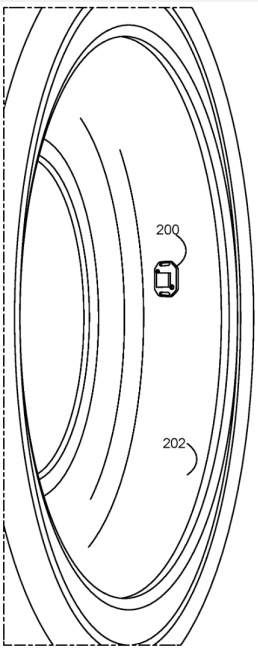


FIG. 11B

[0116] FIGS. 11A-11B shows a tire sensor dock 1100, in accordance with some embodiments. In some embodiments, tire sensor dock 1100 is adapted to receive a tire sensor device 1110 (FIG. 11B) (e.g., which may be functionally analogous to tire sensor device 200, FIG. 2). For example, tire sensor dock 1100 includes an opening 1104 that provides a snug fit with the tire sensor device 1110. In some embodiments, tire sensor dock 1100 is adapted to receive (e.g., mate with) a tire sensor device 1110 such that the tire sensor device 1110 is non-rotatably positioned within the sensor dock. For example, tire sensor dock 1100 includes or has formed therein

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	a boss 1102 which abuts the tire sensor device 1110 and prevents rotation (e.g., the tire sensor device 1110 has formed therein a complementary feature that receives the boss 1102 and prevents rotation). Alternatively, tire sensor dock 1100 is adapted to receive a boss formed on the tire sensor device 1110.
[1b] an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity,	*Dodani-063 discloses, teaches, and/or suggests an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity. For example:* *See, e.g.*, **1[pre]**, above. **[0013]** FIGS. 2A-2B illustrate a tire sensor device disposed on an inner surface of a tire opposite a tread, in accordance with some embodiments.  FIG. 2A **[0041]** FIGS. 2A-2B illustrate a tire sensor device **200** disposed on an inner surface of a tire **202** opposite a tread, in accordance with some embodiments. In some embodiments, the tire sensor device **200** has dimensions less than 5 cm (e.g., in width W)×5 cm (e.g., in length L)×2 cm (e.g., in height H above the inner surface of the tire **202**). In some embodiments, the tire sensor device **200** has dimensions less than 10 cm×10 cm×4 cm. In some embodiments, tire sensor device **200** incudes a plurality of sensors including a microphone, a temperature sensor, and an

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	accelerometer (e.g., includes sensor board **100**, FIG. 1). In some embodiments, tire sensor device **200** is configured to operate (e.g., obtain measurements from the plurality of sensors) while tire **202** is in use (e.g., while the vehicle is moving and the tire is pressurized to a pressure above 30 pounds per square inch (psi)). **[0042]** As illustrated, the tire sensor device **200** is affixed to the inner surface of the tire. For example, the sensor may be affixed to the inner surface of the tire using an industrial strength epoxy. As a result, there is no need to modify the manufacturing process of the tire and no damage results from affixing the sensor module to the tire. The sensor module may be affixed to the tire in any other suitable, non-invasive manner. In some circumstances, the tire sensor device **200** is installed at the time of manufacture, although the tire sensor device **200** may also be installed at a later time. In some circumstances, the tire sensor device **200** is mounted at a midline of the inner surface of the tire, opposite the tread, although tire sensor device **200** may be installed elsewhere. In addition, two or more tire sensor devices **200** may be installed on a single tire. In some embodiments, the tire sensor device **200** is installed with a particular alignment relative to the tire (e.g., a first predetermined axis of the tire sensor device **200** is installed in a direction aligned with a circumference of the tire, such that the tire sensor device **200**'s accelerometers are aligned along a known axis with respect to the tire). **[0043]** In some embodiments, the tire sensor device **200** is affixed to the inner surface of the tire through a tire sensor dock (e.g., tire sensor dock **1100**, FIGS. 11A-11B) **[0023]** FIGS. 11A-11B show a tire sensor dock, in accordance with some embodiments.

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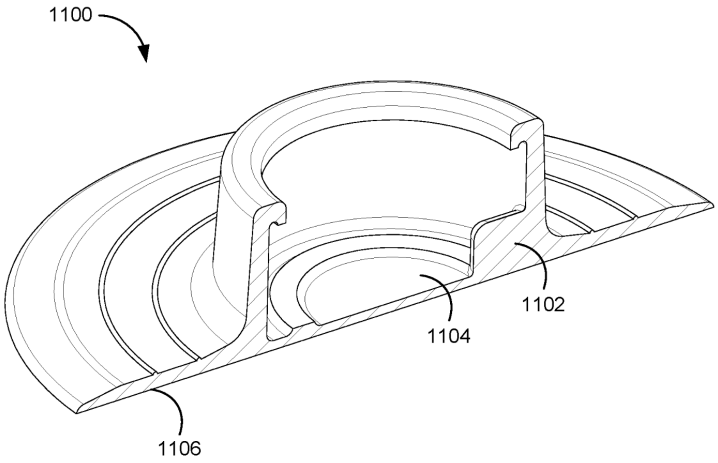


FIG. 11A

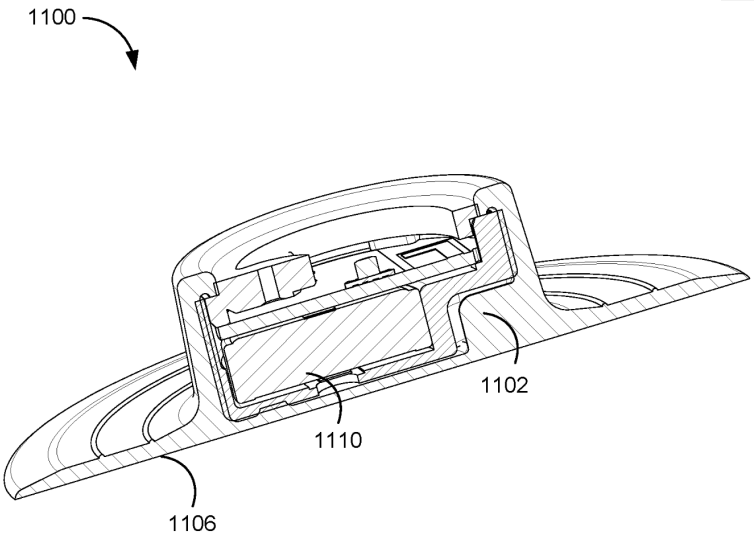
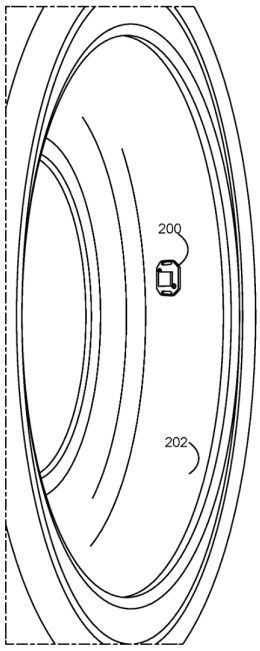


FIG. 11B

[0116] FIGS. 11A-11B shows a tire sensor dock 1100, in accordance with some embodiments. In some embodiments, tire sensor dock 1100 is adapted to receive a tire sensor device 1110 (FIG. 11B) (e.g., which may be functionally analogous to tire sensor device 200, FIG. 2). For example, tire sensor dock 1100 includes an opening 1104 that provides a snug fit with the tire sensor device 1110. In some embodiments, tire sensor dock 1100 is adapted to receive (e.g., mate with) a tire sensor device 1110 such that the tire sensor device 1110 is non-rotatably positioned within the sensor dock. For example, tire sensor dock 1100 includes or has formed therein

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	a boss 1102 which abuts the tire sensor device 1110 and prevents rotation (e.g., the tire sensor device 1110 has formed therein a complementary feature that receives the boss 1102 and prevents rotation). Alternatively, tire sensor dock 1100 is adapted to receive a boss formed on the tire sensor device 1110.
[1c] wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing,	*Dodani-063 discloses, teaches, and/or suggests wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing. For example:* *See, e.g.*, **1[pre]**, above. **[0013]** FIGS. 2A-2B illustrate a tire sensor device disposed on an inner surface of a tire opposite a tread, in accordance with some embodiments.  FIG. 2A **[0041]** FIGS. 2A-2B illustrate a tire sensor device **200** disposed on an inner surface of a tire **202** opposite a tread, in accordance with some embodiments. In some embodiments, the tire sensor device **200** has dimensions less than 5 cm (e.g., in width W)×5 cm (e.g., in length L)×2 cm (e.g., in height H above the inner surface of the tire **202**). In some embodiments, the tire sensor device **200** has dimensions less than 10 cm×10 cm×4 cm. In some embodiments, tire sensor device **200** incudes a plurality of sensors including a microphone, a temperature sensor, and an accelerometer (e.g., includes sensor board **100**, FIG. 1). In some

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	embodiments, tire sensor device **200** is configured to operate (e.g., obtain measurements from the plurality of sensors) while tire **202** is in use (e.g., while the vehicle is moving and the tire is pressurized to a pressure above 30 pounds per square inch (psi)). **[0042]** As illustrated, the tire sensor device **200** is affixed to the inner surface of the tire. For example, the sensor may be affixed to the inner surface of the tire using an industrial strength epoxy. As a result, there is no need to modify the manufacturing process of the tire and no damage results from affixing the sensor module to the tire. The sensor module may be affixed to the tire in any other suitable, non-invasive manner. In some circumstances, the tire sensor device **200** is installed at the time of manufacture, although the tire sensor device **200** may also be installed at a later time. In some circumstances, the tire sensor device **200** is mounted at a midline of the inner surface of the tire, opposite the tread, although tire sensor device **200** may be installed elsewhere. In addition, two or more tire sensor devices **200** may be installed on a single tire. In some embodiments, the tire sensor device **200** is installed with a particular alignment relative to the tire (e.g., a first predetermined axis of the tire sensor device **200** is installed in a direction aligned with a circumference of the tire, such that the tire sensor device **200**'s accelerometers are aligned along a known axis with respect to the tire). **[0043]** In some embodiments, the tire sensor device **200** is affixed to the inner surface of the tire through a tire sensor dock (e.g., tire sensor dock **1100**, FIGS. 11A-11B) **[0023]** FIGS. 11A-11B show a tire sensor dock, in accordance with some embodiments.

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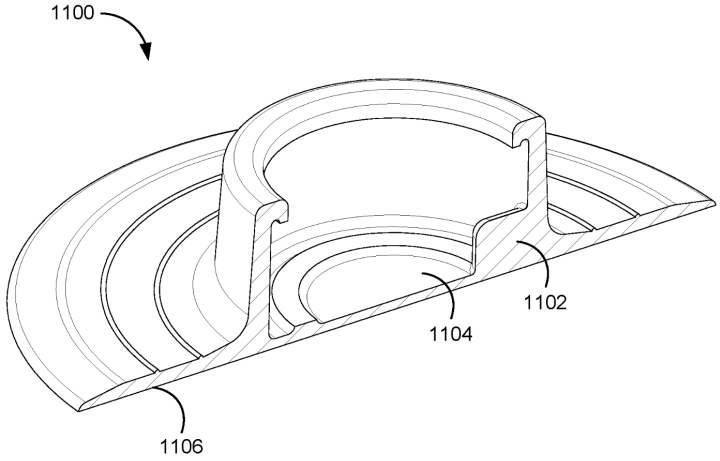


FIG. 11A

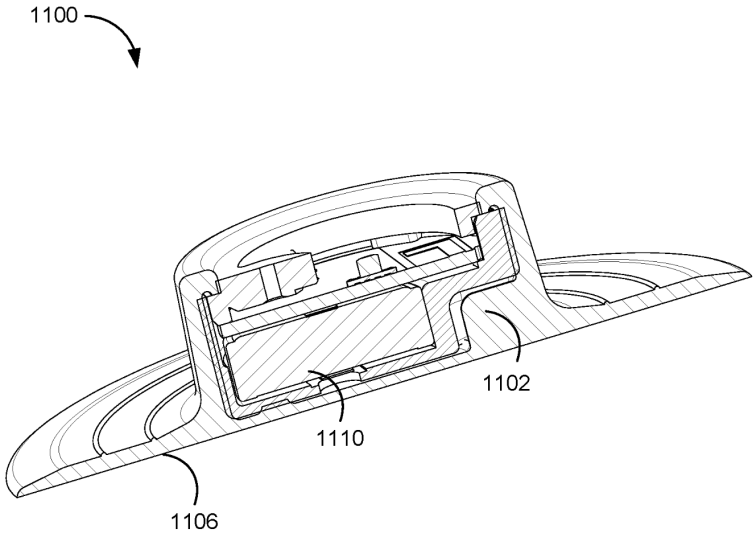
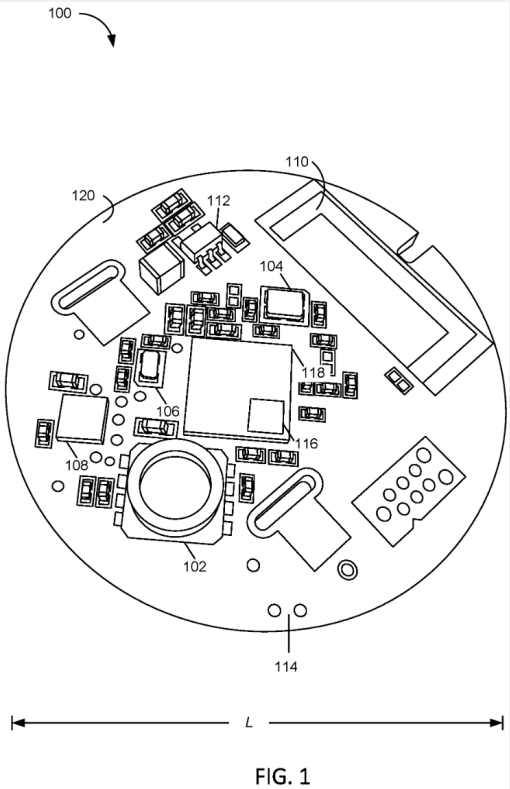


FIG. 11B

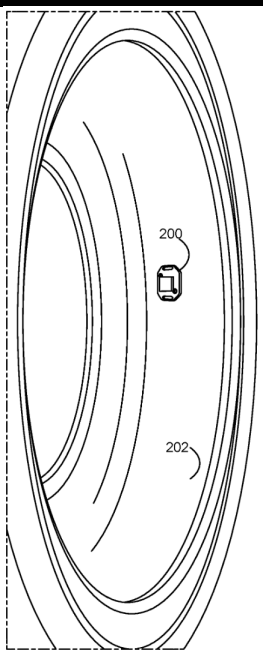
[0116] FIGS. 11A-11B shows a tire sensor dock 1100, in accordance with some embodiments. In some embodiments, tire sensor dock 1100 is adapted to receive a tire sensor device 1110 (FIG. 11B) (e.g., which may be functionally analogous to tire sensor device 200, FIG. 2). For example, tire sensor dock 1100 includes an opening 1104 that provides a snug fit with the tire sensor device 1110. In some embodiments, tire sensor dock 1100 is adapted to receive (e.g., mate with) a tire sensor device 1110 such that the tire sensor device 1110 is non-rotatably positioned within the sensor dock. For example, tire sensor dock 1100 includes or has formed therein

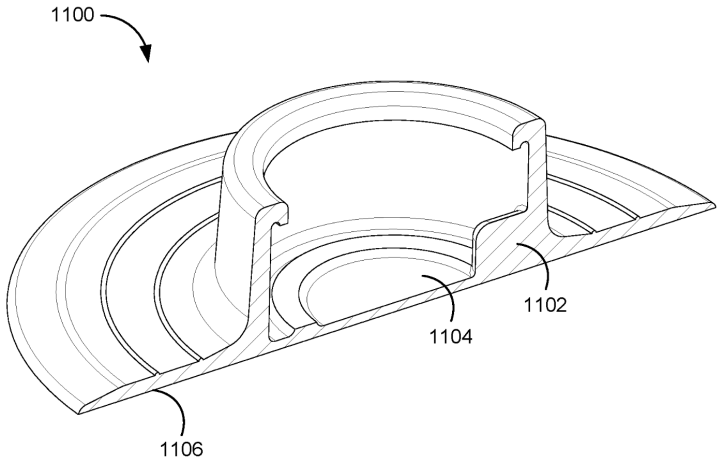
'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	a boss 1102 which abuts the tire sensor device 1110 and prevents rotation (e.g., the tire sensor device 1110 has formed therein a complementary feature that receives the boss 1102 and prevents rotation). Alternatively, tire sensor dock 1100 is adapted to receive a boss formed on the tire sensor device 1110.
[1d] wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use; and	*Dodani-063 discloses, teaches, and/or suggests wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use. For example:* *See, e.g.*, **1[pre]**, above. **[0012]** FIG. 1 is an illustration of a sensor board of a tire sensor device, in accordance with some embodiments.  FIG. 1 **[0028]** FIG. 1 is an illustration of a sensor board **100** of a tire sensor device, in accordance with some embodiments. The sensor board **100** has several components, including but not limited to a pressure sensor **102**, a microphone **104**, a temperature sensor **106**, an accelerometer **108**, an antenna **110**, a voltage regulator **112**, an analog input **114**, memory **116**, and one or more

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	processors **118**. The various sensors are configured to collect data and supply the data to the memory **116** and/or one or more processors **118**. In some embodiments, the several components including the various sensors are affixed to a common (i.e., the same) polychlorinated biphenyl (PCB) board **120** (e.g., the various sensors have a fixed position with respect to one another). In some embodiments, the PCB board **120** has printed thereon wires to connect the several components to one another. Note that, in various embodiments, any of the aforementioned sensors may be omitted. For example, in some embodiments, sensor board **100**, or a tire sensor device that includes sensor board **100**, does not include a microphone, does not includes a temperature sensors, and/or does not include an accelerometer. **[0031]** In some embodiments, the pressure sensor **102** is adapted to capture and/or measure the pressure of a tire to which the sensor board **100** is affixed. For example, the pressure sensor **102** may be part number MS580305BA01-00 (MS5803-05BA), manufactured by TE CONNECTIVITY. **[0033]** In some embodiments, the temperature sensor **106** is adapted to measure temperature variation within and/or proximate to the tire, for example, as the tire is driven on a road surface. For example, the temperature sensor **106** may be part number TMP102-Q1, manufactured by TEXAS INSTRUMENTS. **[0034]** In some embodiments, the accelerometer **108** is adapted to detect and/or measure changes in the motion of the tire, for example, as the tire is driven on a road surface. For example, the accelerometer **108** may be part number ADXL372, manufactured by ANALOG DEVICES. In some embodiments, the accelerometer has a sampling rate of at least 3000 Hertz (Hz) (or 4000 Hz or 5000 Hz). In some embodiments, the accelerometer **108** has a sampling rate of 6400 Hz. In some embodiments, the accelerometer **108** has a sampling rate sufficient to acquire data (e.g., measurements) at a frequency greater than a frequency of rotation of the tire (e.g., at a predefined speed and for a predefined tire size and/or predefined circumference). For example, in some embodiments, the tire sensor device is adapted to operate (e.g., acquire multiple samples per wheel rotation) at speeds up to 120 miles per hour (mph) in a P215/60R16 tire. **[0035]** In some embodiments, the antenna **110** (e.g., a radio frequency (RF) antenna) is adapted to transmit data from the

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	sensor board. For example, the antenna may be a printed on-board antenna. In some embodiments, the antenna **110** is adapted to communicate in an industrial, scientific and medical (ISM) radio band. In some embodiments, as described in greater detail with reference to FIGS. 7A-7C and FIG. 8, the antenna **110** is adapted to communicate over a plurality of bands (e.g., the antenna **110** is a multi-mode antenna). In some embodiments, the antenna **110** is adapted to communicate over BLUETOOTH (e.g., in a 2.4 GHz band). In some embodiments, antenna **110** is adapted to communicate over a 900 MHz Global System for Mobile Communications (GSM) band. In some embodiments, antenna **110** is adapted to communicate over a 415 MHz ISM band. In some embodiments, antenna **110** is an integral part of the tire sensor devices described herein (e.g., tire sensor device **200**, FIG. 2). In some embodiments, an antenna is separate from and communicatively coupled to the tire sensor devices described herein. **[0038]** In some embodiments, the one or more processors **118** are adapted to analyze data stored in the memory **116** and/or received from one or more of the sensors on the sensor board. In some embodiments, the one or more processors **118** comprise one or more microprocessors (e.g., the microprocessor comprises one or more central processing units (CPUs) and/or general processing units (GPUs)). In some embodiments, the one or more processors **118** comprise one or more field programmable gate arrays (FPGAs). In some embodiments, the one or more processors **118** comprise one or more application specific integrated circuits (ASICs). In some embodiments, the one or more processors **118** are embodied as a system-on-chip (SoC) (e.g., part number nRF52832, or a similar part such as nRF52840, manufactured by NORDIC SEMICONDUCTOR). The nRF52832 is an ultra-low power multiprotocol SoC with hardware support on-chip for BLUETOOTH® 5. The nRF52832 may further includes near-field communication (NFC) capabilities. **[0039]** In some embodiments, memory **116** is adapted to store data captured and/or generated by one or more sensors on the sensor board **100**. In some embodiments, memory **116** includes high-speed random access memory, such as DRAM, SRAM, DDR RAM, or other random access solid-state memory devices; and may include non-volatile memory, such as one or more flash memory devices, or other non-volatile solid-state storage devices. Memory **116** optionally includes one or more storage devices remotely located from one

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	or more processors **118**. Memory **116**, or, alternatively, the non-volatile solid-state memory device(s) within memory **116**, includes a non-transitory computer-readable storage medium. In some embodiments, memory **116** comprises flash memory. For example, the flash memory may be part number W25N01GVZEIG TR (W25N01GV), manufactured by WINBOND ELECTRONICS. In some embodiments, memory **116** is packaged with the one or more processors **118** (e.g., as a single microprocessor). **[0041]** FIGS. 2A-2B illustrate a tire sensor device 200 disposed on an inner surface of a tire 202 opposite a tread, in accordance with some embodiments. In some embodiments, the tire sensor device 200 has dimensions less than 5 cm (e.g., in width W)×5 cm (e.g., in length L)×2 cm (e.g., in height H above the inner surface of the tire 202). In some embodiments, the tire sensor device 200 has dimensions less than 10 cm×10 cm×4 cm. In some embodiments, tire sensor device 200 incudes a plurality of sensors including a microphone, a temperature sensor, and an accelerometer (e.g., includes sensor board 100, FIG. 1). In some embodiments, tire sensor device 200 is configured to operate (e.g., obtain measurements from the plurality of sensors) while tire 202 is in use (e.g., while the vehicle is moving and the tire is pressurized to a pressure above 30 pounds per square inch (psi)).
[1e] a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.	*Dodani-063 discloses, teaches, and/or suggests a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.. For example:* *See, e.g.*, **1[pre]**, above. **[0013]** FIGS. 2A-2B illustrate a tire sensor device disposed on an inner surface of a tire opposite a tread, in accordance with some embodiments.

