IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT: U.S. Patent No. 8,031,064 REEXAMINATION CONTROL NO.:

DATE OF ISSUE: October 4, 2011 GROUP ART UNIT:

DATE OF FILING: September 17, 2008 EXAMINER:

INVENTORS: Hung-Chih Yu CONFIRMATION NO.:

TITLE: TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME

REQUEST FOR *EX PARTE* REEXAMINATION OF U.S. PATENT NO. 8,031,064 BY THIRD PARTY

Mail Stop: EX PARTE REEXAMINATION
Attn: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Reexamination under 35 U.S.C. §§302-307 and 37 C.F.R. §1.510 is hereby requested of 8 and 10-15 of United States Patent No. 8,031,064 entitled Tire Pressure Detecting Apparatus and Tire Pressure Detector Identification Copying Method for The Same, which issued on October 4, 2011 to inventor Hung-Chih Yu (hereinafter the " '064 patent"). This patent is still within its term of enforcement, and has not been judicially determined to be invalid or

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unenforceable. A copy of the '064 patent is submitted herewith, in accordance with 37 C.F.R. §1.510(b)(4).

Pursuant to 37 C.F.R. §1.510, included with this request for *ex parte* reexamination are:

- the fee for requesting *ex parte* reexamination;
- a statement pointing out each substantial new question of patentability based on the cited patents and printed publications;
- an identification of every claim for which reexamination is requested, and a detailed explanation of the pertinence and manner of applying the patents and printed publications to every claim for which reexamination is requested;
- a copy of every patent or printed publication relied upon or referred to in the request for *ex parte* reexamination, accompanied by an English language translation of all the necessary and pertinent parts of any non-English language patent or printed publication;
- a copy of the entire patent including the front face, drawings, and specification/claims (in double column format) for which reexamination is requested, and a copy of any disclaimer, certificate of correction, or reexamination certificate issued in the patent;

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- a certification that the request for reexamination has been served in its entirety on the patent owner (through the attorney of record during prosecution) at the address shown in the accompanying Certificate of Service.

I. CLAIMS FOR WHICH REEXAMINATION IS REQUESTED AND PRIOR ART ON WHICH REQUEST FOR REEXAMINATION IS BASED

U.S. PATENT DOCUMENTS

Patent/Pub. No.	*Inventor*	*Date*
U.S. 7,079,033	Itou	July 18, 2006
U.S. 6,941,801	Lemense, et al. (hereinafter "Lemense")	September 13, 2005
U.S. 6,414,592	Dixit, et al. (hereinafter "Dixit")	July 2, 2002
U.S. 6,927,679	Taguchi, et al. (hereinafter "Taguchi")	August 9, 2005

The '064 patent issued with claims 1-13. After the previous reexamination (Control No. 90/012,430) claims 1-7 and 9 were cancelled. Claims 14-23 were added, with claims 14-17, 19-21 and 23 being subsequently cancelled (claims 18 and 22 being renumbered as claims 14 and 15 in the Ex Parte Reexamination Certificate issued November 7, 2013 "Reexamination Certificate"). Therefore, reexamination is requested of the claims present in the '064 patent

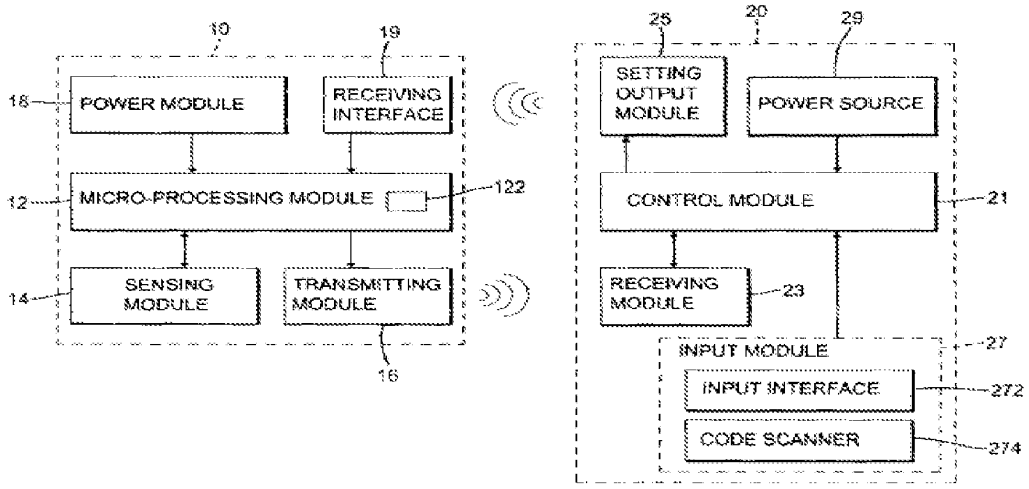
following the previous reexamination, as indicated in the Reexamination Certificate. Specifically, reexamination is requested of claims 8 and 10-15 of the '064 patent.

II. THE '064 PATENT DISCLOSURE AND PROSECUTION HISTORY

The '064 patent issued on October 4, 2011 from Application No. 12/283,979 (hereinafter " the '979 application") filed September 17, 2008.

The '064 patent is directed to a tire pressure detecting apparatus that has an identification rewritable tire pressure detector and a setting apparatus.[1]

Figure 1 of the '064 patent, reproduced below, illustrates the tire pressure detecting apparatus.



[1] See the '064 patent at Abstract.

The tire pressuring detecting apparatus, as defined by independent claim 1 of the '064 patent, includes an identification rewritable tire pressure detector 10 and a setting apparatus 20.

The identification rewritable tire pressure detector 10 includes a micro-processing module 12, a sensing module 14, a transmitting module 16, a power module 18 and a receiving interface 19.[2] The micro-processing module 12 has a rewritable memory unit capable of recording an identification.[3] The sensing module 14 is electrically connected to the micro-processing module and has a pressure-detecting unit that detects a pressure and sends a detection result to the micro-processing module.[4] The transmitting module 16 is controlled by the micro-processing module to transmit a radio frequency (RF) signal including the detection result and an identification of the identification rewritable tire pressure detector.[5] The power module 18 is electronically connected to the micro-processing module and provides electric power to the identification rewritable tire pressure detector.[6] The receiving interface 19 is electronically connected to the micro-processing module and receives and sends an external signal to the

[2] Id. at column 2, line 34 through column 3, line 28, and Figure 1.

[3] Id. at column 2, lines 43-50.

[4] Id. at column 2, lines 51-64.

[5] Id. at column 2, line 65 though column 3, line 2.

[6] Id. at column 3, lines 3-5.

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micro-processing module. The external signal includes an external identification to be written into the rewritable memory.[7]

The setting apparatus 20 communicates with the identification rewritable tire pressure detector 10 and includes a control module 21.[8] Furthermore, the setting apparatus 20 includes an input module 27, a receiving module 23, a setting output module 25, and a power source 29.[9] The input module 27 is electronically connected to the control module and allows an operator to input an identification to be written into the identification rewritable tire pressure detector.[10] The receiving module 23 is electronically connected to the control module and receives the RF signal from the identification rewritable tire pressure detector and sends the RF signal to the control module.[11] The setting output module 25 is controlled by the control module to send the external signal to the receiving interface, where the external signal is generated by the control module and includes the identification that is provided by the input module.[12] The power source 29 is electronically connected to the control module and provides electrical power to the setting apparatus.[13]

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[7] Id. at column 3, lines 6-28.

[8] Id. at column 3, lines 29-34.

[9] Id. at column 3, line 29 through column 4, line 3.

[10] Id. at column 3, lines 53-55.

[11] Id. at column 3, lines 35-42.

[12] Id. at column 3, lines 43-52.

[13] Id. at column 4, lines 4-6.

Independent claim 10 defines a tire pressure identification copying method.[14] The method includes providing the setting apparatus, reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus, and wirelessly writing the old identification into a new identification rewritable tire pressure detector by the setting apparatus.

During prosecution of the '064 patent, Taguchi was applied against the claimed invention in an anticipation rejection. In response, in an Amendment filed on March 29, 2011, the Applicant amended independent claim 1 to recite that the setting apparatus includes "an input module being electronically connected to the control module and allowing an operator to input an identification to be written into the identification rewritable tire pressure detector." In distinguishing the claimed invention of the '064 patent from Taguchi, the Applicant argued that Taguchi failed to teach or suggest the newly added feature of the input module. Specifically, the Applicant explained that the input module 27 of the claimed invention receives an identification captured from a source tire pressure and that since the input module 27 performs a different operation from that of Taguchi, it was not possible to interpret the ID registration tool 60 and the ID receiving section 61, of Taguchi, as the claimed input module.[15]

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[14] Id. at column 4, lines 7-44 and Figure 3.

[15] See Amendment filed in '064 patent on March 25, 2011.

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In response to Applicant's Amendment, the Examiner issued a Notice of Allowance on June 9, 2011. The '064 patent subsequently issued on October 4, 2011.

On August 10, 2012 a Request for Ex Parte Reexamination of the '064 was filed by a third party requestor and reexamination was ordered on September 4, 2012.

During the reexamination, claims 1-7 and 9 were cancelled. Claims 14-23 were added, with claims 14-17, 19-21, and 23 subsequently being cancelled. Ultimately, claims 8, 10-13, 18, and 22 were deemed allowable.

Claims 18 and 22 were similar to independent claim 1 and included the features of independent claim 1. Additionally, claim 18 recited:

> "a setting apparatus arranged to communicate with the identification rewritable tire pressure detector via wireless, including: reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and wirelessly writing the old identification into a new identification rewritable tire pressure detector by the setting apparatus."

Somewhat similarly, claim 22 recited:

> "a setting apparatus arranged to communicate with the identification rewritable tire pressure detector via wireless, including: reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and wirelessly writing the old identification into a new identification rewritable tire pressure detector by the setting apparatus."

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The patentability of claims 8 and 10-13 was confirmed because the prior art did not teach or suggest "the input module is a code scanner," as recited in claim 8, and the reference cited against claims 10-13, 18 and 22 was not considered prior art.

A Reexamination Certificate was issued on November 7, 2013 in which the patentability of claims 8 and 10-13 was confirmed, application claims 18 and 22 were added to the '064 patent renumbered as claim 14 and 15, and claims 1 – 7 and 9 were cancelled.

III. KEY PRINCIPLES OF ANTICIPATION PERTINENT TO THE REEXAMINATION

A. The Patent Statute (35 U.S.C. § 102)

Section 102 states:

"A person shall be entitled to a patent unless -

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or

(c) he has abandoned the invention, or

(d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the

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date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or

(e) the invention was described in - (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for the purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language; or

(f) he did not himself invent the subject matter sought to be patented, or

(g)(1) during the course of an interference conducted under section 135 or section 291, another inventor involved therein establishes, to the extent permitted in section 104, that before such person's invention thereof the invention was made by such other inventor and not abandoned, suppressed, or concealed, or (2) before such person's invention thereof, the invention was made in this country by another inventor who had not abandoned, suppressed, or concealed it. In determining priority of invention under this subsection, there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other."[16]

B. Anticipation Standard

The M.P.E.P. sets forth:

> "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). >"When a claim covers several structures or compositions, either generically or as alternatives, the claim is deemed anticipated if any of the structures or compositions within

[16] 35 U.S.C. §102.

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> the scope of the claim is known in the prior art." *Brown v. 3M*, 265 F.3d 1349, 1351, 60 USPQ2d 1375, 1376 (Fed. Cir. 2001) (claim to a system for setting a computer clock to an offset time to address the Year 2000 (Y2K) problem, applicable to records with year date data in "at least one of two-digit, three-digit, or four-digit" representations, was held anticipated by a system that offsets year dates in only two-digit formats). See also MPEP § 2131.02.< "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co*., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is not required. *In re Bond*, 910 F.2d 831, 15 USPQ2d 1566 (Fed. Cir. 1990). Note that, in some circumstances, it is permissible to use multiple references in a 35 U.S.C. 102 rejection."[17]

Accordingly, to support an anticipation rejection, the applied prior art reference must, expressly or inherently, disclose each and every feature of the claimed invention.

IV. KEY PRINCIPLES OF OBVIOUSNESS PERTINENT TO THE REEXAMINATION

A. The Patent Statute (35 U.S.C. § 103(a))

Section 103 precludes issuance of a patent when "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would

[17] M.P.E.P. §2131.

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have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains."[18]

B. KSR's Obviousness Standard

The Supreme Court, in its *KSR* decision, set forth the current standard for obviousness.[19] While affirming the applicability of the well-known Graham factors, the Supreme Court rejected the Federal Circuit's existing "teaching, suggestion, or motivation" test as being too "rigid" and "narrow."[20] The Supreme Court indicated that a more "expansive and flexible" approach should be applied.[21]

The Supreme Court emphasized that "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results."[22] Thus, when assessing the obviousness of a claim, the U.S.P.T.O. "must ask whether the improvement is more than a predictable use of prior art elements according to their established functions."[23]

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[18] 35 U.S.C. §103(a).

[19] *KSR Int'l Co. v. Teleflex, Inc.* 127 S. Ct. 1727 (2007).

[20] Id. at 1739 and 1741-1743.

[21] Id. at 1739.

[22] Id. at 1739-1740.

[23] Id. at 1740.

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Moreover, the rationale to combine prior art references can come from a variety of sources, not just the prior art itself or the specific problem the patentee was trying to solve."[24] Additionally, the expansive and flexible approach of the Supreme Court encourages the use of "common sense" when addressing obviousness.[25]

The Supreme Court stressed that applying the obviousness test is particularly straightforward in cases that involve "the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement."[26]

C. USPTO's Guidelines Based on the KSR Obviousness Standard

Following the Supreme Court's decision in *KSR*, the U.S.P.T.O. issued new obviousness examination guidelines identifying multiple "rationales" for supporting obviousness rejections[27]. The guidelines included the following, non-limiting, examples:

- Combining prior art elements according to known methods to yield predictable results;

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[24] Id. at 1742.

[25] Id. at 1742-1743.

[26] Id. at 1740.

[27] Federal Register, Vol. 72, No. 195, pp. 57526-35 (Oct. 10, 2007).

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- Simple substitution of known elements for other known elements to obtain predictable results;
- Use of a known technique to improve similar devices (methods or products) in the same way;
- Applying a known technique to a known device (method or product) in the same way;
- "Obvious to try;" and
- Some teaching, suggestion, or motivation in the prior art that would have lead one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.[28]

V. STATEMENT OF GROUNDS OF UNPATENTABILITY

1. Claim 8 is unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Dixit and Itou.

2. Claim 8 is unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense and Itou.

[28] Id. at 57528-34.

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3. Claim 10 is unpatentable under 35 U.S.C. §102 (a) and (b) as being anticipated by Lemense.

4. Claims 14 and 15 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense and Dixit.

5. Claim 14 and 15 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense.

VI. STATEMENT POINTING OUT EACH SUBSTANTIAL NEW QUESTION OF PATENTABILITY

Taguchi was cited, and applied against the claims, during examination of the '064 patent application. None of the other prior art references cited in this request were considered during examination of the '064 patent. Additionally, none of the other references in this request were considered during the previous reexamination. Furthermore, the relied upon references are non-cumulative and include a new technical teaching.

A substantial new question of patentability is found at least because the listed references disclose the features that the Applicant of the '064 patent relied upon for patentability. Reexamination is requested of claims 8 and 10-15 of the '064 patent. That is, the feature upon which allowance of the '064 was based (i.e., the "input module") is disclosed by Lemense and

Dixit. Additionally, Itou teaches the code scanner recited in claim 8. A detailed explanation of how the cited references establish a substantial new question of patentability is provided below.

1. Independent Claims

Independent claim 10

Lemense discloses a tire pressure detector identification copying method as defined in claim 10 of the '064 patent. Specifically, Lemense discloses a method and system for monitoring vehicular tire pressure and replacing or servicing tires mounted on wheels containing tire pressure sensing units.[29] The vehicle tires include sensor units 15-18 mounted on the vehicle tires. Each sensor unit includes a communication section for transmitting data and an ID code to a control module 20.[30] The system and method utilizes a service tool 24 for interacting with a sensor unit. The method includes interrogating the sensor units using the service tool 24 to receive an ID code from each sensor.[31] After a technician removes a tire for service, the sensor units are re-tested. Any non-working tires are replaced. The service tool is used to replicate or clone the ID code of the broken sensor unit into a replacement sensor unit over a LF

[29] See Lemense at column 1, lines 14-16.

[30] Id. at column 2, lines 35-43.

[31] Id. at column 3, lines 15-37 and Figure 4, Step 41.

communication link between the service tool and the replacement tire sensor unit. Thus, Lemense teaches each and every feature recited in claim 10 of the '064 patent.

Because the teachings of Lemense provide subject matter of the '064 patent that was not taught or suggested by any of the prior art cited in the '064 patent, the teachings of Lemense raise a substantial new question of patentability.

Thus, there is a substantial new question of patentability with respect to independent claim 10.

Independent claims 14 and 15

Taguchi in combination with Lemense and/or Dixit discloses a tire pressure detecting system as defined in claims 14 and 15 of the '064 patent. Specifically, the prosecution history of the '064 patent makes it clear that Taguchi discloses a tire pressure detector and setting apparatus with all of the features cited in claims 14 and 15 (i.e., as was defined in independent claim 1 at the time the '064 patent issued) with the exception of the manual ID input. Lemense and Dixit each disclose the manual ID input as recited in claims 14 and 15 of the '064 patent, following the previous reexamination. Specifically, Dixit includes a plurality of manual input arrangements 42A-42D (Figure 1), each associated with one of the tire sensor units.[32] Additionally, as

[32] See Dixit at column 3, lines 38-45.

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illustrated in Figure 2, Dixit includes a transmitter device 44 that a person manually operates to input an identification code via an input key pad 50. Furthermore, Lemense includes a service tool 24 including a microcontroller 30. The microcontroller 30 performs various functions to interrogate a sensor unit using the service tool 24 to receive an ID code from each sensor.[33] The microcontroller 30 is connected to an interface 36 that includes an input device (i.e., keypad 26). Because the teachings of Taguchi in combination with Lemense and/or Dixit provide subject matter of the '064 patent that was not taught or suggested by any of the prior art cited in the '064 patent, the teachings of Taguchi in combination with Lemense and/or Dixit raise a substantial new question of patentability.

Thus, there is a substantial new question of patentability with respect to independent claims 14 and 15.

Claim 8

Taguchi in combination with Itou and Lemense or Dixit discloses a tire pressure detecting apparatus as defined in claim 8. Specifically, the prosecution history of the '064 patent makes it clear that Taguchi discloses a tire pressure detector and setting apparatus with all of the features cited in claim 8 (i.e., as was defined in independent claim 1 at the time the '064 patent

[33] See Lemense at column 3, lines 4-36.

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issued) with the exception of the manual ID input. Lemense and Dixit each disclose the manual ID input as recited in claim 8 of the '064 patent. Specifically, Dixit includes a plurality of manual input arrangements 42A-42D (Figure 1), each associated with one of the tire sensor units.[34] Additionally, as illustrated in Figure 2, Dixit includes a transmitter device 44 that a person manually operates to input an identification code via an input key pad 50. Furthermore, Lemense includes a service tool 24 including a microcontroller 30. The microcontroller 30 performs various functions to interrogate a sensor unit using the service tool 24 to receive an ID code from each sensor.[35] The microcontroller 30 is connected to an interface 36 that includes an input device (i.e., keypad 26). Moreover, Itou includes an ID registration tool 60 that is used to read the IDs from bar codes 5/6/7/8 for wiring the bar codes in the tire pressure monitoring apparatus 50.[36] The bar codes are representative of the IDs of the pressure sensors 10/20/30/40.[37] The ID registration tool 60 is composed on a bar-code reading unit 61 and an ID transmitting unit 62 for transmitting the IDs. Because the teachings of Taguchi in combination with Itou and Lemense or Dixit provide subject matter of the '064 patent that was not taught or suggested by

[34] See Dixit at column 3, lines 38-45.

[35] See Lemense at column 3, lines 4-36.

[36] See Itou at column 17, lines 32-44.

[37] Id. at column 17, lines 37-39.

any of the prior art cited in the '064 patent, the teachings of Taguchi in combination with Itou and Lemense or Dixit raise a substantial new question of patentability.

Thus, there is a substantial new question of patentability with respect to claim 8.

2. Dependent Claims

Because a substantial new question of patentability is found with respect to independent claim 10, there is also a substantial new question of patentability with respect to dependent claims 11-13 dependent from claim 10.

VII. DETAILED EXPLANATION OF PERTINENCE AND MANNER OF APPLYING CITED PRIOR ART TO EVERY CLAIM FOR WHICH REEXAMINATION IS REQUESTED

Ground No. 1: §103(a) Rejection over Taguchi in view of Dixit and Itou

Claim 8 is unpatentable under 35 U.S.C. § 103(a) over Taguchi, which was filed on June 25, 2003, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent, in view of Dixit, which was filed on January 2, 2001, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent, and Itou, which was

filed on June 4, 2003, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent.

Claim 8

Claim 8 is reproduced below:

8. (Original): The tire pressure detecting apparatus as claimed in claim 1, wherein the input module is a code scanner.

As is clear from above, claim 8 is dependent from claim 1 of the '064 patent, and thus includes all of the limitations of claim 1. See 37 CFR § 1.75(c). Accordingly, the features of dependent claim 8 are addressed below wherein all limitations from now-cancelled claim 1 are incorporated into claim 8.

The correspondence between the tire pressure detector recited in claim 8 of the '064 patent and the tire pressure detecting apparatus described in Taguchi, taken in view of Dixit and Itou, is illustrated in the claim chart below.

Taguchi relates to a tire pressure detecting apparatus. The embodiment depicted in Figure 2 of Taguchi contains almost each and every element of the tire pressure detecting apparatus in claim 8 (including the limitations of now-cancelled independent claim 1) of the '064 patent. Dixit and Itou are similarly directed to tire pressure monitoring system and teach the

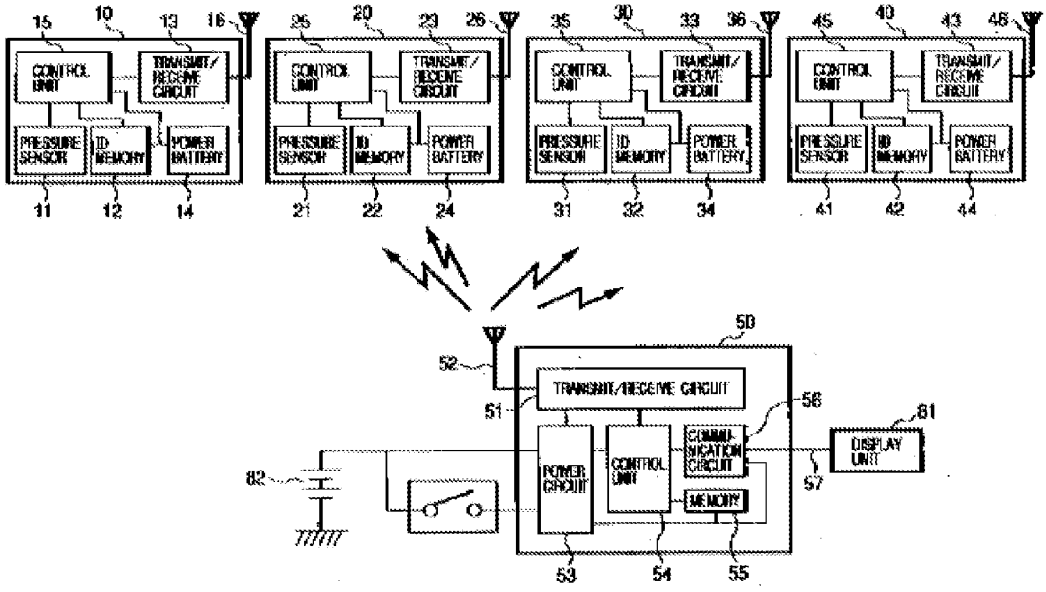
features lacking from Taguchi. A claim chart showing the one-for-one correspondence is set forth below.

Claim 8 (including features of independent claim 1)	**Taguchi in view of Dixit and Itou**
A tire pressure detecting apparatus, comprising:	**Taguchi:** combination of pressure sensors 10/20/30/40 and monitoring apparatus 50 (see Figure 2).
an identification rewritable tire pressure detector comprising:	**Taguchi:** pressure sensors 10/20/30/40 (Figure 2), including rewritable ID memory 12; into which a transmitter ID is written during a registration process (see Abstract and column 11, lines 49-54).
a micro-processing module having a rewritable memory unit being capable of recording an identification;	**Taguchi:** combination of control unit 15 and ID memory 12 (Figure 2).
a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit, the pressure-detecting unit detecting a tire pressure and sending a detection result to the micro-processing module;	**Taguchi:** pressure sensor 11 (Figure 2). Pressure sensor 11 and ID memory 12 are electrically connected, as illustrated in Figure 2.
a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal comprising the detection result and an identification of the identification rewritable tire pressure detector;	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2; column 11, lines 16-25; describing transmission of detected pressure signal from sensor 11 and sensor ID stored in memory unit 12).
a power module electrically connected to the micro-processing module and providing electrical power to the identification rewritable tire pressure detector;	**Taguchi:** power battery 14 (Figure 2).
a receiving interface electronically connected to the microprocessing module, receiving and sending an external signal to the micro-processing module, where the external signal comprises an external identification to be written into the rewritable memory unit;	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2), step S140 "receive transmitted receiver ID by sensor" (Figure 3).
a setting apparatus communicating with the identification rewritable tire pressure detector and having a control module;	**Taguchi:** tire pressure monitor 50, which transmits the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit 12, including control unit 54.
an input module being electronically connected to the control module and allowing an operator	**Dixit:** data input arrangements 42A-42D (Figures 1 and 2) and keypad 50.

to input an identification to be written into the identification rewritable tire pressure;	
a receiving unit module electronically connected to the control module, receiving the RF signal from the identification rewritable tire pressure detector or a tire pressure detector and sending the RF signal to the control module;	**Taguchi:** transmit/receive circuit 51 and antenna 52 (Figure 2; and column 11, lines 27-35).
a setting output module controlled by the control module to send the external signal to the receiving interface, where the external signal is generated by the control module and comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module;	**Taguchi:** combination of the transmit/receive circuit 51 and the antenna 52 in Figure 2.
a power source electronically connected to the control module and providing electrical power to the setting apparatus.	**Taguchi:** power circuit 53 (Figure 2).
The tire pressure detecting apparatus as claimed in claim 1, wherein the input module is a code scanner.	**Itou:** ID registration tool 60 including bar code reading unit 61 and ID transmitting unit 62 for transmitting the IDs (Figure 2).

Reference is made to Figure 2 of Taguchi, reproduced below

FIG. 2



Taguchi discloses a tire pressure detecting apparatus including a plurality of sensors 10/20/30/40 and a monitoring apparatus 50. The pressure sensors 10/20/30/40 include a rewritable ID memory 12, in which a transmitter ID is written during a registration process.[38] The ID memory 12 is capable of recording an ID.[39] The pressure sensor 11 is electrically connected to the ID memory 12, as is illustrated in Figure 2. The pressure sensor 11 detects the tire pressure and sends the results to the control unit 15. The transmit/receive circuit 13 in combination with the antenna 16 periodically transmits the combination of detected pressure signal and the sensor ID in a signal with a predetermined frequency.[40] The pressure detector also includes a power module (power battery 14) that provides power to the pressure sensor. Furthermore, the transmit/receive circuit 13 is electronically connected to the microprocessing module, to receive and send an external signal to the microprocessing module, where the external signal includes an external identification to be written into the rewriteable memory unit.[41]

Taguchi further includes a setting apparatus (i.e., tire pressure monitor 50). The tire pressure monitor 50 sends the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit. The setting apparatus includes a control unit/module 54.[42] The tire pressure

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[38] Taguchi at column 11, lines 49-54.

[39] Id. at column 10, line 65-column 11, line 2.

[40] Id. at column 2, lines 56-59 and column 18, lines 4-9.

[41] Id. at Figure 4, S140.

[42] Id. at Figure 4, S130.

monitor 50 includes a receiving module (transmit/receive circuit 51 and antenna 52) electrically connected to the control module.[43] Furthermore, the tire pressure monitor 50 includes a setting output module (i.e., combination of the transmit/receive circuit 51 and the antenna 52). Specifically, Taguchi teaches sending a receiver ID from the monitoring apparatus to the pressure sensors 10/20/30/40.[44] Additionally, the tire pressure monitor 50 includes a power circuit 53 electrically connected to the control unit 53 and provides electrical power to the tire pressure monitor.

It was established during prosecution of the '064 patent that Taguchi teaches each of the above features of claim 1.

Taguchi, however, fails to teach or suggest an input module to input an identification to be written into the identification rewritable tire pressure, as recited in claim 8 (by incorporation from original independent claim 1). Dixit, however, teaches the claimed input module. Specifically, Dixit includes a plurality of manual input arrangements 42A-42D (Figure 1), each associated with one of the tire sensor units.[45] Additionally, as illustrated in Figure 2, Dixit includes a transmitter device 44 that a person manually operates to input an identification code

[43] Id. at column 11, lines 25-35 and Figure 3B, S21.

[44] Id. at column 11, lines 60-62 and Figure 3, S130.

[45] See Dixit at column 3, lines 38-45.

via an input key pad 50.[46] Thus, Dixit teaches the above feature missing from the disclosure of Taguchi.

Moreover, the modified device will perform the same functions with predictable results based on the teachings of Taniguchi and Dixit. Also, it would have been obvious to one of ordinary skill in the at the time the claimed invention was made to modify Taguchi to include the input module of Dixit to enable replacement and monitoring of tire pressure sensors without previously storing the ID, by enabling the user to visually observe the ID and manually input the ID.

The combination of Taguchi and Dixit fails to teach or suggest that the input module is a code scanner. Itou, however, teaches the above feature of the claimed invention. That is, Itou teaches a method of acquiring the ID of the outdated tire pressure sensor by access to a bar code and writing the ID into the new tire pressure sensor. Indeed, Itou includes an ID registration tool 60 that is used to read the IDs from bar codes 5/6/7/8 for wiring the bar codes in the tire pressure monitoring apparatus 50.[47] The bar codes are representative of the IDs of the pressure sensors 10/20/30/40.[48] The ID registration tool 60 is composed on a bar-code reading unit 61 and an ID

[46] Id. at column 4, lines 22-25.

[47] See Itou at column 17, lines 32-44.

[48] Id. at column 17, lines 37-39.

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transmitting unit 62 for transmitting the IDs.[49] Thus, Itou teaches the above feature of claim 8 missing from the disclosure of Taguchi and Dixit.

Moreover, it would have been obvious to one of ordinary skill in the art to modify the system of Taguchi (in view of Dixit) to include the ID registration tool 60 of Itou because "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results."[50] Furthermore, the proposed modification would prevent mistaken ID registration in the tire pressure monitoring system of Taguchi.[51]

Thus, claim 8 is obvious over Taguchi in view of Dixit and Itou under 35 U.S.C. § 103, and should be cancelled.

Ground No. 2: §103(a) Rejection over Taguchi in view of Lemense and Itou

Claim 8 is unpatentable under 35 U.S.C. § 103(a) over Taguchi, which was filed on June 25, 2003, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent, in view of Lemense, which was filed on December 19, 2003, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent, and Itou, which was filed on June 4, 2003, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent.

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[49] Id. at column 17, lines 45-55.

[50] *KSR* at 1739-1740.

[51] See Itou at column 2, lines 22-31.

Claim 8

Claim 8 is reproduced below:

8. (Original): The tire pressure detecting apparatus as claimed in claim 1, wherein the input module is a code scanner.

As is clear from above, claim 8 is dependent from claim 1 of the '064 patent, and thus includes all of the limitations of claim 1. See 37 CFR § 1.75(c). Accordingly, the features of dependent claim 8 are addressed below wherein all limitations from now-cancelled claim 1 are incorporated into claim 8.

The correspondence between the tire pressure detector recited in claim 8 of the '064 patent and the tire pressure detecting apparatus described in Taguchi, taken in view of Lemense and Itou, is illustrated in the claim chart below.

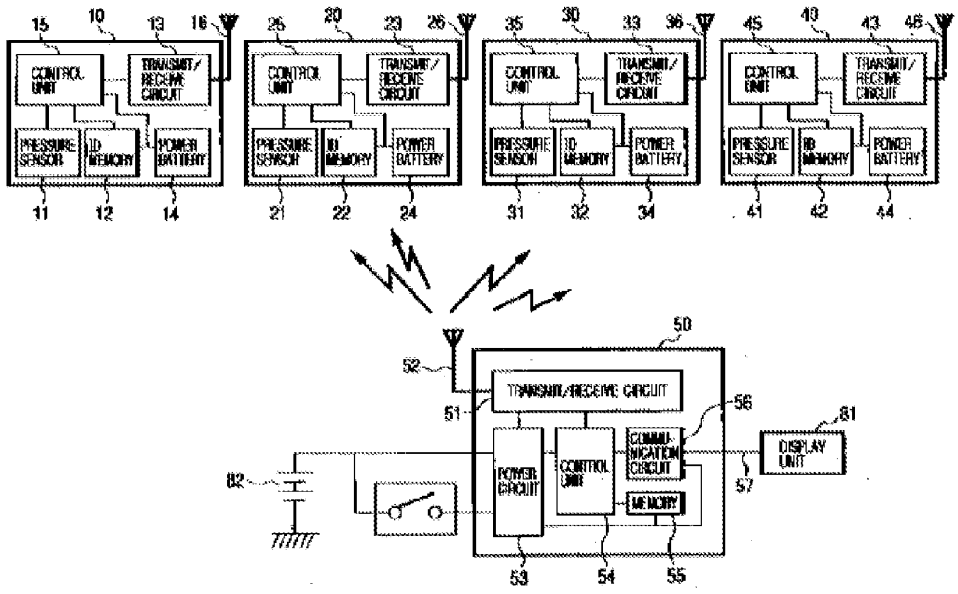
Taguchi relates to a tire pressure detecting apparatus. The embodiment depicted in Figure 2 of Taguchi contains almost each and every element of the tire pressure detecting apparatus in claim 8 (and original independent claim 1) of the '064 patent. Lemense and Itou are similarly directed to tire pressure monitoring system and teach the features lacking from Taguchi. A claim chart showing the one-for-one correspondence is set forth below.

Claim 8 (including features from independent claim 1)	Taguchi in view of Lemense and Itou
A tire pressure detecting apparatus, comprising:	**Taguchi:** combination of pressure sensors 10/20/30/40 and monitoring apparatus 50 (see Figure 2).
an identification rewritable tire pressure detector comprising:	**Taguchi:** pressure sensors 10/20/30/40 (Figure 2), including rewritable ID memory 12; into which a transmitter ID is written during a registration process (see Abstract and column 11, lines 49-54).
a micro-processing module having a rewritable memory unit being capable of recording an identification;	**Taguchi:** combination of control unit 15 and ID memory 12 (Figure 2).
a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit, the pressure-detecting unit detecting a tire pressure and sending a detection result to the micro-processing module;	**Taguchi:** pressure sensor 11 (Figure 2). Pressure sensor 11 and ID memory 12 are electrically connected, as illustrated in Figure 2.
a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal comprising the detection result and an identification of the identification rewritable tire pressure detector;	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2; column 11, lines 16-25; describing transmission of detected pressure signal from sensor 11 and sensor ID stored in memory unit 12).
a power module electrically connected to the micro-processing module and providing electrical power to the identification rewritable tire pressure detector;	**Taguchi:** power battery 14 (Figure 2).
a receiving interface electronically connected to the microprocessing module, receiving and sending an external signal to the micro-processing module, where the external signal comprises an external identification to be written into the rewritable memory unit;	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2), step S140 "receive transmitted receiver ID by sensor" (Figure 3).
a setting apparatus communicating with the identification rewritable tire pressure detector and having a control module;	**Taguchi:** tire pressure monitor 50, which transmits the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit 12, including control unit 54.
an input module being electronically connected to the control module and allowing an operator to input an identification to be written into the identification rewritable tire pressure;	**Lemense:** keypad 26.
a receiving unit module electronically connected to the control module, receiving the RF signal from the identification rewritable tire	**Taguchi:** transmit/receive circuit 51 and antenna 52 (Figure 2; and column 11, lines 27-35).

pressure detector or a tire pressure detector and sending the RF signal to the control module;	
a setting output module controlled by the control module to send the external signal to the receiving interface, where the external signal is generated by the control module and comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module;	**Taguchi:** combination of the transmit/receive circuit 51 and the antenna 52 in Figure 2.
a power source electronically connected to the control module and providing electrical power to the setting apparatus.	**Taguchi:** power circuit 53 (Figure 2).
The tire pressure detecting apparatus as claimed in claim 1, wherein the input module is a code scanner.	**Itou:** ID registration tool 60 including bar code reading unit 61 and ID transmitting unit 62 for transmitting the IDs (Figure 2).

Reference is made to Figure 2 of Taguchi, reproduced below.

FIG. 2



Taguchi discloses a tire pressure detecting apparatus including a plurality of sensors 10/20/30/40 and a monitoring apparatus 50. The pressure sensors 10/20/30/40 include a

rewritable ID memory 12, in which a transmitter ID is written during a registration process.[52] The ID memory 12 is capable of recording an ID.[53] The pressure sensor 11 is electrically connected to the ID memory 12, as is illustrated in Figure 2. The pressure sensor 11 detects the tire pressure and sends the results to the control unit 15. The transmit/receive circuit 13 in combination with the antenna 16 periodically transmits the combination of detected pressure signal and the sensor ID in a signal with a predetermined frequency.[54] The pressure detector also includes a power module (power battery 14) that provides power to the pressure sensor. Furthermore, the transmit/receive circuit 13 is electronically connected to the microprocessing module, to receive and send an external signal to the microprocessing module, where the external signal includes an external identification to be written into the rewriteable memory unit.[55]

Taguchi further includes a setting apparatus (i.e., tire pressure monitor 50). The tire pressure monitor 50 sends the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit. The setting apparatus includes a control unit/module 54.[56] The tire pressure monitor 50 includes a receiving module (transmit/receive circuit 51 and antenna 52) electrically

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[52] Taguchi at column 11, lines 49-54.

[53] Id. at column 10, line 65-column 11, line 2.

[54] Id. at column 2, lines 56-59 and column 18, lines 4-9.

[55] Id. at Figure 4, S140.

[56] Id. at Figure 4, S130.

connected to the control module.[57] Furthermore, the tire pressure monitor 50 includes a setting output module (i.e., combination of the transmit/receive circuit 51 and the antenna 52). Specifically, Taguchi teaches sending a receiver ID from the monitoring apparatus to the pressure sensors 10/20/30/40.[58] Additionally, the tire pressure monitor 50 includes a power circuit 53 electrically connected to the control unit 53 and provides electrical power to the tire pressure monitor.

It was established during prosecution of the '064 patent that Taguchi teaches each of the above features of claim 1.

Taguchi, however, fails to teach or suggest an input module to input an identification to be written into the identification rewritable tire pressure, as recited in claim 8 (by incorporation from original independent claim 1). Lemense, however, teaches the claimed input module. Specifically, Lemense includes a service tool 24 including a microcontroller 30. The microcontroller 30 performs various functions to interrogate a sensor unit using the service tool 24 to receive an ID code from each sensor.[59] The microcontroller 30 is connected to an interface 36 that includes an input device (i.e., keypad 26). Thus, Lemense teaches the above feature missing from the disclosure of Taguchi.

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[57] Id. at column 11, lines 25-35 and Figure 3B, S21.

[58] Id. at column 11, lines 60-62 and Figure 3, S130.

[59] Lemense at column 3, lines 4-36.

Moreover, the modified device will perform the same functions with predictable results based on the teachings of Taguchi and Lemense. Also, it would have been obvious to one of ordinary skill in the at the time the claimed invention was made to modify Taguchi to include the input module of Lemense to enable replacement and monitoring of tire pressure sensors without previously storing the ID, by enabling the user to visually observe the ID and manually input the ID.

The combination of Taguchi and Lemense fails to teach or suggest that the input module is a code scanner. Itou, however, teaches the above feature of the claimed invention. That is, Itou teaches a method of acquiring the ID of the outdated tire pressure sensor by access to a bar code and writing the ID into the new tire pressure sensor. Indeed, Itou includes an ID registration tool 60 that is used to read the IDs from bar codes 5/6/7/8 for wiring the bar codes in the tire pressure monitoring apparatus 50.[60] The bar codes are representative of the IDs of the pressure sensors 10/20/30/40.[61] The ID registration tool 60 is composed on a bar-code reading unit 61 and an ID transmitting unit 62 for transmitting the IDs.[62] Thus, Itou teaches the above feature of claim 8 missing from the disclosure of Taguchi and Lemense.

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[60] See Itou at column 17, lines 32-44.

[61] Id. at column 17, lines 37-39.

[62] Id. at column 17, lines 45-55.

Moreover, it would have been obvious to one of ordinary skill in the art to modify the system of Taguchi (in view of Lemense) to include the ID registration tool 60 of Itou because "[t]he combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results."[63] Furthermore, the proposed modification would prevent mistaken ID registration in the tire pressure monitoring system of Taguchi.[64]

Thus, claim 8 is obvious over Taguchi in view of Lemense and Itou under 35 U.S.C. § 103, and should be cancelled.

Ground No. 3: §102(b) Rejection over Lemense

Claims 10-13 are anticipated under 35 U.S.C. § 102(a) or (b) by Lemense, which was filed on December 19, 2003, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent.

Claim 10

Lemense relates to a method and system for replacing at least one tire of a vehicle.[65] The embodiments depicted in Figures 1-4 of Lemense contain each and every element of claim 10 of

[63] *KSR* at 1739-1740.

[64] See Itou at column 2, lines 22-31.

[65] See Lemense at Abstract; column 2, line 35 through column 4, line 15, and Figures 1-4.

the '064 patent. Therefore, Lemense anticipates claim 10. A claim chart showing the one-for-one correspondence is set forth below.

Claim 10	**Lemense**
A tire pressure detector identification copying method comprising the steps of:	A method for replacing a tire of a vehicle including cloning ID codes (e.g., see Lemense at Abstract and Figure 4).
providing a setting apparatus;	Service tool 24 is provided for interacting with sensor unit 23 (see Lemense at column 2, lines 63-65).
reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and	Service tool 24 receives and stores ID code (see Lemense at column 3, lines 14-37).
wirelessly writing the old identification into a new identification rewriteable tire pressure detector by the setting apparatus.	The service tool is used to replicate or clone the ID code of a broken sensor unit into a replacement sensor unit over a LF communication link between the service tool and the replacement sensor unit (see Lemense at column 3, lines 22-26 and 51-67, and column 4, lines 1-15).

Claim 10 of the '064 patent is clearly anticipated by Lemense.

Lemense discloses a method and system for monitoring vehicular tire pressure and replacing or servicing tires mounted on wheels containing tire pressure sensing units.[66] The vehicle tires include sensor units 15-18 mounted on the vehicle tires. Each sensor unit includes a communication section for transmitting data and an ID code to a control module 20.[67] The system and method utilizes a service tool 24 for interacting with a sensor unit.

The method includes interrogating the sensor units using the service tool 24 to receive an ID code from each sensor.[68] After a technician removes a tire for service, the sensor units are re-tested. Any non-working tires are replaced. The service tool is used to replicate or clone the ID code of the broken sensor unit into a replacement sensor unit over a LF communication link between the service tool and the replacement tire sensor unit.[69]

Therefore, Lemense teaches each and every limitation of claim 10. Accordingly, claim 10 is properly anticipated by Lemense.

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[66] Id. at column 1, lines 14-16.

[67] Id. at column 2, lines 35-43.

[68] Id. at column 3, lines 15-37 and Figure 4, Step 41.

[69] Id. at column 3, lines 37-64.

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Claim 11

Claim 11 requires verifying the identification newly recorded in the new identification rewriteable tire pressure detector. After a new or repaired tire is installed onto each wheel, each sensor unit is retested to ensure that it is still functioning using the same test procedure shown in steps 40-43 of Figure 4 of Lemense.[70] This includes interrogating the sensor to receive the ID code.[71]

Thus, claim 11 is properly anticipated by Lemense and lacks novelty.

Claim 12

Claim 12 requires that the setting apparatus receives a wireless signal containing the old identification from the old tire pressure detector in the step of reading the old identification. Lemense discloses that the service tool 24 receives the ID code from each of the sensor units during interrogating the sensor units.[72]

Thus, claim 12 is properly anticipated by Lemense and lacks novelty.

[70] Id. at column 4, lines 10-15.

[71] Id. at column 3, lines 37-46.

[72] Id. at column 3, lines 23-26.

Claim 13

Claim 13 requires that the setting apparatus receives the old identification through an input module in the step of reading the old identification. Lemense teaches that the old identification is received through an input module (i.e., microcontroller 30).[73]

Thus, claim 13 is properly anticipated by Lemense and lacks novelty.

In view of the anticipatory description in Lemense of a method within the scope of claims 10-13 of the '064 patent, these claims lack novelty and should be cancelled.

Ground No. 4: §103(a) Rejection over Taguchi in view of Lemense and Dixit

Claims 14 and 15 are unpatentable under 35 U.S.C. § 103(a) over Taguchi, which was filed on June 25, 2003, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent, in view of Dixit, which was filed on January 2, 2001, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent, and Lemense, which was filed on December 19, 2003, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent.

[73] Id. at column 3, lines 14-37 and Figure 3.

Claim 14

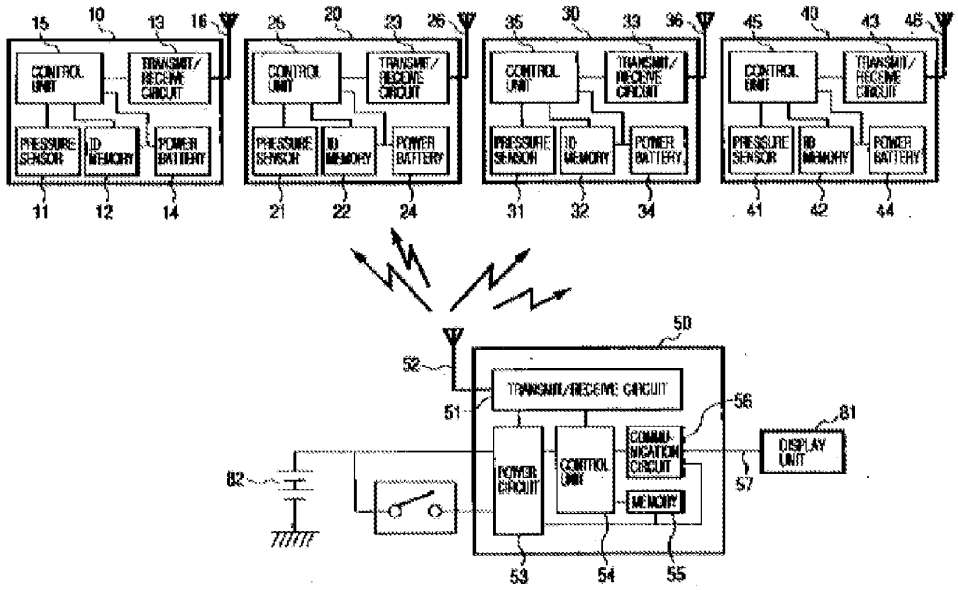
Taguchi relates to a tire pressure detecting apparatus. The embodiment depicted in Figure 2 of Taguchi contains almost each and every element of the tire pressure detecting apparatus in claim 14 of the '064 patent. Dixit and Lemense are similarly directed to a tire pressure monitoring system and teach the features lacking from Taguchi. A claim chart showing the one-for-one correspondence is set forth below.

Claim 14	**Taguchi in view of Lemense and Dixit**
A tire pressure detecting system, comprising:	**Taguchi:** combination of pressure sensors 10/20/30/40 and monitoring apparatus 50 (see Figure 2).
an identification rewritable tire pressure detector comprising:	**Taguchi:** pressure sensors 10/20/30/40 (Figure 2), including rewritable ID memory 12; into which a transmitter ID is written during a registration process (see Abstract and column 11, lines 49-54).
a micro-processing module having a rewritable memory unit to record an identification;	**Taguchi:** combination of control unit 15 and ID memory 12 (Figure 2).
a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;	**Taguchi:** pressure sensor 11 (Figure 2). Pressure sensor 11 and ID memory 12 are electrically connected, as illustrated in Figure 2.
a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal including the detection result and the identification of the identification rewritable tire pressure detector;	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2; column 11, lines 16-25; describing transmission of detected pressure signal from sensor 11 and sensor ID stored in memory unit 12).
a power module electronically connected to the micro-processing module to supply power to the identification rewritable tire pressure detector; and	**Taguchi:** power battery 14 (Figure 2).
an interface arranged to receive and send an external signal to the micro-processing module, where the external signal comprises an external identification to be written into the rewritable	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2), step S140 "receive transmitted receiver ID by sensor" (Figure 3).

memory unit;	
a setting apparatus arranged to communicate with the identification rewritable tire pressure detector via wireless, including:	**Taguchi:** tire pressure monitor 50, which transmits the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit 12.
reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and	**Lemense:** Service tool 24 receives and stores ID code (see Lemense at column 3, lines 14-37).
wirelessly writing the old identification into a new identification rewriteable tire pressure detector by the setting apparatus, wherein the setting apparatus comprises:	**Lemense:** The service tool is used to replicate or clone the ID code of a broken sensor unit into a replacement sensor unit over a LF communication link between the service tool and the replacement sensor unit (see Lemense at column 3, lines 22-26 and 51-67, and column 4, lines 1-15).
a control module;	**Taguchi:** control unit 54.
an input module connected to the control module to allow an operator to input an identification to be written into the identification rewritable tire pressure;	**Dixit:** data input arrangements 42A-42D (Figures 1 and 2) and keypad 50.
a receiving unit module connected to the control module to receive the RF signal from the identification rewritable tire pressure detector and to send the RF signal to the control module;	**Taguchi:** transmit/receive circuit 51 and antenna 52 (Figure 2; and column 11, lines 27-35).
a setting output module controlled by the control module to send the external signal to the identification rewriteable tire pressure detector, via the interface, where the external signal comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and	**Taguchi:** combination of the transmit/receive circuit 51 and the antenna 52 in Figure 2.
a power source connected to the control module and providing electrical power to the setting apparatus.	**Taguchi:** power circuit 53 (Figure 2).

Reference is made to Figure 2 of Taguchi, reproduced below.

FIG. 2



Taguchi discloses a tire pressure detecting apparatus including a plurality of sensors 10/20/30/40 and a monitoring apparatus 50. The pressure sensors 10/20/30/40 include a rewritable ID memory 12, in which a transmitter ID is written during a registration process.[74] The ID memory 12 is capable of recording an ID.[75] The pressure sensor 11 is electrically connected to the ID memory 12, as is illustrated in Figure 2. The pressure sensor 11 detects the tire pressure and sends the results to the control unit 15. The transmit/receive circuit 13 in combination with the antenna 16 periodically transmits the combination of detected pressure

[74] Taguchi at column 11, lines 49-54.

[75] Id. at column 10, line 65-column 11, line 2.

signal and the sensor ID in a signal with a predetermined frequency.[76] The pressure detector also includes a power module (power battery 14) that provides power to the pressure sensor. Furthermore, the transmit/receive circuit 13 is electronically connected to the microprocessing module, to receive and send an external signal to the microprocessing module, where the external signal includes an external identification to be written into the rewriteable memory unit.[77]

Taguchi further includes a setting apparatus (i.e., tire pressure monitor 50). The tire pressure monitor 50 sends the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit. The setting apparatus includes a control unit/module 54.[78] The tire pressure monitor 50 includes a receiving module (transmit/receive circuit 51 and antenna 52) electrically connected to the control module.[79] Furthermore, the tire pressure monitor 50 includes a setting output module (i.e., combination of the transmit/receive circuit 51 and the antenna 52). Specifically, Taguchi teaches sending a receiver ID from the monitoring apparatus to the pressure sensors 10/20/30/40.[80] Additionally, the tire pressure monitor 50 includes a power circuit 53 electrically connected to the control unit 53 and provides electrical power to the tire pressure monitor.

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[76] Id. at column 2, lines 56-59 and column 18, lines 4-9.

[77] Id. at Figure 4, S140.

[78] Id. at Figure 4, S130.

[79] Id. at column 11, lines 25-35 and Figure 3B, S21.

[80] Id. at column 11, lines 60-62 and Figure 3, S130.

Indeed, it was established during prosecution of the '064 patent that Taguchi teaches each of the above features from claim 14 (the above features of claim 14 were recited in claim 1 of the '064 patent).

Taguchi, however, fails to teach or suggest an input module to input an identification to be written into the identification rewritable tire pressure, as recited in claim 14.

Lemense, however, teaches the claimed input module. Specifically, Lemense includes a service tool 24 including a microcontroller 30. The microcontroller 30 performs various functions to interrogate a sensor unit using the service tool 24 to receive an ID code from each sensor.[81] The microcontroller 30 is connected to an interface 36 that includes an input device (i.e., keypad 26). Thus, Lemense teaches the above feature missing from the disclosure of Taguchi.

Furthermore, Dixit includes a plurality of manual input arrangements 42A-42D (Figure 1), each associated with one of the tire sensor units.[82] Additionally, with as illustrated in Figure 2, Dixit includes a transmitter device 44 that person manually operates to input an identification code via an input key pad 50.[83] Thus, Dixit teaches the above feature missing from the disclosure of Taguchi.

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[81] Lemense at column 3, lines 4-36.

[82] See Dixit at column 3, lines 38-45.

[83] Id. at column 4, lines 22-25.

Moreover, the modified device will perform the same functions with predictable results based on the teachings of Taguchi, Lemense and Dixit. Also, it would have been obvious to one of ordinary skill in the at the time the claimed invention was made to modify Taguchi in view of Lemense and Dixit to enable replacement and monitoring of tire pressure sensors without previously storing the ID, by enabling the user to visually observe the ID and manually input the ID.

Claim 15

Taguchi relates to a tire pressure detecting apparatus. The embodiment depicted in Figure 2 of Taguchi contains almost each and every element of the tire pressure detecting apparatus in claim 15 of the '064 patent. Dixit and Lemense are similarly directed to a tire pressure monitoring system and teaches the features lacking from Taguchi. A claim chart showing the one-for-one correspondence is set forth below.

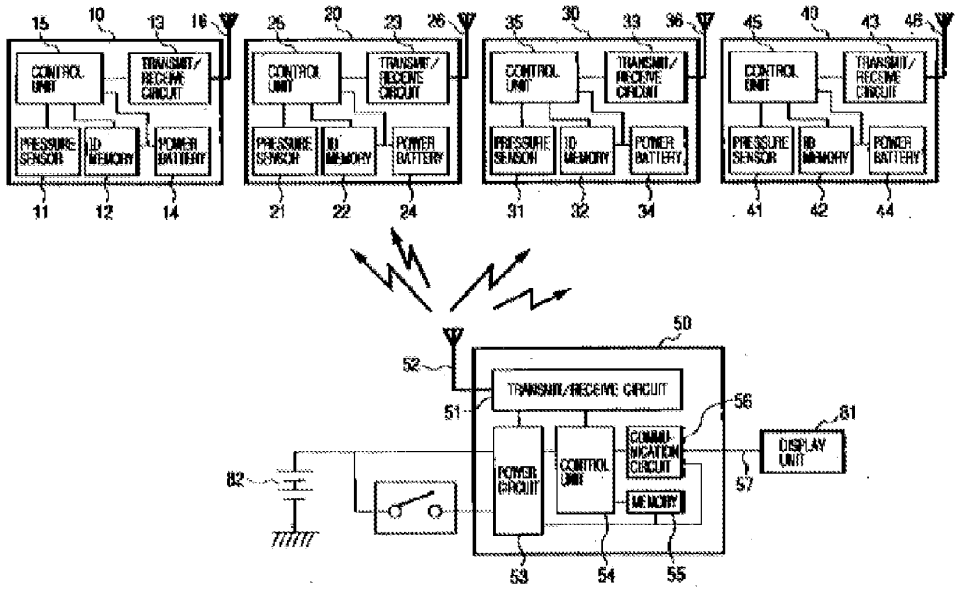
Claim 15	**Taguchi in view of Lemense and Dixit**
A tire pressure detecting system, comprising:	**Taguchi:** combination of pressure sensors 10/20/30/40 and monitoring apparatus 50 (see Figure 2).
an identification rewritable tire pressure detector comprising:	**Taguchi:** pressure sensors 10/20/30/40 (Figure 2), including rewritable ID memory 12; into which a transmitter ID is written during a registration process (see Abstract and column 11, lines 49-54).
a micro-processing module having a rewritable memory unit to record an identification;	**Taguchi:** combination of control unit 15 and ID memory 12 (Figure 2).
a sensing module electrically connected to the micro-processing module and having a	**Taguchi:** pressure sensor 11 (Figure 2). Pressure sensor 11 and ID memory 12 are electrically

pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;	connected, as illustrated in Figure 2.
a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal including the detection result and the identification of the identification rewritable tire pressure detector;	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2; column 11, lines 16-25; describing transmission of detected pressure signal from sensor 11 and sensor ID stored in memory unit 12).
a power module electronically connected to the micro-processing module to supply power to the identification rewritable tire pressure detector; and	**Taguchi:** power battery 14 (Figure 2).
an interface arranged to receive and send an external signal to the micro-processing module, where the external signal comprises an external identification to be written into the rewritable memory unit;	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2), step S140 "receive transmitted receiver ID by sensor" (Figure 3).
a setting apparatus arranged to communicate with the identification rewritable tire pressure detector via wireless, including:	**Taguchi:** tire pressure monitor 50, which transmits the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit 12.
reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and	**Lemense:** Service tool 24 receives and stores ID code (see Lemense at column 3, lines 14-37).
writing the old identification into a new identification rewriteable tire pressure detector by the setting apparatus, wherein the setting apparatus comprises:	**Lemense:** The service tool is used to replicate or clone the ID code of a broken sensor unit into a replacement sensor unit over a LF communication link between the service tool and the replacement sensor unit (see Lemense at column 3, lines 22-26 and 51-67, and column 4, lines 1-15).
a control module;	**Taguchi:** control unit 54.
an input module connected to the control module to allow an operator to input an identification to be written into the identification rewritable tire pressure;	**Dixit:** data input arrangements 42A-42D (Figures 1 and 2) and keypad 50.
a receiving unit module connected to the control module to receive the RF signal from the identification rewritable tire pressure detector and to send the RF signal to the control module;	**Taguchi:** transmit/receive circuit 51 and antenna 52 (Figure 2; and column 11, lines 27-35).
a setting output module controlled by the control module to send the external signal to the identification rewriteable tire pressure detector, via the interface, where the external signal comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and	**Taguchi:** combination of the transmit/receive circuit 51 and the antenna 52 in Figure 2.

a power source connected to the control module and providing electrical power to the setting apparatus.	**Taguchi:** power circuit 53 (Figure 2).

Reference is made to Figure 2 of Taguchi, reproduced below.

FIG. 2



Taguchi discloses a tire pressure detecting apparatus including a plurality of sensors 10/20/30/40 and a monitoring apparatus 50. The pressure sensors 10/20/30/40 include a rewritable ID memory 12, in which a transmitter ID is written during a registration process.[84] The ID memory 12 is capable of recording an ID.[85] The pressure sensor 11 is electrically connected to the ID memory 12, as is illustrated in Figure 2. The pressure sensor 11 detects the tire pressure and sends the results to the control unit 15. The transmit/receive circuit 13 in

[84] Taguchi at column 11, lines 49-54.

[85] Id. at column 10, line 65-column 11, line 2.

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combination with the antenna 16 periodically transmits the combination of detected pressure signal and the sensor ID in a signal with a predetermined frequency.[86] The pressure detector also includes a power module (power battery 14) that provides power to the pressure sensor. Furthermore, the transmit/receive circuit 13 is electronically connected to the microprocessing module, to receive and send an external signal to the microprocessing module, where the external signal includes an external identification to be written into the rewriteable memory unit.[87]

Taguchi further includes a setting apparatus (i.e., tire pressure monitor 50). The tire pressure monitor 50 sends the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit. The setting apparatus includes a control unit/module 54.[88] The tire pressure monitor 50 includes a receiving module (transmit/receive circuit 51 and antenna 52) electrically connected to the control module.[89] Furthermore, the tire pressure monitor 50 includes a setting output module (i.e., combination of the transmit/receive circuit 51 and the antenna 52). Specifically, Taguchi teaches sending a receiver ID from the monitoring apparatus to the pressure sensors 10/20/30/40.[90] Additionally, the tire pressure monitor 50 includes a power

[86] Id. at column 2, lines 56-59 and column 18, lines 4-9.

[87] Id. at Figure 4, S140.

[88] Id. at Figure 4, S130.

[89] Id. at column 11, lines 25-35 and Figure 3B, S21.

[90] Id. at column 11, lines 60-62 and Figure 3, S130.

circuit 53 electrically connected to the control unit 53 and provides electrical power to the tire pressure monitor.

Indeed, it was established during prosecution of the '064 patent that Taguchi teaches each of the above features of claim 15 (the above features were recited in independent claim 1 of the '064 patent).

Taguchi, however, fails to teach or suggest an input module to input an identification to be written into the identification rewritable tire pressure, as recited in claim 15.

Lemense, however, teaches the claimed input module. Specifically, Lemense includes a service tool 24 including a microcontroller 30. The microcontroller 30 performs various functions to interrogate a sensor unit using the service tool 24 to receive an ID code from each sensor.[91] The microcontroller 30 is connected to an interface 36 that includes an input device (i.e., keypad 26). Thus, Lemense teaches the above feature missing from the disclosure of Taguchi.

Furthermore, Dixit includes a plurality of manual input arrangements 42A-42D (Figure 1), each associated with one of the tire sensor units.[92] Additionally, with as illustrated in Figure 2, Dixit includes a transmitter device 44 that person manually operates to input an identification

[91] Lemense at column 3, lines 4-36.

[92] See Dixit at column 3, lines 38-45.

code via an input key pad 50.[93] Thus, Dixit teaches the above feature missing from the disclosure of Taguchi.

Moreover, the modified device will perform the same functions with predictable results based on the teachings of Taguchi, Lemense and Dixit. Also, it would have been obvious to one of ordinary skill in the at the time the claimed invention was made to modify Taguchi in view of Lemense and Dixit to enable replacement and monitoring of tire pressure sensors without previously storing the ID, by enabling the user to visually observe the ID and manually input the ID.

Therefore, the combination of Taguchi, Lemense and Dixit teaches each and every feature of claims 14 and 15. Accordingly, claims 14 and 15 should be cancelled.

Ground No. 5: §103(a) Rejection over Taguchi in view of Lemense

Claims 14 and 15 are unpatentable under 35 U.S.C. § 103(a) over Taguchi, which was filed on June 25, 2003, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent, in view of Lemense, which was filed on December 19, 2003, and thus qualifies as prior art under 35 U.S.C. § 102(a) and (b) against the claims of the '064 patent.

[93] Id. at column 4, lines 22-25.

Claim 14

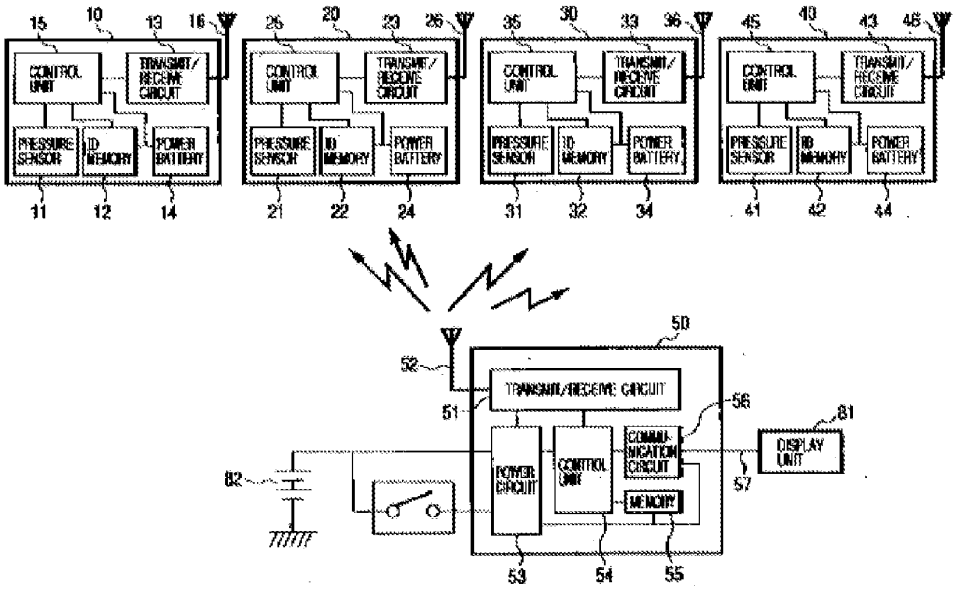
Taguchi relates to a tire pressure detecting apparatus. The embodiment depicted in Figure 2 of Taguchi contains almost each and every element of the tire pressure detecting apparatus in claim 14 of the '064 patent. Lemense is similarly directed to a tire pressure monitoring system and teaches the features lacking from Taguchi. A claim chart showing the one-for-one correspondence is set forth below.