’421 Claim Element	Disclosures from Prior Art (Dodani-063)
	 FIG. 2A **[0041]** FIGS. 2A-2B illustrate a tire sensor device **200** disposed on an inner surface of a tire **202** opposite a tread, in accordance with some embodiments. In some embodiments, the tire sensor device **200** has dimensions less than 5 cm (e.g., in width W)×5 cm (e.g., in length L)×2 cm (e.g., in height H above the inner surface of the tire **202**). In some embodiments, the tire sensor device **200** has dimensions less than 10 cm×10 cm×4 cm. In some embodiments, tire sensor device **200** incudes a plurality of sensors including a microphone, a temperature sensor, and an accelerometer (e.g., includes sensor board **100**, FIG. 1). In some embodiments, tire sensor device **200** is configured to operate (e.g., obtain measurements from the plurality of sensors) while tire **202** is in use (e.g., while the vehicle is moving and the tire is pressurized to a pressure above 30 pounds per square inch (psi)). **[0042]** As illustrated, the tire sensor device **200** is affixed to the inner surface of the tire. For example, the sensor may be affixed to the inner surface of the tire using an industrial strength epoxy. As a result, there is no need to modify the manufacturing process of the tire and no damage results from affixing the sensor module to the tire. The sensor module may be affixed to the tire in any other suitable, non-invasive manner. In some circumstances, the tire sensor device **200** is installed at the time of manufacture, although the tire sensor device **200** may also be installed at a later time. In some circumstances, the tire sensor device **200** is

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	mounted at a midline of the inner surface of the tire, opposite the tread, although tire sensor device **200** may be installed elsewhere. In addition, two or more tire sensor devices **200** may be installed on a single tire. In some embodiments, the tire sensor device **200** is installed with a particular alignment relative to the tire (e.g., a first predetermined axis of the tire sensor device **200** is installed in a direction aligned with a circumference of the tire, such that the tire sensor device **200**'s accelerometers are aligned along a known axis with respect to the tire). **[0043]** In some embodiments, the tire sensor device **200** is affixed to the inner surface of the tire through a tire sensor dock (e.g., tire sensor dock **1100**, FIGS. 11A-11B) **[0023]** FIGS. 11A-11B show a tire sensor dock, in accordance with some embodiments.  FIG. 11A

'421 Claim Element	Disclosures from Prior Art (Dodani-063)

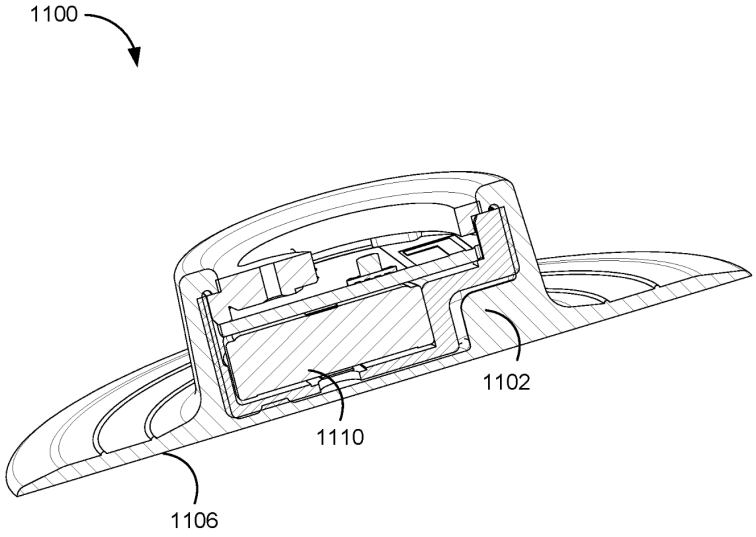
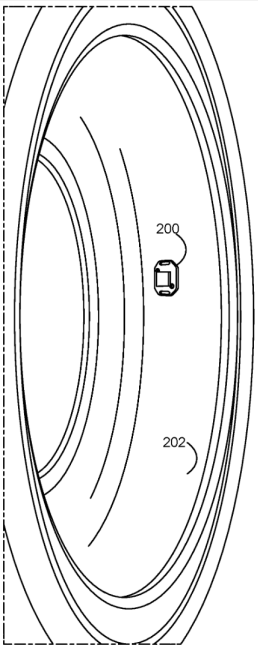


FIG. 11B

[0116] FIGS. 11A-11B shows a tire sensor dock 1100, in accordance with some embodiments. In some embodiments, tire sensor dock 1100 is adapted to receive a tire sensor device 1110 (FIG. 11B) (e.g., which may be functionally analogous to tire sensor device 200, FIG. 2). For example, tire sensor dock 1100 includes an opening 1104 that provides a snug fit with the tire sensor device 1110. In some embodiments, tire sensor dock 1100 is adapted to receive (e.g., mate with) a tire sensor device 1110 such that the tire sensor device 1110 is non-rotatably positioned within the sensor dock. For example, tire sensor dock 1100 includes or has formed therein a boss 1102 which abuts the tire sensor device 1110 and prevents rotation (e.g., the tire sensor device 1110 has formed therein a complementary feature that receives the boss 1102 and prevents rotation). Alternatively, tire sensor dock 1100 is adapted to receive a boss formed on the tire sensor device 1110.

[0117] A bottom surface **1106** of the tire sensor dock **1100** is further adapted to be affixed to the inner surface of a tire. In some embodiments, the tire sensor dock **1100** is made of natural rubber. The tire sensor dock **1100** is affixed and chemically bonded to the tire using a gum (e.g., a rubber vulcanizing cement) that cross-links with inner surface of the tire (e.g., thus, the tire sensor dock **1100** is permanently affixed to the tire). The durometer of the rubber of the tire sensor dock **1100** is similar to that of a tire after vulcanization (e.g., ranges between 40-80 depending on the stiffness required). In some embodiments, the tire sensor

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	dock **1100** has a similar stiffness (e.g., within 5% or within 10%) to that of the tire so that the tire sensor dock **1100** flexes in a similar manner as the tire as it is rolling on the ground. Having a similar stiffness as the tire reduces shear stresses between the tire and the sensor dock caused by vibrations while in use and increases the lifespan of the tire sensor dock **1100** (e.g., the tire sensor dock **1100** can withstand speeds up to 300 mph and is designed to last at least 5 years).
2. The sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member assembly. For example:* *See, e.g.*, **1[pre]**, above. **[0013]** FIGS. 2A-2B illustrate a tire sensor device disposed on an inner surface of a tire opposite a tread, in accordance with some embodiments.  FIG. 2A **[0041]** FIGS. 2A-2B illustrate a tire sensor device **200** disposed on an inner surface of a tire **202** opposite a tread, in accordance with some embodiments. In some embodiments, the tire sensor device **200** has dimensions less than 5 cm (e.g., in width W)×5 cm (e.g., in length L)×2 cm (e.g., in height H above the inner surface

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	of the tire **202**). In some embodiments, the tire sensor device **200** has dimensions less than 10 cm×10 cm×4 cm. In some embodiments, tire sensor device **200** incudes a plurality of sensors including a microphone, a temperature sensor, and an accelerometer (e.g., includes sensor board **100**, FIG. 1). In some embodiments, tire sensor device **200** is configured to operate (e.g., obtain measurements from the plurality of sensors) while tire **202** is in use (e.g., while the vehicle is moving and the tire is pressurized to a pressure above 30 pounds per square inch (psi)). **[0042]** As illustrated, the tire sensor device **200** is affixed to the inner surface of the tire. For example, the sensor may be affixed to the inner surface of the tire using an industrial strength epoxy. As a result, there is no need to modify the manufacturing process of the tire and no damage results from affixing the sensor module to the tire. The sensor module may be affixed to the tire in any other suitable, non-invasive manner. In some circumstances, the tire sensor device **200** is installed at the time of manufacture, although the tire sensor device **200** may also be installed at a later time. In some circumstances, the tire sensor device **200** is mounted at a midline of the inner surface of the tire, opposite the tread, although tire sensor device **200** may be installed elsewhere. In addition, two or more tire sensor devices **200** may be installed on a single tire. In some embodiments, the tire sensor device **200** is installed with a particular alignment relative to the tire (e.g., a first predetermined axis of the tire sensor device **200** is installed in a direction aligned with a circumference of the tire, such that the tire sensor device **200**'s accelerometers are aligned along a known axis with respect to the tire). **[0043]** In some embodiments, the tire sensor device **200** is affixed to the inner surface of the tire through a tire sensor dock (e.g., tire sensor dock **1100**, FIGS. 11A-11B) **[0023]** FIGS. 11A-11B show a tire sensor dock, in accordance with some embodiments.

'421 Claim Element	Disclosures from Prior Art (Dodani-063)

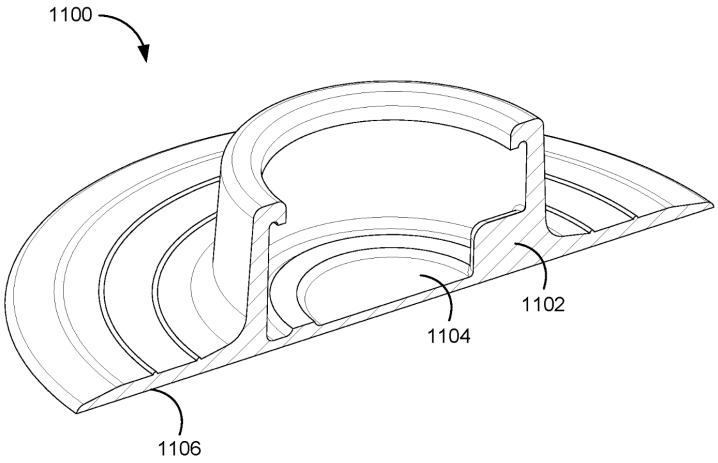


FIG. 11A

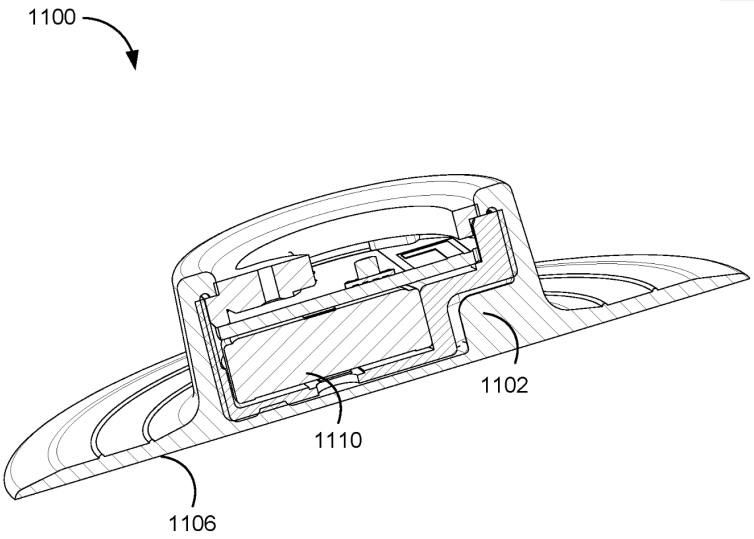


FIG. 11B

[0116] FIGS. 11A-11B shows a tire sensor dock 1100, in accordance with some embodiments. In some embodiments, tire sensor dock 1100 is adapted to receive a tire sensor device 1110 (FIG. 11B) (e.g., which may be functionally analogous to tire sensor device 200, FIG. 2). For example, tire sensor dock 1100 includes an opening 1104 that provides a snug fit with the tire sensor device 1110. In some embodiments, tire sensor dock 1100 is adapted to receive (e.g., mate with) a tire sensor device 1110 such that the tire sensor device 1110 is non-rotatably positioned within the sensor dock. For example, tire sensor dock 1100 includes or has formed therein

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	a boss 1102 which abuts the tire sensor device 1110 and prevents rotation (e.g., the tire sensor device 1110 has formed therein a complementary feature that receives the boss 1102 and prevents rotation). Alternatively, tire sensor dock 1100 is adapted to receive a boss formed on the tire sensor device 1110. **[0117]** A bottom surface **1106** of the tire sensor dock **1100** is further adapted to be affixed to the inner surface of a tire. In some embodiments, the tire sensor dock **1100** is made of natural rubber. The tire sensor dock **1100** is affixed and chemically bonded to the tire using a gum (e.g., a rubber vulcanizing cement) that cross-links with inner surface of the tire (e.g., thus, the tire sensor dock **1100** is permanently affixed to the tire). The durometer of the rubber of the tire sensor dock **1100** is similar to that of a tire after vulcanization (e.g., ranges between 40-80 depending on the stiffness required). In some embodiments, the tire sensor dock **1100** has a similar stiffness (e.g., within 5% or within 10%) to that of the tire so that the tire sensor dock **1100** flexes in a similar manner as the tire as it is rolling on the ground. Having a similar stiffness as the tire reduces shear stresses between the tire and the sensor dock caused by vibrations while in use and increases the lifespan of the tire sensor dock **1100** (e.g., the tire sensor dock **1100** can withstand speeds up to 300 mph and is designed to last at least 5 years).
5. The sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein. For example:* *See, e.g.*, **1[pre]**, above. **[0043]** In some embodiments, the tire sensor device **200** is affixed to the inner surface of the tire through a tire sensor dock (e.g., tire sensor dock **1100**, FIGS. 11A-11B) **[0023]** FIGS. 11A-11B show a tire sensor dock, in accordance with some embodiments.

'421 Claim Element	Disclosures from Prior Art (Dodani-063)

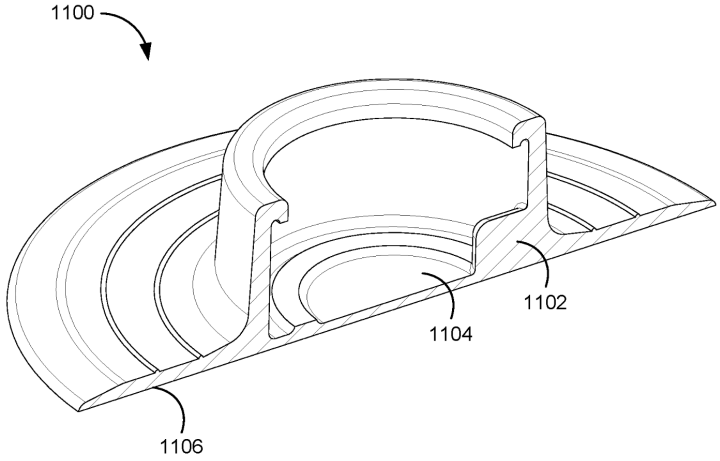


FIG. 11A

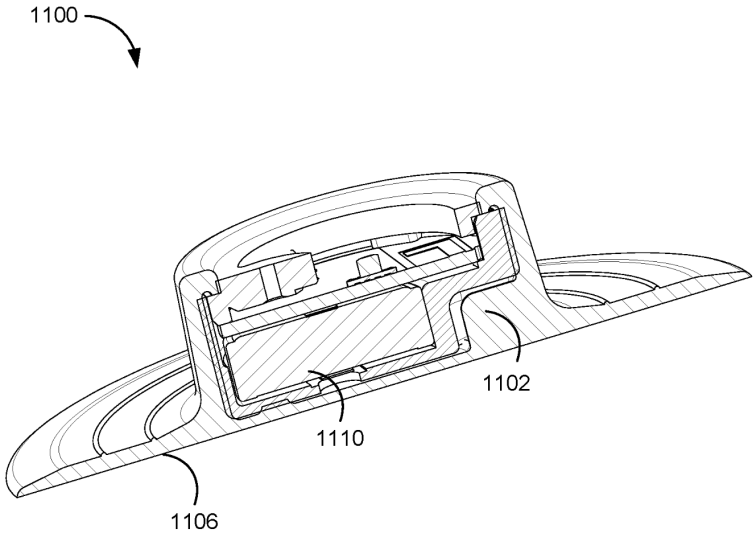


FIG. 11B

[0116] FIGS. 11A-11B shows a tire sensor dock 1100, in accordance with some embodiments. In some embodiments, tire sensor dock 1100 is adapted to receive a tire sensor device 1110 (FIG. 11B) (e.g., which may be functionally analogous to tire sensor device 200, FIG. 2). For example, tire sensor dock 1100 includes an opening 1104 that provides a snug fit with the tire sensor device 1110. In some embodiments, tire sensor dock 1100 is adapted to receive (e.g., mate with) a tire sensor device 1110 such that the tire sensor device 1110 is non-rotatably positioned within the sensor dock. For example, tire sensor dock 1100 includes or has formed therein

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	a boss 1102 which abuts the tire sensor device 1110 and prevents rotation (e.g., the tire sensor device 1110 has formed therein a complementary feature that receives the boss 1102 and prevents rotation). Alternatively, tire sensor dock 1100 is adapted to receive a boss formed on the tire sensor device 1110. **[0117]** A bottom surface **1106** of the tire sensor dock **1100** is further adapted to be affixed to the inner surface of a tire. In some embodiments, the tire sensor dock **1100** is made of natural rubber. The tire sensor dock **1100** is affixed and chemically bonded to the tire using a gum (e.g., a rubber vulcanizing cement) that cross-links with inner surface of the tire (e.g., thus, the tire sensor dock **1100** is permanently affixed to the tire). The durometer of the rubber of the tire sensor dock **1100** is similar to that of a tire after vulcanization (e.g., ranges between 40-80 depending on the stiffness required). In some embodiments, the tire sensor dock **1100** has a similar stiffness (e.g., within 5% or within 10%) to that of the tire so that the tire sensor dock **1100** flexes in a similar manner as the tire as it is rolling on the ground. Having a similar stiffness as the tire reduces shear stresses between the tire and the sensor dock caused by vibrations while in use and increases the lifespan of the tire sensor dock **1100** (e.g., the tire sensor dock **1100** can withstand speeds up to 300 mph and is designed to last at least 5 years).
7. The sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member. For example:* *See, e.g.*, **1[pre]**, above. **[0043]** In some embodiments, the tire sensor device **200** is affixed to the inner surface of the tire through a tire sensor dock (e.g., tire sensor dock **1100**, FIGS. 11A-11B) **[0023]** FIGS. 11A-11B show a tire sensor dock, in accordance with some embodiments.