Claim 14	**Taguchi in view of Lemense**
A tire pressure detecting system, comprising:	**Taguchi:** combination of pressure sensors 10/20/30/40 and monitoring apparatus 50 (see Figure 2).
an identification rewritable tire pressure detector comprising:	**Taguchi:** pressure sensors 10/20/30/40 (Figure 2), including rewritable ID memory 12; into which a transmitter ID is written during a registration process (see Abstract and column 11, lines 49-54).
a micro-processing module having a rewritable memory unit to record an identification;	**Taguchi:** combination of control unit 15 and ID memory 12 (Figure 2).
a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;	**Taguchi:** pressure sensor 11 (Figure 2). Pressure sensor 11 and ID memory 12 are electrically connected, as illustrated in Figure 2.
a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal including the detection result and the identification of the identification rewritable tire pressure detector;	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2; column 11, lines 16-25; describing transmission of detected pressure signal from sensor 11 and sensor ID stored in memory unit 12).
a power module electronically connected to the micro-processing module to supply power to the identification rewritable tire pressure detector; and	**Taguchi:** power battery 14 (Figure 2).
an interface arranged to receive and send an external signal to the micro-processing module, where the external signal comprises an external identification to be written into the rewritable	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2), step S140 "receive transmitted receiver ID by sensor" (Figure 3).

memory unit;	
a setting apparatus arranged to communicate with the identification rewritable tire pressure detector via wireless, including:	**Taguchi:** tire pressure monitor 50, which transmits the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit 12.
reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and	**Lemense:** Service tool 24 receives and stores ID code (see Lemense at column 3, lines 14-37).
wirelessly writing the old identification into a new identification rewriteable tire pressure detector by the setting apparatus, wherein the setting apparatus comprises:	**Lemense:** The service tool is used to replicate or clone the ID code of a broken sensor unit into a replacement sensor unit over a LF communication link between the service tool and the replacement sensor unit (see Lemense at column 3, lines 22-26 and 51-67, and column 4, lines 1-15).
a control module;	**Taguchi:** control unit 54.
an input module connected to the control module to allow an operator to input an identification to be written into the identification rewritable tire pressure;	**Lemense:** keypad 26.
a receiving unit module connected to the control module to receive the RF signal from the identification rewritable tire pressure detector and to send the RF signal to the control module;	**Taguchi:** transmit/receive circuit 51 and antenna 52 (Figure 2; and column 11, lines 27-35).
a setting output module controlled by the control module to send the external signal to the identification rewriteable tire pressure detector, via the interface, where the external signal comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and	**Taguchi:** combination of the transmit/receive circuit 51 and the antenna 52 in Figure 2.
a power source connected to the control module and providing electrical power to the setting apparatus.	**Taguchi:** power circuit 53 (Figure 2).

Reference is made to Figure 2 of Taguchi, reproduced below.

FIG. 2



Taguchi discloses a tire pressure detecting apparatus including a plurality of sensors 10/20/30/40 and a monitoring apparatus 50. The pressure sensors 10/20/30/40 include a rewritable ID memory 12, in which a transmitter ID is written during a registration process.[94] The ID memory 12 is capable of recording an ID.[95] The pressure sensor 11 is electrically connected to the ID memory 12, as is illustrated in Figure 2. The pressure sensor 11 detects the tire pressure and sends the results to the control unit 15. The transmit/receive circuit 13 in combination with the antenna 16 periodically transmits the combination of detected pressure

[94] Taguchi at column 11, lines 49-54.

[95] Id. at column 10, line 65-column 11, line 2.

signal and the sensor ID in a signal with a predetermined frequency.[96] The pressure detector also includes a power module (power battery 14) that provides power to the pressure sensor. Furthermore, the transmit/receive circuit 13 is electronically connected to the microprocessing module, to receive and send an external signal to the microprocessing module, where the external signal includes an external identification to be written into the rewriteable memory unit.[97]

Taguchi further includes a setting apparatus (i.e., tire pressure monitor 50). The tire pressure monitor 50 sends the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit. The setting apparatus includes a control unit/module 54.[98] The tire pressure monitor 50 includes a receiving module (transmit/receive circuit 51 and antenna 52) electrically connected to the control module.[99] Furthermore, the tire pressure monitor 50 includes a setting output module (i.e., combination of the transmit/receive circuit 51 and the antenna 52). Specifically, Taguchi teaches sending a receiver ID from the monitoring apparatus to the pressure sensors 10/20/30/40.[100] Additionally, the tire pressure monitor 50 includes a power circuit 53 electrically connected to the control unit 53 and provides electrical power to the tire pressure monitor.

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[96] Id. at column 2, lines 56-59 and column 18, lines 4-9.

[97] Id. at Figure 4, S140.

[98] Id. at Figure 4, S130.

[99] Id. at column 11, lines 25-35 and Figure 3B, S21.

[100] Id. at column 11, lines 60-62 and Figure 3, S130.

Indeed, it was established during prosecution of the '064 patent that Taguchi teaches each of the above features of claim 14 (the above features were recited in independent claim 1 of the '064 patent).

Taguchi, however, fails to teach or suggest an input module to input an identification to be written into the identification rewritable tire pressure, as recited in claim 14.

Lemense, however, teaches the claimed input module. Specifically, Lemense includes a service tool 24 including a microcontroller 30. The microcontroller 30 performs various functions to interrogate a sensor unit using the service tool 24 to receive an ID code from each sensor.[101] The microcontroller 30 is connected to an interface 36 that includes an input device (i.e., keypad 26). Thus, Lemense teaches the above feature missing from the disclosure of Taguchi.

Moreover, the modified device will perform the same functions with predictable results based on the teachings of Taguchi and Lemense. Also, it would have been obvious to one of ordinary skill in the at the time the claimed invention was made to modify Taguchi in view of Lemense to enable replacement and monitoring of tire pressure sensors without previously storing the ID, by enabling the user to visually observe the ID and manually input the ID.

[101] Lemense at column 3, lines 4-36.

Claim 15

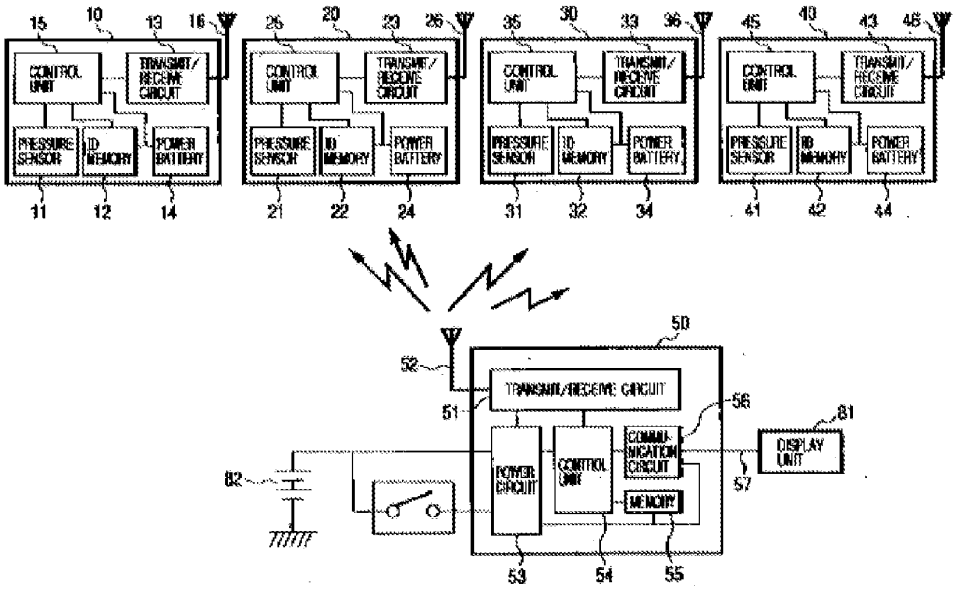
Taguchi relates to a tire pressure detecting apparatus. The embodiment depicted in Figure 2 of Taguchi contains almost each and every element of the tire pressure detecting apparatus in claim 15 of the '064 patent. Lemense is similarly directed to a tire pressure monitoring system and teaches the features lacking from Taguchi. A claim chart showing the one-for-one correspondence is set forth below.

Claim 15	**Taguchi in view of Lemense**
A tire pressure detecting system, comprising:	**Taguchi:** combination of pressure sensors 10/20/30/40 and monitoring apparatus 50 (see Figure 2).
an identification rewritable tire pressure detector comprising:	**Taguchi:** pressure sensors 10/20/30/40 (Figure 2), including rewritable ID memory 12; into which a transmitter ID is written during a registration process (see Abstract and column 11, lines 49-54).
a micro-processing module having a rewritable memory unit to record an identification;	**Taguchi:** combination of control unit 15 and ID memory 12 (Figure 2).
a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;	**Taguchi:** pressure sensor 11 (Figure 2). Pressure sensor 11 and ID memory 12 are electrically connected, as illustrated in Figure 2.
a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal including the detection result and the identification of the identification rewritable tire pressure detector;	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2; column 11, lines 16-25; describing transmission of detected pressure signal from sensor 11 and sensor ID stored in memory unit 12).
a power module electronically connected to the micro-processing module to supply power to the identification rewritable tire pressure detector; and	**Taguchi:** power battery 14 (Figure 2).
an interface arranged to receive and send an external signal to the micro-processing module, where the external signal comprises an external identification to be written into the rewritable	**Taguchi:** transmit/receive circuit 13 and antenna 16 (Figure 2), step S140 "receive transmitted receiver ID by sensor" (Figure 3).

memory unit;	
a setting apparatus arranged to communicate with the identification rewritable tire pressure detector via wireless, including:	**Taguchi:** tire pressure monitor 50, which transmits the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit 12.
reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and	**Lemense:** Service tool 24 receives and stores ID code (see Lemense at column 3, lines 14-37).
writing the old identification into a new identification rewriteable tire pressure detector by the setting apparatus, wherein the setting apparatus comprises:	**Lemense:** The service tool is used to replicate or clone the ID code of a broken sensor unit into a replacement sensor unit over a LF communication link between the service tool and the replacement sensor unit (see Lemense at column 3, lines 22-26 and 51-67, and column 4, lines 1-15).
a control module;	**Taguchi:** control unit 54.
an input module connected to the control module to allow an operator to input an identification to be written into the identification rewritable tire pressure;	**Lemense:** keypad 26.
a receiving unit module connected to the control module to receive the RF signal from the identification rewritable tire pressure detector and to send the RF signal to the control module;	**Taguchi:** transmit/receive circuit 51 and antenna 52 (Figure 2; and column 11, lines 27-35).
a setting output module controlled by the control module to send the external signal to the identification rewriteable tire pressure detector, via the interface, where the external signal comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and	**Taguchi:** combination of the transmit/receive circuit 51 and the antenna 52 in Figure 2.
a power source connected to the control module and providing electrical power to the setting apparatus.	**Taguchi:** power circuit 53 (Figure 2).

Reference is made to Figure 2 of Taguchi, reproduced below.

FIG. 2



Taguchi discloses a tire pressure detecting apparatus including a plurality of sensors 10/20/30/40 and a monitoring apparatus 50. The pressure sensors 10/20/30/40 include a rewritable ID memory 12, in which a transmitter ID is written during a registration process.[102] The ID memory 12 is capable of recording an ID.[103] The pressure sensor 11 is electrically connected to the ID memory 12, as is illustrated in Figure 2. The pressure sensor 11 detects the tire pressure and sends the results to the control unit 15. The transmit/receive circuit 13 in combination with the antenna 16 periodically transmits the combination of detected pressure

[102] Taguchi at column 11, lines 49-54.

[103] Id. at column 10, line 65-column 11, line 2.

signal and the sensor ID in a signal with a predetermined frequency.[104] The pressure detector also includes a power module (power battery 14) that provides power to the pressure sensor. Furthermore, the transmit/receive circuit 13 is electronically connected to the microprocessing module, to receive and send an external signal to the microprocessing module, where the external signal includes an external identification to be written into the rewriteable memory unit.[105]

Taguchi further includes a setting apparatus (i.e., tire pressure monitor 50). The tire pressure monitor 50 sends the receiver ID to the pressure sensors 10/20/30/40 for storage in the ID memory unit. The setting apparatus includes a control unit/module 54.[106] The tire pressure monitor 50 includes a receiving module (transmit/receive circuit 51 and antenna 52) electrically connected to the control module.[107] Furthermore, the tire pressure monitor 50 includes a setting output module (i.e., combination of the transmit/receive circuit 51 and the antenna 52). Specifically, Taguchi teaches sending a receiver ID from the monitoring apparatus to the pressure sensors 10/20/30/40.[108] Additionally, the tire pressure monitor 50 includes a power circuit 53 electrically connected to the control unit 53 and provides electrical power to the tire pressure monitor.

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[104] Id. at column 2, lines 56-59 and column 18, lines 4-9.

[105] Id. at Figure 4, S140.

[106] Id. at Figure 4, S130.

[107] Id. at column 11, lines 25-35 and Figure 3B, S21.

[108] Id. at column 11, lines 60-62 and Figure 3, S130.

Indeed, it was established during prosecution of the '064 patent that Taguchi teaches the above features of claim 15 (the above features were recited in claim 1 of the '064 patent).

Taguchi, however, fails to teach or suggest an input module to input an identification to be written into the identification rewritable tire pressure, as recited in claim 15.

Lemense, however, teaches the claimed input module. Specifically, Lemense includes a service tool 24 including a microcontroller 30. The microcontroller 30 performs various functions to interrogate a sensor unit using the service tool 24 to receive an ID code from each sensor.[109] The microcontroller 30 is connected to an interface 36 that includes an input device (i.e., keypad 26). Thus, Lemense teaches the above feature missing from the disclosure of Taguchi.

Moreover, the modified device will perform the same functions with predictable results based on the teachings of Taguchi and Lemense. Also, it would have been obvious to one of ordinary skill in the at the time the claimed invention was made to modify Taguchi in view of Lemense to enable replacement and monitoring of tire pressure sensors without previously storing the ID, by enabling the user to visually observe the ID and manually input the ID.

Therefore, the combination of Taguchi, Lemense and Dixit teach each and every feature of claims 14 and 15. Accordingly, claims 14 and 15 should be cancelled.

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[109] Lemense at column 3, lines 4-36.

VIII. CONCLUSION

For the above reasons, it is respectfully requested that this request for *ex parte* reexamination be granted and that all claims be held unpatentable.

Date: 28 February 2014

Respectfully submitted,

/Vincent M DeLuca/

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Attorney for Third Party Requester

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CERTIFICATE OF SERVICE

I hereby certify that a true copy of the foregoing Request for Ex-Parte Reexamination was served on the patent owner by mailing a copy of same to the below address on this 28th day of February, 2014, by United States Mail, postage prepaid.

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/Vincent M DeLuca/
Vincent M. DeLuca, Esq.
Registration No. 32,408

Orange Exhibit No. 2003
IPR2024-00744

US008031064B2

(12) **United States Patent**
Yu

(10) **Patent No.: US 8,031,064 B2**
(45) **Date of Patent: Oct. 4, 2011**

(54) **TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME**

(75) Inventor: **Hung-Chih Yu**, Taichung (TW)

(73) Assignee: **Orange Electronic Co., Ltd.**, Tanzih Hsiang Taichung Hsien (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 420 days.

(21) Appl. No.: **12/283,979**

(22) Filed: **Sep. 17, 2008**

(65) **Prior Publication Data**

US 2010/0066524 A1 Mar. 18, 2010

(51) **Int. Cl.**
B60C 23/00 (2006.01)

(52) **U.S. Cl.** **340/447**; 340/442; 340/445; 73/146; 73/146.5

(58) **Field of Classification Search** 340/442–449, 340/425.5, 426.3, 10.06, 10.1; 73/146, 146.2–146.5
See application file for complete search history.

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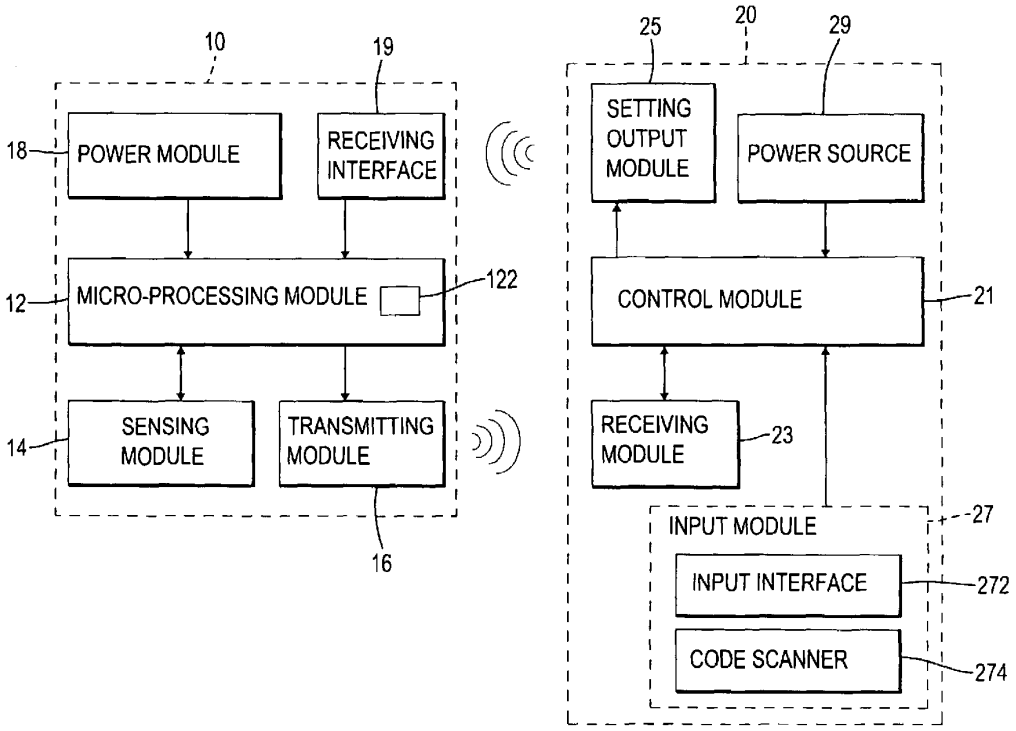
* cited by examiner

Primary Examiner — Anh V La
(74) *Attorney, Agent, or Firm* — Charles E. Baxley

(57) **ABSTRACT**

A tire pressure detecting apparatus has an identification rewriteable tire pressure detector and a setting apparatus. The tire pressure detector is securely mounted on a valve stem inside a tire of a vehicle and has a micro-processing module, a sensing module, a transmitting module and a receiving interface, where the micro-processing module has a memory unit. The setting apparatus is capable of reading or inputting an identification from a failure tire pressure detector, transmits the identification to the identification rewriteable tire pressure detector and writes the identification into the memory unit.

13 Claims, 4 Drawing Sheets



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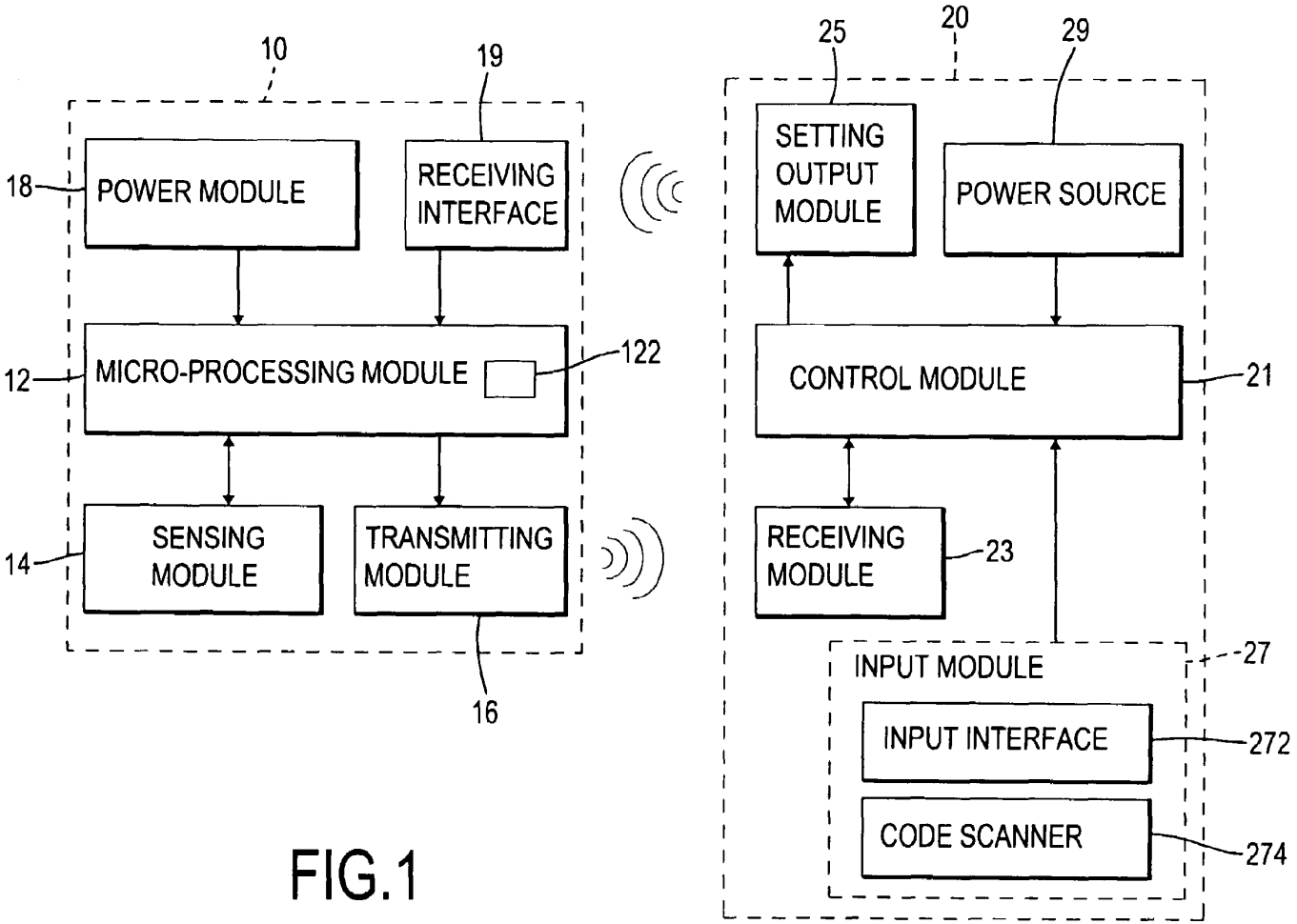


FIG.1

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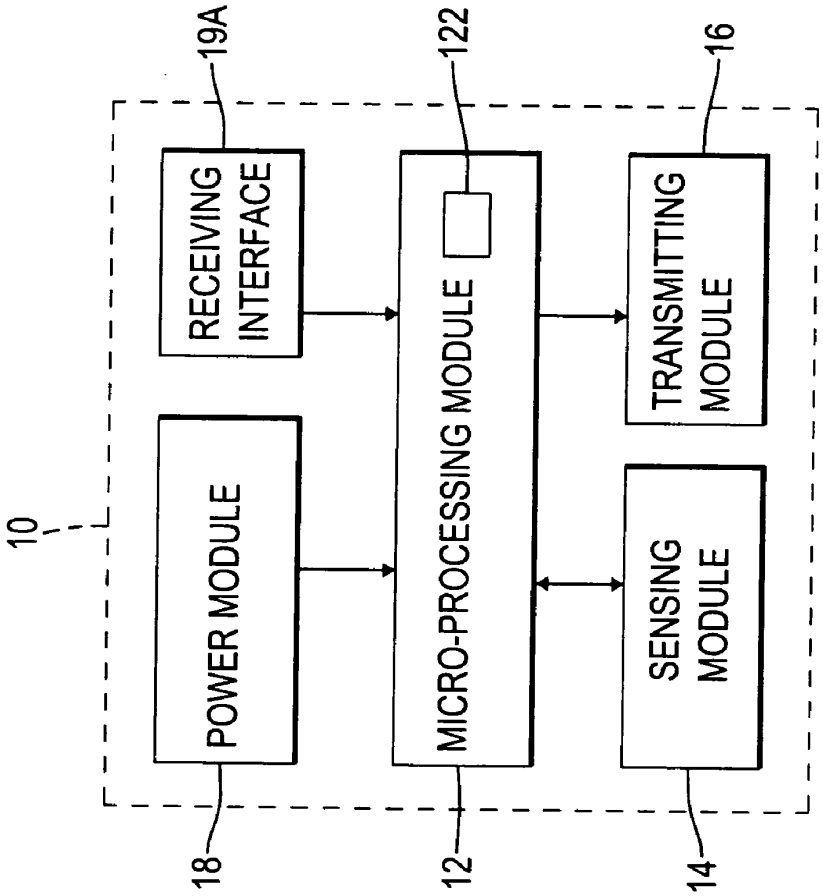


FIG.2

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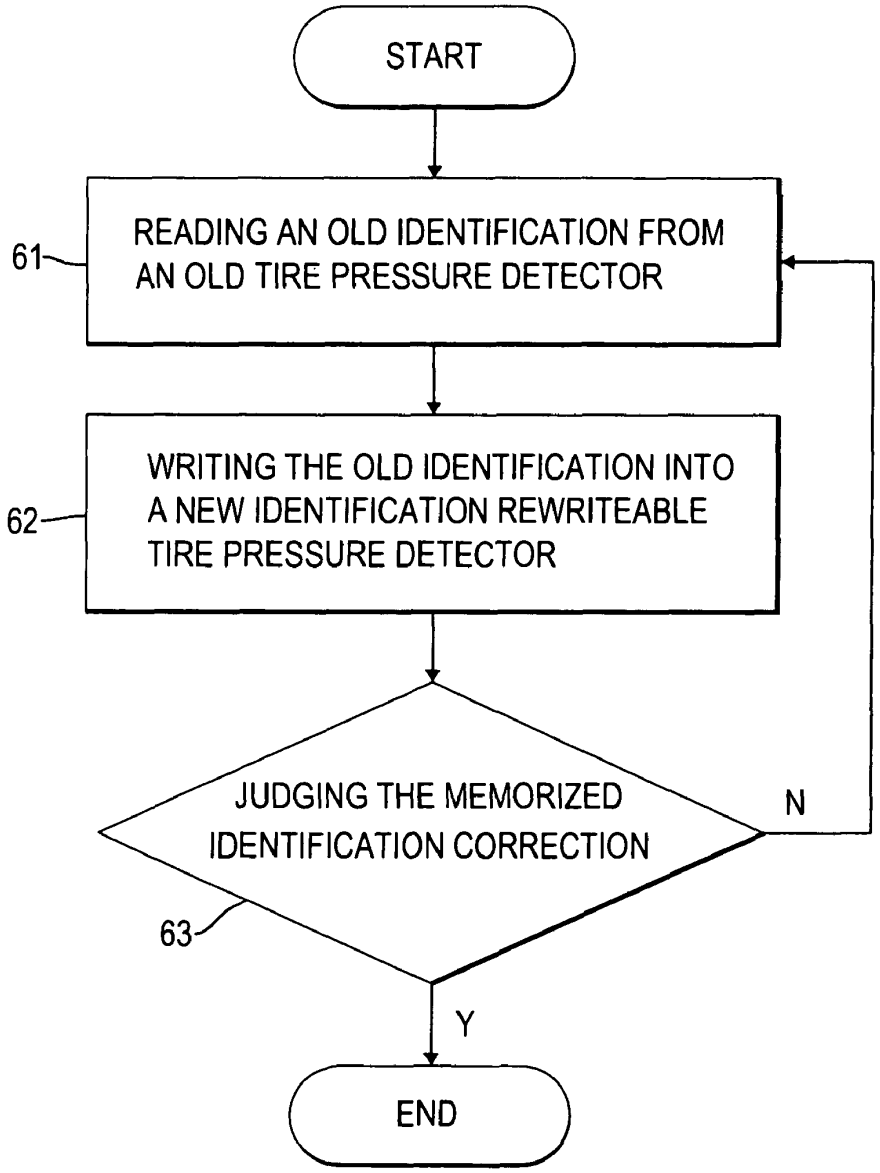


FIG.3

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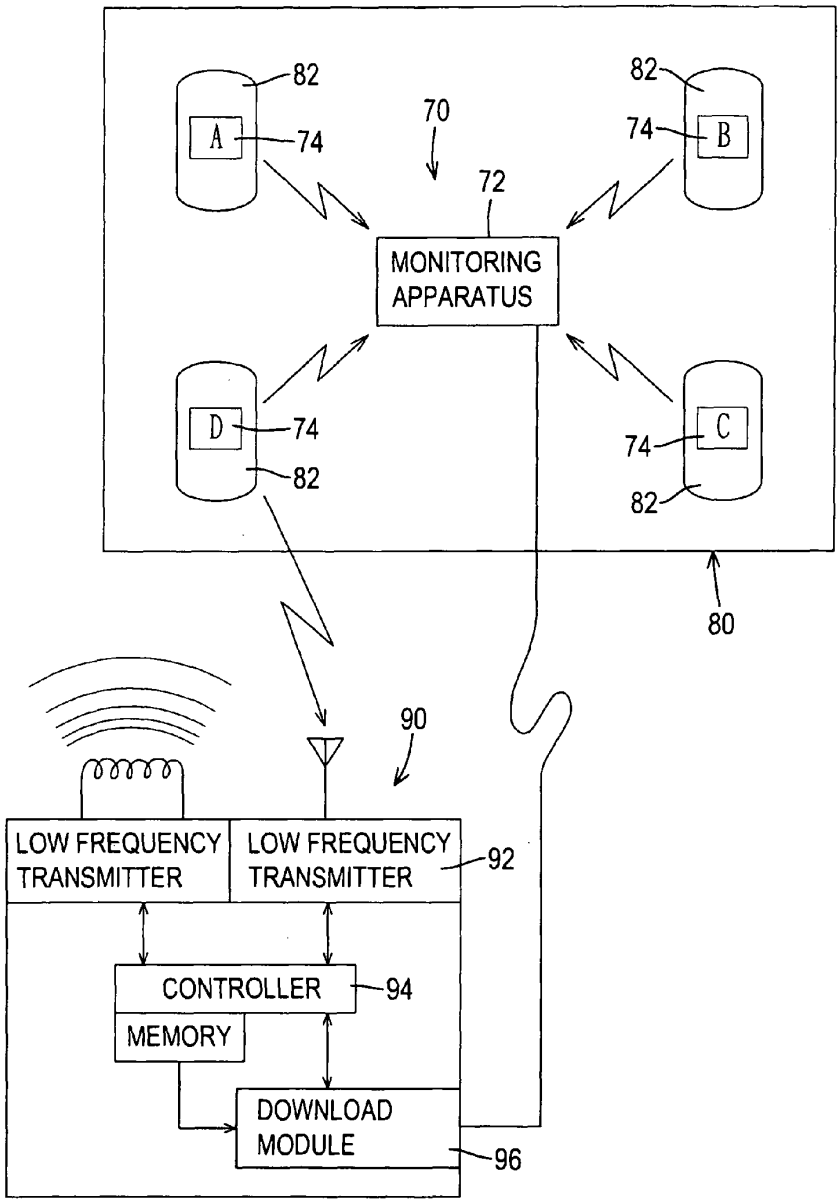

82
A
74
70
72
82
74
B
MONITORING APPARATUS
D
74
82
74
C
82
80
90
LOW FREQUENCY TRANSMITTER
LOW FREQUENCY TRANSMITTER
92
CONTROLLER
94
MEMORY
DOWNLOAD MODULE
96

FIG.4

TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME

BACKGROUND OF THE INVENTION

1. Field of Invention

The present invention relates to a tire pressure detecting apparatus, and more particularly to an identification rewriteable tire pressure detecting apparatus.

2. Description of the Related Art

Various Tire Pressure Monitoring Systems (TPMSs) may be applied for monitoring air pressure inside tires of a vehicle to alert a driver of abnormal tire pressure or to easily check correct tire pressures are set, and a conventional TPMS comprises a tire pressure detector connected to an inner end of a valve stem. Normally, an average lifetime of the tire pressure detectors is five years, users need to change the tire pressure detectors after the tire pressure detector is failure. However, tire pressure detectors have different installation methods depending on manufacturers of the tire pressure detectors, to request an original manufacturer for installing a new tire pressure detector is necessary but troublesome.