'421 Claim Element	Disclosures from Prior Art (Dodani-063)

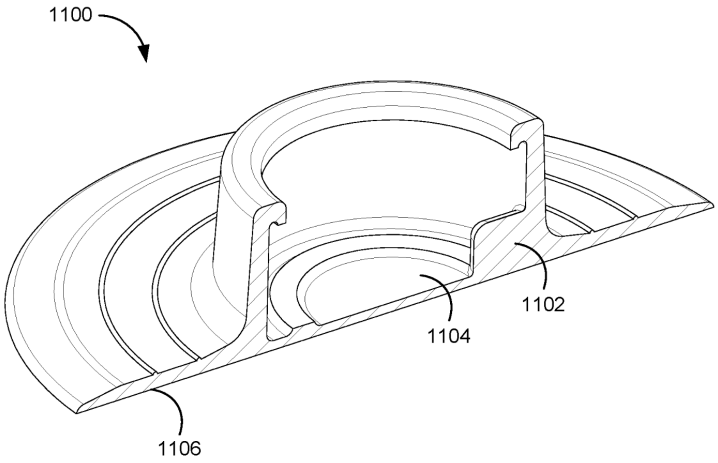


FIG. 11A

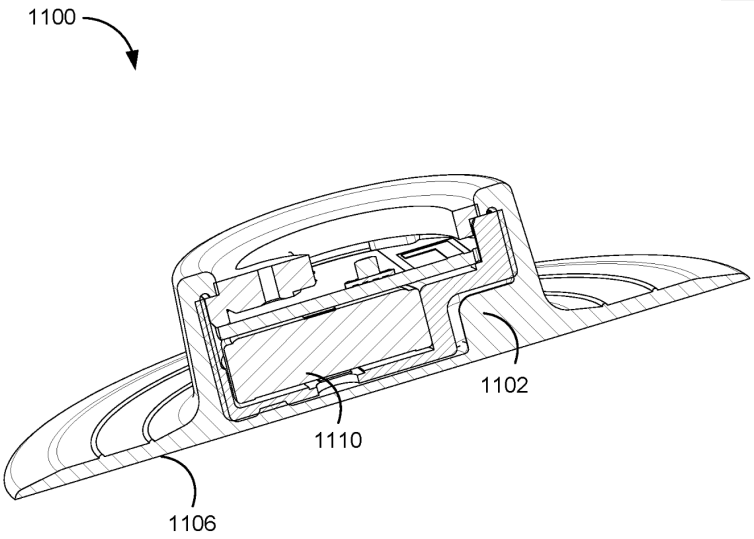


FIG. 11B

[0116] FIGS. 11A-11B shows a tire sensor dock 1100, in accordance with some embodiments. In some embodiments, tire sensor dock 1100 is adapted to receive a tire sensor device 1110 (FIG. 11B) (e.g., which may be functionally analogous to tire sensor device 200, FIG. 2). For example, tire sensor dock 1100 includes an opening 1104 that provides a snug fit with the tire sensor device 1110. In some embodiments, tire sensor dock 1100 is adapted to receive (e.g., mate with) a tire sensor device 1110 such that the tire sensor device 1110 is non-rotatably positioned within the sensor dock. For example, tire sensor dock 1100 includes or has formed therein

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	a boss 1102 which abuts the tire sensor device 1110 and prevents rotation (e.g., the tire sensor device 1110 has formed therein a complementary feature that receives the boss 1102 and prevents rotation). Alternatively, tire sensor dock 1100 is adapted to receive a boss formed on the tire sensor device 1110. **[0117]** A bottom surface **1106** of the tire sensor dock **1100** is further adapted to be affixed to the inner surface of a tire. In some embodiments, the tire sensor dock **1100** is made of natural rubber. The tire sensor dock **1100** is affixed and chemically bonded to the tire using a gum (e.g., a rubber vulcanizing cement) that cross-links with inner surface of the tire (e.g., thus, the tire sensor dock **1100** is permanently affixed to the tire). The durometer of the rubber of the tire sensor dock **1100** is similar to that of a tire after vulcanization (e.g., ranges between 40-80 depending on the stiffness required). In some embodiments, the tire sensor dock **1100** has a similar stiffness (e.g., within 5% or within 10%) to that of the tire so that the tire sensor dock **1100** flexes in a similar manner as the tire as it is rolling on the ground. Having a similar stiffness as the tire reduces shear stresses between the tire and the sensor dock caused by vibrations while in use and increases the lifespan of the tire sensor dock **1100** (e.g., the tire sensor dock **1100** can withstand speeds up to 300 mph and is designed to last at least 5 years).
8. The sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith. For example:* *See, e.g.*, **1[pre]**, above. **[0043]** In some embodiments, the tire sensor device **200** is affixed to the inner surface of the tire through a tire sensor dock (e.g., tire sensor dock **1100**, FIGS. 11A-11B) **[0023]** FIGS. 11A-11B show a tire sensor dock, in accordance with some embodiments.

'421 Claim Element	Disclosures from Prior Art (Dodani-063)

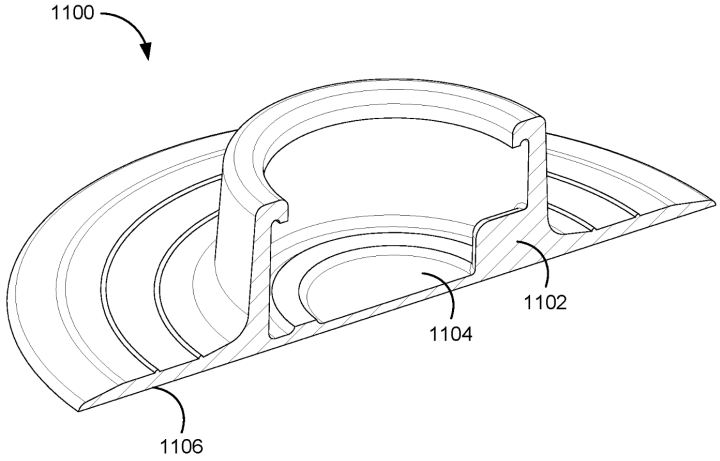


FIG. 11A

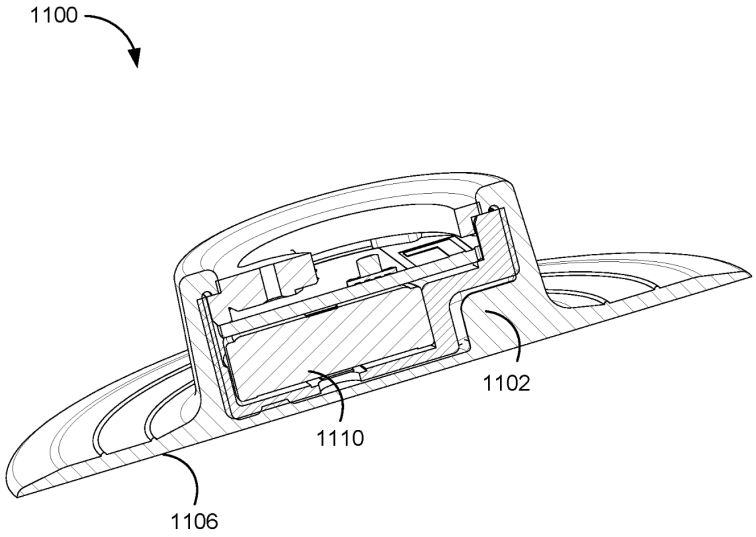
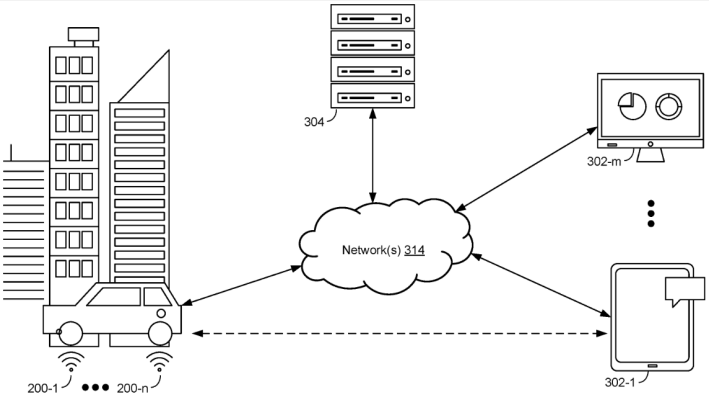


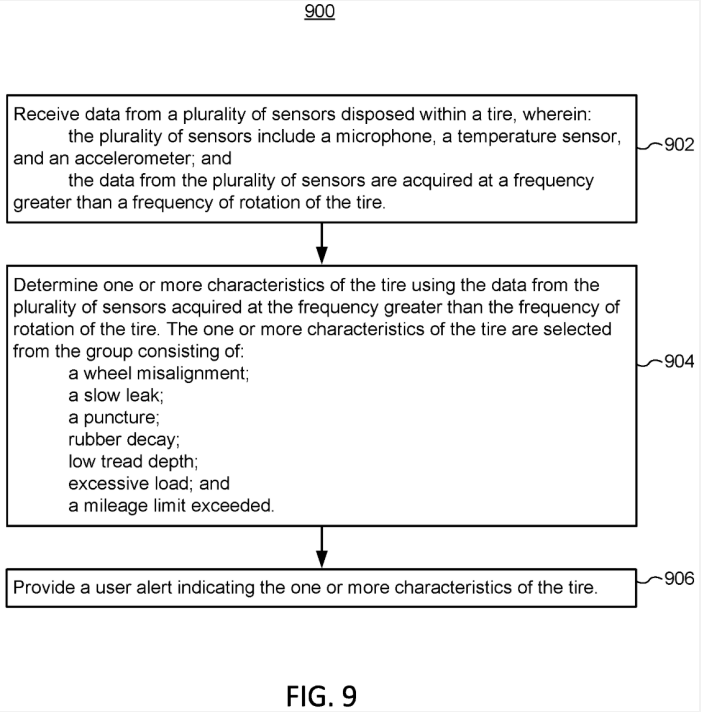
FIG. 11B

[0116] FIGS. 11A-11B shows a tire sensor dock 1100, in accordance with some embodiments. In some embodiments, tire sensor dock 1100 is adapted to receive a tire sensor device 1110 (FIG. 11B) (e.g., which may be functionally analogous to tire sensor device 200, FIG. 2). For example, tire sensor dock 1100 includes an opening 1104 that provides a snug fit with the tire sensor device 1110. In some embodiments, tire sensor dock 1100 is adapted to receive (e.g., mate with) a tire sensor device 1110 such that the tire sensor device 1110 is non-rotatably positioned within the sensor dock. For example, tire sensor dock 1100 includes or has formed therein

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	a boss 1102 which abuts the tire sensor device 1110 and prevents rotation (e.g., the tire sensor device 1110 has formed therein a complementary feature that receives the boss 1102 and prevents rotation). Alternatively, tire sensor dock 1100 is adapted to receive a boss formed on the tire sensor device 1110. **[0117]** A bottom surface **1106** of the tire sensor dock **1100** is further adapted to be affixed to the inner surface of a tire. In some embodiments, the tire sensor dock **1100** is made of natural rubber. The tire sensor dock **1100** is affixed and chemically bonded to the tire using a gum (e.g., a rubber vulcanizing cement) that cross-links with inner surface of the tire (e.g., thus, the tire sensor dock **1100** is permanently affixed to the tire). The durometer of the rubber of the tire sensor dock **1100** is similar to that of a tire after vulcanization (e.g., ranges between 40-80 depending on the stiffness required). In some embodiments, the tire sensor dock **1100** has a similar stiffness (e.g., within 5% or within 10%) to that of the tire so that the tire sensor dock **1100** flexes in a similar manner as the tire as it is rolling on the ground. Having a similar stiffness as the tire reduces shear stresses between the tire and the sensor dock caused by vibrations while in use and increases the lifespan of the tire sensor dock **1100** (e.g., the tire sensor dock **1100** can withstand speeds up to 300 mph and is designed to last at least 5 years).
9. The sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member. For example:* *See, e.g.*, **1[pre]**, above. "[INSERT]" (Dodani-063, cite.)
10. The sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device. For example:* *See, e.g.*, **1[pre]**, above.

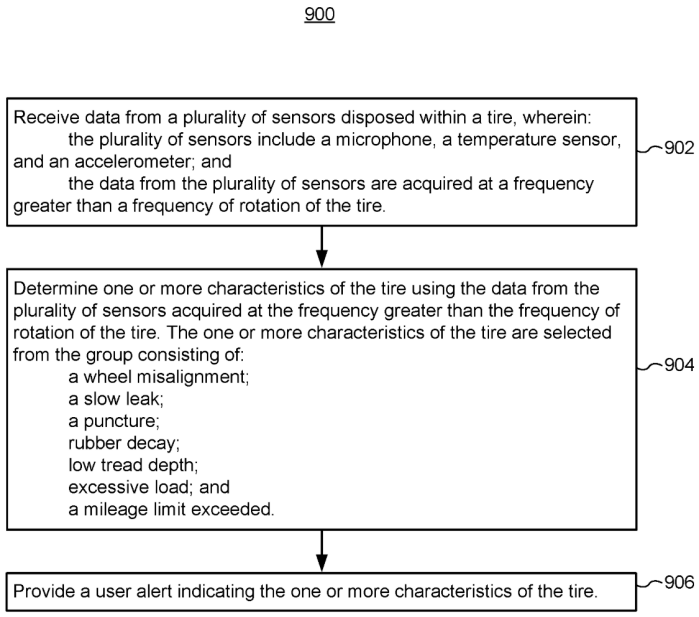
'421 Claim Element	Disclosures from Prior Art (Dodani-063)
reaching the electrical sensor device.	**[0117]** A bottom surface **1106** of the tire sensor dock **1100** is further adapted to be affixed to the inner surface of a tire. In some embodiments, the tire sensor dock **1100** is made of natural rubber. The tire sensor dock **1100** is affixed and chemically bonded to the tire using a gum (e.g., a rubber vulcanizing cement) that cross-links with inner surface of the tire (e.g., thus, the tire sensor dock **1100** is permanently affixed to the tire). The durometer of the rubber of the tire sensor dock **1100** is similar to that of a tire after vulcanization (e.g., ranges between 40-80 depending on the stiffness required). In some embodiments, the tire sensor dock **1100** has a similar stiffness (e.g., within 5% or within 10%) to that of the tire so that the tire sensor dock **1100** flexes in a similar manner as the tire as it is rolling on the ground. Having a similar stiffness as the tire reduces shear stresses between the tire and the sensor dock caused by vibrations while in use and increases the lifespan of the tire sensor dock **1100** (e.g., the tire sensor dock **1100** can withstand speeds up to 300 mph and is designed to last at least 5 years).
11. A sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication.	*Dodani-063 discloses, teaches, and/or suggests a sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication. For example:* *See, e.g.*, **1[pre]**, above. **Abstract** A tire sensor device for monitoring a condition of a tire includes a plurality of sensors including a temperature sensor and an accelerometer. The tire sensing device further includes memory configured to store data received by the plurality of sensors and one or more processors coupled with the memory. The one or more processors are configured to perform one or more initial processing operations on the data received by the plurality of sensors. The tire sensor device further includes an antenna, coupled with the one or more processors, configured to wirelessly communicate with one or more external devices. **[0035]** In some embodiments, the antenna **110** (e.g., a radio frequency (RF) antenna) is adapted to transmit data from the sensor board. For example, the antenna may be a printed on-board antenna. In some embodiments, the antenna **110** is adapted to communicate in an industrial, scientific and medical (ISM) radio band. In some embodiments, as described in greater detail with

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	reference to FIGS. 7A-7C and FIG. 8, the antenna **110** is adapted to communicate over a plurality of bands (e.g., the antenna **110** is a multi-mode antenna). In some embodiments, the antenna **110** is adapted to communicate over BLUETOOTH (e.g., in a 2.4 GHz band). In some embodiments, antenna **110** is adapted to communicate over a 900 MHz Global System for Mobile Communications (GSM) band. In some embodiments, antenna **110** is adapted to communicate over a 415 MHz ISM band. In some embodiments, antenna **110** is an integral part of the tire sensor devices described herein (e.g., tire sensor device **200**, FIG. 2). In some embodiments, an antenna is separate from and communicatively coupled to the tire sensor devices described herein. **[0014]** FIG. 3 is a block diagram illustrating a tire monitoring system, in accordance with some embodiments.  FIG. 3 **[0047]** In some embodiments, electronic device **302-1** communicates directly with one or more tire sensor devices **200** (as illustrated by the dotted line connecting tire sensor devices **200** and electronic device **302-1**). For example, electronic device **302-1** is able to communicate directly (e.g., through a wired connection (e.g., analog input **114**, FIG. 1) and/or through a short-range wireless signal (e.g., using antenna **110**. FIG. 1), such as those associated with personal-area-network (e.g., BLUETOOTH/BLE) communication technologies, radio-frequency-based near-field communication technologies, infrared communication technologies, etc.) with a tire sensor device **200**. In some embodiments, electronic device **302-1** communicates with the tire sensor device **200** through network(s) **314**. In some embodiments,

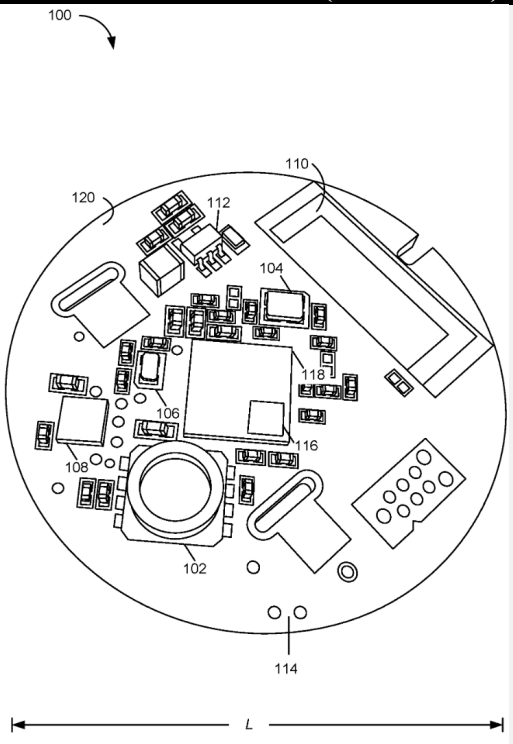
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	electronic device **302-1** uses the direct connection with tire sensor device **200** to receive data from the plurality of sensors on the tire sensor device **200**. For example, electronic device **302-1** acts as a transceiver for data from the plurality of sensors on tire sensor device **200** and uploads the data to a tire monitoring server **304**. Alternatively, the tire sensor device may communicate with an onboard diagnostic (OBD) dongle (e.g., an OBD-II data dongle) on a vehicle or a vehicle modem, which acts as a transceiver for data from the plurality of sensors on tire sensor device **200** and uploads the data to a tire monitoring server **304**. **[0021]** FIG. 9 is a flow diagram of a method for providing a user alert indicating one or more characteristics of a tire, in accordance with some embodiments.  FIG. 9 **[0090]** FIG. 9 is a flow diagram of a method **900** for providing a user alert indicating one or more characteristics of a tire, in accordance with some embodiments. In some embodiments, various operations of method **900** are performed by a tire sensor device (e.g., tire sensor device **200**, FIG. 2). In some embodiments, various operations of method **900** are performed by a tire monitoring server (e.g., tire monitoring server **304**, FIG. 3) that receives data from a tire sensor device. In some embodiments, various operations of method **900** are performed by an electronic device (e.g., electronic device **302-1** and/or electronic device **302-**