For instance, FIG. **4** shows an existed tire pressure detecting system (**70**), the tire pressure detecting system (**70**) comprises a monitoring apparatus (**72**) and four tire pressure detectors (**74**). The monitoring apparatus (**72**) is installed inside a car (**80**) and the tire pressure detectors (**74**) are respectively installed inside four tires (**82**) of the car (**80**). The monitoring apparatus (**72**) continuously receives wireless signals sent from the tire pressure detectors (**74**). Each tire pressure detector (**74**) has an identification (ID) recorded therein so that the wireless signal sent by the tire pressure detector (**74**) may be recognized by the monitoring apparatus (**72**) since the wireless signal stream comprises the identification. In other words, the monitoring apparatus (**72**) recognizes the tire pressure detectors (**74**) by identifying the IDs in the received wireless signals. Hence, when one of the tire pressure detector (**74**) is replaced by a new one, a setting apparatus (**90**) is necessary for introducing a new ID of the new tire pressure detector (**74**) to the monitoring apparatus (**72**). The setting apparatus (**90**) has a receiving module (**92**), a controller (**94**) and a download module (**96**). The receiving module (**92**) is electronically connected to the controller (**94**), receives wireless signals from the tire pressure detectors (**74**) and sends the received wireless signals to the controller (**94**). The controller (**92**) controls the download module (**96**) to write the ID of the tire pressure detector (**74**) into the monitoring apparatus (**72**), thereby the monitoring apparatus (**72**) may start to read wireless signal after the ID is recognizable.

However, the setting apparatus (**90**) is only fitted with some specific tire pressure detectors (**74**) that have to be manufactured by the same company. Flexibility and convenience of changing the tire pressure detector (**74**) are not good since users have to look for specific service centers that have the setting apparatus (**90**) to change the tire pressure detectors (**74**).

The present invention provides a tire pressure detecting apparatus to obviate or mitigate the shortcoming of the conventional the tire pressure detector.

SUMMARY OF THE INVENTION

The primary objective of the present invention is to provide a tire pressure detecting apparatus which is identification rewriteable thereby an new tire pressure detector can be easily replaced a failure tire pressure detector by coping the identification of the failure tire pressure detector directly.

The tire pressure detecting apparatus has an identification rewriteable tire pressure detector and a setting apparatus. The tire pressure detector is securely mounted on a valve stem inside a tire of a vehicle and has a micro-processing module, a sensing module, a transmitting module and a receiving interface, where the micro-processing module has a memory unit. The setting apparatus is capable of reading or inputting an identification from a failure tire pressure detector, transmits the identification to the identification rewriteable tire pressure detector and writes the identification into the memory unit.

Other objectives, advantages and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a tire pressure detecting apparatus in accordance with the present invention;

FIG. **2** is a block diagram of an identification rewriteable tire pressure detector in accordance with the present invention;

FIG. **3** is a flow chart of a tire pressure detector identification copying method in accordance with the present invention; and

FIG. **4** is a block diagram of a tire pressure detecting system and a setting apparatus in accordance with the prior art.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIGS. **1** and **2**, a tire pressure detecting apparatus in accordance with the present invention has an identification rewriteable tire pressure detector (**10**) and a setting apparatus (**20**).

The identification rewriteable tire pressure detector (**10**) is securely mounted on a valve stem inside a tire of a vehicle and has a micro-processing module (**12**), a sensing module (**14**), a transmitting module (**16**), a power module (**18**) and a receiving interface (**19**, **19**A).

The micro-processing module (**12**) has a memory unit (**122**). The memory unit (**122**) is a writeable memory and may memorize a preset identification therein, where the preset identification may be an identical 8-bit integer numbered and is given when the identification rewriteable tire pressure detector (**10**) is manufactured. Either the memory unit (**122**) is empty without memorizing any preset identification therein.

The sensing module (**14**) is electronically connected to the micro-processing module (**12**) and may have a pressure-detecting unit, at least one acceleration-detecting unit, a temperature-detecting unit and/or the like. The sensing module (**14**) is controlled by the micro-processing module (**12**) to respectively detect continuously a tire pressure signal, acceleration direction signals and a tire temperature signal of the vehicle and send a detection result to the micro-processing module (**12**). Wherein, when two acceleration-detecting units are included, the two acceleration-detecting units may detect a turning acceleration and a tuning direction of the vehicle, where the turning acceleration and the tuning direction are calculated from the detection results of the acceleration-detecting units.

The transmitting module (**16**) is controlled by the micro-processing module (**12**) to transmit a radio frequency (RF) signal, where the RF signal comprises the detection results

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and may have the preset identification. The RF signal may have frequencies such as 315 MHz, 433 MHz or the like.

The power module (**18**) is electronically connected to the micro-processing module (**12**) and provides electric power to the identification rewriteable tire pressure detector (**10**).

The receiving interface (**19**, **19**A) is electronically connected to the micro-processing module (**12**), receives an external signal, outputs the external signal to the micro-processing module (**12**) and may be a connector or a low frequency receiver that are respectively shown on FIG. **1** and FIG. **2**. The external signal may have an external identification thereby the micro-processing module (**12**) receives and memorizes the external identification into the memory unit (**122**) to overwrite and be the preset identification that is originally memorized in the memory unit (**122**). The low frequency receiver receives the external signal having a low frequency relating to the frequency of the RF signal. In a preferred embodiment of the present invention, the external signal is at kilo-Hz scale such like 125 kHz and is sent from the setting apparatus (**20**). A reason for adopting the low frequency receiver is that the low frequency wireless signal has a lower transparency, thereby the receiving interface (**19**) has to be placed nearby the setting apparatus (**20**) when receiving the low frequency wireless signal from the source. Hence, a person may decide to receive the external signal from one particular source by adjusting a distance with the particular source.

The setting apparatus (**20**) communicates with the identification rewriteable tire pressure detector (**10**) and tire pressure detectors that are generally using a same range of frequencies and has a control module (**21**), a receiving module (**23**), a setting output module (**25**), an input module (**27**) and a power source (**29**).

The receiving module (**23**) is electronically connected to the control module (**21**) and receives the RF signal from the identification rewriteable tire pressure detector (**10**) or the tire pressure detectors that are capable of sending the RF signals. The receiving module (**23**) sends the received RF signal to the control module (**21**) thereby the control module (**21**) has the preset identification of the identification rewriteable tire pressure detector (**10**) or the tire pressure detector.

The setting output module (**25**) is controlled by the control module (**21**) to send the external signal to the receiving interface (**19**, **19**A). Wherein, the external signal is generated by the control module (**21**) and may comprise the external identification that is identical to preset identification in the RF signal received from the receiving module (**23**). The setting output module (**25**) may be an outputting connector corresponding and being electronically connected to the connector (**19**A) or may be a wireless transmitting interface sending the external signal wirelessly to the receiving interface (**19**).

The input module (**27**) is electronically connected to the control module (**21**), accepts the preset identification that is keyed in or scanned in and may have an input interface (**272**) and a code scanner (**274**).

The input interface (**272**) is electronically connected to the control module (**21**), may be a dip switch, a keyboard or the like, is capable of accepting a setup by a person to input the preset identification of a failure tire pressure detector. The person may acquire the preset identification directly from the failure tire pressure detector since the preset identification is printed or listed on a surface of the tire pressure detector. The identification may be a set of integer or a barcode printed or formed on the surface of the tire pressure detector.

The code scanner (**274**) is electronically connected to the control module (**21**) and is controlled by the control module (**21**) to scan the barcode on the tire pressure detector and interpret the barcode as the preset identification for the control module (**21**).

The power source (**29**) is electronically connected to the control module (**21**) and provides electrical power to the setting apparatus (**20**).

With reference to FIG. **3**, a tire pressure detector identification copying method in accordance with the present invention has steps comprising: reading an old identification from an old tire pressure detector (**61**), writing the old identification into a new identification rewriteable tire pressure detector (**62**) and judging the memorized identification correction (**63**).

In the step of reading an old identification from an old tire pressure detector (**61**), a serviceman may use the setting apparatus (**20**) to receive the RF signal wirelessly from any old tire pressure detector or directly input the external identification (i.e. old identification) of the old tire pressure detector. If the old tire pressure detector is totally failed and can not transmit the RF signal, the serviceman may scan the barcode or input the external identification of old tire pressure detector directly through the input module (**27**).

In the step of writing the old identification into a new identification rewriteable tire pressure detector (**62**), after the external identification of the old tire pressure detector is acquired, the serviceman may rewrite the external identification into a new identification rewriteable tire pressure detector. If the new identification rewriteable tire pressure detector already has the preset identification therein, the external identification of the old tire pressure detector is overwrote the external identification.

In the step of judging the memorized identification correction (**63**), after the external identification of the old tire pressure detector has been memorized in the new identification rewriteable tire pressure detector, the serviceman may use the setting apparatus (**20**) to receive wireless signals from the new identification rewriteable tire pressure detector. The setting apparatus (**20**) judges the consistence of the identifications acquired from the old tire pressure detector and the new identification rewriteable tire pressure. When the identifications is not consistence, the setting apparatus performs the step of writing the old identification into a new identification rewriteable tire pressure detector (**62**) again.

As described above, a car user may easily replace a failed tire pressure detector with one identification rewriteable tire pressure detector (**10**) by few steps as described above. No more complicate sequence is needed to reset or introduce a new identification of a new tire pressure detector to a monitoring system installed inside the car.

Even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only. Changes may be made in detail, especially in matters of shape, size and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A tire pressure detecting apparatus comprising:

an identification rewritable tire pressure detector comprising:

a micro-processing module having a rewritable memory unit being capable of recording an identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit, the

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pressure-detecting unit detecting a tire pressure and sending a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal comprising the detection result and an identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module and providing electric power to the identification rewriteable tire pressure detector; and

a receiving interface electronically connected to the micro-processing module, receiving and sending an external signal to the micro-processing module, where the external signal comprises an external identification to be written into the rewriteable memory unit; and

a setting apparatus communicating with the identification rewriteable tire pressure detector and having a control module;

an input module being electronically connected to the control module and allowing an operator to input an identification to be written into the identification rewriteable tire pressure;

a receiving module electronically connected to the control module, receiving the RF signal from the identification rewriteable tire pressure detector or a tire pressure detector and sending the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the receiving interface, where the external signal is generated by the control module and comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source electronically connected to the control module and providing electrical power to the setting apparatus.

2. The tire pressure detecting apparatus as claimed in claim **1**, wherein

the receiving interface is a connector; and

the setting output module is an outputting connector corresponding and being electronically connected to the receiving interface and sends the external signal to the receiving interface.

3. The tire pressure detecting apparatus as claimed in claim **1**, wherein

the receiving interface is a low frequency receiver and receives the external signal wirelessly; and

the setting output module is a wireless transmitting interface sending the external signal wirelessly to the receiving interface.

4. The tire pressure detecting apparatus as claimed in claim **1**, wherein the input module is a dip switch.

5. The tire pressure detecting apparatus as claimed in claim **1**, wherein the sensing module further has at least one acceleration-detecting unit and a temperature-detecting unit.

6. The tire pressure detecting apparatus as claimed in claim **2**, wherein the sensing module further has at least one acceleration-detecting unit and a temperature-detecting unit.

7. The tire pressure detecting apparatus as claimed in claim **3**, wherein the sensing module further has at least one acceleration-detecting unit and a temperature-detecting unit.

8. The tire pressure detecting apparatus as claimed in claim **1**, wherein the input module is a code scanner.

9. The tire pressure detecting apparatus as claimed in claim **1**, wherein the input module is a keyboard.

10. A tire pressure detector identification copying method comprising steps of;

providing a setting apparatus;

reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and

wirelessly writing the old identification into a new identification rewriteable tire pressure detector by the setting apparatus.

11. The method as claimed in claim **10**, further comprising a step of;

verifying the identification newly recorded in the new identification rewriteable tire pressure detector.

12. The method as claimed in claim **10**, wherein the setting apparatus receives a wireless signal containing the old identification from the old tire pressure detector in the step of reading the old identification.

13. The method as claimed in claim **10**, wherein the setting apparatus receives the old identification through an input module in the step of reading the old identification.

* * * * *

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(12) EX PARTE REEXAMINATION CERTIFICATE (9926th)

United States Patent
Yu

(10) Number: US 8,031,064 C1
(45) Certificate Issued: Nov. 7, 2013

(54) **TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME**

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(73) Assignee: **Orange Electronic Co., Ltd.**, Tanzih Hsiang, Taichung Hsien (TW)

Reexamination Request:
No. 90/012,430, Aug. 10, 2012

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Appl. No.: **12/283,979**
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B60C 23/00 (2006.01)

(52) **U.S. Cl.**
USPC **340/447**; 340/442; 340/445; 73/146; 73/146.5

(58) **Field of Classification Search**
None
See application file for complete search history.

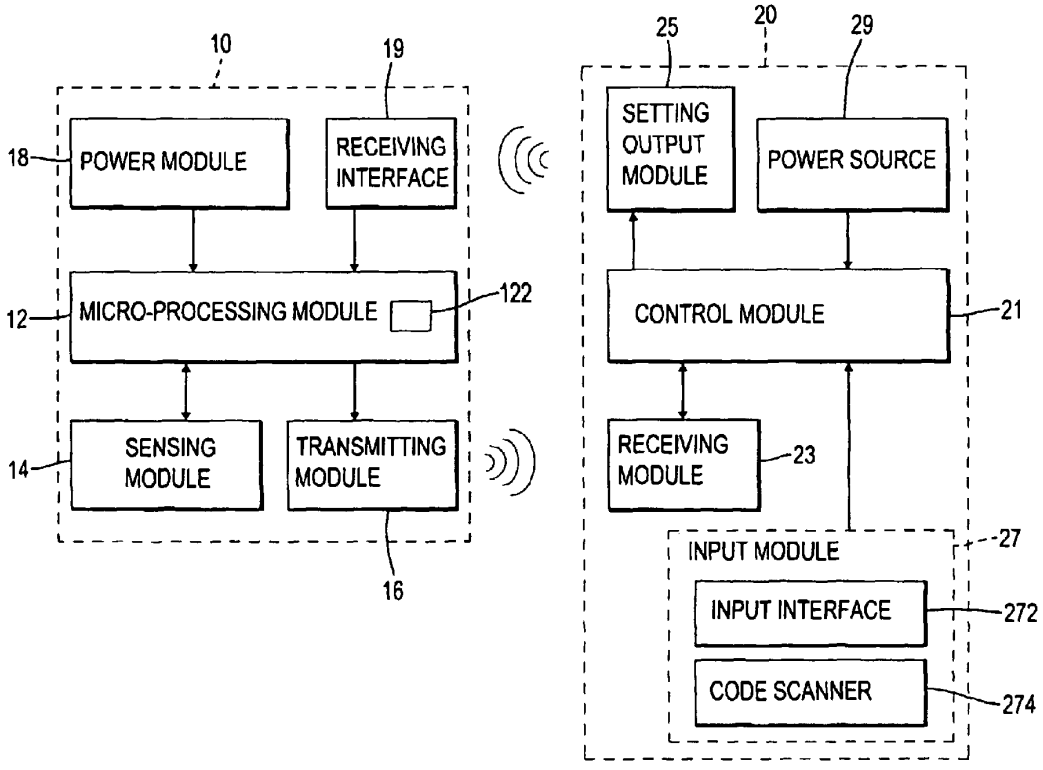
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To view the complete listing of prior art documents cited during the proceeding for Reexamination Control Number 90/012,430, please refer to the USPTO's public Patent Application Information Retrieval (PAIR) system under the Display References tab.

Primary Examiner — Hetul Patel

(57) **ABSTRACT**

A tire pressure detecting apparatus has an identification rewriteable tire pressure detector and a setting apparatus. The tire pressure detector is securely mounted on a valve stem inside a tire of a vehicle and has a micro-processing module, a sensing module, a transmitting module and a receiving interface, where the micro-processing module has a memory unit. The setting apparatus is capable of reading or inputting an identification from a failure tire pressure detector, transmits the identification to the identification rewriteable tire pressure detector and writes the identification into the memory unit.



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EX PARTE REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims **8** and **10-13** is confirmed.

Claims **1-7** and **9** are cancelled.

New claims **14** and **15** are added and determined to be patentable.

14. A tire pressure detecting system, comprising:

an identification rewritable tire detector comprising:

a micro-processing module having a rewritable memory unit to record an identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal including the detection result and the identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module to supply power to the identification rewriteable tire pressure detector; and

an interface arranged to receive and send an external signal to the micro-processing module, where the external signal comprises an external identification to be written into the rewriteable memory unit; and

a setting apparatus arranged to communicate with the identification rewriteable tire pressure detector, via wireless, including:

reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and

wirelessly writing the old identification into a new identification rewriteable tire pressure detector by the setting apparatus,

wherein the setting apparatus comprises:

a control module;

an input module connected to the control module to enable an operator to input an identification to be written into the identification rewriteable tire pressure detector;

a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector and to send the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the identification rewriteable tire pressure detector, via the interface, where the external signal comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source connected to the control module to supply power to the setting apparatus.

15. A tire pressure detecting system comprising:

an identification rewritable tire pressure detector comprising:

a micro-processing module having a rewritable memory unit to record an identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal including the detection result and the identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module to supply power to the identification rewriteable tire pressure detector;

an interface arranged to receive and send an external signal to the micro-processing module, where the external signal comprises an external identification to be written into the rewriteable memory unit; and

a setting apparatus arranged to communicate with the identification rewriteable tire pressure detector, including:

reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and

writing the old identification into a new identification rewriteable tire pressure detector by the setting apparatus,

wherein the setting apparatus comprises:

a control module;

an input module connected to the control module to enable an operator to input an identification to be written into the identification rewriteable tire pressure detector;

a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector and to send the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the identification rewriteable tire pressure detector, via the interface, where the external signal comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source connected to the control module to supply power to the setting apparatus.

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(12) **United States Patent**
Dixit et al.

(10) **Patent No.: US 6,414,592 B1**
(45) **Date of Patent: Jul. 2, 2002**

(54) **TIRE CONDITION SENSOR COMMUNICATION WITH TIRE LOCATION PROVIDED VIA MANUALLY INPUTTED UPDATE**

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(73) Assignee: **TRW Inc.**, Lyndhurst, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(58) **Field of Search** 73/146.5; 340/442, 340/445, 447; 200/61.22

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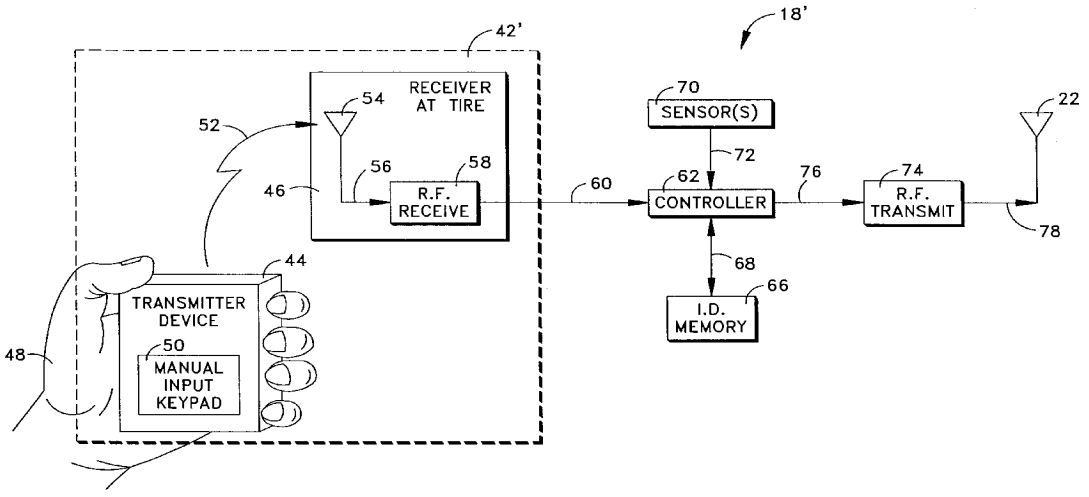
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Primary Examiner—Brent A. Swarthout
(74) *Attorney, Agent, or Firm*—Tarolli, Sundheim, Covell, Tummino & Szabo L.L.P.

(57) **ABSTRACT**

A tire condition communication system **(10)** and method for a vehicle **(12)** that has a tire (e.g., **14A**). A sensor **(70)**, associated with the tire (e.g., **14A**), senses at least one tire condition. A memory **(66)**, associated with the tire (e.g., **14A**), holds an identification. A transmitter arrangement **(22** and **74)**, associated with the tire (e.g., **14A**), transmits a signal (e.g., **24A**) that indicates the held identification and the sensed tire condition. A receiver arrangement **(28** and **30)**, associated with the vehicle **(12)**, receives the transmitted signal (e.g., **24A**). An identification update device is associated with the tire and is operatively connected to the memory **(66)**. The update device receives an update identification and provides the received location identification to the memory **(66)** to be held as the held identification. An input device is manually actuated to provide the update identification. In one example, a receiver **(46)** at the tire and a manually actuated transmitter **(44)** provided the update and input devices. In another example, a switch **(116)** and a manually actuatable part (e.g., a valve stem part) at the tire provide the update and input devices.

13 Claims, 3 Drawing Sheets



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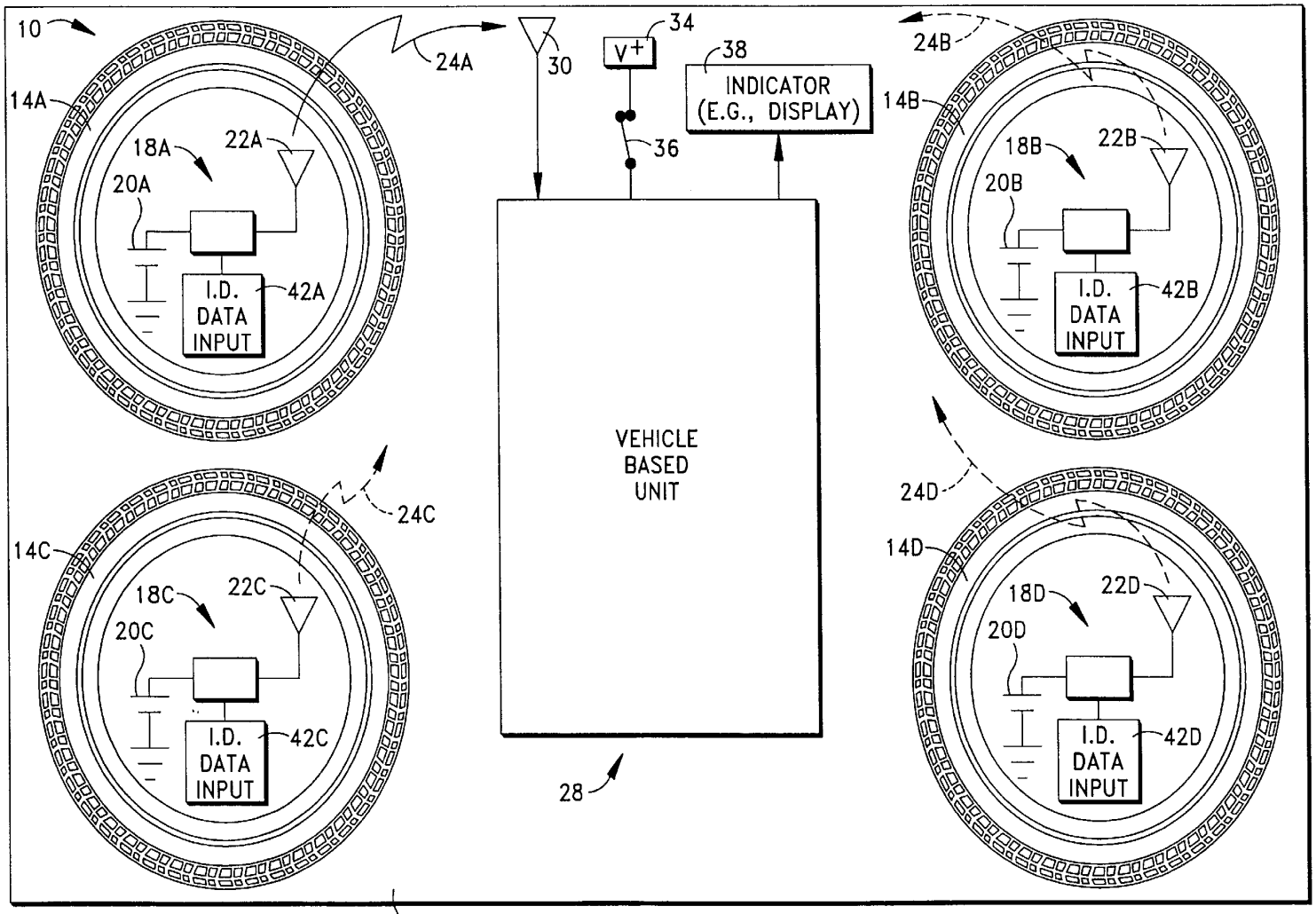


Fig.1

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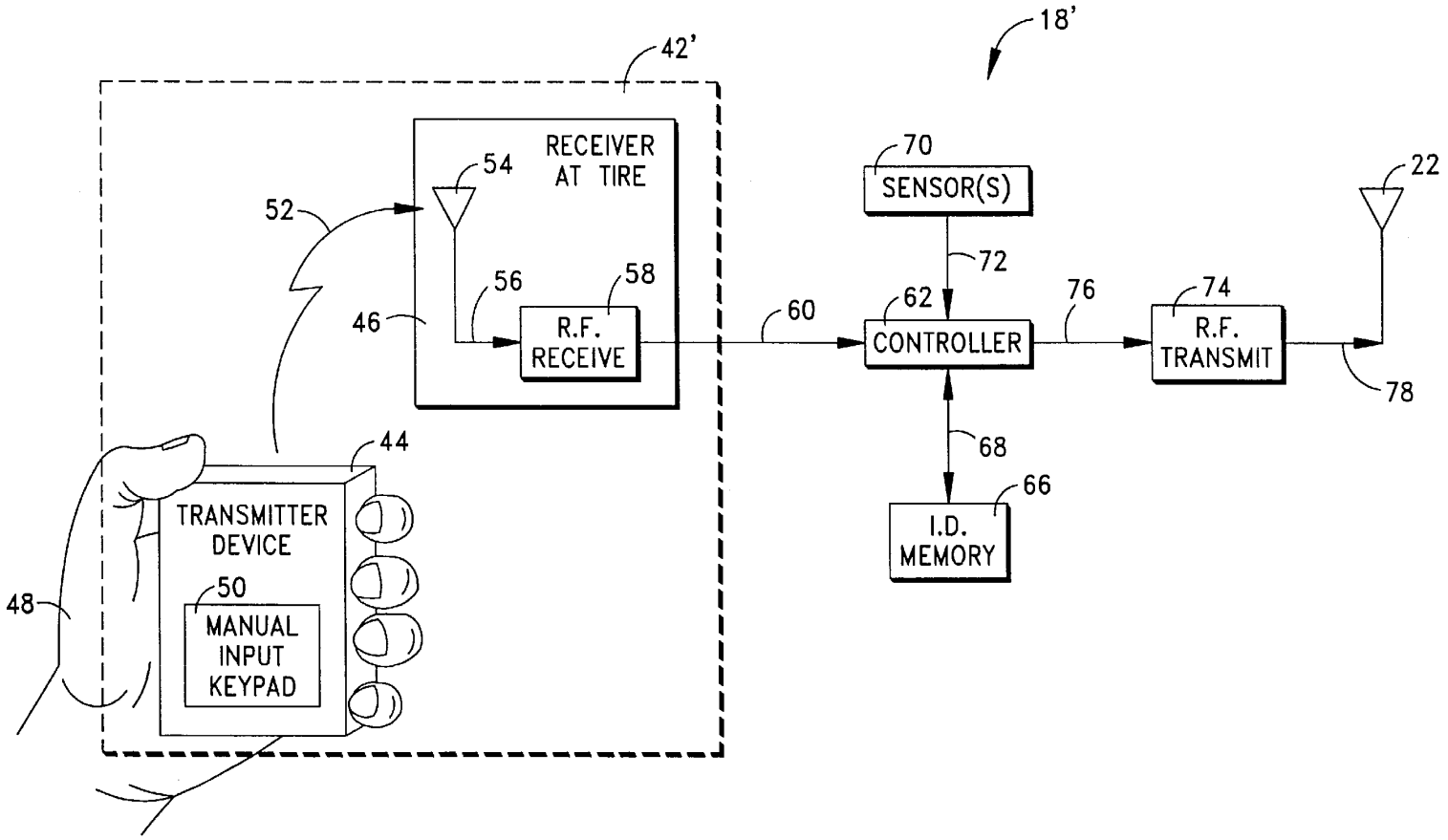


Fig.2

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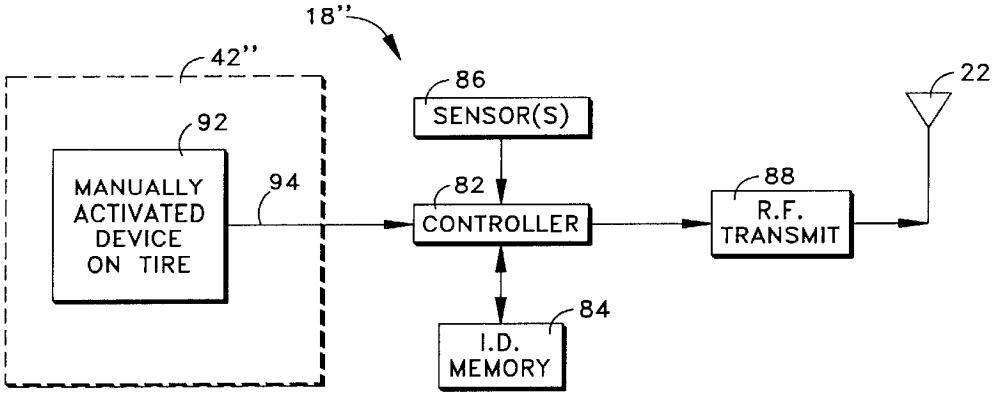


Fig.3

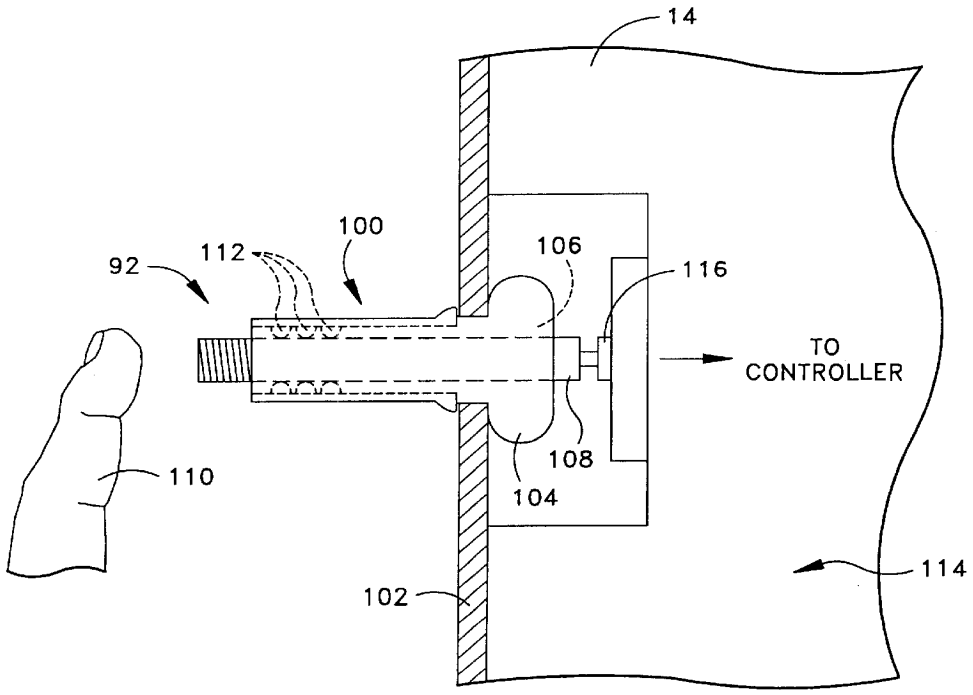


Fig.4

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TIRE CONDITION SENSOR COMMUNICATION WITH TIRE LOCATION PROVIDED VIA MANUALLY INPUTTED UPDATE

TECHNICAL FIELD

The present invention relates to a tire condition monitoring system for providing indication of a tire operation parameter, such as tire inflation pressure, to a vehicle operator. The present invention relates specifically to a tire condition monitoring system that provides ready identification of a tire providing condition information and avoids misidentification due to previous tire position change via tire position rotation or the like.

BACKGROUND OF THE INVENTION

Numerous tire condition monitoring systems have is been developed in order to provide tire operation information to a vehicle operator. One example type of a tire condition monitor system is a tire: pressure monitor system that detects when air pressure within a tire drops below a predetermined threshold pressure value.

There is an increasing need for the use of tire pressure monitoring systems due to the increasing use of "run-flat" tires for vehicles such as automobiles. A run-flat tire enables a vehicle to travel an extended distance after significant loss of air pressure within that tire. However, a vehicle operator may have difficulty recognizing the significant loss of air pressure within the tire because the loss of air pressure may cause little change in vehicle handling and visual appearance of the tire.

Typically, a tire pressure monitoring system includes a pressure sensing device, such as a pressure switch, an internal power source, and a communications link that provides the tire pressure information from a location at each tire to a central receiver. The central receiver is typically connected to an indicator or display located on a vehicle instrument panel.

The communications link between each tire and the central receiver is often a wireless link. In particular, radio frequency signals are utilized to transmit information from each of the tires to the central receiver. However, in order for the central receiver to be able to proper associate received tire pressure information with the tire associated with the transmission, some form of identification of the origin of the signal must be utilized. Such a need for identification of the origin of the transmitted tire information signal becomes especially important subsequent to a tire position change, such a routine maintenance tire position rotation.

SUMMARY OF THE INVENTION

In accordance with one aspect, the present invention provides a tire condition communication system for a vehicle that has a tire. Sensor means, associated with the tire, senses at least one tire condition. Memory means, associated with the tire, holds an identification. Transmitter means, associated with the tire and operatively connected to the sensor means and the memory means, transmits a signal that indicates the held identification and the sensed tire condition. Receiver means, associated with the vehicle, for receives the transmitted signal indicative of the held identification and the sensed tire condition. The system includes manually actuated input means, associated with the tire and operatively connected to the memory means, for inputting an update identification to be held by the memory means as the held identification.

In accordance with another aspect, the present invention provides a method of communicating information within tire condition monitoring system for a vehicle that has a tire. An input means is manually actuated to input update identification information for a tire condition sensor unit located at the tire. The input identification is held at the tire condition sensor unit. A tire condition is sensed via operation of the tire condition sensor unit. A signal is transmitted from the tire condition sensor unit, wherein the transmitted the signal indicates the held identification and the sensed tire condition. The transmitted signal is received at a location on the vehicle.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the present invention will become apparent to those skilled in the art to which the present invention relates upon reading the following description with reference to the accompanying drawings, in which:

FIG. **1** is a schematic block diagram of a vehicle that contains a tire condition communication system in accordance with the present invention;

FIG. **2** is a schematic function block diagram of a first embodiment of a tire condition sensor unit and an associated first embodiment of a manually actuated identification update arrangement;

FIG. **3** is a schematic function block diagram of a second embodiment of a tire condition sensor unit and an associated second embodiment of a manually actuated identification update arrangement; and

FIG. **4** is a partial cross-section of a tire that contains an identification input device in accordance with the embodiment the identification update arrangement of FIG. **3**.

DESCRIPTION OF EXAMPLE EMBODIMENTS

A tire condition communication system **10** is schematically shown within an associated vehicle **12** in FIG. **1**. The vehicle **12** has a plurality of inflatable tires (e.g., **14**A). In the illustrated example, the vehicle **12** has four tires **14**A–**14**D. It is to be appreciated that the vehicle **12** may have a different number of tires. For example, the vehicle **12** may include a fifth tire (not shown) that is stored as a spare tire.

The system **10** includes a plurality of tire condition sensor units (e.g., **18**A) for sensing one or more tire conditions at the vehicle tires (e.g., **14**A). Preferably, the number of tire condition sensor units **18**A–**18**D is equal to the number of tires **14**A–**14**D provided within the vehicle **12**. In the illustrated example, all of the tire condition sensor units **18**A–**18**D have the same components. Identical components are identified with identical reference numbers, with different alphabetic suffixes. It is to be appreciated that, except as noted, all of the tire condition sensor units **18**A–**18**D function in the same manner. For brevity, operation of one of the tire condition sensor units (e.g., **18**A) is discussed in detail with the understanding that the discussion is generally applicable to the other tire condition sensor units (e.g., **18**B–**18**D).

Each tire condition sensor unit (e.g., **18**A) includes a power supply (e.g., a battery **20**A) that provides electrical energy to various components within the respective sensor unit. The electrical energy enables the tire condition sensor unit (e.g., **18**A) to energize a radio frequency antenna (e.g., **22**A) to emit a radio frequency signal (e.g., **24**A) that conveys one or more sensed conditions along with a fixed identification to a central, vehicle-based unit **28**.

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A radio frequency antenna **30** receives the tire condition signal (e.g., **24**A) from the tire condition sensor unit (e.g., **18**A) and the conveyed information is processed. In one example, the system **10** is designed to operate with the tire condition signals **24**A–**24**D in the FM portion of the radio frequency range. Each antenna (e.g., **22**A) in conjunction with the antenna **30** comprises part of a means for communication from the respective tire condition sensor unit (e.g., **18**A) to the vehicle-based unit **28**.

A power supply (e.g., a vehicle battery) **34**, which is operatively connected (e.g., through a vehicle ignition switch **36**) to the vehicle-based unit **28**, provides electrical energy to permit performance of the processing and the like. The vehicle-based unit **28** utilizes the processed information to provide information to a vehicle operator via an indicator device **38**. In one example, the indicator device **38** may be a visual display that is located on an instrument panel of the vehicle **12**. Accordingly, the vehicle operator is apprised of the sensed condition(s) at the tire (e.g., **14**A).

It is to be noted that the sensed condition may be any condition at the tire (e.g., **14**A). For example, the sensed condition may be inflation pressure of the tire (e.g., **14**A), temperature of the tire, motion of the tire, or even a diagnostic condition of the tire condition sensor unit (e.g., **18**A) itself.

It should be noted that a single antenna of the vehicle-based unit **28** receives all of the tire condition signals **24**A–**24**D from a plurality of tire condition sensor units **18**A–**18**D. In order for the vehicle-based unit **28** to accurately "know" which tire (e.g., **14**A), via the associated tire condition sensor unit (e.g., **18**A), is providing the tire condition signal (e.g., **24**A), the tire condition signal conveys an identification of the tire. In order for the tire condition sensor unit (e.g., **18**A) to output the tire condition signal (e.g., **24**A) with an identification of the tire, the identification is provided to the tire condition sensor unit.

The provision of the location identification to the respective tire condition sensor unit is accomplished by the system **10** including a manually actuated identification data input arrangement (e.g., **42**A) for the respective tire condition sensor unit (e.g., **18**A). In the illustrated example of FIG. **1**, a plurality of manual input arrangements **42**A–**42**D are provided, with each manual input arrangement (e.g., **42**A) being associated with a different tire condition sensor unit (e.g., **18**A).

A different identification value is associated with each specific tire mounting location. Typically, the tire mount locations on a vehicle are identified as right-front, right-rear, left-front, left-rear, and spare mount locations. When a tire (e.g., **14**A) is located at a certain tire mounting location, the identification associated with that location is manually input via the manual input arrangement (e.g., **42**A). For example, when the locations of the tires **14**A–**14**D are changed, such as during a routine maintenance tire rotation, a new location identification is manually input for each tire.

The tire condition sensor unit (e.g., **18**A) utilizes the manually input location identification as the identification that is transmitted within its tire condition signal (e.g., **24**A) sent to the vehicle-based unit **28**. The vehicle-based unit **28** is programmed (e.g., taught) or has learned to recognize the location identifications for the various tire mount locations on the vehicle. Accordingly, when the vehicle-based unit **28** receives a tire condition signal (e.g., **24**A) that contains a certain location identification, the vehicle-based unit will interpret the signal as originating from a tire located at that vehicle mount location.

It is contemplated that the manual input of location identification data for use by the associated tire condition sensor unit(e.g., **18**A) may be accomplished by different methods, formats, etc. FIG. **2** illustrates a first example of a tire condition sensor unit **18'** and an associated manual input arrangement **42'**.

It is to be noted that the tire condition sensor unit **18'** and the manual input arrangement **42'** are indicated using reference numerals with primes, to signify that the examples are for a first specific discussion. Also, it is to noted that the tire condition sensor unit **18'** and the manual input arrangement **42'** are indicated without use of alphabetic suffixes to signify that the examples are generic to all of the tire condition sensor units and all of the identification provision units, respectively.

The manual input arrangement **42'** includes a manually actuatable radio frequency transmitter device **44**, located remote from the tire (e.g., **14**A), and a radio frequency receiver **46**, located at the tire. In one example, the receiver **46** is located within the tire (e.g., **14**A) with the associated tire condition sensor unit **18'**.

The transmitter device **44** is preferably a hand-held unit that a person **48** (e.g., a service technician) manually operates to inputs an identification code via an input keypad **50** on the hand-held transmitter device. The transmitter device **44** outputs a radio frequency signal **52** that conveys the input identification code and that is intended for reception by an antenna **54** of the receiver **46** at the tire (e.g., **14**A).

The antenna **54** is operatively connected **56** to RF receive circuitry **58** of the receiver **46**. In turn, the RF receive circuitry **58** is operatively connected **60** to a controller **62** of the tire condition sensor unit **18'**. When the antenna **54** receives the radio frequency signal **52** that conveys an update location identification, an electrical stimulus signal is provided by the antenna to the RF receive circuitry **58**. In turn, data bits that represent the location identification are provided to the controller **62**. A location identification memory **66** is operatively connected **68** to the controller **62**. The controller **62** provides the update location identification data to the memory **66** for storage therein.

One or more condition sensors **70** are operatively connected **72** to the controller **62**. RF transmit circuitry **74** is operatively connected **76** to the controller **62** and operatively connected **78** to the associated antenna **22**. In order to provide the tire condition signal (e.g., **24**A) for reception by the vehicle-based unit **28**, the controller **62** receives sensory information from the sensor(s) **70** and receives the location identification from the memory **66**. The controller **62** assembles a message packet that contains the identification location and the sensory information and provides the message packet to the RF transmit circuitry **74**. In turn, the RF transmit circuitry **74** provides a stimulus electrical signal to the antenna **22** such that the tire condition signal (e.g., **24**A) is emitted.

It is to be noted that the hand-held transmitter device **44** may be a device that can sequentially communicate with all of the tire condition sensor units **18**A–**18**D of the system **10** at the vehicle **12**, thus, avoiding the need to have a separate transmitters for each tire condition sensor unit. Moreover, the hand-held transmitter device **44** may be utilized to communicate with tire condition sensor units within different tire condition communication systems at different vehicles. In other words, the transmitter device may be a generic or universal tool used to program location identification to various tire condition sensor units.

FIG. **3** schematically illustrates another example of a tire condition sensor unit **18"** with an associated manual input

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arrangement **42**". It is to be noted that the tire condition sensor unit **18**" and the manual input arrangement **42**" are indicated using reference numerals with double primes, to signify that the examples are for a second specific discussion. Also, it is to noted that the tire condition sensor unit **18**" and the manual input arrangement **42**" are indicated without use of alphabetic suffixes to signify that the examples are generic to all of the tire condition sensor units and all of the identification provision units, respectively.

The tire condition sensor unit **18**" includes a controller **82**, a location identification memory **84**, one or more sensors **86**, and RF transmit circuitry **88** similar to the embodiment shown in FIG. **2**. The identification memory **84**, the sensor (s) **86**, and the RF transmit circuitry **88** are operatively connected to the controller **82** similar to the embodiments shown in FIG. **2**.

In the embodiment shown in FIG. **3**, the manual input arrangement **42**" includes a manually actuated device **92** located on the tire (e.g., **14**A) that is operatively connected **94** to the controller **82**. The device **92** may be any device that is manually actuated to input information (e.g., a string of data bits) to the controller **82**.

FIG. **4** illustrates one example of the manually actuatable device **92** that is utilized to input location information. Specifically, the device **92** is partially integrated into an inflation valve stem assembly **100** utilized to supply air pressure into the tire **14**. The stem assembly **100** is mounted onto a rigid metal wheel side wall **102**. A first portion **104** of the stem assembly **100** provides a mounting arrangement and engages the side wall **102** to provide an air tight sealing arrangement with the side wall. The first portion **104** is hollow and provides a passageway **106** for air flow into the tire **14**.

A second portion **108** of the stem assembly **100** is movable relative to the first portion **104** when the second portion is manually depressed by a person (e.g., a technician) **110**. One or more sealing devices (O-rings) **112** seal against air pressure loss between the first portion **104** of the stem assembly **100** and the second portion **108** of the stem assembly.

In the illustrated example, the second portion **108** extends the length of the stem assembly **100** and protrudes into the pressurized interior **114** of the tire **14**. A micro-switch **116** is engaged with an end of the second portion **108** within the tire interior **114**. When the second portion **108** of the stem assembly **100** is pressed via manual actuation, the second portion moves sufficiently far to toggle the micro-switch **116**. Each push results in one toggling of the micro-switch **116**. The micro-switch **116** is operatively connected to the controller **82** such that the toggling of the micro-switch is supplied as an input to the controller. Accordingly, data is entered by a sequence of pushes on the second portion **108** of the stem assembly **100** to repeatedly toggle the micro-switch **116**. The controller interprets the toggles of the micro-switch to derive an input location identification value, and supplies the value to the memory for storage therein.

From the above description of the invention, those skilled in the art will perceive improvements, changes and modifications. Such improvements, changes and modifications within the skill of the art are intended to be covered by the appended claims.

Having described the invention, the following is claimed:

1. A tire condition communication system for a vehicle that has a tire, said system comprising:

sensor means, located within the tire, for sensing at least one tire condition;

memory means, located within the tire, for holding an identification;

transmitter means, located within the tire and operatively connected to said sensor means and said memory means, for transmitting a signal that indicates the held identification and the sensed tire condition;

receiver means, associated with the vehicle, for receiving the transmitted signal indicative of the held identification and the sensed tire condition;

manually actuatable input means, located on the exterior surface of the tire and operatively connected to said memory means, for inputting an update identification to be held by said memory means as the held identification wherein said manually actuatable input means on the tire includes a portion of an inflation valve assembly.

2. A system as set forth in claim **1**, wherein said inflation valve assembly includes a first portion and a second portion, said second portion being movable in relation to said first portion and being said manually actuatable input means.

3. A system as set forth in claim **2**, wherein said first portion includes an outer sleeve in an air tight sealing arrangement with the side wall of the tire and said second portion extends through the center of said first portion.

4. A system as set forth in claim **1**, wherein the at least one sensed tire condition includes tire temperature.

5. A system as set forth in claim **1**, wherein the at least one sensed tire condition includes rotational direction of the tire.

6. A method of communicating information within a tire condition monitoring system for a vehicle that has a tire, said method comprising the steps of:

inputting, via an input means, update identification information for a tire condition sensor unit located within the tire by manually actuating a portion of the input means located on the exterior of the tire;

holding the input update identification information at the tire condition sensor unit;

sensing a tire condition via operation of the tire condition sensor unit;

transmitting a signal from the tire condition sensor unit, the transmitted signal indicating the held update identification information and the sensed tire condition; and

receiving the transmitted signal at a location on the vehicle;

wherein said step of inputting update identification information via input means includes the step of actuating a portion of an inflation valve assembly.

7. A method as set forth in claim **6**, wherein said step of actuating a portion of the inflation value assembly includes the step of moving the portion relative to a remainder of the inflation valve assembly so as to actuate a switch operatively connected to said tire condition sensor unit.

8. A method as set forth in claim **6**, wherein the step of sensing a tire condition includes the step of sensing tire temperature.

9. A method as set forth in claim **6**, wherein the step of sensing a tire condition includes the step of sensing rotational direction of the tire.

10. A tire condition communication system for a vehicle that has a tire, said system comprising: a tire condition sensing unit associated with the tire, the tire condition sensing unit including a sensor for sensing at least one tire condition and a memory for storing identification information indicative of a location of the tire on the vehicle, said tire condition sensing unit, in response to sensing the at least one tire condition, outputting a first signal that includes the

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identification information and tire condition information indicative of the at least one tire condition sensed; and

a transmitter for outputting a second signal that includes updated identification information indicative of the location of the tire on the vehicle,

the tire condition sensing unit receiving the second signal and replacing the identification information stored in said memory with the updated identification information;

wherein said transmitter includes a manually actuatable switch located at the tire and operatively connected to said tire condition sensing unit, said tire condition sensing unit interpreting sequential toggling of said switch to derive the updated identification information.

11. The tire condition communication system of claim **10** wherein said transmitter further includes a portion of an inflation valve assembly of the tire, the portion of the inflation valve assembly engaging said switch, manual actuation of said portion of said inflation valve assembly toggling said switch.

12. A method of communicating information within a tire condition monitoring system for a vehicle having a tire, said method comprising the steps of:

sensing at least one tire condition with a tire condition sensing unit;

storing identification information in the tire condition sensing unit, the identification information being indicative of a location of the tire on the vehicle;

outputting from the tire condition sensing unit a first signal that includes the identification information and tire condition information indicative of the at least one tire condition sensed;

outputting from a transmitter a second signal that includes updated identification information indicative of the location of the tire on the vehicle; and

receiving the second signal at the tire condition sensing unit and replacing the identification information stored with the updated identification information;

further including the steps of sequentially toggling a switch located at the tire, the switch being operatively connected to said tire condition sensing unit; and

deriving the updated identification information by interpreting said sequential toggling of the switch.

13. A tire condition communication apparatus for a vehicle that has a tire comprising:

a sensor assembly, located within the tire, including a tire condition sensor, a memory for storing identification data, a transmitter, and a manually actuated input means for inputting the identification data, which extends to the exterior surface of the tire;

A receiver, located within the vehicle, for receiving tire condition information from said sensor assembly;

wherein said input means extends to the exterior of the tire through an inflation valve.

* * * * *

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US006927679B2

(12) **United States Patent**
Taguchi et al.

(10) **Patent No.: US 6,927,679 B2**
(45) **Date of Patent: Aug. 9, 2005**

(54) **ID REGISTRATION METHOD, ID COLLATION SYSTEM INCORPORATED IN A VEHICLE CONTROL SYSTEM, EMBODIED AS A PNEUMATIC TIRE PRESSURE MONITORING APPARATUS ASSOCIATED WITH PNEUMATIC PRESSURE SENSORS, AND AN ID REGISTRATION TOOL COMBINED WITH PNEUMATIC TIRE PRESSURE MONITORING APPARATUS**

(75) Inventors: **Akihiro Taguchi**, Oobu (JP); **Shintarou Itou**, Toyokawa (JP); **Ryozo Okumura**, Kariya (JP)

(73) Assignee: **Denso Corporation**, Kariya (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 11 days.

(21) Appl. No.: **10/602,699**

(22) Filed: **Jun. 25, 2003**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

Jun. 26, 2002 (JP) 2002-185394

(51) **Int. Cl.**[7] **B60C 23/00**

(52) **U.S. Cl.** ..... **340/442**; 340/445; 340/447; 340/825.69; 340/10.1; 73/146.2; 116/34 R

(58) **Field of Search** ..... 340/10.1, 442, 340/445, 447, 443, 461, 525, 825.69, 825.72; 73/146.5, 146.2, 4; 116/34 R

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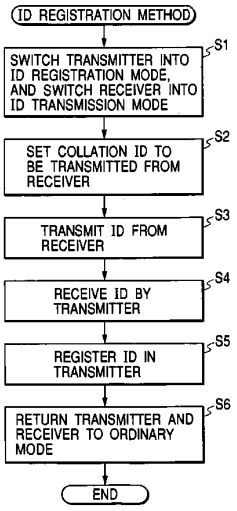
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Primary Examiner—Davetta W. Goins
(74) *Attorney, Agent, or Firm*—Posz Law Group, PLC

(57) **ABSTRACT**

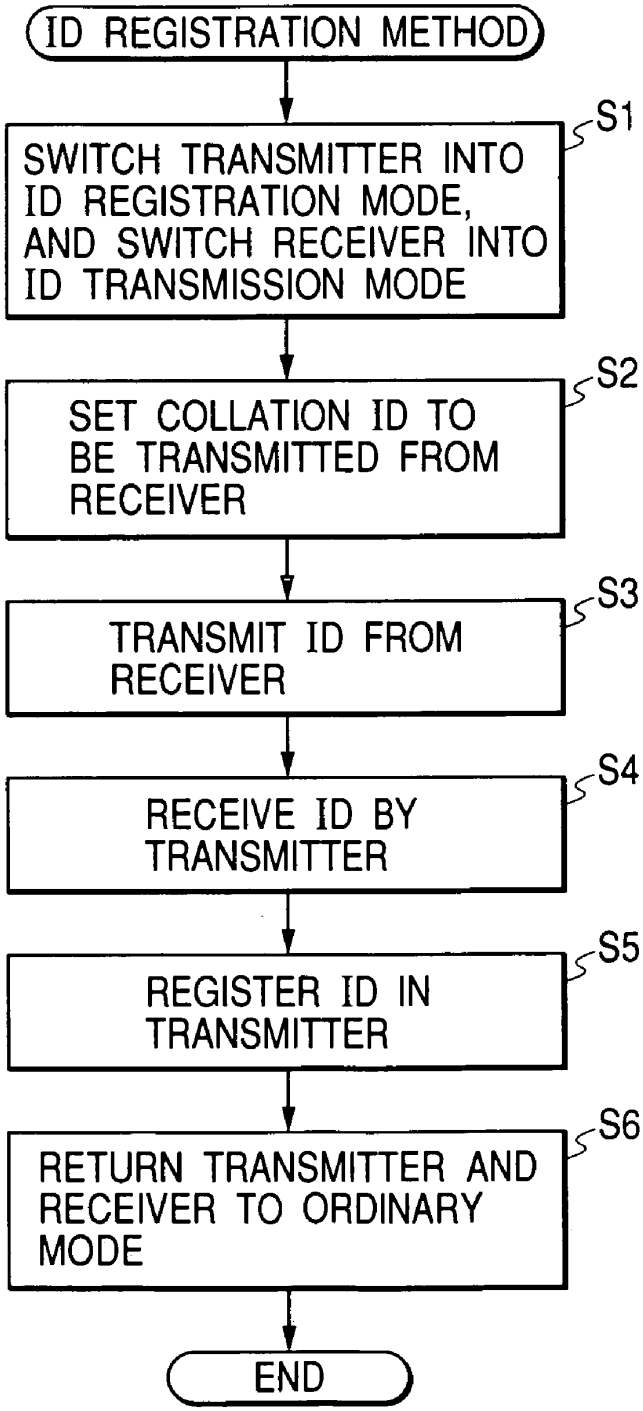
A transmitter mode switching apparatus switches a transmitter into an ID registration mode, while a receiver mode switching apparatus switches a receiver into an ID transmission mode (step S1). Then, a collation ID to be transmitted from the receiver is set based on an ID assigned inherently to the receiver (step S2). Subsequently, an ID transmitting apparatus of the receiver transmits the collation ID (step S3). An ID receiving apparatus of the transmitter receives the collation ID (step S4). An ID registration apparatus of the transmitter stores the received collation ID as a registered ID of the transmitter (step S5). After the ID registration is accomplished, the transmitter mode switching apparatus returns the transmitter to an ordinary mode, while the receiver mode switching apparatus returns the receiver to an ordinary mode (step S6).

23 Claims, 21 Drawing Sheets



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FIG. 1



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FIG. 2

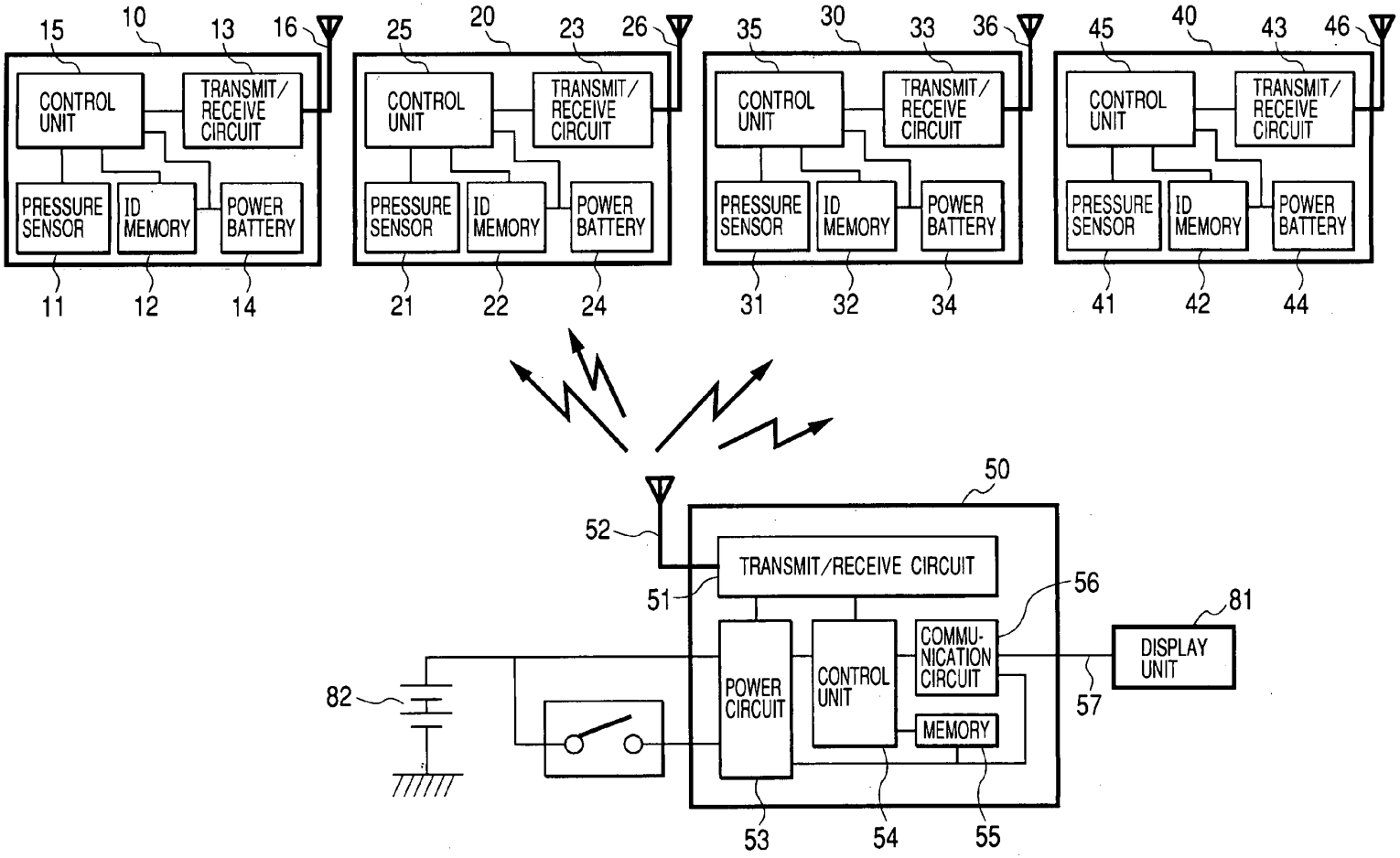

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CONTROL UNIT
TRANSMIT/ RECEIVE CIRCUIT
PRESSURE SENSOR
ID MEMORY
POWER BATTERY
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TRANSMIT/RECEIVE CIRCUIT
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COMMU- NICATION CIRCUIT
DISPLAY UNIT
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82
POWER CIRCUIT
CONTROL UNIT
MEMORY
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FIG. 3A

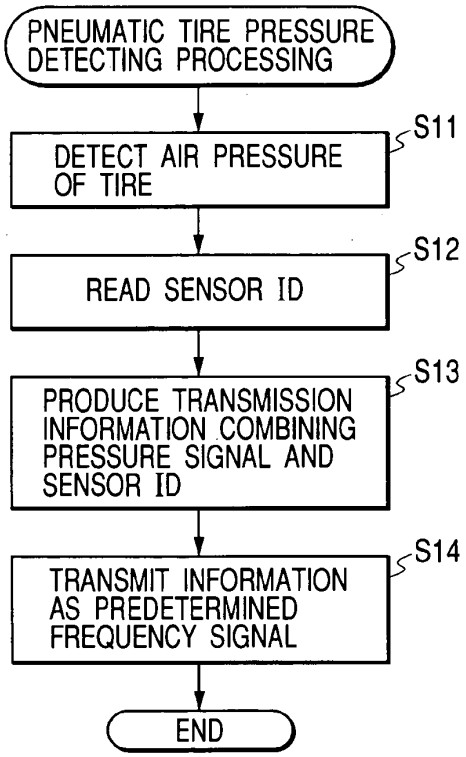
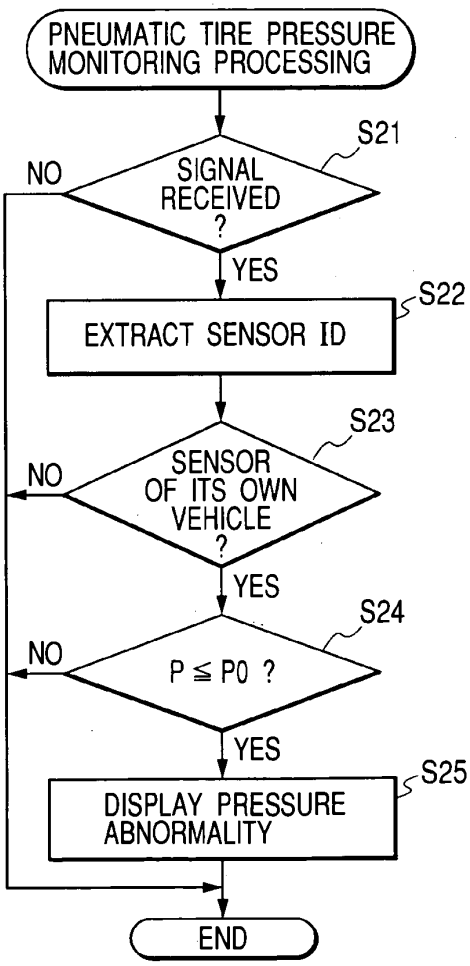
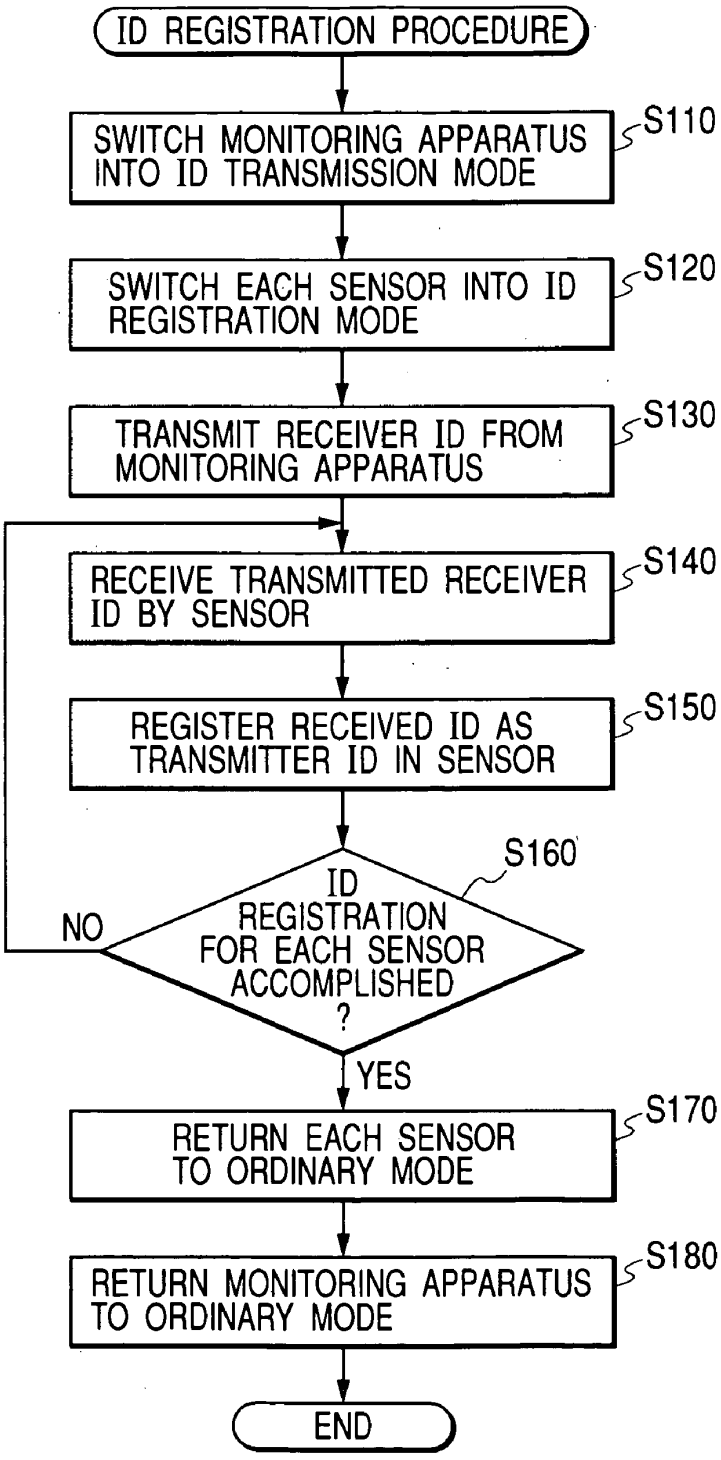