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	2, FIG. 3) communicatively-coupled with a tire sensor device and/or communicatively-coupled with a tire monitoring server.
12. The sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*Dodani-063 discloses, teaches, and/or suggests the sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.*, **1[pre]**, above. **Abstract** A tire sensor device for monitoring a condition of a tire includes a plurality of sensors including a temperature sensor and an accelerometer. The tire sensing device further includes memory configured to store data received by the plurality of sensors and one or more processors coupled with the memory. The one or more processors are configured to perform one or more initial processing operations on the data received by the plurality of sensors. The tire sensor device further includes an antenna, coupled with the one or more processors, configured to wirelessly communicate with one or more external devices. **[0005]** The present disclosure provides a tire sensor device for monitoring a condition of a tire. The tire sensor device includes a plurality of sensors including, optionally, a microphone, a temperature sensor, and an accelerometer. The tire sensor device further includes memory configured to store data (e.g., measurements) received by the plurality of sensors. The tire sensor device further includes a microprocessor coupled with the memory. The microprocessor is configured to perform one or more initial processing operations on the data received by the plurality of sensors. The one or more initial processing operations include determining one or more tire characteristics using data from the plurality of sensors acquired at a frequency greater than a frequency of rotation of the tire. The tire sensor device further includes an antenna, coupled with the microprocessor, configured to wirelessly communicate with one or more external devices (note, however, that the antenna may be separate from and communicatively coupled with the tire sensor device). The tire sensor device has dimensions less than 5 cm×5 cm×2 cm. **[0007]** Further, the present disclosure provides a method of alerting a user to changes in tire characteristics. The method includes receiving data from a plurality of sensors disposed within

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	a tire. The plurality of sensors include, optionally, a microphone, a temperature sensor, and an accelerometer. The data from the plurality of sensors are acquired at a frequency greater than a frequency of rotation of the tire. The method includes determining one or more characteristics of the tire using the data from the plurality of sensors acquired at a frequency greater than a frequency of rotation of the tire, the one or more characteristics of the tire selected from the group consisting of: a wheel misalignment; a slow leak; a puncture; rubber decay; low tread depth; excessive load; and a mileage limit exceeded. The method further includes providing a user alert indicating the one or more characteristics of the tire. **[0034]** In some embodiments, the accelerometer **108** is adapted to detect and/or measure changes in the motion of the tire, for example, as the tire is driven on a road surface. For example, the accelerometer **108** may be part number ADXL372, manufactured by ANALOG DEVICES. In some embodiments, the accelerometer has a sampling rate of at least 3000 Hertz (Hz) (or 4000 Hz or 5000 Hz). In some embodiments, the accelerometer **108** has a sampling rate of 6400 Hz. In some embodiments, the accelerometer **108** has a sampling rate sufficient to acquire data (e.g., measurements) at a frequency greater than a frequency of rotation of the tire (e.g., at a predefined speed and for a predefined tire size and/or predefined circumference). For example, in some embodiments, the tire sensor device is adapted to operate (e.g., acquire multiple samples per wheel rotation) at speeds up to 120 miles per hour (mph) in a P215/60R16 tire. **[0035]** In some embodiments, the antenna **110** (e.g., a radio frequency (RF) antenna) is adapted to transmit data from the sensor board. For example, the antenna may be a printed on-board antenna. In some embodiments, the antenna **110** is adapted to communicate in an industrial, scientific and medical (ISM) radio band. In some embodiments, as described in greater detail with reference to FIGS. 7A-7C and FIG. 8, the antenna **110** is adapted to communicate over a plurality of bands (e.g., the antenna **110** is a multi-mode antenna). In some embodiments, the antenna **110** is adapted to communicate over BLUETOOTH (e.g., in a 2.4 GHz band). In some embodiments, antenna **110** is adapted to communicate over a 900 MHz Global System for Mobile Communications (GSM) band. In some embodiments, antenna **110** is adapted to communicate over a 415 MHz ISM band. In some embodiments, antenna **110** is an integral

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	part of the tire sensor devices described herein (e.g., tire sensor device **200**, FIG. 2). In some embodiments, an antenna is separate from and communicatively coupled to the tire sensor devices described herein. **[0021]** FIG. 9 is a flow diagram of a method for providing a user alert indicating one or more characteristics of a tire, in accordance with some embodiments.  FIG. 9 **[0090]** FIG. 9 is a flow diagram of a method **900** for providing a user alert indicating one or more characteristics of a tire, in accordance with some embodiments. In some embodiments, various operations of method **900** are performed by a tire sensor device (e.g., tire sensor device **200**, FIG. 2). In some embodiments, various operations of method **900** are performed by a tire monitoring server (e.g., tire monitoring server **304**, FIG. 3) that receives data from a tire sensor device. In some embodiments, various operations of method **900** are performed by an electronic device (e.g., electronic device **302-1** and/or electronic device **302-2**, FIG. 3) communicatively-coupled with a tire sensor device and/or communicatively-coupled with a tire monitoring server. "[INSERT]" (Dodani-063, cite.) **[0108]** In some embodiments, method **1000** include mounting (**1002**) a tire sensor device (e.g., tire sensor device **200**) on a

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	respective tire of each vehicle of a plurality of vehicles. The tire sensor device includes: a plurality of sensors including a microphone, a temperature sensor, and an accelerometer; and memory configured to store data received by the plurality of sensors. The one or more processors are coupled with the memory and configured to perform one or more initial processing operations on the data received by the plurality of sensors. The tire sensor device optionally includes an antenna, coupled with the one or more processors, configured to wirelessly communicate with one or more external devices. **[0024]** Some embodiments of the present disclosure provide a tire sensor device (e.g., a sensor board and/or a packaged) that is adapted to be mounted to a tire without invasive mounting requirements. The tire sensor device includes a plurality of sensors beyond a TPMS, including, optionally, a high-frequency accelerometer, a microphone, and/or a temperature sensor. The tire sensor device is further adapted to capture, measure, and analyze data from the tire using the plurality of sensors. The data may be transmitted to a server, which may analyze the data to quantify and characterize the effects of various external factors. These factors include, but are not limited to, road conditions, driver behavior, and environmental changes. By using a high-frequency accelerometer, for example, characteristics of individual rotations of each tire (e.g., the tires "footprint") can be determined. Tire conditions and degradation, such as rubber decay and/or low tread, can be identified by quantifying, characterizing, and removing the effects of external factors (e.g., road conditions).
20. The sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device. For example:* *See, e.g.*, **1[pre]**, above. **[0012]** FIG. 1 is an illustration of a sensor board of a tire sensor device, in accordance with some embodiments.

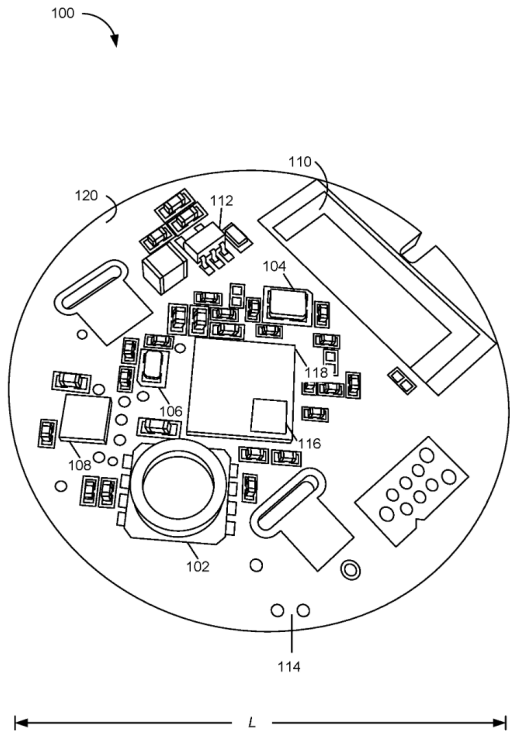
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	 FIG. 1 **[0028]** FIG. 1 is an illustration of a sensor board **100** of a tire sensor device, in accordance with some embodiments. The sensor board **100** has several components, including but not limited to a pressure sensor **102**, a microphone **104**, a temperature sensor **106**, an accelerometer **108**, an antenna **110**, a voltage regulator **112**, an analog input **114**, memory **116**, and one or more processors **118**. The various sensors are configured to collect data and supply the data to the memory **116** and/or one or more processors **118**. In some embodiments, the several components including the various sensors are affixed to a common (i.e., the same) polychlorinated biphenyl (PCB) board **120** (e.g., the various sensors have a fixed position with respect to one another). In some embodiments, the PCB board **120** has printed thereon wires to connect the several components to one another. Note that, in various embodiments, any of the aforementioned sensors may be omitted. For example, in some embodiments, sensor board **100**, or a tire sensor device that includes sensor board **100**, does not include a microphone, does not includes a temperature sensors, and/or does not include an accelerometer. **[0031]** In some embodiments, the pressure sensor **102** is adapted to capture and/or measure the pressure of a tire to which the sensor board **100** is affixed. For example, the pressure sensor **102** may

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	be part number MS580305BA01-00 (MS5803-05BA), manufactured by TE CONNECTIVITY. **[0033]** In some embodiments, the temperature sensor **106** is adapted to measure temperature variation within and/or proximate to the tire, for example, as the tire is driven on a road surface. For example, the temperature sensor **106** may be part number TMP102-Q1, manufactured by TEXAS INSTRUMENTS. **[0034]** In some embodiments, the accelerometer **108** is adapted to detect and/or measure changes in the motion of the tire, for example, as the tire is driven on a road surface. For example, the accelerometer **108** may be part number ADXL372, manufactured by ANALOG DEVICES. In some embodiments, the accelerometer has a sampling rate of at least 3000 Hertz (Hz) (or 4000 Hz or 5000 Hz). In some embodiments, the accelerometer **108** has a sampling rate of 6400 Hz. In some embodiments, the accelerometer **108** has a sampling rate sufficient to acquire data (e.g., measurements) at a frequency greater than a frequency of rotation of the tire (e.g., at a predefined speed and for a predefined tire size and/or predefined circumference). For example, in some embodiments, the tire sensor device is adapted to operate (e.g., acquire multiple samples per wheel rotation) at speeds up to 120 miles per hour (mph) in a P215/60R16 tire. **[0035]** In some embodiments, the antenna **110** (e.g., a radio frequency (RF) antenna) is adapted to transmit data from the sensor board. For example, the antenna may be a printed on-board antenna. In some embodiments, the antenna **110** is adapted to communicate in an industrial, scientific and medical (ISM) radio band. In some embodiments, as described in greater detail with reference to FIGS. 7A-7C and FIG. 8, the antenna **110** is adapted to communicate over a plurality of bands (e.g., the antenna **110** is a multi-mode antenna). In some embodiments, the antenna **110** is adapted to communicate over BLUETOOTH (e.g., in a 2.4 GHz band). In some embodiments, antenna **110** is adapted to communicate over a 900 MHz Global System for Mobile Communications (GSM) band. In some embodiments, antenna **110** is adapted to communicate over a 415 MHz ISM band. In some embodiments, antenna **110** is an integral part of the tire sensor devices described herein (e.g., tire sensor device **200**, FIG. 2). In some embodiments, an antenna is separate from and communicatively coupled to the tire sensor devices described herein.

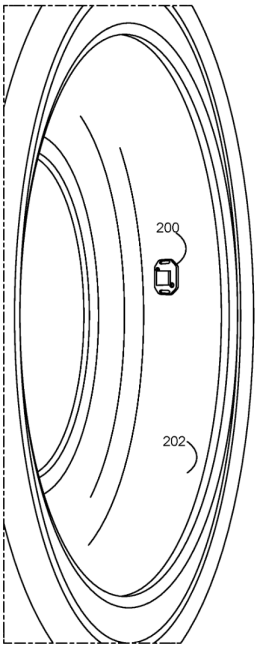
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	[0036] In some embodiments, the voltage regulator **112** is adapted to regulate battery power (e.g., ensures that the antenna **110** receives a consistent voltage within specifications). Regulating the voltage to antenna **110** helps reduce transient noise in the signal sent from the antenna **110**, reducing the overall power draw and improving efficiency. For example, the voltage regulator **112** may be part number TPS62740, manufactured by TEXAS INSTRUMENTS. **[0038]** In some embodiments, the one or more processors **118** are adapted to analyze data stored in the memory **116** and/or received from one or more of the sensors on the sensor board. In some embodiments, the one or more processors **118** comprise one or more microprocessors (e.g., the microprocessor comprises one or more central processing units (CPUs) and/or general processing units (GPUs)). In some embodiments, the one or more processors **118** comprise one or more field programmable gate arrays (FPGAs). In some embodiments, the one or more processors **118** comprise one or more application specific integrated circuits (ASICs). In some embodiments, the one or more processors **118** are embodied as a system-on-chip (SoC) (e.g., part number nRF52832, or a similar part such as nRF52840, manufactured by NORDIC SEMICONDUCTOR). The nRF52832 is an ultra-low power multiprotocol SoC with hardware support on-chip for BLUETOOTH® 5. The nRF52832 may further includes near-field communication (NFC) capabilities. **[0039]** In some embodiments, memory **116** is adapted to store data captured and/or generated by one or more sensors on the sensor board **100**. In some embodiments, memory **116** includes high-speed random access memory, such as DRAM, SRAM, DDR RAM, or other random access solid-state memory devices; and may include non-volatile memory, such as one or more flash memory devices, or other non-volatile solid-state storage devices. Memory **116** optionally includes one or more storage devices remotely located from one or more processors **118**. Memory **116**, or, alternatively, the non-volatile solid-state memory device(s) within memory **116**, includes a non-transitory computer-readable storage medium. In some embodiments, memory **116** comprises flash memory. For example, the flash memory may be part number W25N01GVZEIG TR (W25N01GV), manufactured by WINBOND ELECTRONICS. In some

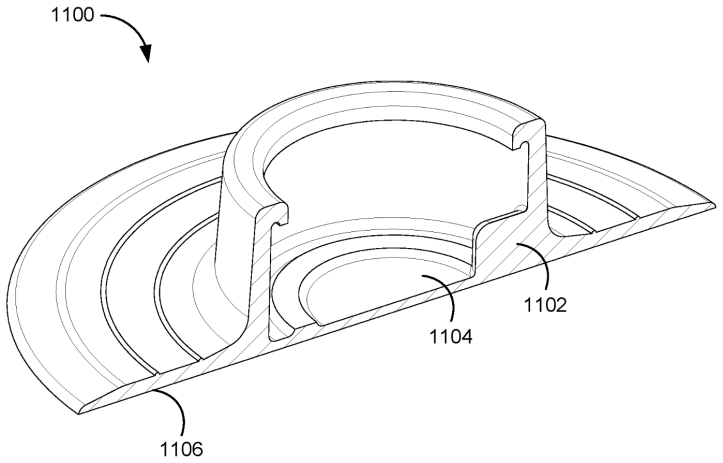
'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	embodiments, memory **116** is packaged with the one or more processors **118** (e.g., as a single microprocessor).
21. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor. For example:* *See, e.g.*, **1[pre]**, above. **[0038]** In some embodiments, the one or more processors **118** are adapted to analyze data stored in the memory **116** and/or received from one or more of the sensors on the sensor board. In some embodiments, the one or more processors **118** comprise one or more microprocessors (e.g., the microprocessor comprises one or more central processing units (CPUs) and/or general processing units (GPUs)). In some embodiments, the one or more processors **118** comprise one or more field programmable gate arrays (FPGAs). In some embodiments, the one or more processors **118** comprise one or more application specific integrated circuits (ASICs). In some embodiments, the one or more processors **118** are embodied as a system-on-chip (SoC) (e.g., part number nRF52832, or a similar part such as nRF52840, manufactured by NORDIC SEMICONDUCTOR). The nRF52832 is an ultra-low power multiprotocol SoC with hardware support on-chip for BLUETOOTH® 5. The nRF52832 may further includes near-field communication (NFC) capabilities. **[0039]** In some embodiments, memory **116** is adapted to store data captured and/or generated by one or more sensors on the sensor board **100**. In some embodiments, memory **116** includes high-speed random access memory, such as DRAM, SRAM, DDR RAM, or other random access solid-state memory devices; and may include non-volatile memory, such as one or more flash memory devices, or other non-volatile solid-state storage devices. Memory **116** optionally includes one or more storage devices remotely located from one or more processors **118**. Memory **116**, or, alternatively, the non-volatile solid-state memory device(s) within memory **116**, includes a non-transitory computer-readable storage medium. In some embodiments, memory **116** comprises flash memory. For example, the flash memory may be part number W25N01GVZEIG TR (W25N01GV), manufactured by WINBOND ELECTRONICS. In some

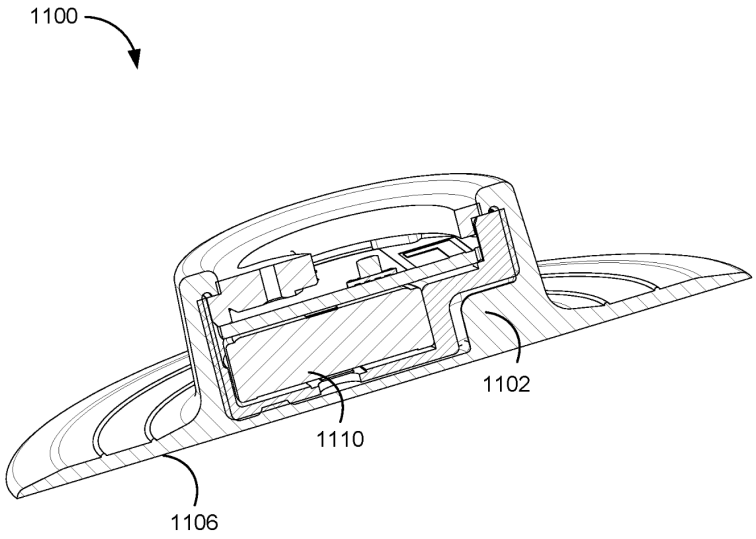
'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	embodiments, memory **116** is packaged with the one or more processors **118** (e.g., as a single microprocessor).
22. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device. For example:* *See, e.g.*, **1[pre]**, above. **[0034]** In some embodiments, the accelerometer **108** is adapted to detect and/or measure changes in the motion of the tire, for example, as the tire is driven on a road surface. For example, the accelerometer **108** may be part number ADXL372, manufactured by ANALOG DEVICES. In some embodiments, the accelerometer has a sampling rate of at least 3000 Hertz (Hz) (or 4000 Hz or 5000 Hz). In some embodiments, the accelerometer **108** has a sampling rate of 6400 Hz. In some embodiments, the accelerometer **108** has a sampling rate sufficient to acquire data (e.g., measurements) at a frequency greater than a frequency of rotation of the tire (e.g., at a predefined speed and for a predefined tire size and/or predefined circumference). For example, in some embodiments, the tire sensor device is adapted to operate (e.g., acquire multiple samples per wheel rotation) at speeds up to 120 miles per hour (mph) in a P215/60R16 tire. **[0051]** In some embodiments, the electronic device **302** includes a location-detection device **440**, such as a global navigation satellite system (GNSS) (e.g., GPS (global positioning system), GLONASS, Galileo, BeiDou) or other geo-location receiver, and/or location-detection software for determining the location of the electronic device **302** (e.g., module for finding a position of the electronic device **302** using trilateration of measured signal strengths for nearby devices).
23. The sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object. For example:* *See, e.g.*, **1[pre]**, above.

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environment, the sensor assembly, or the object.	**[0012]** FIG. 1 is an illustration of a sensor board of a tire sensor device, in accordance with some embodiments.  FIG. 1 **[0028]** FIG. 1 is an illustration of a sensor board **100** of a tire sensor device, in accordance with some embodiments. The sensor board **100** has several components, including but not limited to a pressure sensor **102**, a microphone **104**, a temperature sensor **106**, an accelerometer **108**, an antenna **110**, a voltage regulator **112**, an analog input **114**, memory **116**, and one or more processors **118**. The various sensors are configured to collect data and supply the data to the memory **116** and/or one or more processors **118**. In some embodiments, the several components including the various sensors are affixed to a common (i.e., the same) polychlorinated biphenyl (PCB) board **120** (e.g., the various sensors have a fixed position with respect to one another). In some embodiments, the PCB board **120** has printed thereon wires to connect the several components to one another. Note that, in various embodiments, any of the aforementioned sensors may be omitted. For example, in some embodiments, sensor board **100**, or a tire sensor device that includes sensor board **100**, does not include a microphone, does not includes a temperature sensors, and/or does not include an accelerometer.