FIG. 3B



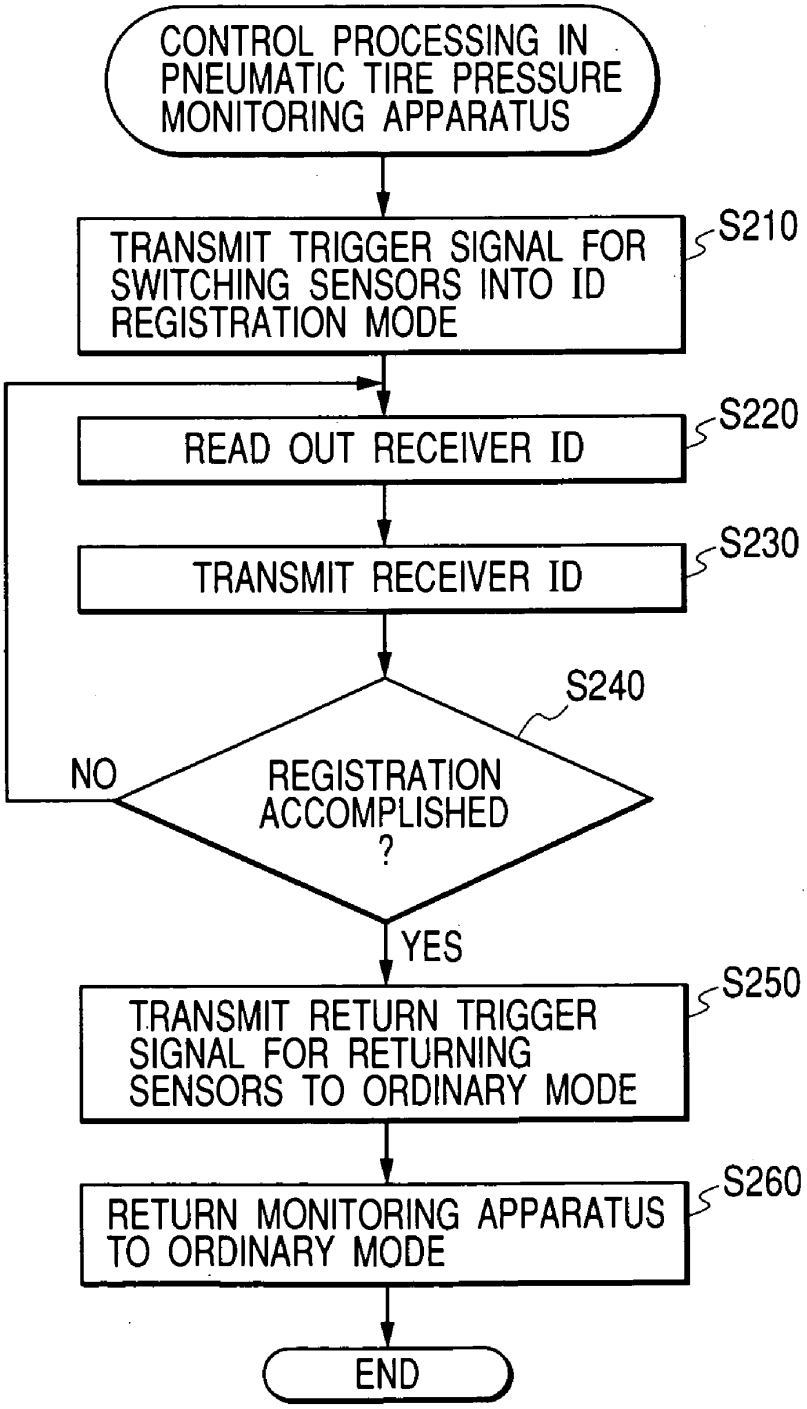
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FIG. 4



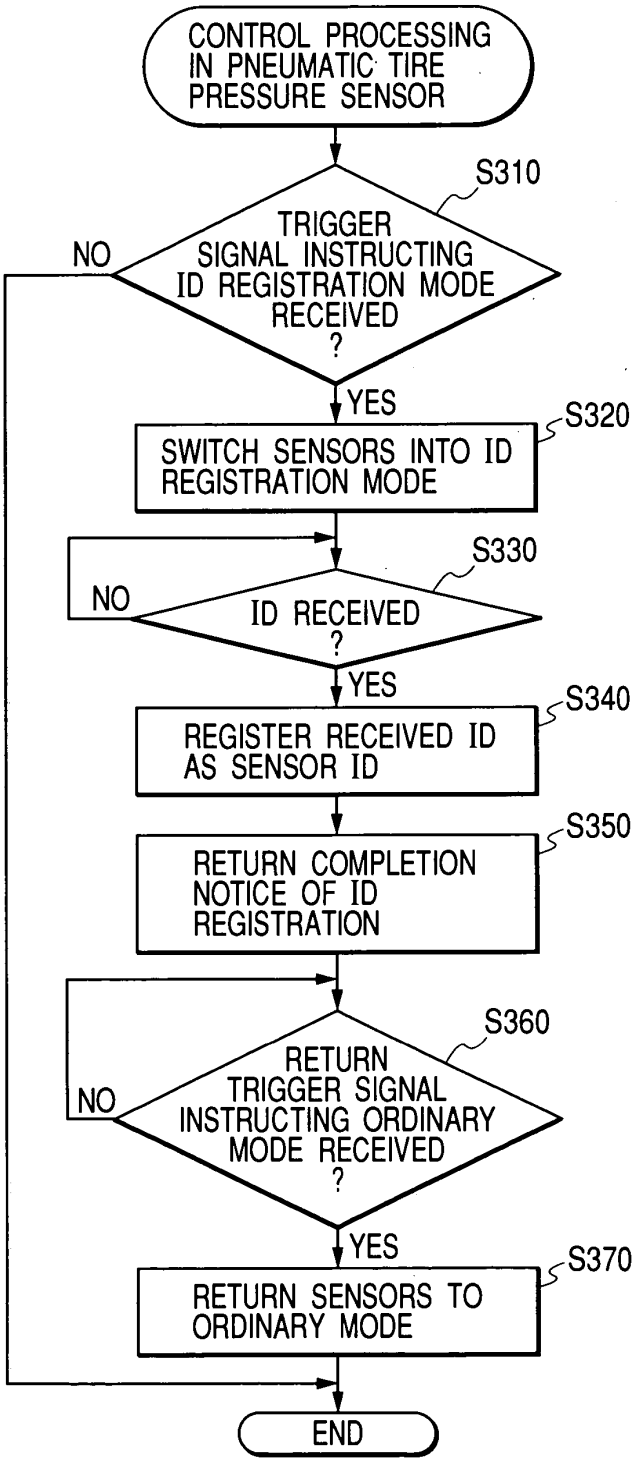
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FIG. 5



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FIG. 6



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FIG. 7

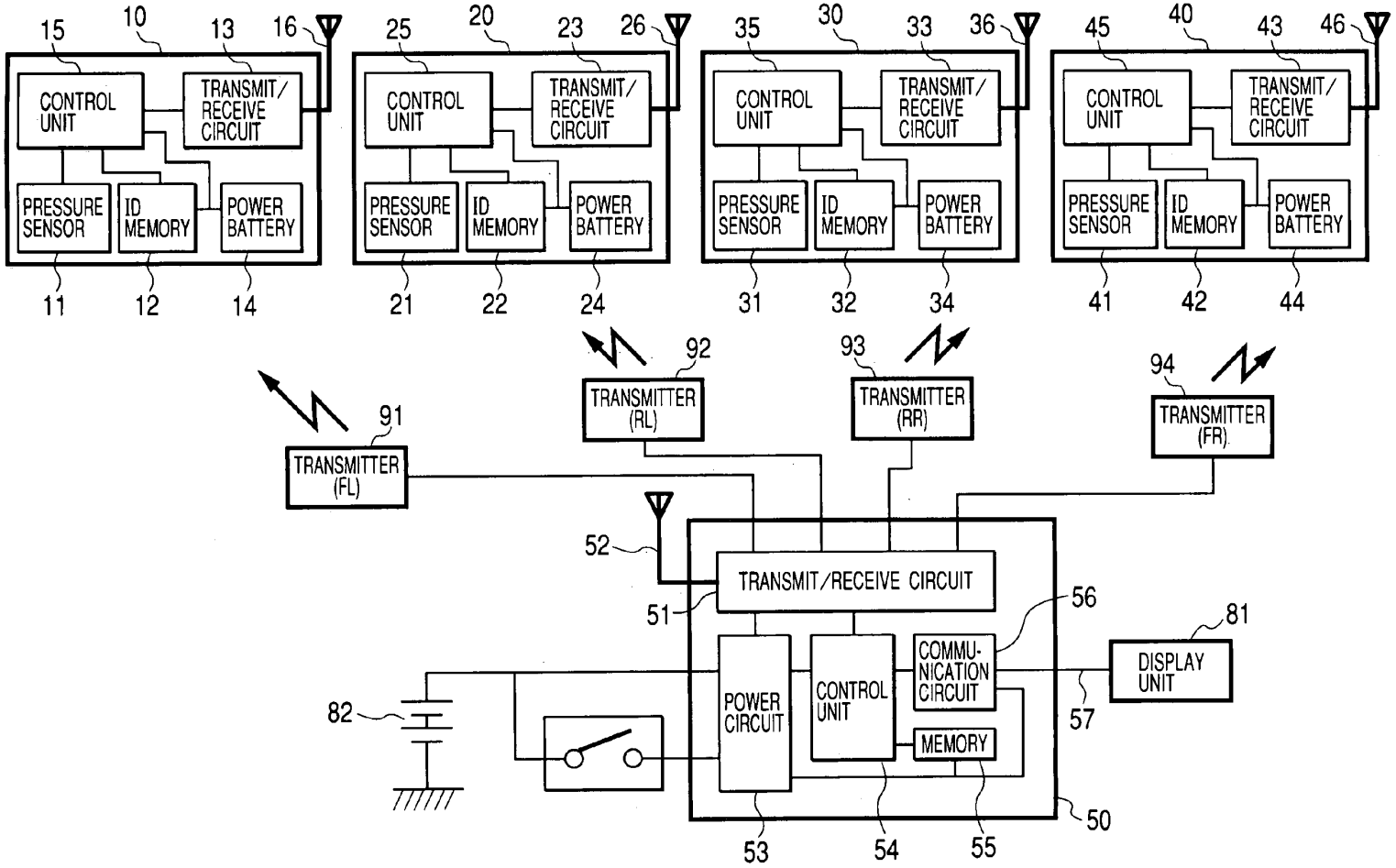
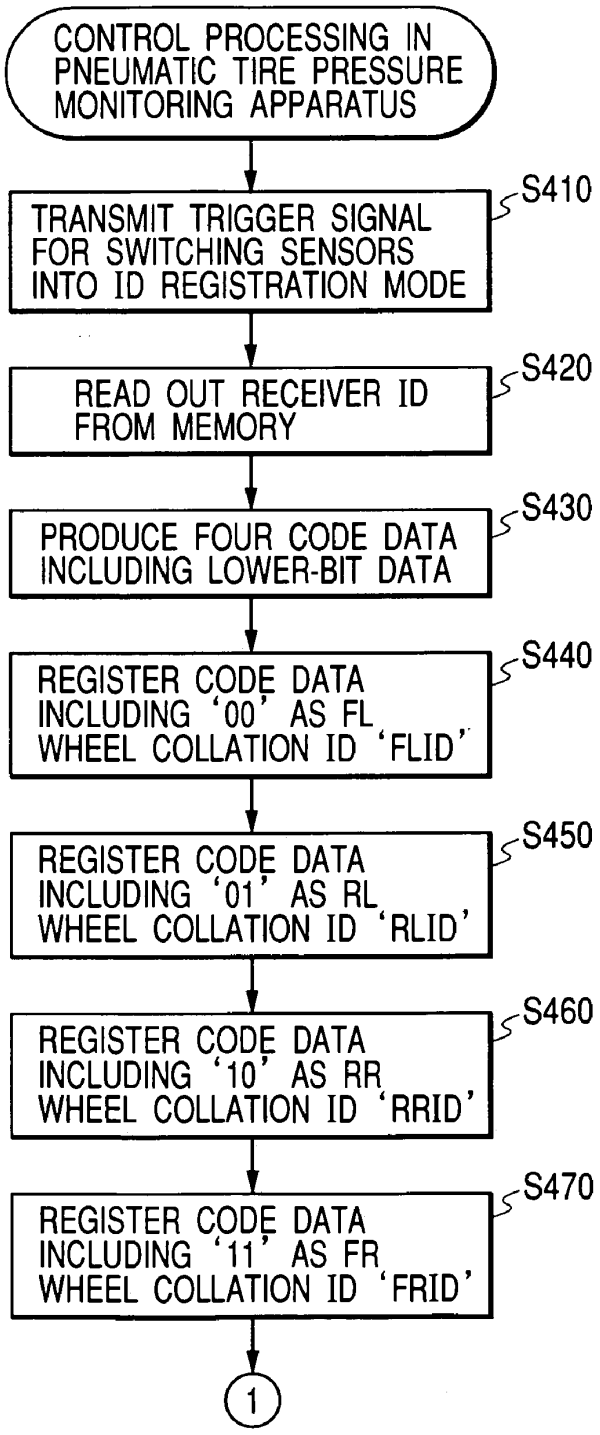
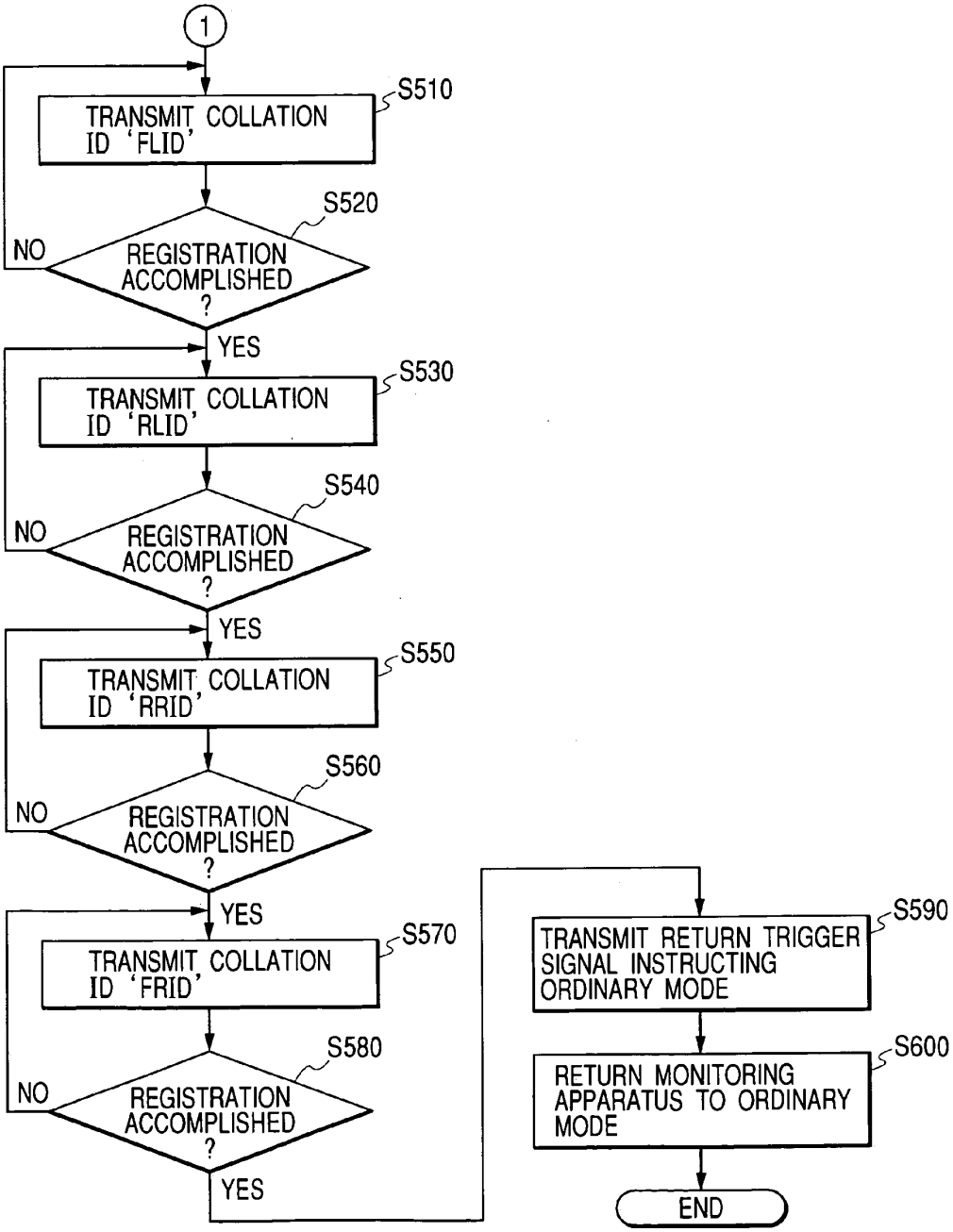

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CONTROL UNIT
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ID MEMORY
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TRANSMITTER (FL)
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TRANSMITTER (RL)
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TRANSMITTER (RR)
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TRANSMITTER (FR)
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TRANSMIT/RECEIVE CIRCUIT
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DISPLAY UNIT
COMMU-NICATION CIRCUIT
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POWER CIRCUIT
CONTROL UNIT
MEMORY
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FIG. 8



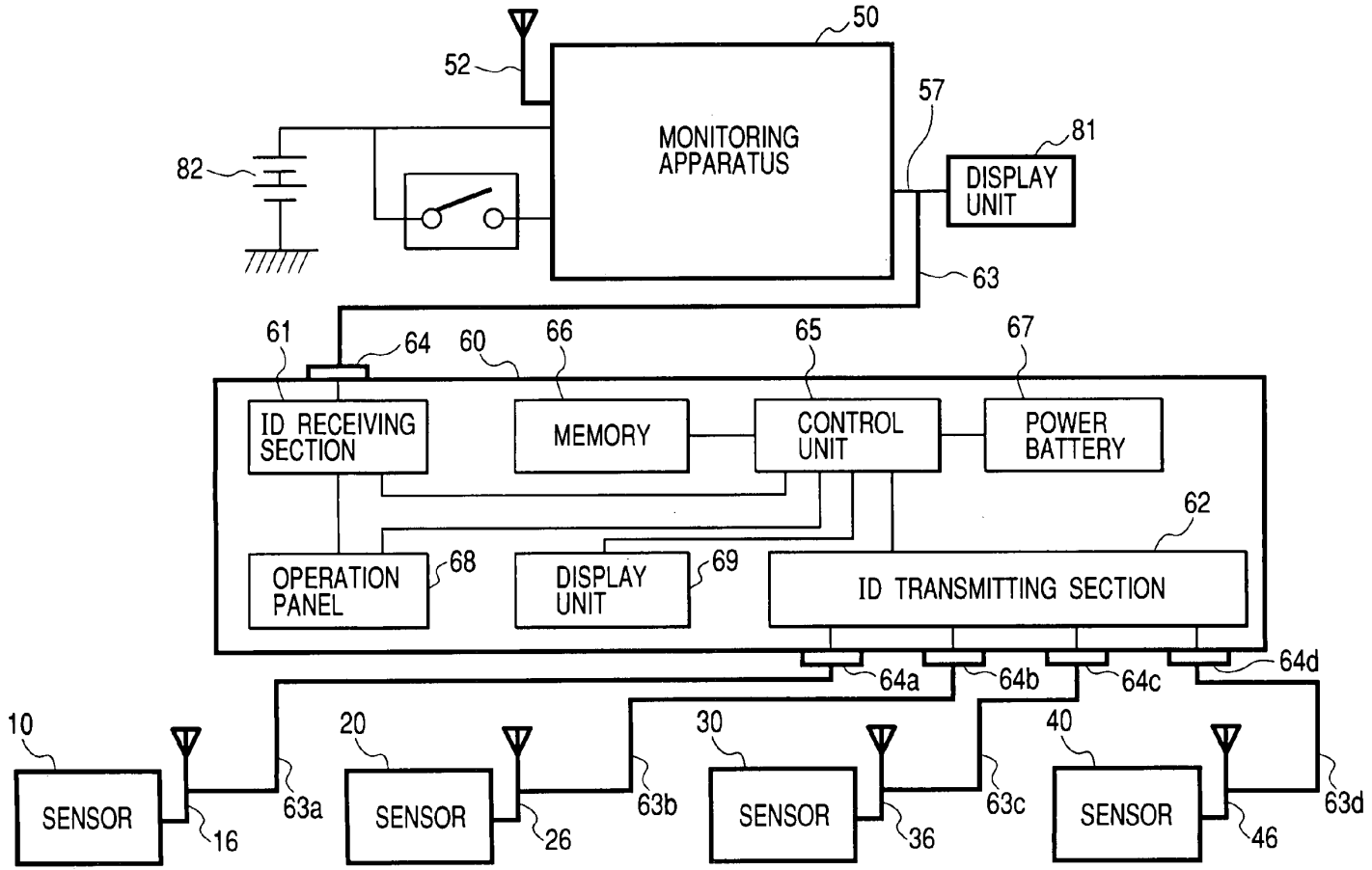
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FIG. 9



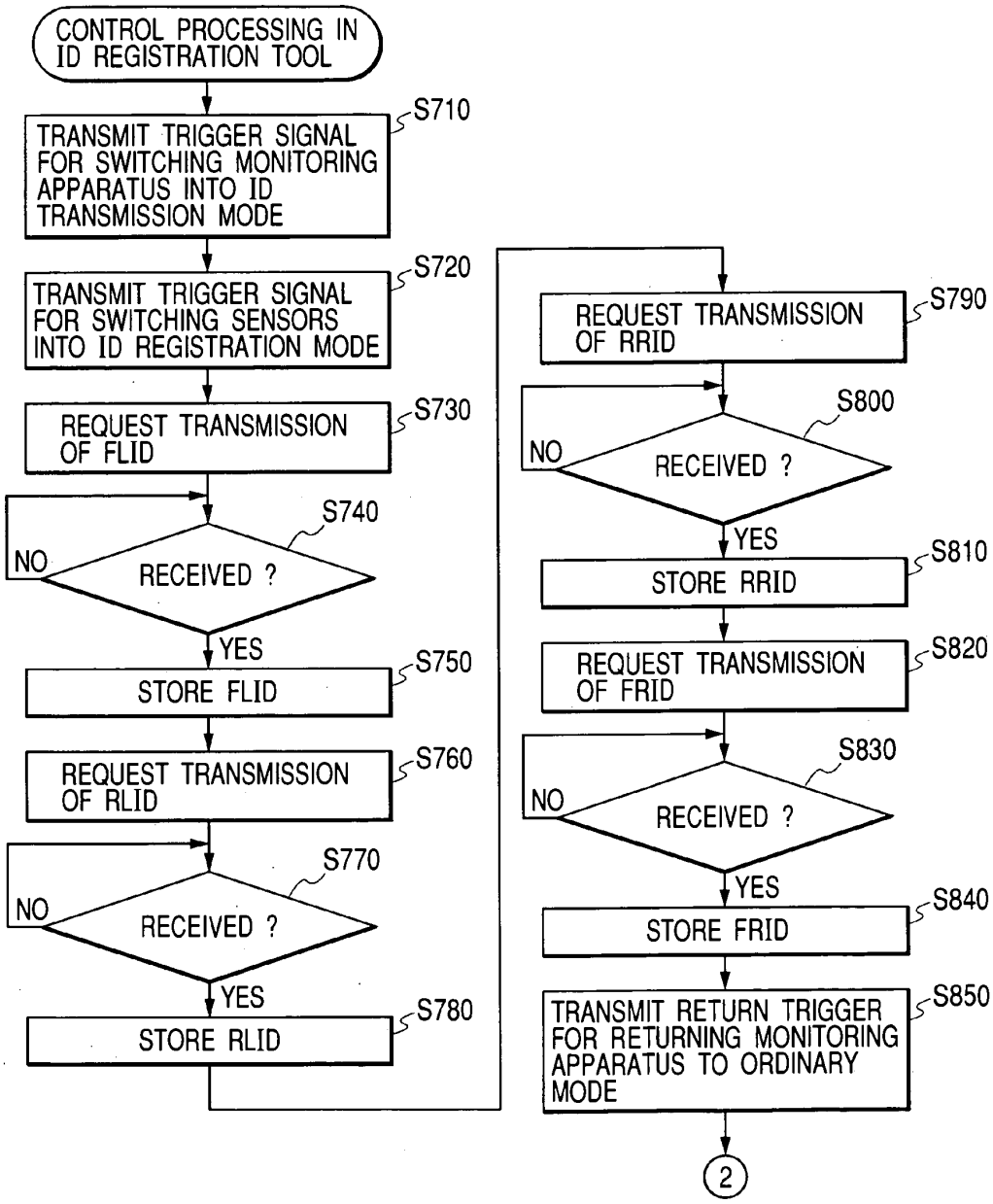
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FIG. 10



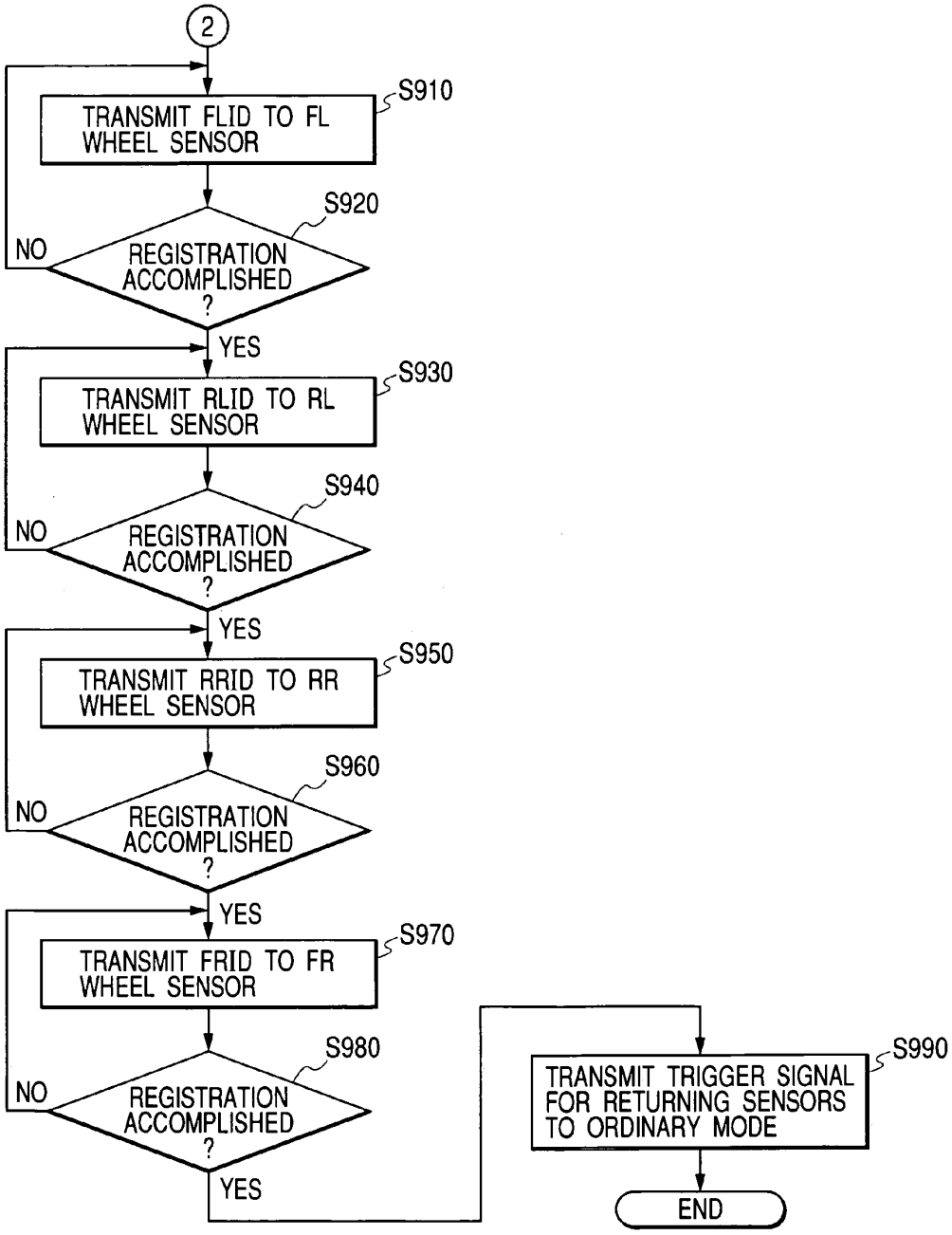
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FIG. 11



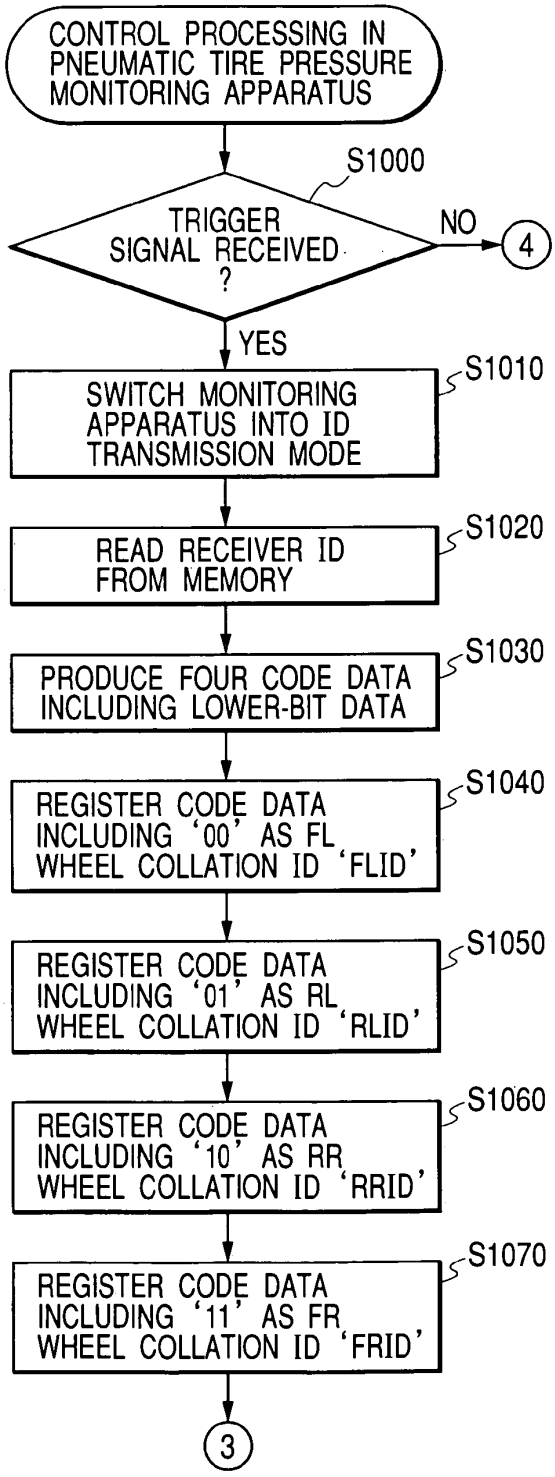
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FIG. 12