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	[0031] In some embodiments, the pressure sensor **102** is adapted to capture and/or measure the pressure of a tire to which the sensor board **100** is affixed. For example, the pressure sensor **102** may be part number MS580305BA01-00 (MS5803-05BA), manufactured by TE CONNECTIVITY. **[0033]** In some embodiments, the temperature sensor **106** is adapted to measure temperature variation within and/or proximate to the tire, for example, as the tire is driven on a road surface. For example, the temperature sensor **106** may be part number TMP102-Q1, manufactured by TEXAS INSTRUMENTS. **[0034]** In some embodiments, the accelerometer **108** is adapted to detect and/or measure changes in the motion of the tire, for example, as the tire is driven on a road surface. For example, the accelerometer **108** may be part number ADXL372, manufactured by ANALOG DEVICES. In some embodiments, the accelerometer has a sampling rate of at least 3000 Hertz (Hz) (or 4000 Hz or 5000 Hz). In some embodiments, the accelerometer **108** has a sampling rate of 6400 Hz. In some embodiments, the accelerometer **108** has a sampling rate sufficient to acquire data (e.g., measurements) at a frequency greater than a frequency of rotation of the tire (e.g., at a predefined speed and for a predefined tire size and/or predefined circumference). For example, in some embodiments, the tire sensor device is adapted to operate (e.g., acquire multiple samples per wheel rotation) at speeds up to 120 miles per hour (mph) in a P215/60R16 tire.
24. The sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire. For example:* *See, e.g.*, **1[pre]**, above. **[0013]** FIGS. 2A-2B illustrate a tire sensor device disposed on an inner surface of a tire opposite a tread, in accordance with some embodiments.

’421 Claim Element	Disclosures from Prior Art (Dodani-063)
	 FIG. 2A **[0041]** FIGS. 2A-2B illustrate a tire sensor device **200** disposed on an inner surface of a tire **202** opposite a tread, in accordance with some embodiments. In some embodiments, the tire sensor device **200** has dimensions less than 5 cm (e.g., in width W)×5 cm (e.g., in length L)×2 cm (e.g., in height H above the inner surface of the tire **202**). In some embodiments, the tire sensor device **200** has dimensions less than 10 cm×10 cm×4 cm. In some embodiments, tire sensor device **200** incudes a plurality of sensors including a microphone, a temperature sensor, and an accelerometer (e.g., includes sensor board **100**, FIG. 1). In some embodiments, tire sensor device **200** is configured to operate (e.g., obtain measurements from the plurality of sensors) while tire **202** is in use (e.g., while the vehicle is moving and the tire is pressurized to a pressure above 30 pounds per square inch (psi)). **[0042]** As illustrated, the tire sensor device **200** is affixed to the inner surface of the tire. For example, the sensor may be affixed to the inner surface of the tire using an industrial strength epoxy. As a result, there is no need to modify the manufacturing process of the tire and no damage results from affixing the sensor module to the tire. The sensor module may be affixed to the tire in any other suitable, non-invasive manner. In some circumstances, the tire sensor device **200** is installed at the time of manufacture, although the tire sensor device **200** may also be installed at a later time. In some circumstances, the tire sensor device **200** is

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	mounted at a midline of the inner surface of the tire, opposite the tread, although tire sensor device **200** may be installed elsewhere. In addition, two or more tire sensor devices **200** may be installed on a single tire. In some embodiments, the tire sensor device **200** is installed with a particular alignment relative to the tire (e.g., a first predetermined axis of the tire sensor device **200** is installed in a direction aligned with a circumference of the tire, such that the tire sensor device **200**'s accelerometers are aligned along a known axis with respect to the tire). **[0043]** In some embodiments, the tire sensor device **200** is affixed to the inner surface of the tire through a tire sensor dock (e.g., tire sensor dock **1100**, FIGS. 11A-11B) **[0023]** FIGS. 11A-11B show a tire sensor dock, in accordance with some embodiments.  FIG. 11A

’421 Claim Element	Disclosures from Prior Art (Dodani-063)
	 FIG. 11B **[0116]** FIGS. 11A-11B shows a tire sensor dock 1100, in accordance with some embodiments. In some embodiments, tire sensor dock 1100 is adapted to receive a tire sensor device 1110 (FIG. 11B) (e.g., which may be functionally analogous to tire sensor device 200, FIG. 2). For example, tire sensor dock 1100 includes an opening 1104 that provides a snug fit with the tire sensor device 1110. In some embodiments, tire sensor dock 1100 is adapted to receive (e.g., mate with) a tire sensor device 1110 such that the tire sensor device 1110 is non-rotatably positioned within the sensor dock. For example, tire sensor dock 1100 includes or has formed therein a boss 1102 which abuts the tire sensor device 1110 and prevents rotation (e.g., the tire sensor device 1110 has formed therein a complementary feature that receives the boss 1102 and prevents rotation). Alternatively, tire sensor dock 1100 is adapted to receive a boss formed on the tire sensor device 1110. **[0117]** A bottom surface **1106** of the tire sensor dock **1100** is further adapted to be affixed to the inner surface of a tire. In some embodiments, the tire sensor dock **1100** is made of natural rubber. The tire sensor dock **1100** is affixed and chemically bonded to the tire using a gum (e.g., a rubber vulcanizing cement) that cross-links with inner surface of the tire (e.g., thus, the tire sensor dock **1100** is permanently affixed to the tire). The durometer of the rubber of the tire sensor dock **1100** is similar to that of a tire after vulcanization (e.g., ranges between 40-80 depending on the stiffness required). In some embodiments, the tire sensor

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
	dock **1100** has a similar stiffness (e.g., within 5% or within 10%) to that of the tire so that the tire sensor dock **1100** flexes in a similar manner as the tire as it is rolling on the ground. Having a similar stiffness as the tire reduces shear stresses between the tire and the sensor dock caused by vibrations while in use and increases the lifespan of the tire sensor dock **1100** (e.g., the tire sensor dock **1100** can withstand speeds up to 300 mph and is designed to last at least 5 years).
28[pre]. A sensor assembly and sensing system for use with an object that rotates in use comprising:	*To the extent that the preamble is limiting, Dodani-063 discloses, teaches, and/or suggests a* sensor assembly and sensing system for use with an object that rotates in use comprising. *For example:* *See, e.g.*, **1[pre]**, **11**, above. *See also following limitations.*
[28a] a housing comprising an outer structure that defines an open internal cavity therein,	*Dodani-063 discloses, teaches, and/or suggests a housing comprising an outer structure that defines an open internal cavity therein. For example:* *See, e.g.*, **[1a]-[1c]**, **10**, above.
[28b] an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device,	*Dodani-063 discloses, teaches, and/or suggests an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device. For example:* *See, e.g.*, **[1a]-[1c]**, **5**, **10**, above.
[28c] wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location.	*Dodani-063 discloses, teaches, and/or suggests wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location. For example:* *See, e.g.*, **[1d]**, above.
[28d] wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the	*Dodani-063 discloses, teaches, and/or suggests wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor. For example:* *See, e.g.*, **[1a]-[1c]**, **20**, above.

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
operating parameter being monitored by the sensor;	
[28e] a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member; and	*Dodani-063 discloses, teaches, and/or suggests a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member. For example:* *See, e.g.*, **[1e]**, **7**, **8**, above.
[28f] a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly.	*Dodani-063 discloses, teaches, and/or suggests a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly. For example:* *See, e.g.*, **1**, **11**, above.
31. The sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity. For example:* *See, e.g.*, **[1c]**, above.
32. The sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member. For example:* *See, e.g.*, **[1e]**, **9**, above.
33. The sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:*

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*See, e.g.*, **[1b]**, **11** above.
34. The sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data.	*Dodani-063 discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data. For example:* *See, e.g.,* **1[pre]**, **[1b]**, **[1d]**, **[1e]**, **11**, **12**, **20**, above.
41[pre] A method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of:	*To the extent that the preamble is limiting, Dodani-063 discloses, teaches, and/or suggests a method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of: vulcanized rubber tire comprising. For example:* *See, e.g.,* **1**, **11**, **12**, **20**, above. *See also following limitations.*
[41a] installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity, and	*Dodani-063 discloses, teaches, and/or suggests installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41b] wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry,	*Dodani-063 discloses, teaches, and/or suggests wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

'421 Claim Element	Disclosures from Prior Art (Dodani-063)
[41c] wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity;	*Dodani-063 discloses, teaches, and/or suggests wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41d] attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object; and	*Dodani-063 discloses, teaches, and/or suggests attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object. For example:* *See, e.g.,* **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41e] monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly.	*Dodani-063 discloses, teaches, and/or suggests monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
43. The method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity.	*Dodani-063 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
44. The method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before	*Dodani-063 discloses, teaches, and/or suggests the method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above

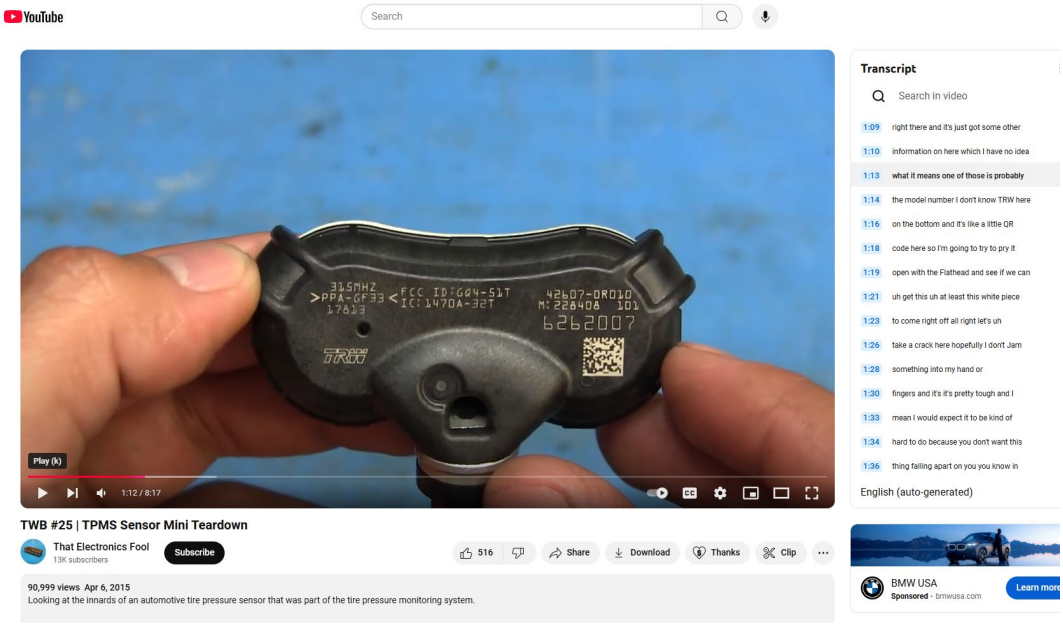
'421 Claim Element	Disclosures from Prior Art (Dodani-063)
or after the object has been formed.	
48. The method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire.	*Dodani-063 discloses, teaches, and/or suggests the method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
50. The method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing.	*Dodani-063 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
51. The method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device.	*Dodani-063 discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
52. The method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor.	*Dodani-063 discloses, teaches, and/or suggests the method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
53. The method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth,	*Dodani-063 discloses, teaches, and/or suggests the method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined*

'421 Claim Element	**Disclosures from Prior Art (Dodani-063)**
slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly.	*from information sent wirelessly from the sensor assembly. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

Invalidity Claim Chart Against U.S. Patent No. 11,835,421 ("'421 Patent")
Based on TRW-TPMS Sensors

The "TRW-TPMS Sensors" are representative of traditional valve-stem mounted TPMS units that have long been available in the prior art. TRW-TPMS Sensors qualify as prior art under at least 35 U.S.C. § 102(a), as reflected in at least the following:

- https://www.youtube.com/watch?v=JQhK8WqRZ2g (dated April 6, 2015)



TRW-TPMS Sensors anticipates and/or renders obvious the Asserted Claims of the '421 Patent (at least as Revvo understands Plaintiff's application of the Asserted Claims in an effort to show infringement).

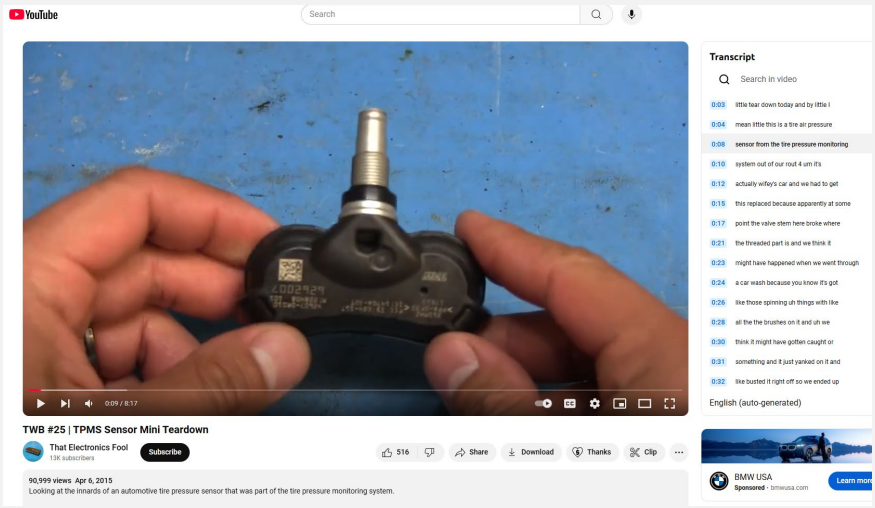
To the extent Plaintiff argues that any element below is not disclosed by TRW-TPMS Sensors, a person of ordinary skill in the art would have found it obvious to combine the teachings of TRW-TPMS Sensors with the background knowledge of a person of ordinary skill in the art and/or the additional references and exemplary teachings set forth in the chart below, to arrive at the claim limitation with a reasonable expectation of success. The chart below provides representative examples of where each element of each claim is found within TRW-TPMS Sensors. Citations are meant to be exemplary, not exhaustive, and Revvo reserves the right to identify and discuss additional portions of the reference in support of its contentions and/or to rebut arguments made by Plaintiff. Citations to figures, drawings, tables, and the link include reference to any accompanying or related text. All internal cross-references are meant to incorporate the cross-referenced material as if fully set forth therein.

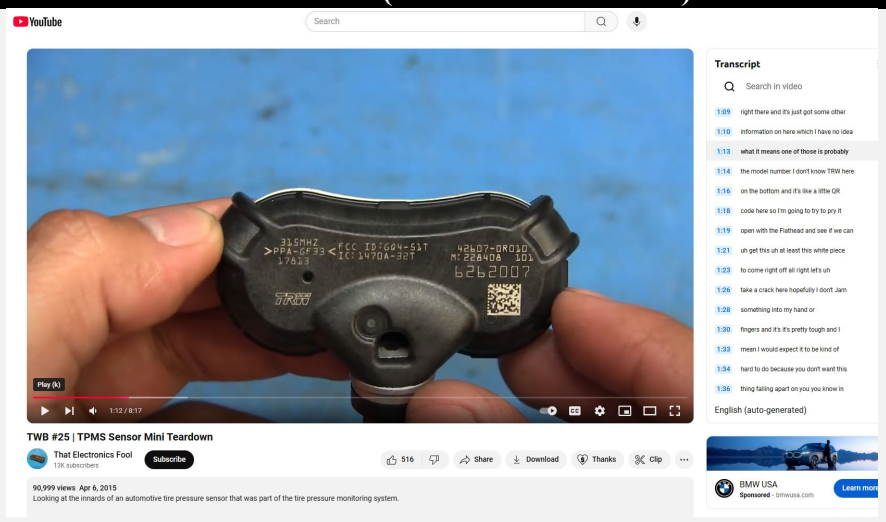
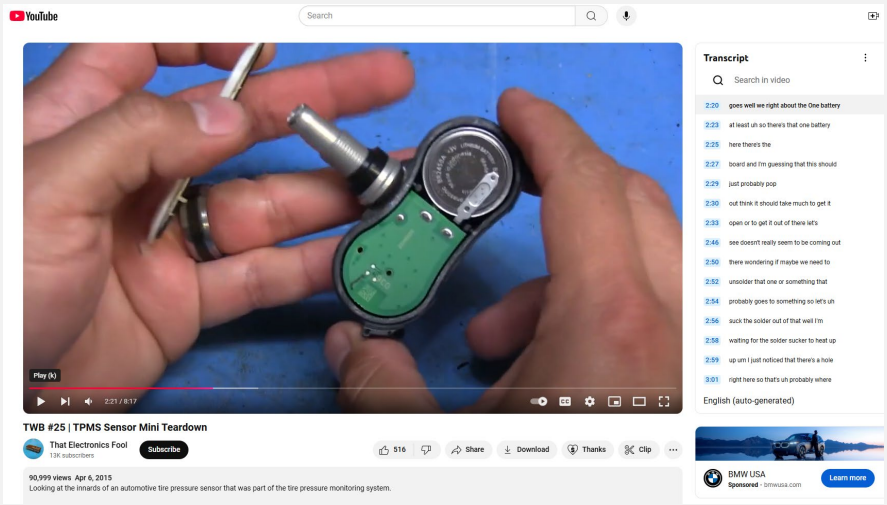
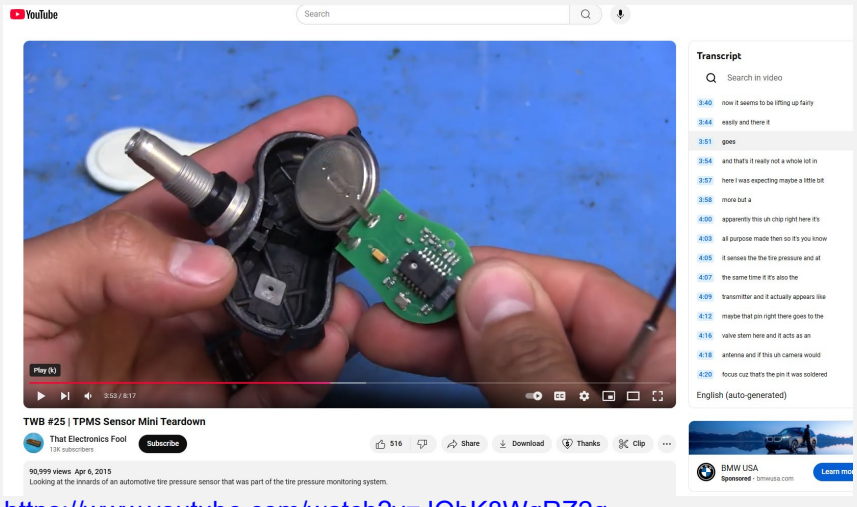
It is Revvo's position that Plaintiff's October 30, 2024 Infringement Contentions have not established that any accused product or service infringes any valid claim. Thus, Revvo's statements below should not be treated as an admission, implication, or suggestion that Revvo agrees with Plaintiff regarding either the scope, construction, or interpretation of any of the

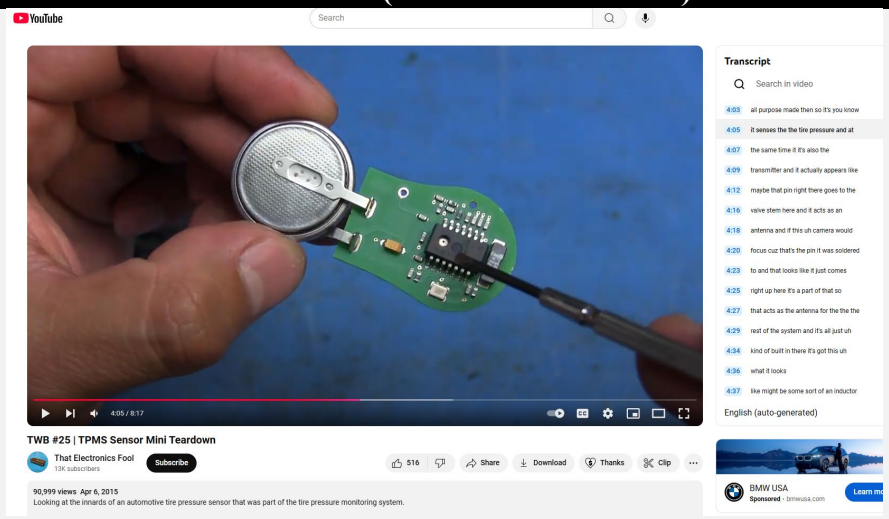
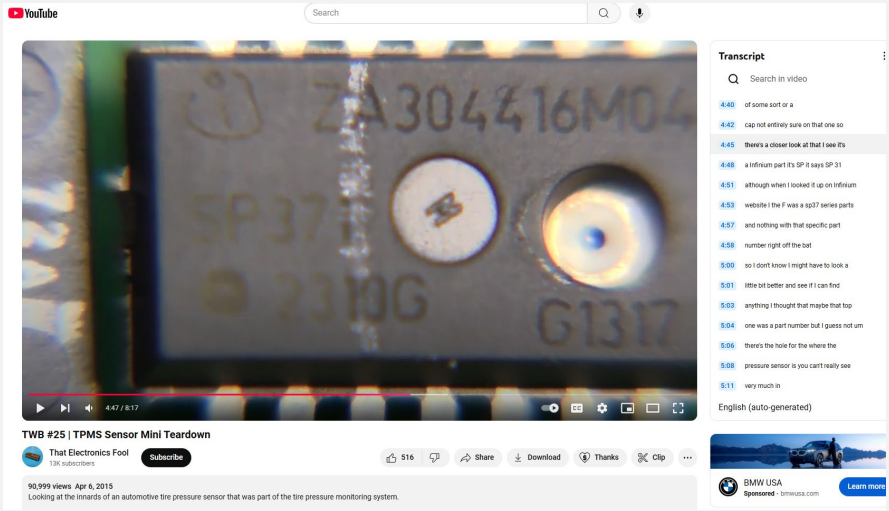
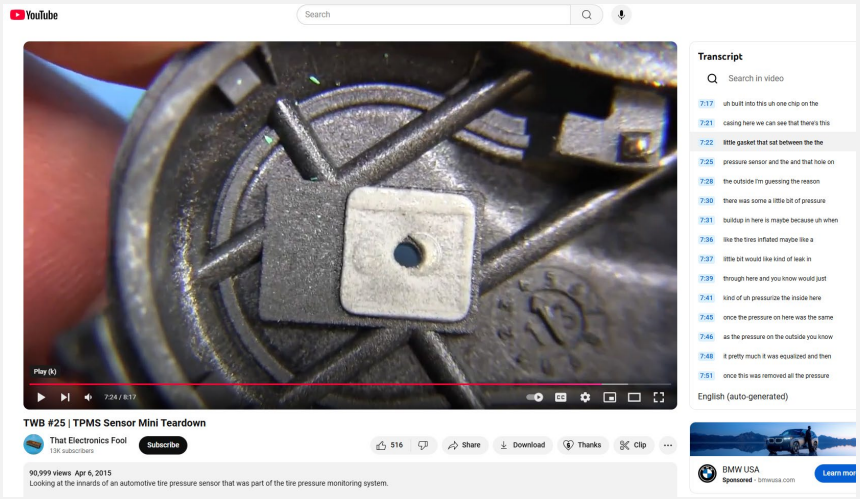
Asserted Claims or the infringement theories advanced by Plaintiff in its Infringement Contentions, including whether any Asserted Claim satisfies 35 U.S.C. §§ 101 or 112. In certain cases, Revvo has specified non-limiting examples of where its application of the prior art is based on Plaintiff's apparent application of the claim element. These statements are not intended to suggest that Revvo agrees with Plaintiff's application of any claim element, suggest a proposed construction at this stage of the case, or suggest that construction is needed, as the parties are not required to exchange terms for construction or propose claim constructions until a later date.