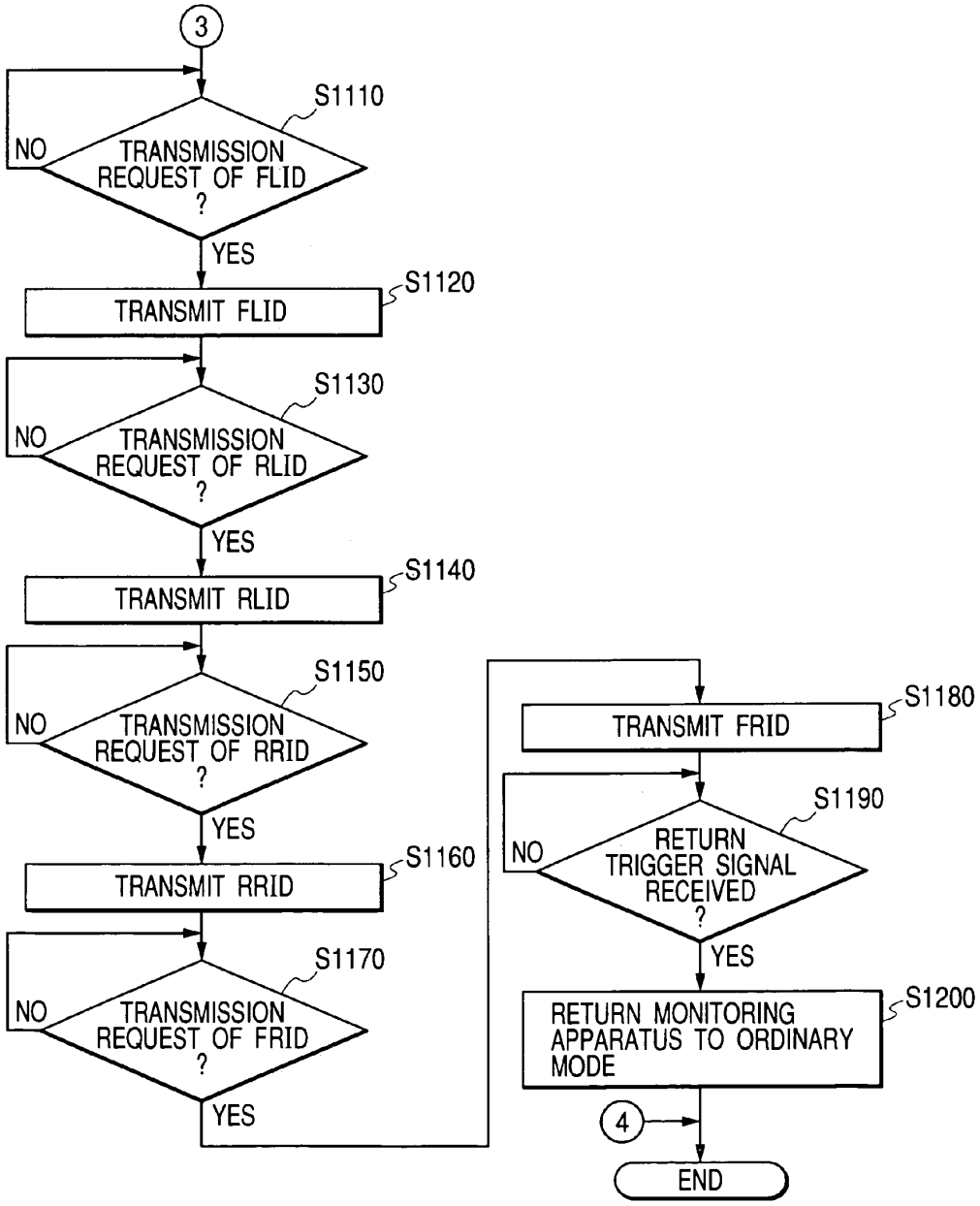
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FIG. 13



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FIG. 14



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FIG. 15

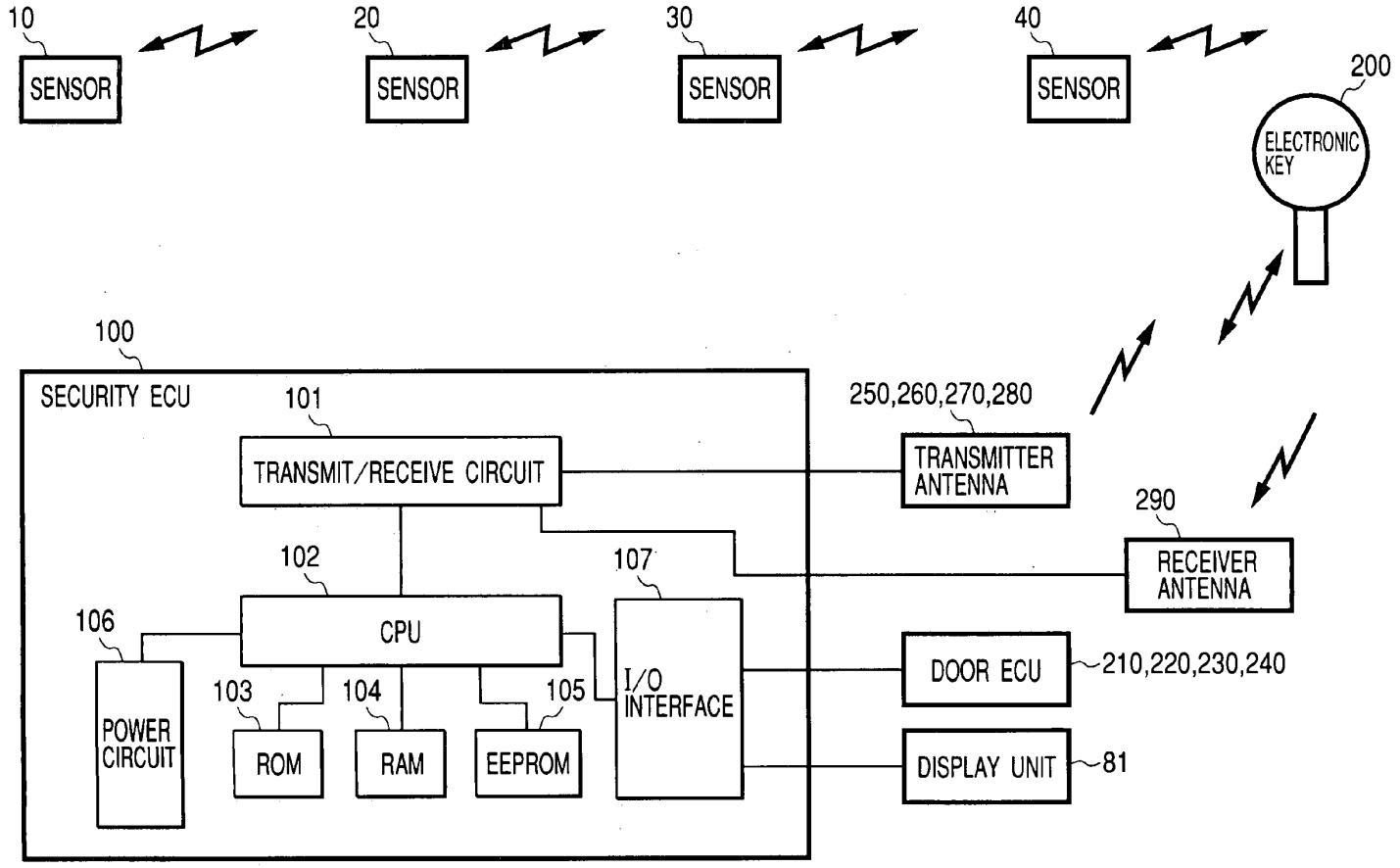
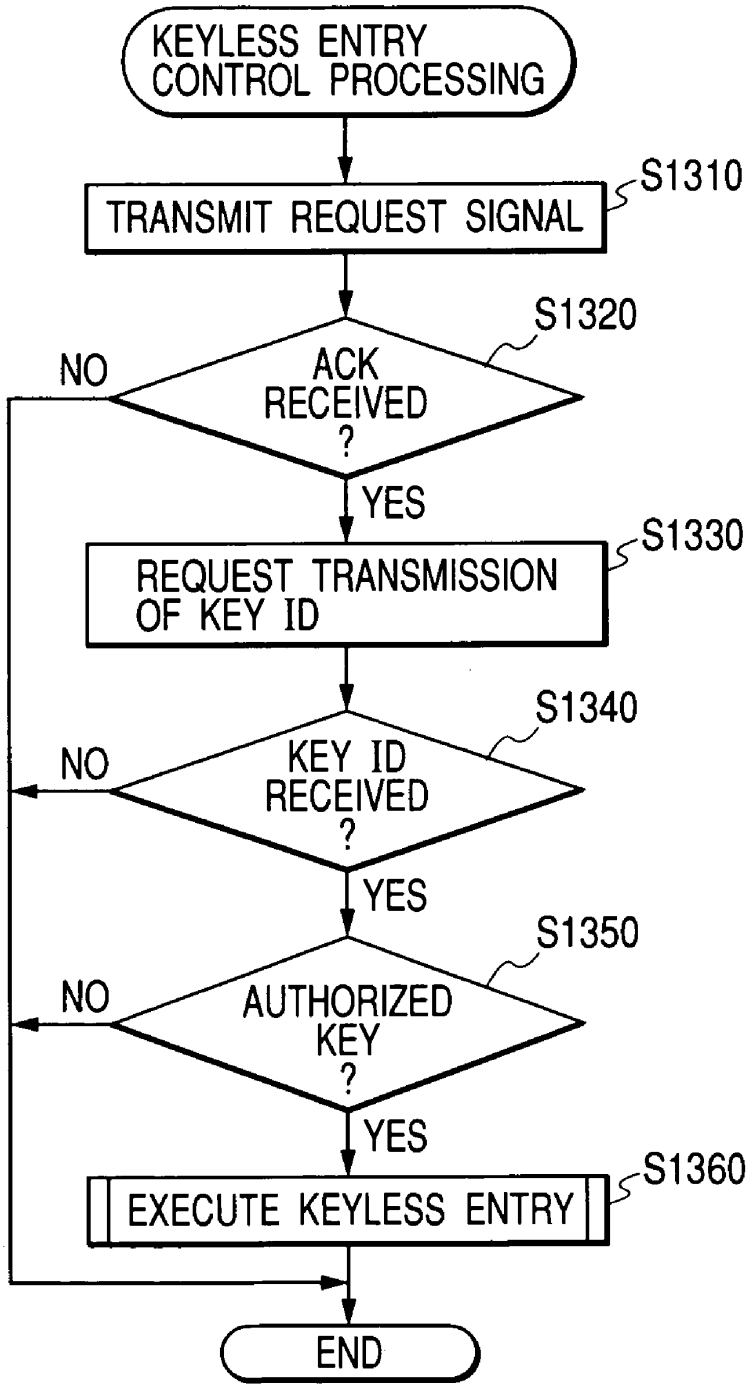
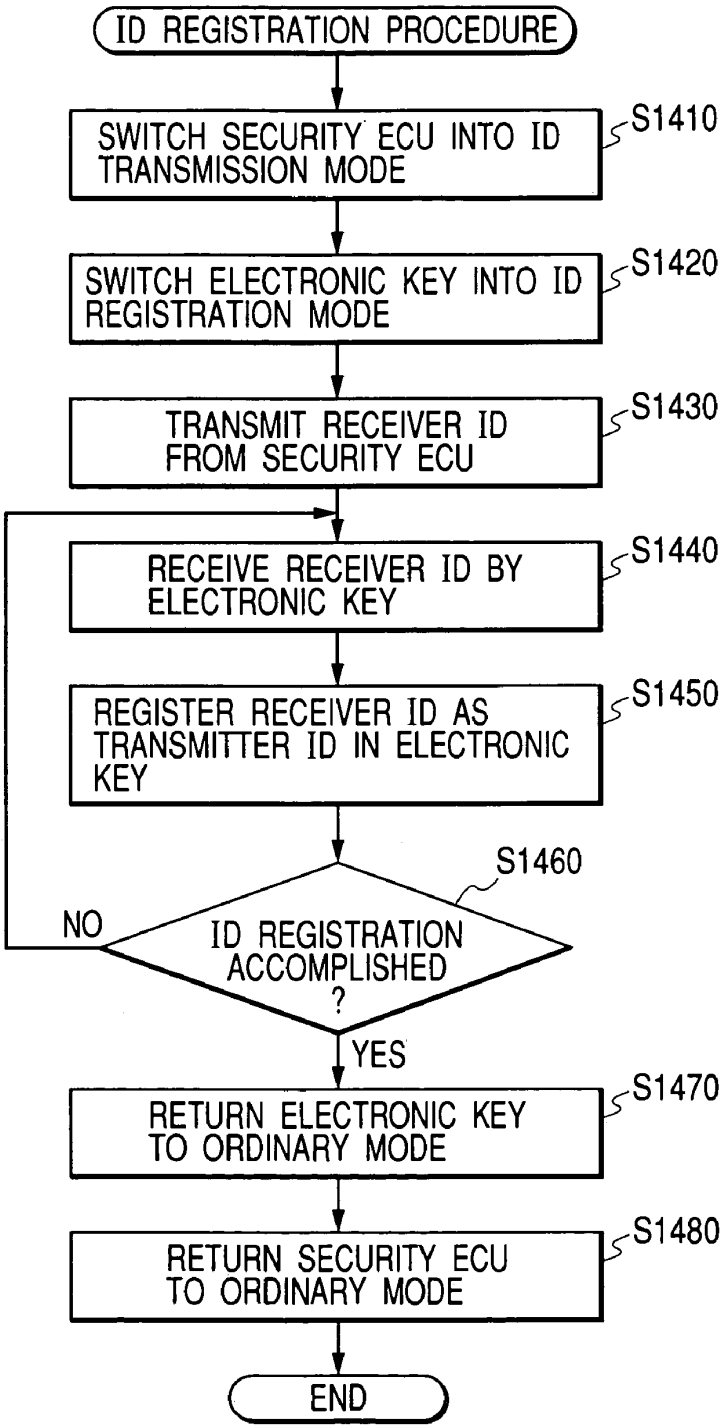

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SENSOR
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SENSOR
30
SENSOR
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SENSOR
200
ELECTRONIC KEY
100
SECURITY ECU
101
TRANSMIT/RECEIVE CIRCUIT
250,260,270,280
TRANSMITTER ANTENNA
290
RECEIVER ANTENNA
102
CPU
107
I/O INTERFACE
106
POWER CIRCUIT
103
ROM
104
RAM
105
EEPROM
DOOR ECU
210,220,230,240
DISPLAY UNIT
81

FIG. 16



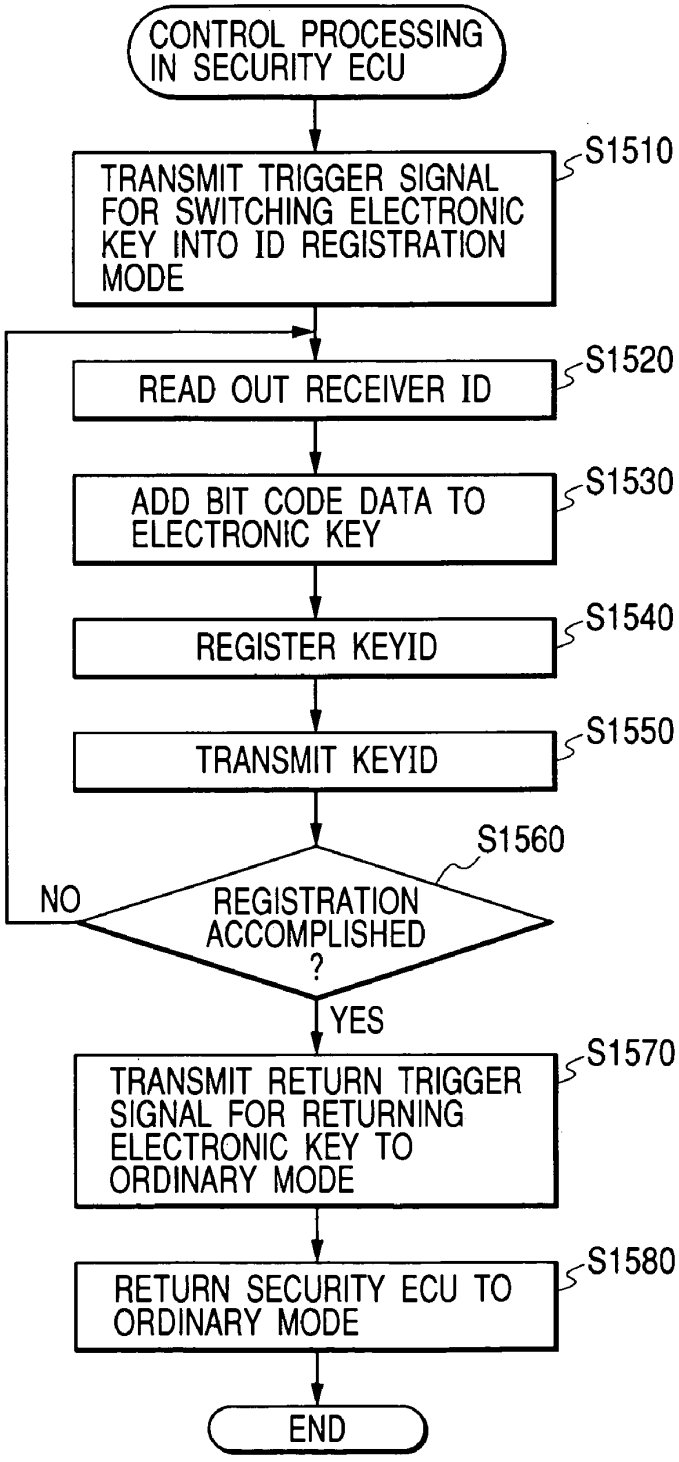
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FIG. 17



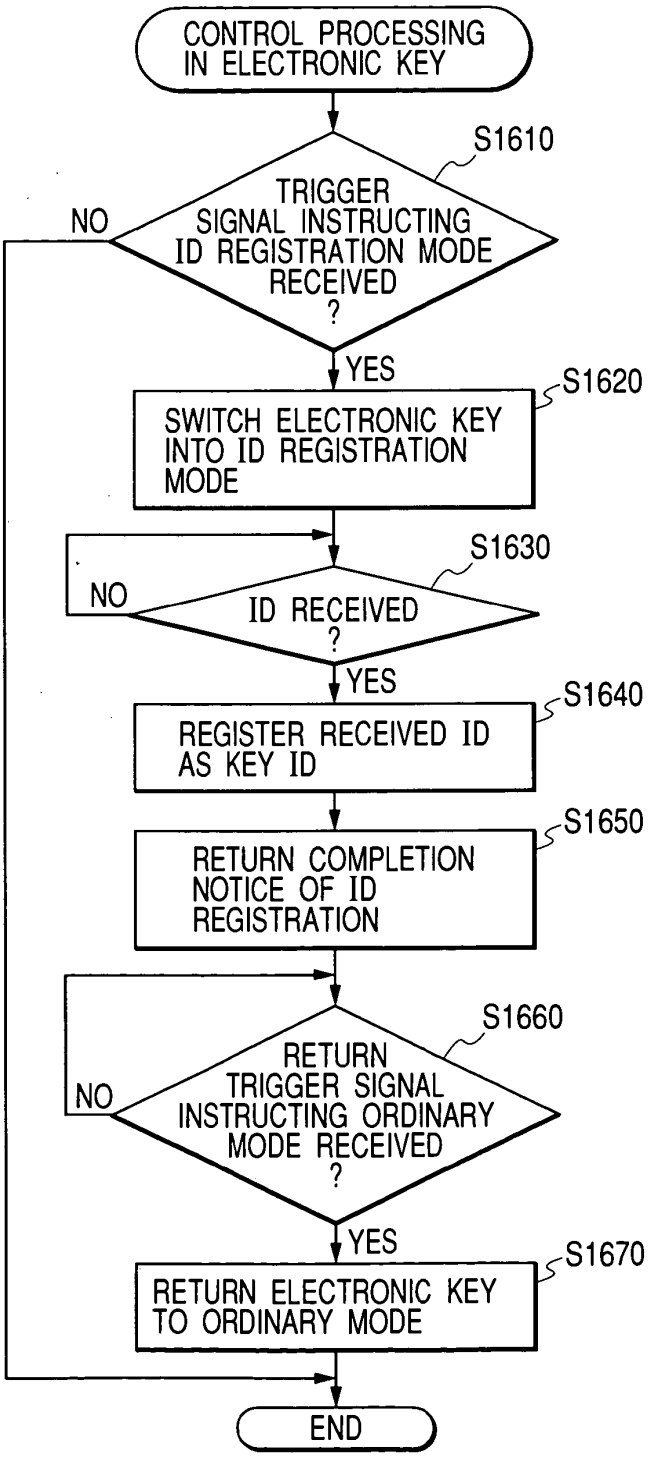
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FIG. 18



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FIG. 19



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FIG. 20
(PRIOR ART)

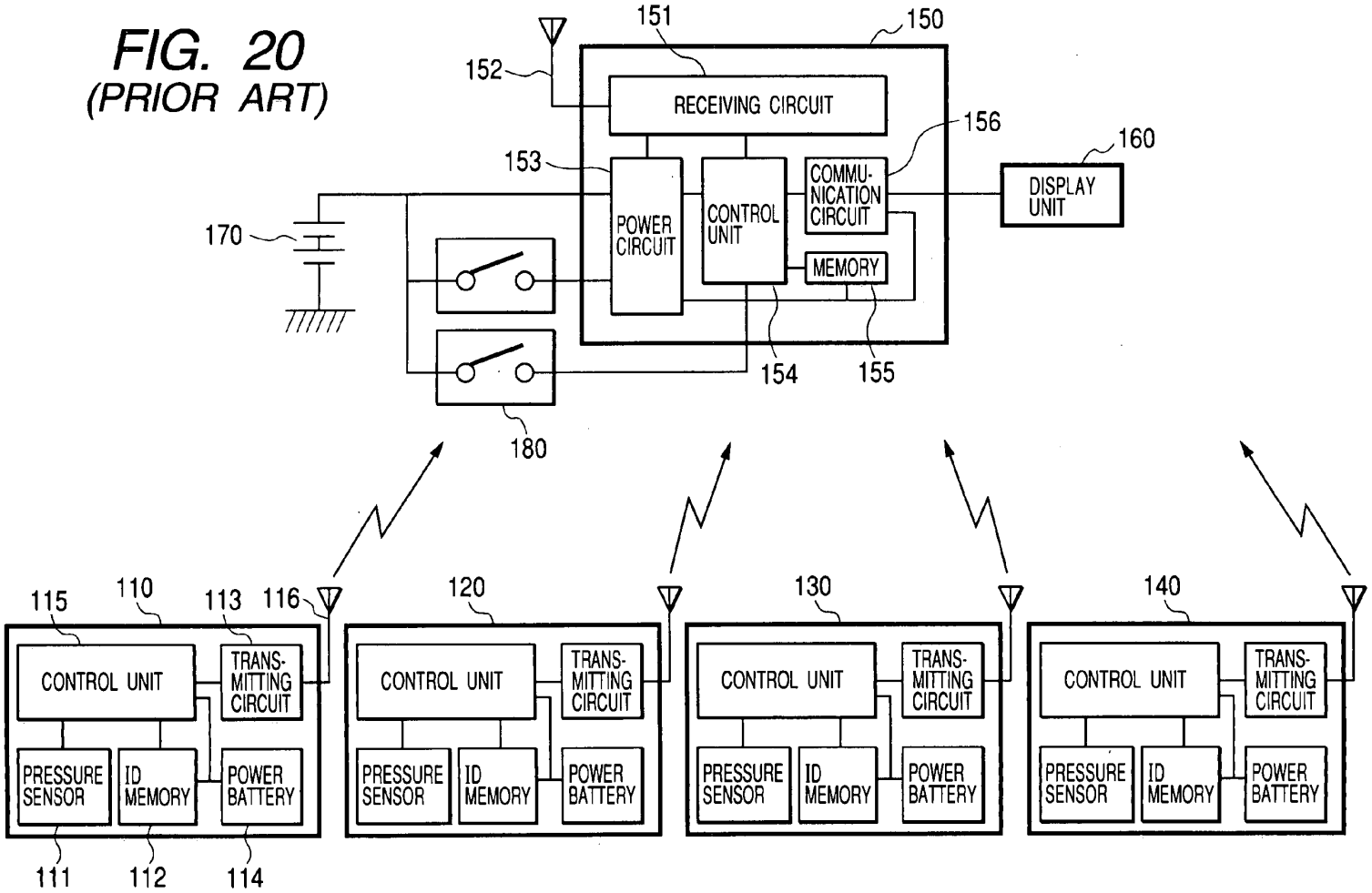
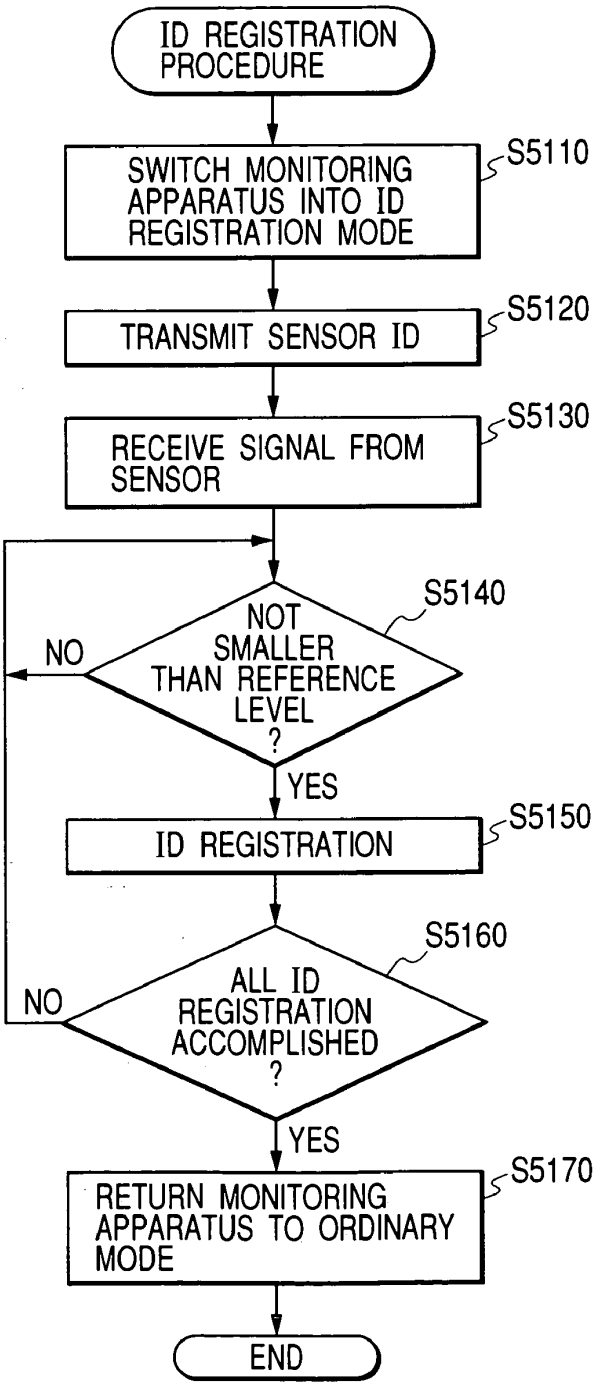


FIG. 21
(PRIOR ART)



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ID REGISTRATION METHOD, ID COLLATION SYSTEM INCORPORATED IN A VEHICLE CONTROL SYSTEM, EMBODIED AS A PNEUMATIC TIRE PRESSURE MONITORING APPARATUS ASSOCIATED WITH PNEUMATIC PRESSURE SENSORS, AND AN ID REGISTRATION TOOL COMBINED WITH PNEUMATIC TIRE PRESSURE MONITORING APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to an ID (i.e., identification) registration method and an ID collation system incorporated in a vehicle control system, embodied as a pneumatic tire pressure monitoring apparatus associated with pneumatic pressure sensors. More specifically, the present invention relates to a pneumatic tire pressure monitoring system monitoring the pneumatic pressure of a tire, an electronic key system performing contactless lock/unlock of a door, and a vehicle security control system controlling the pneumatic tire pressure monitoring system and the electronic key system.

A conventional pneumatic tire pressure monitoring system is, for example, disclosed in Japanese Patent No. 3212311 corresponding to U.S. Pat. No. 5,602,524.

According to this kind of conventional pneumatic tire pressure monitoring system, a pneumatic pressure sensor equipped with a transmitter is attached to each tire. The pneumatic pressure sensor transmits an air-pressure detection signal together with an ID assigned to this sensor. A pneumatic tire pressure monitoring apparatus installed in a vehicle body receives the air-pressure detection signal. When any abnormal tire having a lower air pressure is detected, a warning indicator is turned on.

In this case, each sensor ID is also registered in the pneumatic tire pressure monitoring apparatus, so that the monitoring apparatus can check whether or not the received air-pressure signal is transmitted from the tire of its own vehicle.

According to the above conventional system, the sensor ID is assigned to each sensor at the shipment or delivery stage of this sensor from a sensor maker. Then, this sensor is installed into a designated vehicle in an automobile maker. In this assembling process, the pneumatic tire pressure monitoring apparatus installed in a vehicle body is switched into an ID registration mode so that the ID transmitted from the sensor can be received by the monitoring apparatus and the received ID can be registered in the monitoring apparatus.

More specifically, as shown in FIG. **20**, the conventional pneumatic tire pressure monitoring system includes a plurality of pneumatic pressure sensors **110**, **120**, **130**, and **140** attached to respective tires and a pneumatic tire pressure monitoring apparatus **150** installed in a vehicle body. The pneumatic pressure sensor **110** includes an air pressure sensor **111** detecting the air pressure of a tire, an ID memory **112** storing a registered sensor ID, a transmitting circuit **113**, a power source battery **114**, a control unit **115**, and a transmitting antenna **116**. Other pneumatic pressure sensors **120**, **130**, and **140** are identical in arrangement with the sensor **110**.

The pneumatic tire pressure monitoring apparatus **150** includes a receiving circuit **151**, a receiving antenna **152**, a power source circuit **153**, a control unit **154**, a memory **155**, and a communication circuit **156**. The communication circuit **156** is connected via a signal line to a display unit **160** such as an indicator or LED to transmit display data to the display unit **160**. A vehicle battery **170**, supplying electric power, is connected to the pneumatic tire pressure monitoring apparatus **150**. A mode changing switch **180** is provided to switch the operation of the control unit **154** between an ordinary mode and an ID registration mode.

The ID registration is performed in an automobile manufacturing line in accordance with a procedure shown in FIG. **21**. First of all, the pneumatic tire pressure monitoring apparatus **150** is switched into an ID registration mode (step **S5110**). Next, respective pneumatic pressure sensors **110**, **120**, **130**, and **140** transmit their sensor IDs stored in their ID memories (step **S5120**) into the air. The pneumatic tire pressure monitoring apparatus **150** receives the sensor IDs via the receiving antenna **152** (step **S5130**). Then, the control unit **154** of the pneumatic tire pressure monitoring apparatus **150** makes a judgment as to whether or not the received signal has a level equal to or larger than a reference level (step **S5140**). When the received signal level is not smaller than the reference level (i.e., YES in step **S5140**), the sensor ID included in the received signal is registered in the memory **155** of the pneumatic tire pressure monitoring apparatus **150** (step **S5150**). Then, the control unit **154** makes a judgment as to whether or not the registration of the sensor IDs of respective sensors **110**, **120**, **130**, and **140** has been accomplished (step **S5160**). When the ID registration for respective sensors **110**, **120**, **130**, and **140** is already accomplished (YES in step **S5160**), the mode changing switch **180** is switched to return the monitoring apparatus **150** to the ordinary mode (step **S5170**).

In this manner, according to the conventional system, the sensor ID of the pneumatic pressure sensor actually attached to each tire of a vehicle is registered in the monitoring apparatus. In the ordinary mode, the monitoring apparatus checks whether or not the ID contained in each signal received through the receiving antenna **152** agrees with a collation ID stored in the memory **155**. When the agreement is recognized, the air-pressure condition of the tire is judged based on a received pressure signal. Display of the display unit **160** is performed based on the judgment result. Registering the collation ID as described above is effective in preventing erroneous display performed based on a signal transmitted from a pneumatic pressure sensor attached to a tire of any other vehicle traveling or stopping nearby.

However, many vehicles are successively conveyed on the same assembling line at short intervals of time. Performing the registration of collation ID in such a congested condition will be possibly subjected to the problem of interference occurring in radio data transmission, according to which the monitoring apparatus of a vehicle may erroneously receive the ID signal sent from a pneumatic pressure sensor of a neighboring vehicle. The similar problem occurs in a repair shop in which the re-registering operation of the collation ID is performed.