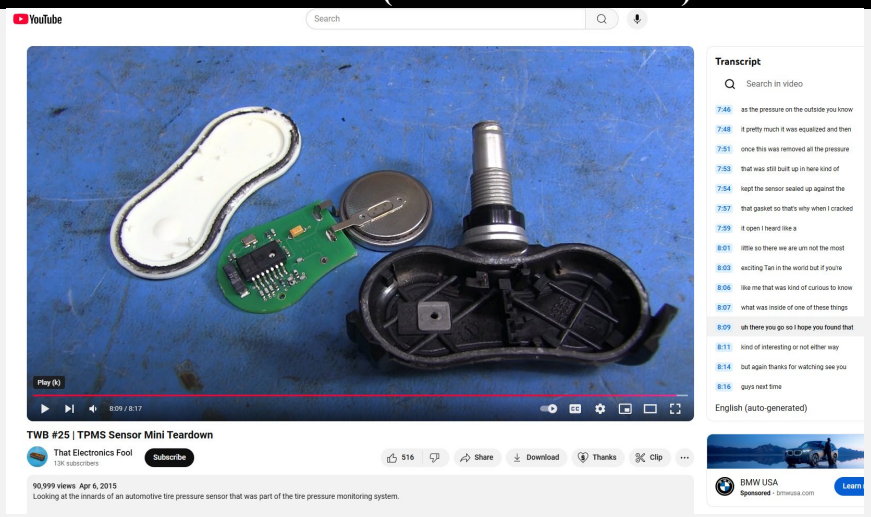
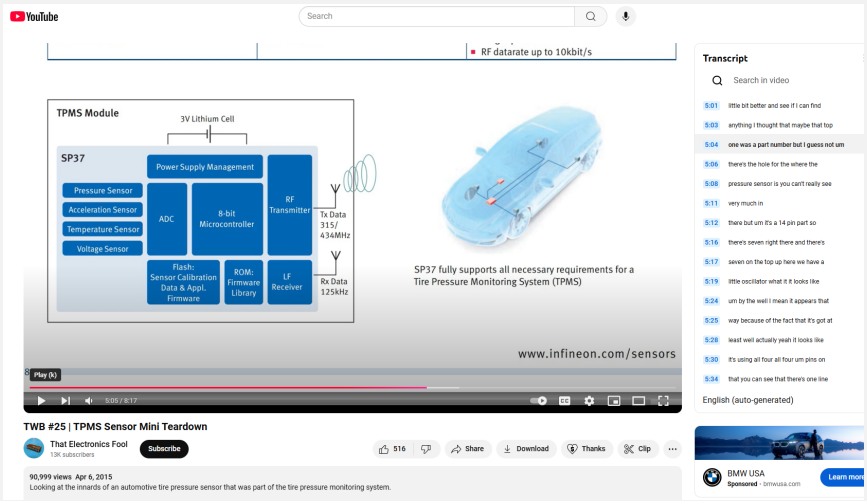
Plaintiff has yet to identify any limitation of the Asserted Claims that it contends is not anticipated and/or rendered obvious by TRW-TPMS Sensors. Revvo therefore expressly reserves the right to respond to any such contention, including by identifying additional obviousness combinations, if Plaintiff makes any such contention.

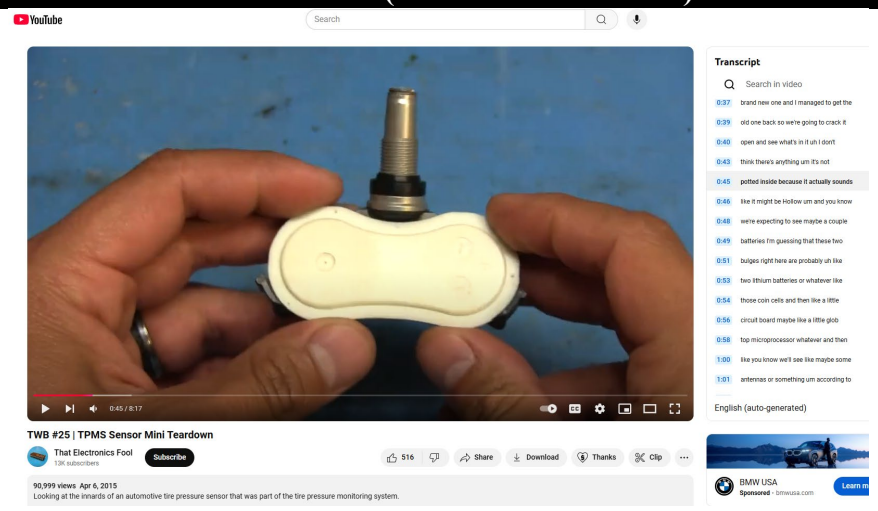
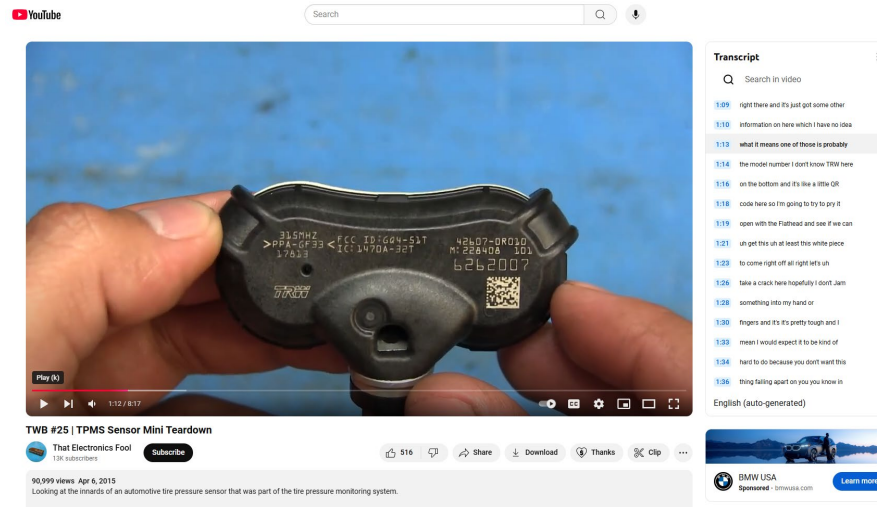
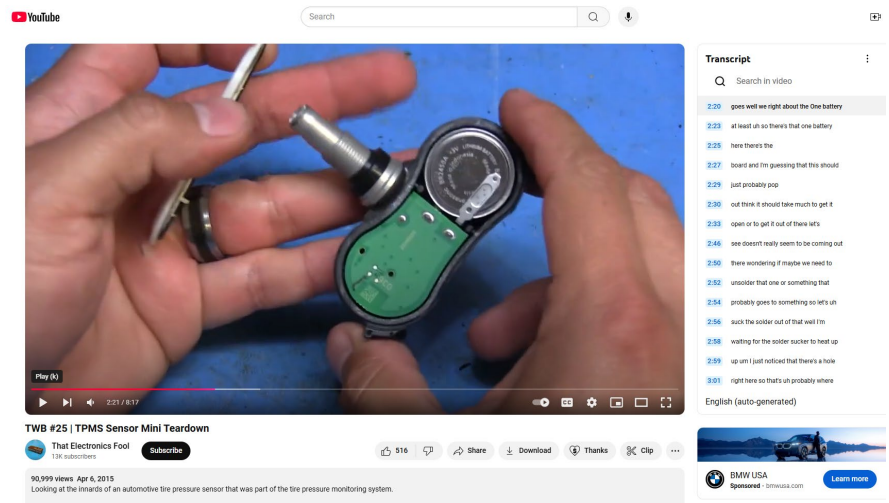
Where Revvo states that TRW-TPMS Sensors "discloses" a limitation, that disclosure may be express, implicit, and/or inherent.

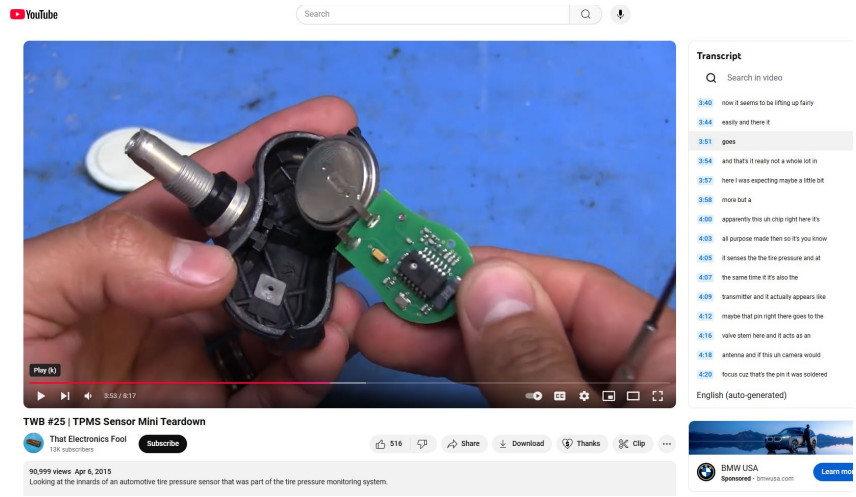
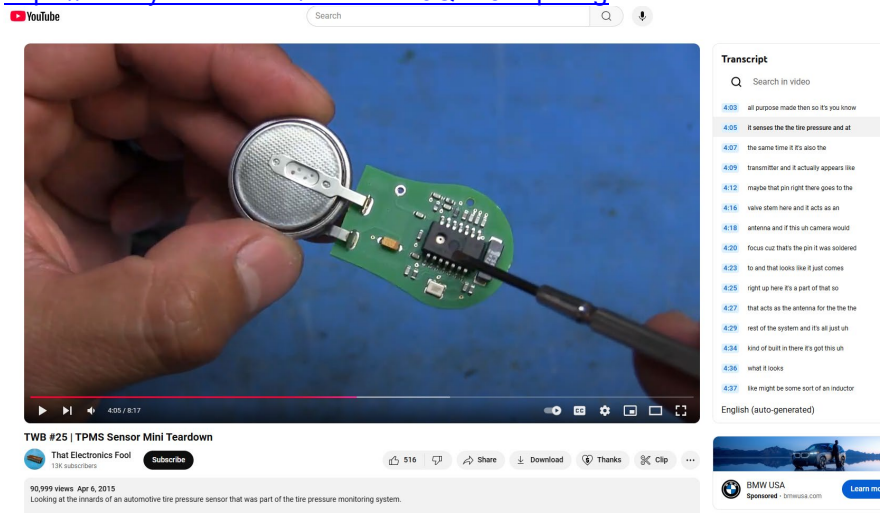
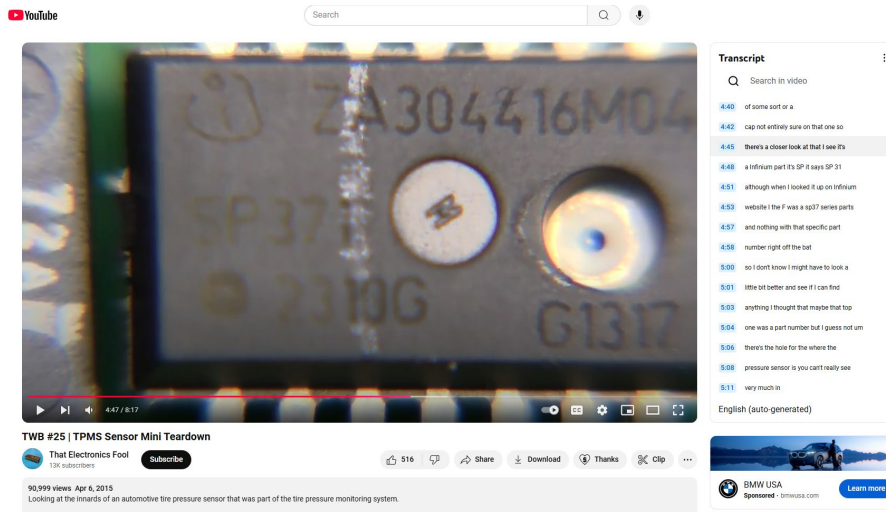
'421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
1[pre]. A sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising:	*To the extent that the preamble is limiting, TRW-TPMS Sensors discloses, teaches, and/or suggests a sensor assembly configured for attachment with an object that is rotated in use, the sensor assembly comprising. For example:*  https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g

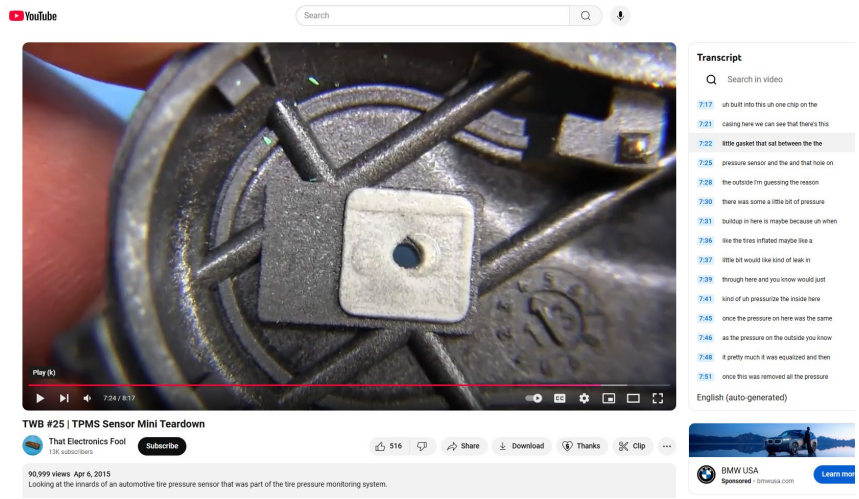
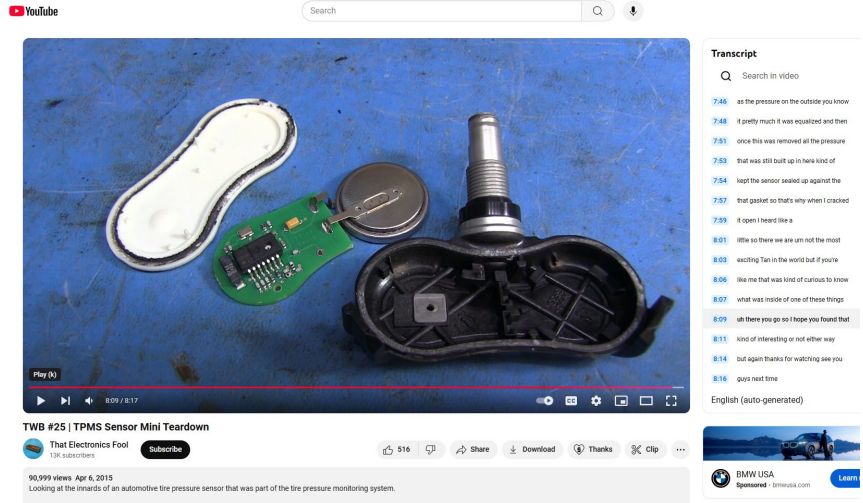
’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g

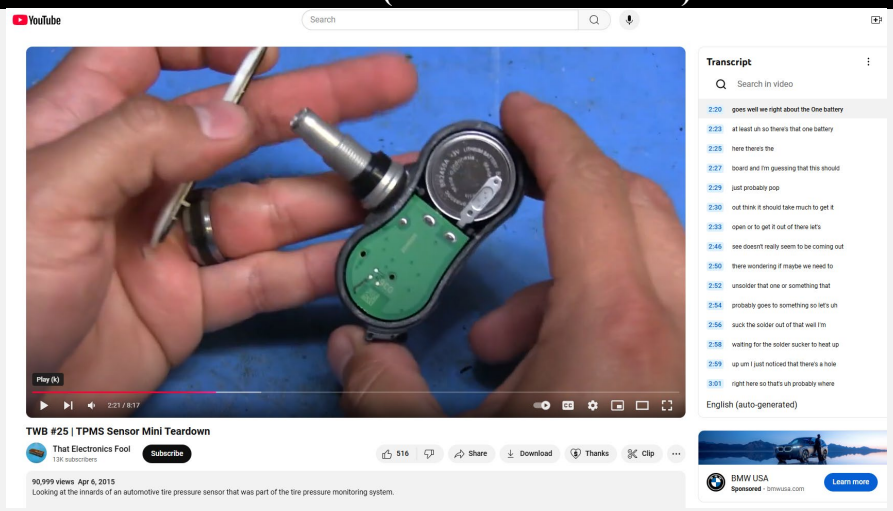
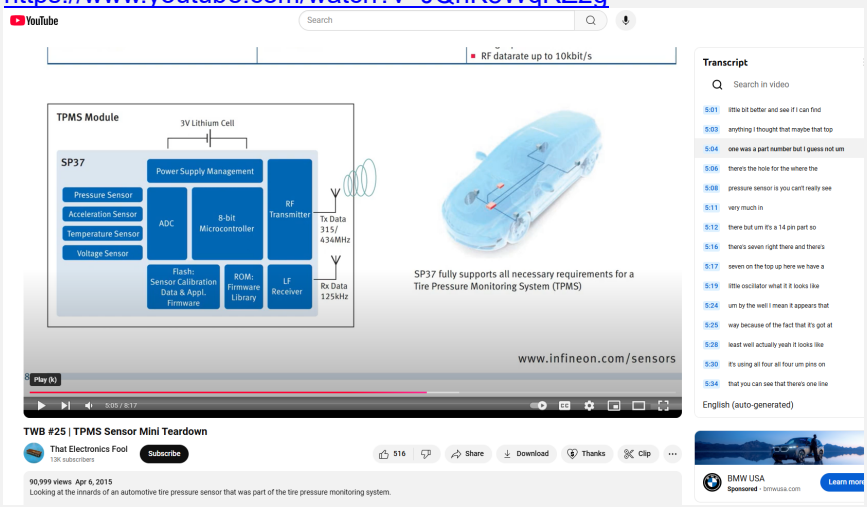
’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g

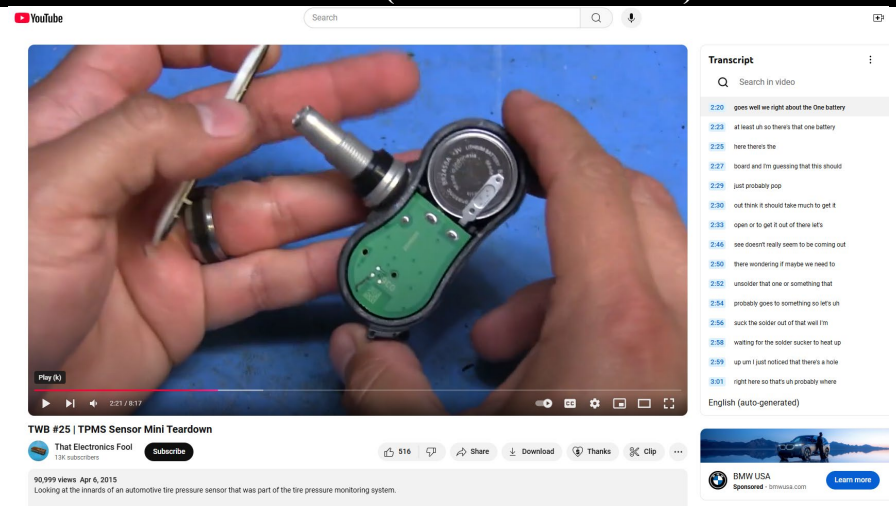
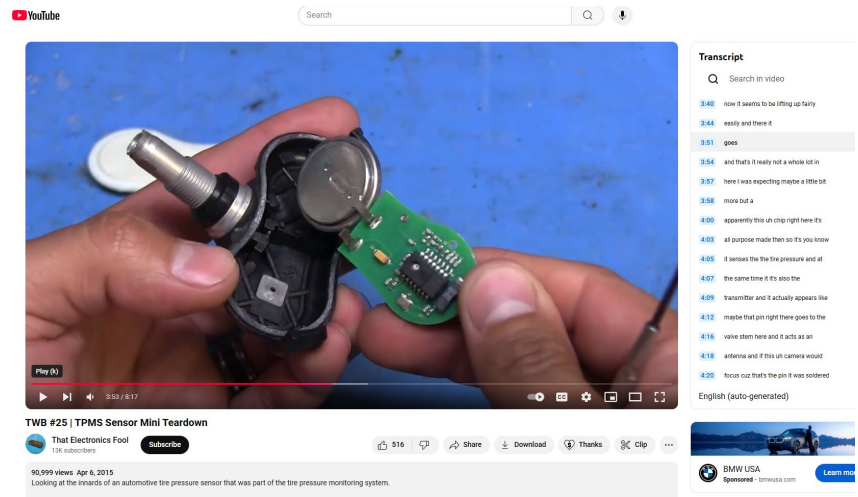
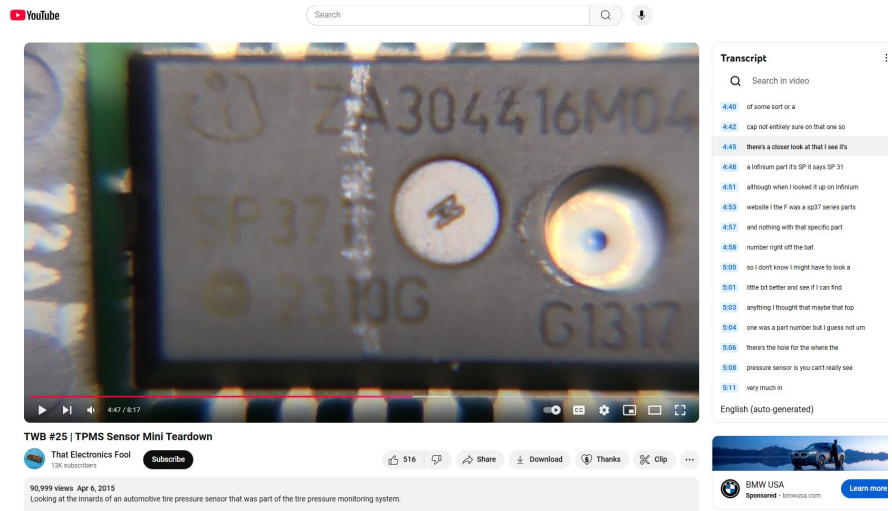
’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g *See also following limitations.*
[1a] a housing comprising an outer surface and an internal cavity that is enclosed within the housing;	*TRW-TPMS Sensors discloses, teaches, and/or suggests a housing comprising an outer surface and an internal cavity that is enclosed within the housing. For example:* *See, e.g.*, **1[pre]**, above.

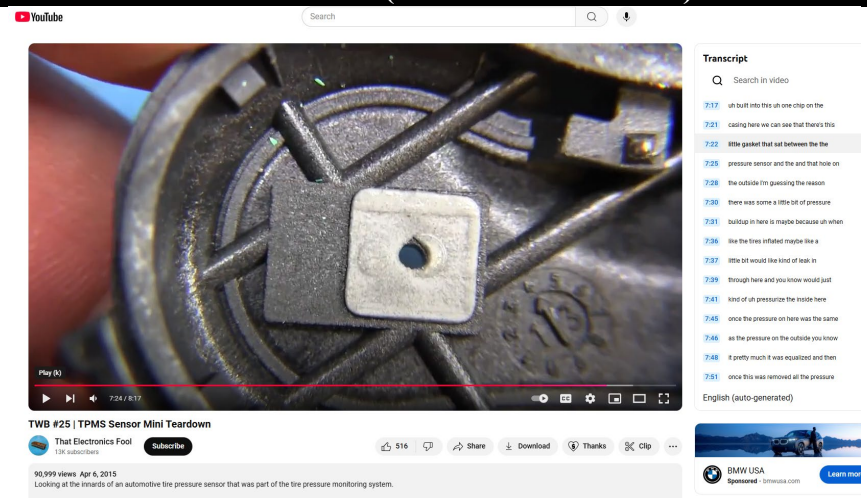
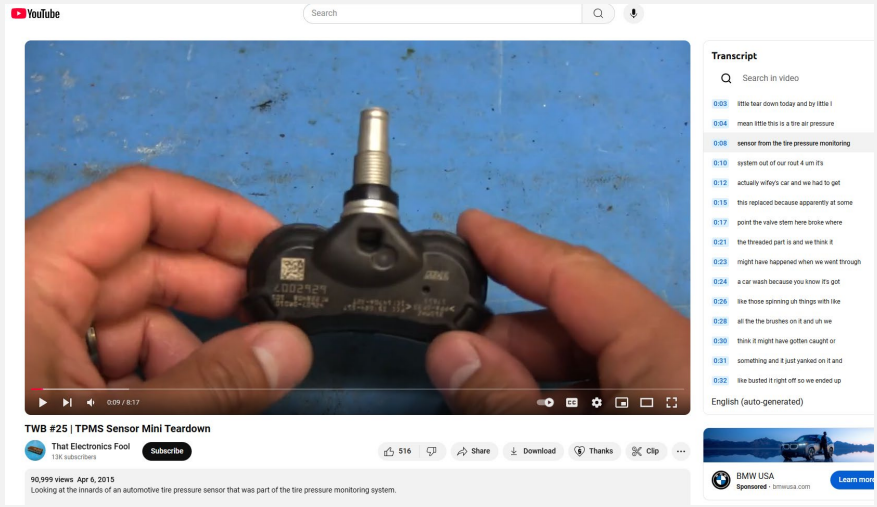
’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g

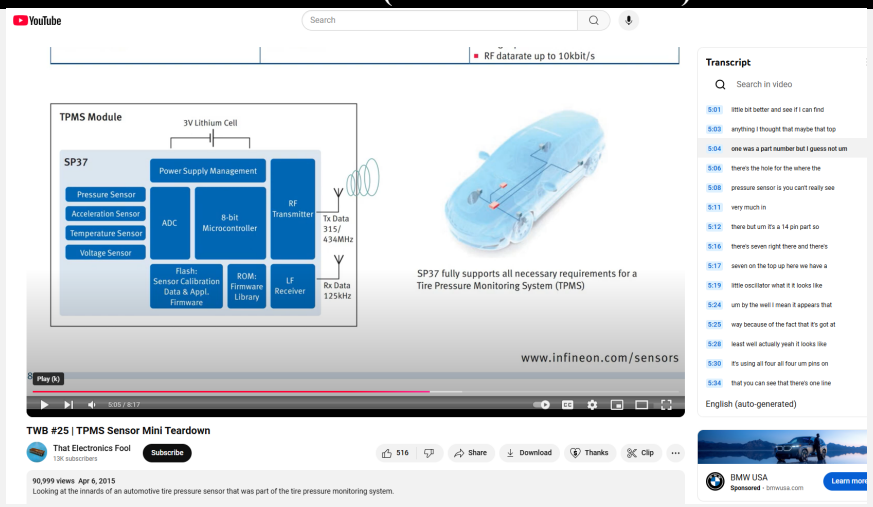
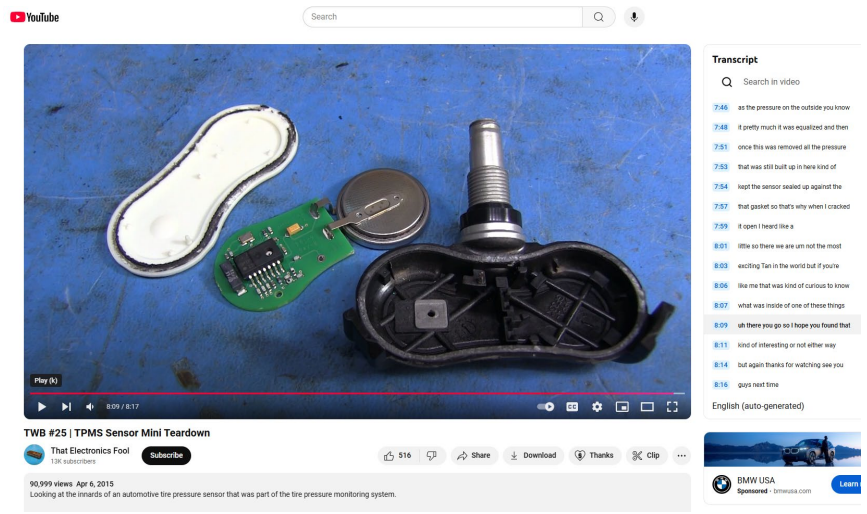
’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g

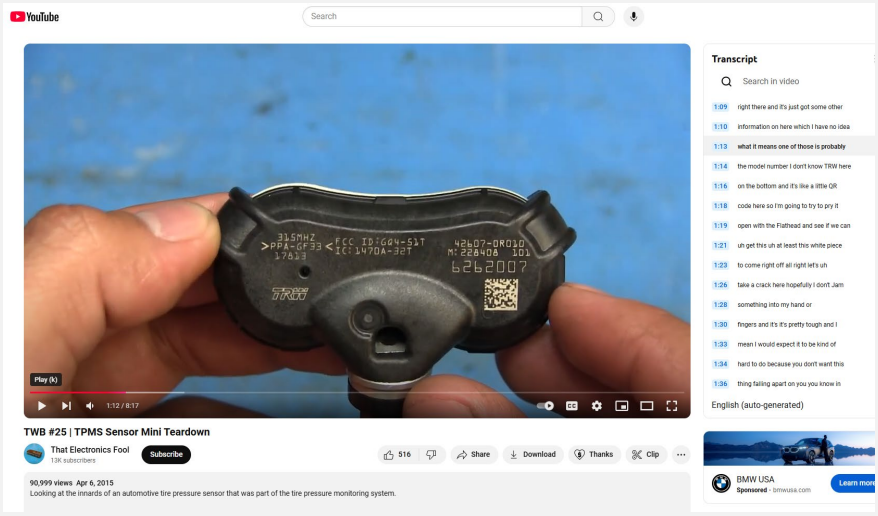
’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g
[1b] an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity,	*TRW-TPMS Sensors discloses, teaches, and/or suggests an electrical sensor device that is disposed within the internal cavity and attached therein to prevent movement of the device within the internal cavity. For example:* *See, e.g.*, **1[pre]**, above.

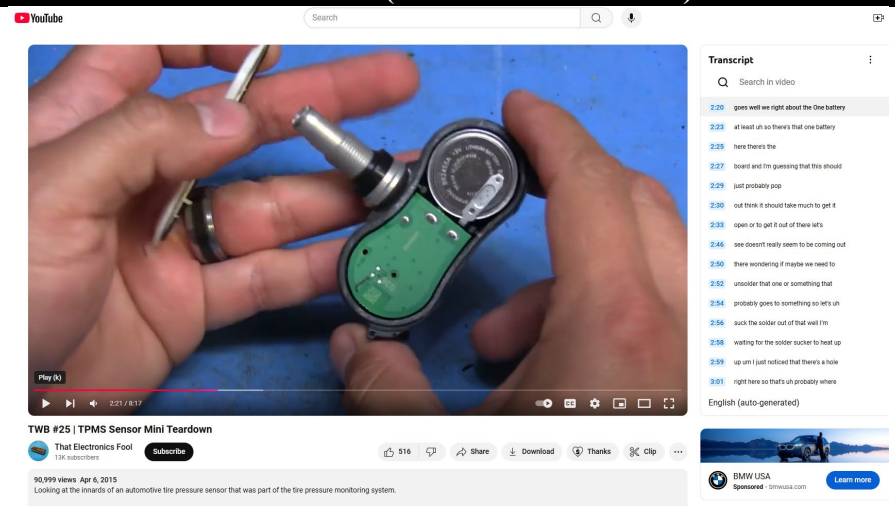
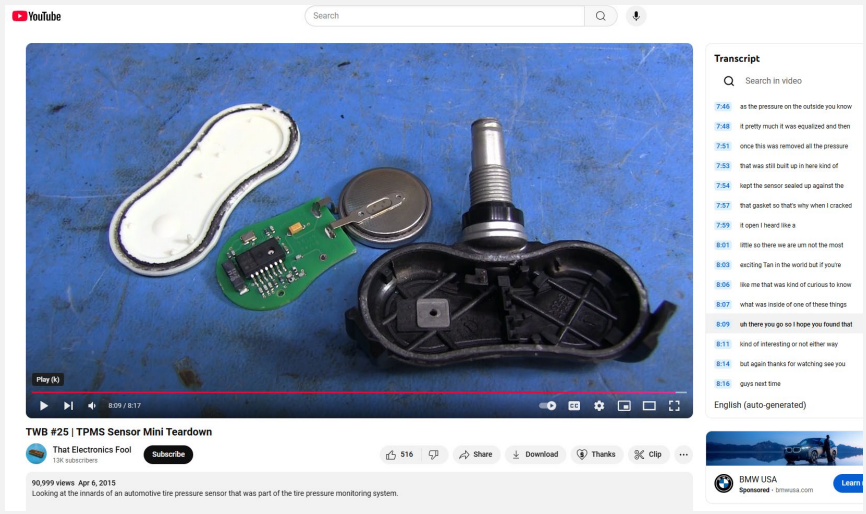
’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g
[1c] wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing,	*TRW-TPMS Sensors discloses, teaches, and/or suggests wherein the internal cavity comprises an unfilled open space above or below the electrical sensor device in the housing. For example:* *See, e.g.*, **1[pre]**, above.

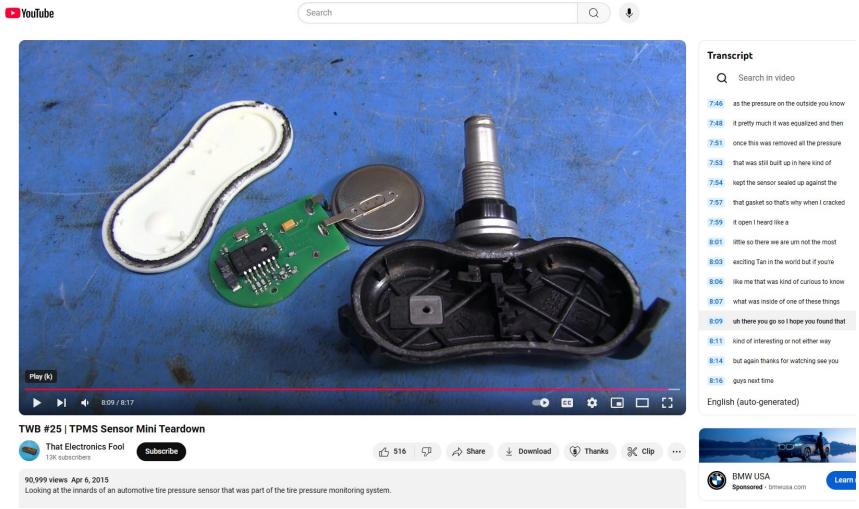
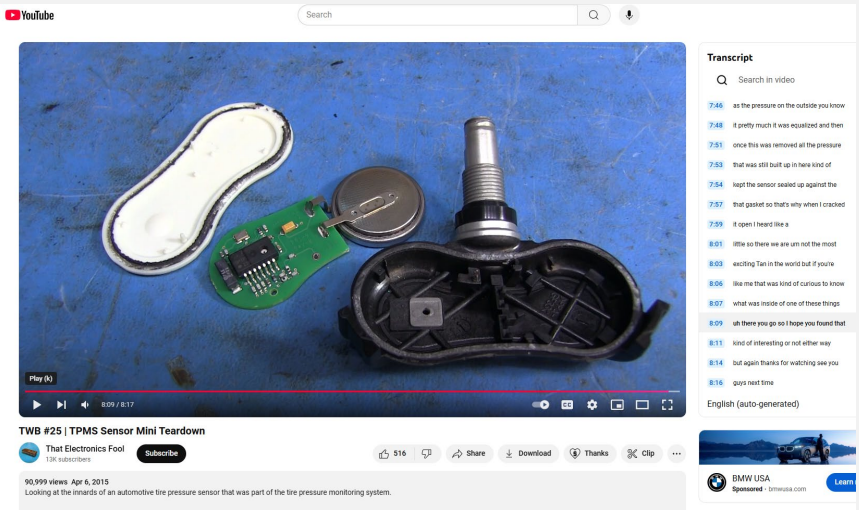
’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g

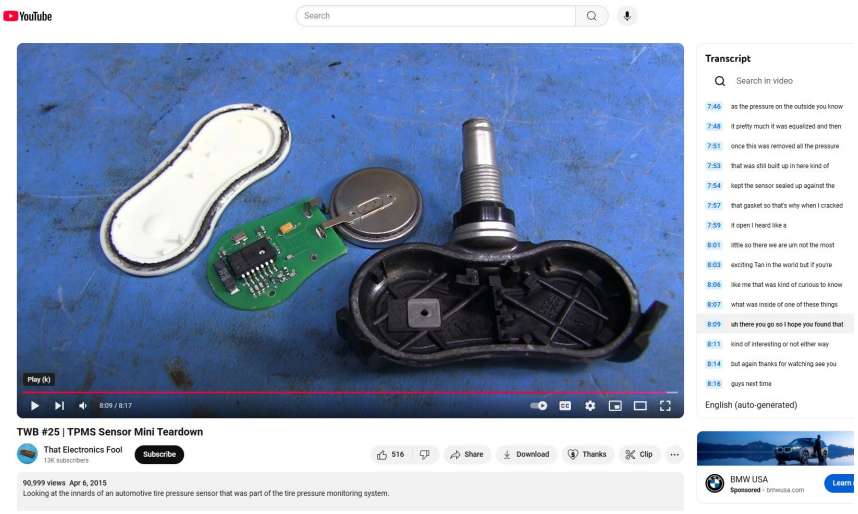
’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g
[1d] wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use; and	*TRW-TPMS Sensors discloses, teaches, and/or suggests wherein the electrical sensor device is configured to sense, transmit and/or receive information regarding surrounding conditions, orientation and/or location when the sensor assembly is attached with the object and the object is rotated in use. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g

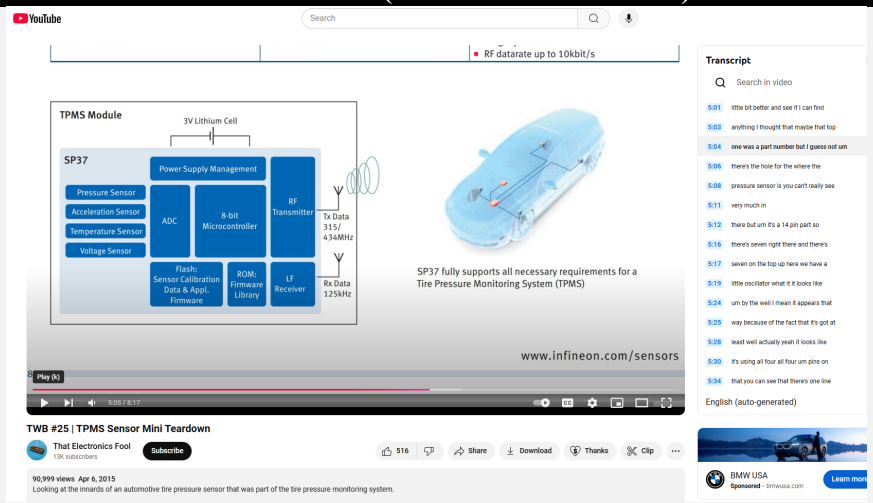
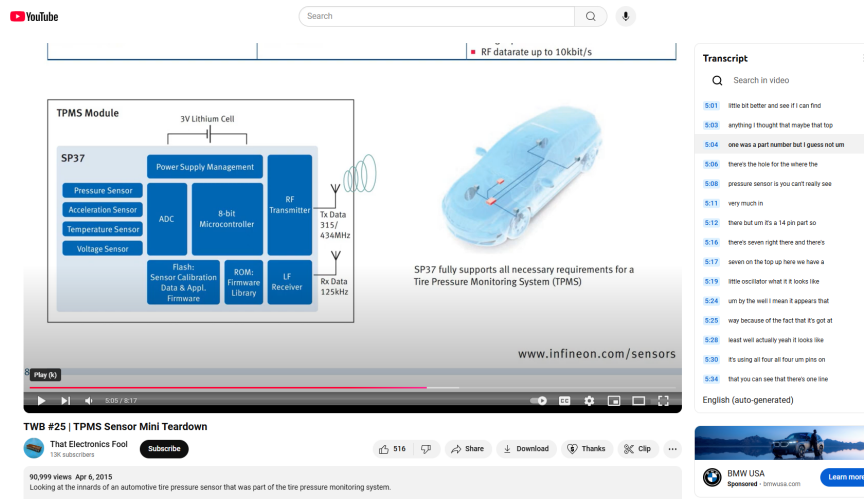
’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g
[1e] a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.	*TRW-TPMS Sensors discloses, teaches, and/or suggests a retaining member that is configured to accommodate attachment of the housing therewith, wherein the retaining member has an outside surface configured for attachment to rotate with the object when the object is rotated in use.. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g The valve stem 12 also includes a seal 40, such as an O-ring or grommet, positioned adjacent or near the retention clip 20. The seal 40 may be constructed of any material. Such as a rubber, plastic, or elastomeric material, that is Suited to form a gas-tight seal. As shown in FIG. 1, the seal 40 is positioned adjacent the annular groove 36 and may have a portion 42 that extends into the annular groove to help

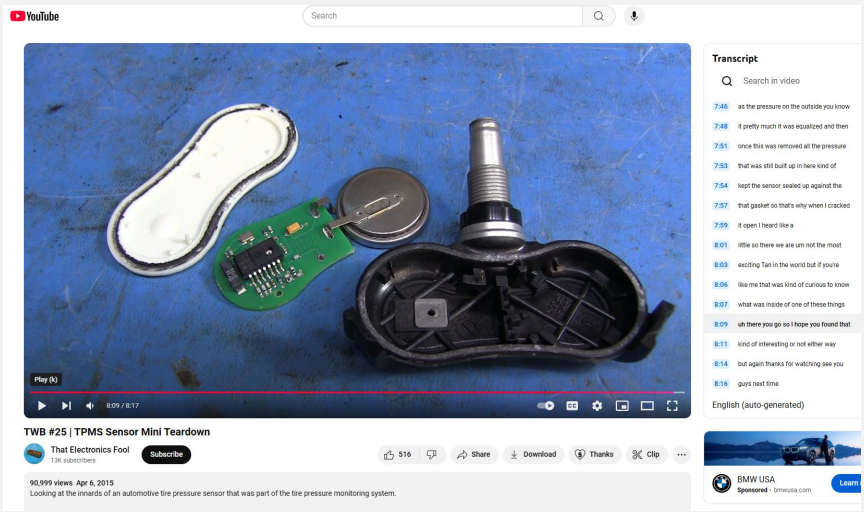
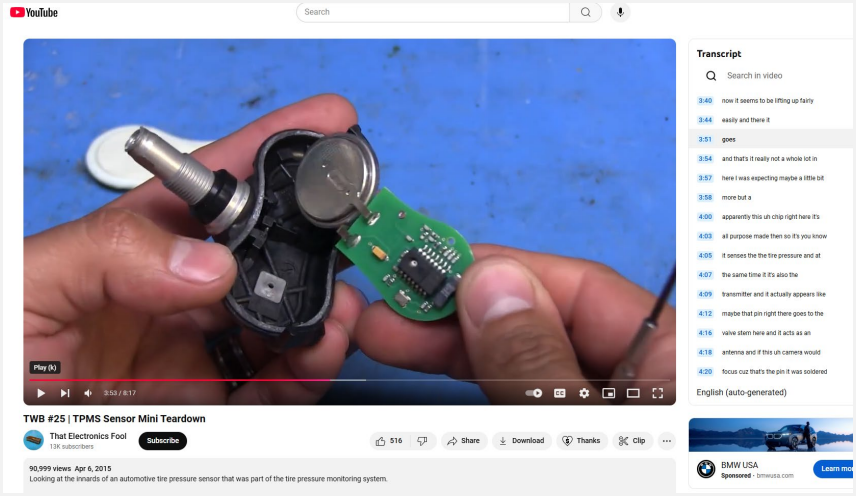
'421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	retain the seal mounted on the valve stem 12. (*See* U.S. Pat. No. 7,516,653 (Blossfeld, TRW).)
2. The sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing outer surface includes one or more display features or indicia that are viewable to a user when the housing is attached with the retaining member assembly. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g
5. The sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device is attached within the internal cavity by one or more surface features within the cavity that contact the electrical sensor device to retain its position therein. For example:* *See, e.g.*, **1[pre]**, above.

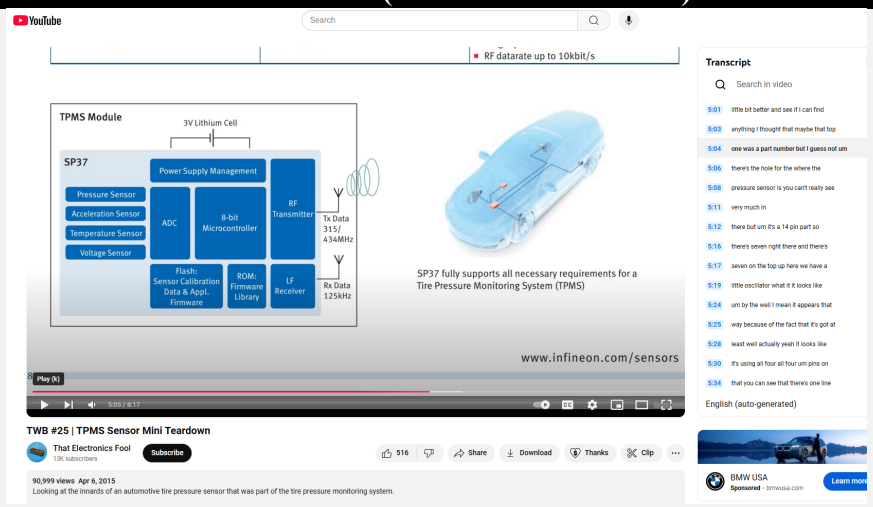
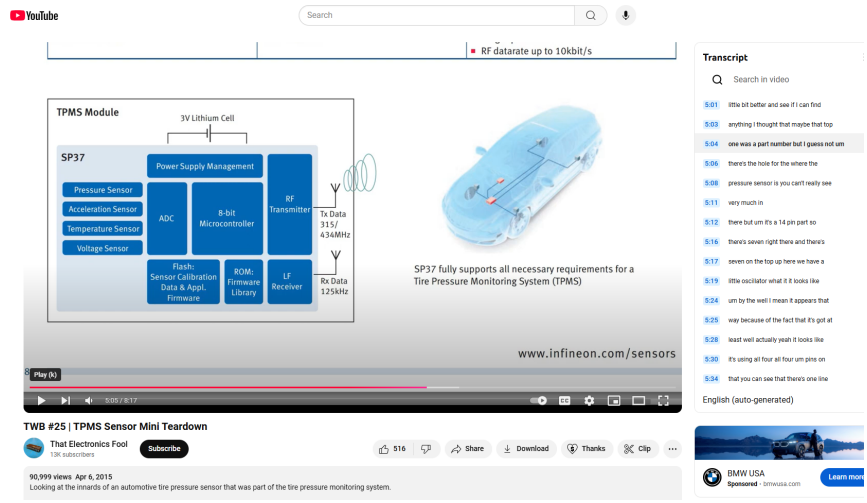
'421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g
7. The sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing and retaining member are configured having a complementary shape to facilitate attachment of the housing with the retaining member. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g
8. The sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 7, wherein the housing comprises a wall structure that surrounds the internal cavity, and wherein the retaining member comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith. For example:*

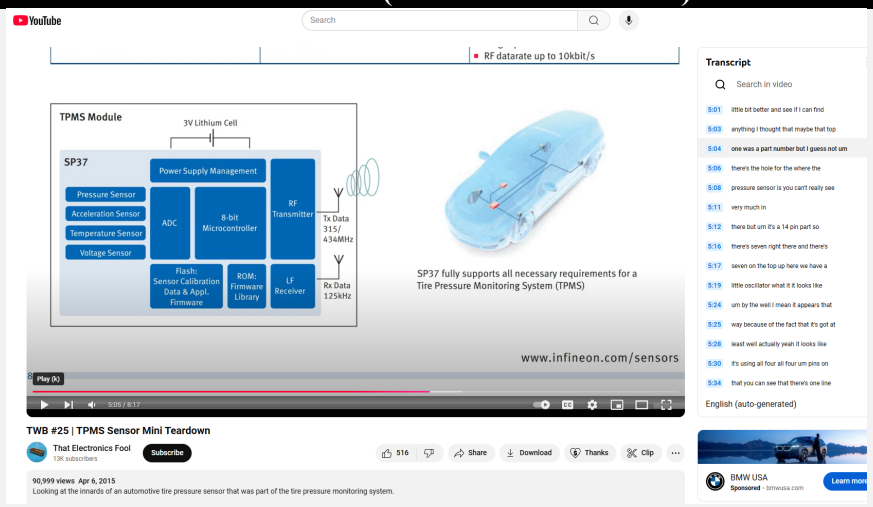
'421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
comprises a wall structure having an open chamber that is configured to accommodate the housing wall structure therein to provide attachment therewith.	*See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g
9. The sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces from the object to the housing when the retaining member is attached to the object and the housing is attached to the retaining member. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g The valve stem 12 also includes a seal 40, such as an O-ring or grommet, positioned adjacent or near the retention clip 20. The seal

’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	40 may be constructed of any material. Such as a rubber, plastic, or elastomeric material, that is Suited to form a gas-tight seal. As shown in FIG. 1, the seal 40 is positioned adjacent the annular groove 36 and may have a portion 42 that extends into the annular groove to help retain the seal mounted on the valve stem 12. (*See* U.S. Pat. No. 7,516,653 (Blossfeld, TRW).)
10. The sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the housing includes an opening through the outside surface to the internal cavity, and further includes a filter that is positioned to filter air passing into the internal cavity before reaching the electrical sensor device. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g
11. A sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication.	*TRW-TPMS Sensors discloses, teaches, and/or suggests a sensing system comprising the sensor assembly as recited in claim 1, wherein the sensing system comprises a receiver that is external from the object and that is configured to receive data from the electrical sensor device by wireless communication. For example:* *See, e.g.*, **1[pre]**, above.

’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g
12. The sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensing system as recited in claim 11, wherein the electrical sensor device comprises an accelerometer sensor connected therewith and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g
20. The sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 1, wherein the electrical sensor device comprises: a printed circuit board comprising electrical circuitry; a portable power source for providing power to the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device. For example:*

’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
the electrical sensor device; at least one sensor element; and an antenna for receiving and/or transmitting information from the electrical sensor device.	*See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g  https://www.youtube.com/watch?v=JQhK8WqRZ2g

’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g
21. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of a storage element and a processor. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g
22. The sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the electrical sensor device comprises one or both of an accelerometer sensor and a global positioning device. For example:* *See, e.g.*, **1[pre]**, above.

’421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
	 https://www.youtube.com/watch?v=JQhK8WqRZ2g
23. The sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the sensor element is configured to sense one or more variables selected from the group consisting of air pressure, temperature, acceleration, and orientation or location of the environment, the sensor assembly, or the object. For example:* *See, e.g.*, **1[pre]**, above.  https://www.youtube.com/watch?v=JQhK8WqRZ2g
24. The sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly as recited in claim 20, wherein the object is a vulcanized rubber vehicle tire, and wherein the retaining member is attached to an inside surface of the vehicle tire or an element attached with the tire that rotates with the tire. For example:*

'421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
of the vehicle tire or an element attached with the tire that rotates with the tire.	*See, e.g.*, **1[pre]**, above.
28[pre]. A sensor assembly and sensing system for use with an object that rotates in use comprising:	*To the extent that the preamble is limiting, TRW-TPMS Sensors discloses, teaches, and/or suggests a* sensor assembly and sensing system for use with an object that rotates in use comprising. *For example:* *See, e.g.*, **1[pre]**, **11**, above. *See also following limitations.*
[28a] a housing comprising an outer structure that defines an open internal cavity therein,	*TRW-TPMS Sensors discloses, teaches, and/or suggests a housing comprising an outer structure that defines an open internal cavity therein. For example:* *See, e.g.*, **[1a]-[1c]**, **10**, above.
[28b] an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device,	*TRW-TPMS Sensors discloses, teaches, and/or suggests an electrical sensor device disposed within the internal cavity and having a fixed placement therein by one or more surface features of the housing configured to contact the electrical sensor device. For example:* *See, e.g.*, **[1a]-[1c]**, **5**, **10**, above.
[28c] wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location.	*TRW-TPMS Sensors discloses, teaches, and/or suggests wherein the electrical sensor device is configured to monitor and transmit and/or receive information regarding surrounding conditions, orientation and/or location. For example:* *See, e.g.*, **[1d]**, above.
[28d] wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor;	*TRW-TPMS Sensors discloses, teaches, and/or suggests wherein the electrical sensor device comprises: a portable power source; a sensor; and an antenna for transmitting and/or receiving information relating to the operating parameter being monitored by the sensor. For example:* *See, e.g.*, **[1a]-[1c]**, **20**, above.
[28e] a retaining member having an outside surface configured for attaching with a surface of the object or an	*TRW-TPMS Sensors discloses, teaches, and/or suggests a retaining member having an outside surface configured for attaching with a surface of the object or an element connected with the object to rotate with the object in use, wherein the retaining member is*

'421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
element connected with the object to rotate with the object in use, wherein the retaining member is configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member; and	*configured to accommodate placement a portion of the housing therein to provide an attachment between the housing and the retaining member. For example:* *See, e.g.*, **[1e]**, **7**, **8**, above.
[28f] a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly.	*TRW-TPMS Sensors discloses, teaches, and/or suggests a receiver external from the object that is configured to receive information from the electrical sensor device wirelessly. For example:* *See, e.g.*, **1**, **11**, above.
31. The sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the internal cavity comprises an open space above or below the electrical sensor device disposed within the internal cavity. For example:* *See, e.g.*, **[1c]**, above.
32. The sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the retaining member is formed from an elastomeric material that mitigates transmission of shock forces received from the object when attached to the object before reaching the housing attached with the retaining member. For example:* *See, e.g.*, **[1e]**, **9**, above.
33. The sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 28, wherein the electrical sensor device comprises an accelerometer sensor and is configured to send data from the accelerometer sensor wirelessly to the external receiver. For example:* *See, e.g.*, **[1b]**, **11** above.

'421 Claim Element	Disclosures from Prior Art (TRW-TPMS Sensors)
34. The sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the sensor assembly and sensing system as recited in claim 33, wherein the object is a vehicle tire and the system is configured to determine one or more parameters consisting of a tire diameter, slip, strain, road conditions or soil conditions, a tire tread depth, a tire radial load, and vehicle camber and/or toe alignment from the accelerometer sensor data. For example:* *See, e.g.,* **1[pre]**, **[1b]**, **[1d]**, **[1e]**, **11**, **12**, **20**, above.
41[pre] A method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of:	*To the extent that the preamble is limiting, TRW-TPMS Sensors discloses, teaches, and/or suggests a method for using a sensor assembly and sensing system with an object that rotates in use comprising the steps of: vulcanized rubber tire comprising. For example:* *See, e.g.,* **1**, **11**, **12**, **20**, above. *See also following limitations.*
[41a] installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity, and	*TRW-TPMS Sensors discloses, teaches, and/or suggests installing an electrical sensor device within an internal cavity of a housing, wherein the housing includes an outer structure that defines the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41b] wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry,	*TRW-TPMS Sensors discloses, teaches, and/or suggests wherein the electrical sensor device comprises a sensor, a portable power source, an antenna, a printed circuit board, and related electrical circuitry. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41c] wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity;	*TRW-TPMS Sensors discloses, teaches, and/or suggests wherein the housing comprises an opening extending from an outer surface of the housing to the internal cavity. For example:* *See, e.g.,* **1[pre]**, **1[a]**, **1[b]**, **1[c]**, **1[d]**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

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[41d] attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object; and	*TRW-TPMS Sensors discloses, teaches, and/or suggests attaching the housing after the step of installing to a retaining member, wherein the retaining member is configured to accommodate attachment with the housing by mechanical or bonding technique, wherein the retaining member is connected with the object before or after formation of the object. For example:* *See, e.g.,* **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
[41e] monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly.	*TRW-TPMS Sensors discloses, teaches, and/or suggests monitoring an operating parameter of the object through the use of the electrical sensing device, wherein information related to the operating parameter is wirelessly transmitted from the electrical sensing device to a receiver that is external from the sensor assembly. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
43. The method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of installing, the electrical sensor device is attached in place within the internal cavity by contact between the electrical sensor device and one or more surface features in the internal cavity. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
44. The method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the method as recited in claim 41, wherein the object is a made from vulcanized rubber, and before the step of attaching, the retaining member is attached with the object or an element that rotates with the object before or after the object has been formed. For example:* *See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above
48. The method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached	*TRW-TPMS Sensors discloses, teaches, and/or suggests the method as recited in claim 44, wherein the object is a vehicle tire, and wherein the retaining member is attached to a surface that is inside of the vehicle tire. For example:*

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to a surface that is inside of the vehicle tire.	*See, e.g.*, **1**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
50. The method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of attaching, the housing is positioned relative to the retaining member according to a display feature that is positioned on the housing. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
51. The method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the method as recited in claim 41, wherein during the step of monitoring, the sensor monitors operating parameters comprising one or more of operating conditions, orientation, and location and transmits by use of the antenna information related to the monitored operating parameter to the receiver, and wherein the electrical device is configured to receive information transmitted from an external device to change one or more feature of the electrical sensor device. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
52. The method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor.	*TRW-TPMS Sensors discloses, teaches, and/or suggests the method as recited in claim 41, wherein the sensor assembly electrical sensor device comprises an accelerometer sensor. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.
53. The method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information	*TRW-TPMS Sensors discloses, teaches, and/or suggests the method as recited in claim 52, wherein the object is a vehicle tire, and wherein during the step of monitoring, one or more of a tire outside diameter, a tire tread depth, slip, strain, road or soil conditions, a tire radial load, and a vehicle camber and/or toe alignment parameter is determined from information sent wirelessly from the sensor assembly. For example:* *See, e.g.*, **1**, **2**, **5**, **8**, **10**, **11**, **12**, **20-23**, above.

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sent wirelessly from the sensor assembly.	