Furthermore, electronic keys are recently used for controlling automotive vehicles by performing radio or wireless communication between the electronic key and an automotive security control computer (i.e., security ECU). For example, the electronic key allows a user to open or close an automotive door without inserting the key into a key cylinder. Furthermore, it is known that the electronic key can be used to start the engine before the user enters into the car. According to such an electronic key system, a key ID of the authorized electronic key is registered in the security ECU. Then, the security ECU performs ID collection with reference to the registered key ID when communicating with the

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electronic key. Thus, even in such an electronic key system, it is necessary to eliminate erroneous ID registration.

The employment of such an electronic key system is not limited to automotive vehicles. For example, a similar key system can be applied to an entrance door of a house in which a security computer is installed. Even in such a housing security system, the ID collation is performed with reference to ID information registered beforehand for an authorized key.

SUMMARY OF THE INVENTION

In view of the above-described problems, the present invention has an object to eliminate ID erroneous registration in an ID collation system which includes a receiver receiving an ID transmitted from a transmitter and performs predetermined processing based on check result with reference to collation ID. More specifically, the present invention has an object to make it easy to register the ID when a transmitter is newly added or the transmitter is modified.

In order to accomplish the above and other related objects, the present invention provides an ID (i.e., identification) registration method for an ID collation system which includes a receiver receiving information transmitted from a transmitter, checks an ID contained in the information received by the receiver, and performs predetermined processing designated by the information based on check result of ID. The ID registration method of the present invention includes a step of switching the transmitter into an ID registration mode and also switching the receiver into an ID transmission mode, a step of causing the receiver to transmit a collation ID determined based on an ID assigned inherently to the receiver, and a step of causing the transmitter to receive the collation ID transmitted from the receiver and store the received collation ID as a registered ID of the transmitter.

The ID registration method of the present invention is opposed in the way of registration to a conventional registration method according to which a transmitter ID is sent from a transmitter to a receiver and registered in the receiver. In other words, the present invention brings the transmitter and the receiver into a reversed master/slave relationship so that a collation ID is transmitted from the receiver to the transmitter, not from the transmitter to the receiver. Namely, the collation ID is stored in the receiver (i.e., master) and the collation ID is transmitted from the receiver to the transmitter (i.e., slave) and registered in the transmitter. The collation ID transmitted from the receiver to the transmitter is, for example, ① an ID registered beforehand in the receiver or ② an ID newly produced by the receiver and registered in the receiver when it is transmitted to the transmitter.

According to the ID registration method of the present invention, it becomes possible to surely prevent the ID registration from being erroneously performed in the receiver. No transmitter ID of other transmitter is registered. Thus, the erroneous ID registration is effectively eliminated. When a faulty transmitter is replaced by a new one, the collation ID stored in the receiver is registered in the new transmitter according to the above-described procedure. Thus, the maintenance is easy.

In the ID registration method of the present invention, the collation ID stored in the receiver is determined based on the ID assigned inherently to the receiver. The ID assigned inherently to the receiver is discriminable from other IDs of receivers installed in other vehicles. Thus, an objective vehicle is discriminable from other vehicles based on the ID assigned inherently to the receiver installed in this objective vehicle. In this case, the collation ID is completely identical with or partly includes "the ID assigned inherently to the receiver."

The above method of determining the collation ID based on the ID assigned inherently to the receiver is preferably employed in a case ① where there are a plurality of transmitters transmitting information used for controlling an apparatus or in a case ② where there are a plurality of different kinds of transmitters transmitting different information to control one or more apparatuses.

In both of the above cases ① and ②, administration and collation of ID in the receiver become easy. The process of judging whether or not a concerned transmitter is an authorized transmitter belonging to the system can be easily performed by checking whether or not the inherent ID of the receiver is contained in the received information. In the above case ①, the collation ID can be constituted by a code combining additional bit data with the inherent ID of the receiver. For example, using two-bit data makes it possible to discriminate a total of four transmitters from each other. Even in the above case ②, the above discrimination among the transmitters becomes feasible by adding a bit or bits for discriminating the type of the transmitters.

To realize the ID registration method, the present invention provides an ID collation system including a transmitter for transmitting information, a receiver for receiving the information transmitted from the transmitter, a control apparatus for checking an ID contained in the information received by the receiver and performing predetermined processing designated by the information based on check result of ID. The ID collation system of the present invention includes a transmitter mode switching apparatus for switching the transmitter into an ID registration mode and a receiver mode switching apparatus for switching the receiver into an ID transmission mode. The receiver includes an ID transmitting apparatus for transmitting a collation ID being determined based on an ID assigned inherently to the receiver and used in ID checking when the receiver is switched into the ID transmission mode by the receiver mode switching apparatus. The transmitter includes an ID receiving apparatus for receiving the collation ID transmitted from the receiver when the transmitter is switched into the ID registration mode by the transmitter mode switching apparatus, and an ID registration apparatus for storing the collation ID received by the ID receiving apparatus as a registered ID of the transmitter.

When the ID registration is performed by the above ID collation system of the present invention, as shown in FIG. **1**, the transmitter mode switching apparatus switches the transmitter into the ID registration mode while the receiver mode switching apparatus switches the receiver into the ID transmission mode (step **S1**). Then, the collation ID to be transmitted from the receiver is set (step **S2**). This step **S2** can include one of the following processes.

(A) a process of reading out a collation ID registered beforehand in the receiver.

(B) a process of producing a collation ID to be registered in the receiver and setting the produced collation ID as transmission information. The produced collation ID is immediately or later registered in a memory of the receiver.

In any case, the collation ID is determined based on an ID assigned inherently to the receiver.

Subsequently, the ID transmitting apparatus of the receiver transmits the collation ID (step **S3**). Then, the ID receiving apparatus of the transmitter receives the collation ID (step **S4**). The ID registration apparatus of the transmitter

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stores the received collation ID as a registered ID of the transmitter (step S5). After the ID registration is accomplished, the transmitter mode switching apparatus returns the transmitter to the ordinary mode while the receiver mode switching apparatus returns the receiver to the ordinary mode (step S6).

Furthermore, to accomplish the above and other objects, the present invention provides a first vehicle control system including a transmitter for transmitting information required to control a device installed in a vehicle, a receiver installed in a vehicle body for receiving the information transmitted from the transmitter, a control apparatus installed in the vehicle body for checking an ID contained in the information received by the receiver with reference to a collation ID and executing control of the device according to the information based on check result of ID, a transmitter mode switching apparatus for switching the transmitter into an ID registration mode, and a receiver mode switching apparatus for switching the receiver into an ID transmission mode. Furthermore, the receiver includes an ID transmitting apparatus for transmitting the collation ID used in ID checking when the receiver is switched into the ID transmission mode by the receiver mode switching apparatus. The transmitter includes an ID receiving apparatus for receiving the collation ID transmitted from the receiver when the transmitter is switched into the ID registration mode by the transmitter mode switching apparatus, and an ID registration apparatus for storing the collation ID received by the ID receiving apparatus as a registered ID of the transmitter. Furthermore, according to the first vehicle control system of the present invention, the device installed in a vehicle is a pneumatic air pressure monitoring apparatus for displaying monitoring result with respect to an air pressure of a tire installed in the vehicle. The transmitter is incorporated in a pneumatic pressure sensor attached to the tire. And, the control apparatus executes control for the display of monitoring result with respect to the air pressure of the tire installed in the vehicle when the information received by the receiver is confirmed based on the result of ID checking as being transmitted from the pneumatic pressure sensor attached to the tire.

It is preferable that the collation ID is transmitted to the transmitter via a transmitter antenna provided in a tire house of the vehicle. This arrangement is convenient when the ID is registered for each of four pneumatic pressure sensors attached to front-left, rear-left, rear-right, and front-right wheels of a vehicle.

Furthermore, the present invention provides a second vehicle control system including a transmitter for transmitting information required to control a device installed in a vehicle, a receiver installed in a vehicle body for receiving the information transmitted from the transmitter, a control apparatus installed in the vehicle body for checking an ID contained in the information received by the receiver with reference to a collation ID and executing control of the device according to the information based on check result of ID, a transmitter mode switching apparatus for switching the transmitter into an ID registration mode, and a receiver mode switching apparatus for switching the receiver into an ID transmission mode. Furthermore, the receiver includes an ID transmitting apparatus for transmitting the collation ID used in ID checking when the receiver is switched into the ID transmission mode by the receiver mode switching apparatus. The transmitter includes an ID receiving apparatus for receiving the collation ID transmitted from the receiver when the transmitter is switched into the ID registration mode by the transmitter mode switching apparatus, and an ID registration apparatus for storing the collation ID received by the ID receiving apparatus as a registered ID of the transmitter. Furthermore, according to the second vehicle control system of the present invention, the device installed in a vehicle is a keyless entry apparatus for executing contactless lock/unlock of a vehicle door, the transmitter is incorporated in an electronic key, and the control apparatus executes the contactless lock/unlock of the vehicle door based on checking result of ID of the electronic key contained in the information received by the receiver.

Furthermore, the present invention provides a third vehicle control system including a transmitter for transmitting information required to control a device installed in a vehicle, a receiver installed in a vehicle body for receiving the information transmitted from the transmitter, a control apparatus installed in the vehicle body for checking an ID contained in the information received by the receiver with reference to a collation ID and executing control of the device according to the information based on check result of ID, a transmitter mode switching apparatus for switching the transmitter into an ID registration mode, and a receiver mode switching apparatus for switching the receiver into an ID transmission mode. The receiver includes an ID transmitting apparatus for transmitting the collation ID used in ID checking when the receiver is switched into the ID transmission mode by the receiver mode switching apparatus. The transmitter includes an ID receiving apparatus for receiving the collation ID transmitted from the receiver when the transmitter is switched into the ID registration mode by the transmitter mode switching apparatus, and an ID registration apparatus for storing the collation ID received by the ID receiving apparatus as a registered ID of the transmitter. Furthermore, according to the third vehicle control system of the present invention, the device installed in a vehicle includes a pneumatic air pressure monitoring apparatus for displaying monitoring result with respect to an air pressure of a tire installed in the vehicle and a keyless entry apparatus for executing contactless lock/unlock of a vehicle door. The transmitter is incorporated in a pneumatic pressure sensor attached to the tire and also in an electronic key. And, the control apparatus executes control for the display of monitoring result with respect to the air pressure of the tire installed in the vehicle when the information received by the receiver is confirmed based on the result of ID checking as being transmitted from the pneumatic pressure sensor attached to the tire, and also executes the contactless lock/unlock of the vehicle door when the information received by the receiver is confirmed based on the result of ID checking as being transmitted from an authorized electronic key.

It is preferable that the collation ID is determined based on an ID assigned inherently to the receiver. Administration of ID in the receiver becomes easy. The ID collation processing for checking whether or not a concerned transmitter belongs to the receiver can be easily done.

For example, according to the electronic key system, it is possible to register a plurality of authorized electronic keys. In such a case, the same ID (i.e., the ID inherent to the receiver) is registered in each authorized electronic key. The receiver is required to perform the ID collation processing commonly for all of the authorized electronic keys. The processing becomes simple. Meanwhile, if it is necessary to discriminate each of the authorized electronic keys, it will be preferable that the collation ID for each key includes additional bit data for identifying each key.

Furthermore, according to the pneumatic tire pressure monitoring system, a total of four transmitters are required

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for the wheels of a four-wheel vehicle. In this case, the processing for identifying whether or not a signal arrives from the pneumatic pressure sensor attached to a tire of this vehicle becomes simple. In general, to precisely perform the pneumatic tire pressure monitoring operation, it is preferable to discriminate each of the wheels. In such a case, two-bit additional code for discriminating each wheel can be added to the collation ID.

Furthermore, a security control system executes control processing for different kinds of devices, such as a combination of the pneumatic tire pressure monitoring system and the electronic key system. In such a security control system, it is possible to use the same ID for the pneumatic pressure sensor and the electronic key. The processing becomes simple. The administration becomes simple, too.

It is preferable that the collation ID is transmitted from the receiver to the transmitter via a predetermined external device. For example, the external device is an ID registration tool carried by an operator or a worker. First of all, the ID registration tool is placed near a receiver to receive the collation ID transmitted from the receiver. Then, this tool is carried to the vicinity of a transmitter and the registered collation ID is transmitted to the transmitter. The ID registration is accomplished in this manner.

Furthermore, it is preferable that the external device is detachably connected via a signal line to the receiver and to the transmitter. Using a signal line or a comparable cable is effective to surely eliminate interference occurring in data transmission.

In the system executing the ID registration by cable, it is preferable that the transmitter mode switching apparatus is provided in the transmitter while the receiver mode switching apparatus is provided in the receiver, and the external device includes a trigger signal transmitting apparatus which transmits a trigger signal for causing the transmitter mode switching apparatus to switch the transmitter into the ID registration mode and a trigger signal for causing the receiver mode switching apparatus to switch the receiver into the ID transmission mode. The ID registration can be smoothly performed.

Furthermore, to accomplish the above and other related objects, the present invention provides a pneumatic tire pressure monitoring apparatus including a receiver for receiving an air-pressure signal transmitted together with a sensor ID from a pneumatic pressure sensor of each tire installed in a vehicle, a control apparatus for checking whether or not a received sensor ID agrees with the sensor ID of the pneumatic pressure sensor of the tire installed in the vehicle and for executing control for monitoring an air pressure of the tire with reference to the air-pressure signal based on check result of ID, a receiver mode switching apparatus for switching the receiver into an ID transmission mode, and an ID transmitting apparatus for transmitting a collation ID used in ID checking when the receiver is switched into the ID transmission mode by the receiver mode switching apparatus, wherein the collation ID is determined based on an ID assigned inherently to the receiver.

According to the pneumatic tire pressure monitoring apparatus of the present invention, in a vehicle assembling line, the receiver mode switching apparatus switches the receiver into the ID transmission mode. Then, the ID transmitting apparatus transmits a collation ID used in ID checking to the pneumatic pressure sensor, thereby performing the ID registration.

Furthermore, as the collation ID is determined based on the ID assigned inherently to the receiver, administration of ID is easy.

Furthermore, to accomplish the above and other related objects, the present invention provides a pneumatic tire pressure sensor including a pressure sensor for detecting an air pressure of a tire, an ID memory for storing a transmitter ID, a transmitting circuit for transmitting the air pressure of the tire detected by the pressure sensor together with the transmitter ID stored in the ID memory, a receiving circuit for receiving a collation ID transmitted from a pneumatic tire pressure monitoring apparatus, and a transmitter ID registering apparatus for registering the collation ID received via the receiving circuit as a transmitter ID and storing the registered transmitter ID in the ID memory.

According to the pneumatic tire pressure sensor of the present invention, the collation ID stored in the pneumatic tire pressure monitoring apparatus is registered in the transmitter as a transmitter ID. Especially, when the sensor is replaced by a new one, the ID registration is accurately and easily performed between the pressure sensor and the monitoring apparatus.

It is, for example, preferable that the receiving circuit receives a signal via a cable and the ID memory is a rewritable memory element having an overwriting function for renewing the data stored therein. Erroneous registration due to interference occurring in data transmission can be surely eliminated.

Furthermore, to accomplish the above and other related objects, the present invention provides an ID registration tool for a pneumatic tire pressure monitoring system including a pneumatic pressure sensor attached to a tire of a vehicle and a pneumatic tire pressure monitoring apparatus installed in a vehicle body to receive an air-pressure signal transmitted from the pneumatic pressure sensor together with a transmitter ID of the pneumatic pressure sensor, thereby monitoring an air pressure of the tire, in which the ID registration tool is used for registering a collation ID between the pneumatic tire pressure monitoring apparatus and the pneumatic pressure sensor. The ID registration tool of the present invention includes an ID transmission requesting apparatus for requesting the pneumatic tire pressure monitoring apparatus to transmit the collation ID used in ID checking, an ID receiving circuit for receiving the collation ID transmitted from the pneumatic tire pressure monitoring apparatus in response to a request of the ID transmission requesting apparatus, and an ID transmitting circuit for transmitting the collation ID received by the ID receiving circuit to the pneumatic pressure sensor.

According to the ID registration tool for a pneumatic tire pressure monitoring system, the ID transmission requesting apparatus requests the pneumatic tire pressure monitoring apparatus to transmit the collation ID. The ID receiving circuit receives the collation ID transmitted from the pneumatic tire pressure monitoring apparatus in response to the request of the ID transmission requesting apparatus. The ID transmitting circuit transmits the received collation ID to the pneumatic pressure sensor. The ID used in the collation in the pneumatic tire pressure monitoring control can be easily registered between the pneumatic tire pressure monitoring apparatus and the pneumatic pressure sensor. As a result, in the case of exchanging pneumatic pressure sensors or in the case of rotating the position of the tires, the ID registration can be accurately performed.

The ID collation system of the present invention is not limited to the above-described vehicle control system and accordingly can be applied, for example, to the ID registra-

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tion of an electronic key in a contactless lock/unlock system for an entrance door of a house. Furthermore, it is needless to say that the ID collation system of the present invention can be also applied to various control systems other than vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description which is to be read in conjunction with the accompanying drawings, in which:

FIG. **1** is a flowchart showing the procedure of ID registration executed in an ID collating system in accordance with the present invention;

FIG. **2** is a block diagram showing a pneumatic tire pressure monitoring system in accordance with a first embodiment of the present invention;

FIG. **3**A is a flowchart showing pneumatic tire pressure detecting processing executed by a pneumatic tire pressure sensor of the pneumatic tire pressure monitoring system in accordance with the first embodiment of the present invention;

FIG. **3**B is a flowchart showing pneumatic tire pressure monitoring processing executed by a pneumatic tire pressure monitoring apparatus of the pneumatic tire pressure monitoring system in accordance with the first embodiment of the present invention;

FIG. **4** is a flowchart showing ID registration procedure in accordance with the first embodiment of the present invention;

FIG. **5** is a flowchart showing the contents of control processing executed in the pneumatic tire pressure monitoring apparatus to realize the ID registration procedure shown in FIG. **4**;

FIG. **6** is a flowchart showing the contents of control processing executed in the pneumatic tire pressure sensor to realize the ID registration procedure shown in FIG. **4**;

FIG. **7** is a block diagram showing a pneumatic tire pressure monitoring system in accordance with a second embodiment of the present invention;

FIG. **8** is a flowchart showing the contents of control processing relating to ID registration executed in the pneumatic tire pressure monitoring apparatus in accordance with the second embodiment of the present invention;

FIG. **9** is a flowchart showing the rest of the control processing relating to ID registration executed in the pneumatic tire pressure monitoring apparatus in accordance with the second embodiment of the present invention;

FIG. **10** is a block diagram showing a pneumatic tire pressure monitoring system including an ID registration tool in accordance with a third embodiment of the present invention;

FIG. **11** is a flowchart showing the contents of control processing of ID registration tool in accordance with the third embodiment of the present invention;

FIG. **12** is a flowchart showing the rest of the control processing of the ID registration tool in accordance with the third embodiment of the present invention;

FIG. **13** is a flowchart showing the contents of control processing executed in the pneumatic tire pressure monitoring system in accordance with the third embodiment of the present invention;

FIG. **14** is a flowchart showing the rest of the control processing executed in the pneumatic tire pressure monitoring system in accordance with the third embodiment of the present invention;

FIG. **15** is a block diagram showing a security control system in accordance with a fourth embodiment of the present invention;

FIG. **16** is a flowchart showing the contents of keyless entry processing in accordance with the fourth embodiment of the present invention;

FIG. **17** is a flowchart showing ID registration procedure in accordance with the fourth embodiment of the present invention;

FIG. **18** is a flowchart showing contents of control processing relating to ID registration to an electronic key executed by the security control system in accordance with a fourth embodiment of the present invention;

FIG. **19** is a flowchart showing the contents of control processing relating to ID registration executed by the electronic key in accordance with the fourth embodiment of the present invention;

FIG. **20** is a block diagram showing a conventional pneumatic tire pressure monitoring system; and

FIG. **21** is a flowchart showing the contents of conventional ID registration procedure.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be explained hereinafter with reference to attached drawings.

FIG. **2** is a block diagram showing a schematic arrangement of a pneumatic tire pressure monitoring system in accordance with a first embodiment of the present invention. As shown in FIG. **2**, the pneumatic tire pressure monitoring system includes a plurality of pneumatic pressure sensors (i.e., transmitters) **10**, **20**, **30**, and **40**, and a pneumatic tire pressure monitoring apparatus (i.e., receiver) **50** equipped in a vehicle body. The pneumatic pressure sensor **10** includes an air pressure sensor **11** detecting the air pressure of a tire, an ID memory **12** storing a registered sensor ID, a transmit/receive circuit **13**, a power source battery **14**, a control unit **15**, and a transmit/receive antenna **16**. The pneumatic pressure sensor **20** includes an air pressure sensor **21** detecting the air pressure of a tire, an ID memory **22** storing a registered sensor ID, a transmit/receive circuit **23**, a power source battery **24**, a control unit **25**, and a transmit/receive antenna **26**. The pneumatic pressure sensor **30** includes an air pressure sensor **31** detecting the air pressure of a tire, an ID memory **32** storing a registered sensor ID, a transmit/receive circuit **33**, a power source battery **34**, a control unit **35**, and a transmit/receive antenna **36**. And, the pneumatic pressure sensor **40** includes an air pressure sensor **41** detecting the air pressure of a tire, an ID memory **42** storing a registered sensor ID, a transmit/receive circuit **43**, a power source battery **44**, a control unit **45**, and a transmit/receive antenna **46**.

Compared with a conventional pneumatic pressure sensor **110** shown in FIG. **20**, the pneumatic pressure sensors **10**, **20**, **30**, and **40** of this embodiment is characterized in that the transmit/receive circuits **13**, **23**, **33**, and **43** have the capability of not only transmitting information, data, and signals but also receiving the same. It is needless to say that the transmit/receive antennas **16**, **26**, **36**, and **46** are for transmitting and receiving the information, data, and signals. Each of the transmit/receive antennas **16**, **26**, **36**, and **46** is a mouth piece of a valve through which the air is introduced into a tire. Each of ID memories **12**, **22**, **32**, and **42** is an EEPROM (i.e., Electrically Erasable and Programmable Read Only Memory) or a comparable rewritable memory

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element which is nonvolatile and has an overwriting function for renewing the data stored therein.

The pneumatic tire pressure monitoring apparatus **50** includes a transmit/receive circuit **51**, a transmit/receive antenna **52**, a power source circuit **53**, a control unit **54**, a memory **55**, and a communication circuit **56**. The communication circuit **56** is connected a via signal line **57** to a display unit **81** such as an indicator or LED to transmit display data to the display unit **81**. The communication circuit **56** also has a function of receiving a signal representing the display condition from the display unit **81**. A vehicle battery **82**, supplying electric power, is connected to the pneumatic tire pressure monitoring apparatus **50**. The memory **55** stores a receiver ID assigned inherently to the pneumatic tire pressure monitoring apparatus **50**.

According to the pneumatic tire pressure monitoring apparatus **50**, as shown in FIG. **3**A, respective pneumatic pressure sensors **10**, **20**, **30**, and **40** detect the air pressure of a corresponding tire (step S**11**), read the sensor ID registered in their associated ID memories **12**, **22**, **32**, and **42** (step S**12**), produce transmission information as a combination of a detected pressure signal and the sensor ID (step S**13**), and transmit this transmission information as a signal of predetermined frequency at predetermined time intervals (step S**14**). The pneumatic tire pressure monitoring apparatus **50**, as shown in FIG. **3**B, checks whether or not the signal of predetermined frequency is received (step S**21**). When the signal of predetermined frequency is received (i.e., YES in step S**21**), the pneumatic tire pressure monitoring apparatus **50** extracts the sensor ID from the received signal (step S**22**), and compares the extracted sensor ID with a collation ID registered beforehand in the memory **55** to check whether or not the received signal is transmitted from any one of the sensors **10**, **20**, **30**, and **40** equipped in its own vehicle (step S**23**). When the received signal is a signal transmitted from any one of the sensors **10**, **20**, **30**, and **40** equipped in the own vehicle (i.e., YES in step S**23**), the pneumatic tire pressure monitoring apparatus **50** compares a momentary tire pressure P calculated based on the pressure signal contained in the received signal with a predetermined judgment value P**0** (step S**24**). When the momentary tire pressure P is less than the judgment value P**0** (i.e., YES in step P**24**), the pneumatic tire pressure monitoring apparatus **50** recognizes that the tire pressure is in the abnormal condition and causes the display unit **81** to indicate the state of abnormal pressure (step S**25**). When the judgment is NO in each of the steps S**21**, S**23**, and S**24**, the pneumatic tire pressure monitoring processing is terminated.

According to this embodiment, the collation ID used in the above pneumatic tire pressure monitoring processing is the receiver ID assigned inherently to the pneumatic tire pressure monitoring apparatus **50**. This receiver ID is registered as a transmitter ID in each of the pneumatic pressure sensors **10**, **20**, **30**, and **40**.

The ID registration is performed in accordance with the procedure shown in the flowchart of FIG. **4**.

First of all, the pneumatic tire pressure monitoring apparatus **50** is switched into an ID transmission mode (step S**110**). Respective pneumatic pressure sensors **10**, **20**, **30**, and **40** are switched into an ID registration mode (step S**120**). Then, the pneumatic tire pressure monitoring apparatus **50** transmits the receiver ID (step S**130**). The receiver ID having been thus transmitted from the monitoring apparatus **50** is received by respective sensors **10**, **20**, **30**, and **40** (step S**140**). The received receiver ID is registered as a transmitter ID in the ID memories **12**, **22**, **32**, and **42** of respective sensors **10**, **20**, **30**, and **40**, respectively (step S**150**). The above processing in the steps S**140** and S**150** is repeated until the ID registration of all sensors **10**, **20**, **30**, and **40** is accomplished (step S**160**). After the ID registration of respective sensors **10**, **20**, **30**, and **40** is accomplished (i.e., YES in step S**160**), the sensors **10**, **20**, **30**, and **40** are returned to the ordinary mode (step S**170**). The monitoring apparatus **50** is returned to the ordinary mode, too (step S**180**). Thus, the ID registration is accomplished.

Next, the contends of a program installed in the pneumatic tire pressure monitoring apparatus **50** to execute the above-described ID registration will be explained with reference to the flowchart shown in FIG. **5**. Depressing a predetermined button provided on an operation panel of the pneumatic tire pressure monitoring apparatus **50** runs the following program. The depression of this button also makes the pneumatic tire pressure monitoring apparatus **50** change its operation from the ordinary mode to the ID transmission mode.

As shown in FIG. **5**, the ID transmission mode processing includes transmission of a trigger signal for switching respective sensors **10**, **20**, **30**, and **40** into the ID registration mode (step S**210**). The frequency of this trigger signal is identical with that used in the pneumatic tire pressure monitoring processing explained with reference to FIG. **3**. Next, the receiver ID registered in the memory **55** is read out (step S**220**). The readout receiver ID is transmitted as a signal having the same frequency as that used in the pneumatic tire pressure monitoring processing (step S**230**). Then, it is checked whether or not a reply with respect to completion of the ID registration has arrived from respective sensors **10**, **20**, **30**, and **40** (step S**240**). When no reply has arrived during a predetermined period of time (i.e., NO in step S**240**), the control procedure returns to the above step S**220**. On the other hand, when the reply with respect to completion of the ID registration has arrived (i.e., YES in step S**240**), a return trigger signal for returning respective sensors **10**, **20**, **30**, and **40** to the ordinary mode is transmitted (step S**250**). The monitoring apparatus **50** is changed to the ordinary mode (step S**260**). Thus, the ID transmission mode processing is accomplished.

Next, the contents of the control processing executed in respective sensors **10**, **20**, **30**, and **40** will be explained. According to this control processing, as shown in FIG. **6**, it is first checked whether or not the trigger signal for switching the operation into the ID registration mode has been received (step S**310**). When no trigger signal is received (i.e., NO in step S**310**), this control processing is terminated. When the trigger signal is received (i.e., YES in step S**310**), each of respective sensors **10**, **20**, **30**, and **40** is switched into the ID registration mode (step S**320**). Then, it is checked whether or not the ID has been received (step S**330**). When the sensors **10**, **20**, **30**, and **40** have received the ID (i.e., YES in step S**330**), the received ID is registered as sensor ID, i.e., transmitter ID, in their ID memories **12**, **22**, **32**, and **42**, respectively (step S**340**). Then, the completion notice of the ID registration is returned (step S**350**). This notice is returned as a signal combined with the transmitter ID registered in the above step S**340**. Thereafter, it is checked whether or not the return trigger signal for returning the operation to the ordinary mode has been received (step S**360**). When the return trigger signal has been received (i.e., YES in step S**360**), the sensors **10**, **20**, **30**, and **40** are returned to the ordinary mode (step S**370**). Thus, the control processing of respective sensors **10**, **20**, **30**, and **40** is accomplished.

In the above step S**340**, the ID registration is executed in such a manner to overwrite a previous ID having been

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already registered in respective ID memories **12**, **22**, **32**, and **42**. Accordingly, in an event that exchange or position rotation of tires is performed, a new ID to be re-registered in respective sensors **10**, **20**, **30**, and **40** as well as in the monitoring apparatus **50** is newly issued by a repair shop or by a dealer.

According to this embodiment, as a result of the above-described control processing executed in the pneumatic tire pressure monitoring apparatus **50** and also in respective pneumatic pressure sensors **10**, **20**, **30**, and **40**, it becomes possible to register the transmitter ID based on the receiver ID. As a result that the transmitter ID agrees with the receiver ID, it becomes possible to easily register a correct transmitter ID to the pneumatic pressure sensor of a newly installed tire by executing the above-described control processing in the case that the tires are exchanged due to puncture or other reasons.

Next, a second embodiment of the present invention will be explained. The pneumatic tire pressure monitoring system in accordance with the second embodiment is similar to the above-described monitoring system of the first embodiment but is different in that respective tire houses are equipped with transmitters **91**, **92**, **93**, and **94** as shown in FIG. **7**. These transmitters **91**, **92**, **93**, and **94** are connected to the transmit/receive circuit **51** of the pneumatic tire pressure monitoring apparatus **50** via signal lines.

The contents of the program installed in the pneumatic tire pressure monitoring system **50** in accordance with the second embodiment will be explained with reference to the flowcharts shown in FIGS. **8** and **9**.

First, as shown in FIG. **8**, the trigger signal for switching respective pneumatic pressure sensors **10**, **20**, **30**, and **40** into the ID registration mode is transmitted (step **S410**). This trigger signal is transmitted via the transmitters **91**, **92**, **93**, and **94** provided in the tire houses. Next, the receiver ID is read out from the memory **55** (step **S420**). Then, the readout receiver ID is modified into a total of four code data by adding each of lower-bit data of '00', '01', '10', and '11' (step **S430**). The code data including the lower-bit '00' is registered as front-left wheel collation ID (i.e., FLID) into the memory **55** (step **S440**). The code data including the lower-bit '01' is registered as rear-left wheel collation ID (i.e., RLID) into the memory **55** (step **S450**). The code data including the lower-bit '10' is registered as rear-right wheel collation ID (i.e., RRID) into the memory **55** (step **S460**). And, the code data including the lower-bit '11' is registered as front-right wheel collation ID (i.e., FRID) into the memory **55** (step **S470**).

Then, as shown in FIG. **9**, the collation ID 'FLID' corresponding to the front-left wheel's pneumatic pressure sensor is read out from the memory **55** and is transmitted to the transmitter **91** provided in the tire house of the front-left wheel (**S510**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **10** attached to the front-left wheel (step **S520**). When no notice is returned from the sensor **10** within a predetermined period of time (i.e., NO in step **S520**), the control procedure returns to the above step **S510**. When the completion notice of the ID registration is returned from the sensor **10** (i.e., YES in step **S520**), the collation ID 'RLID' corresponding to the rear-left wheel's pneumatic pressure sensor is read out from the memory **55** and is transmitted to the transmitter **92** provided in the tire house of the rear-left wheel (**S530**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **20** attached to the rear-left wheel (step **S540**). When no notice is returned from the sensor **20** within a predetermined period of time (i.e., NO in step **S540**), the control procedure returns to the above step **S530**. When the completion notice of the ID registration is returned from the sensor **20** (i.e., YES in step **S540**), the collation ID 'RRID' corresponding to the rear-right wheel's pneumatic pressure sensor is read out from the memory **55** and is transmitted to the transmitter **93** provided in the tire house of the rear-right wheel (**S550**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **30** attached to the rear-right wheel (step **S550**). When no notice is returned from the sensor **30** within a predetermined period of time (i.e., NO in step **S560**), the control procedure returns to the above step **S550**. When the completion notice of the ID registration is returned from the sensor **30** (i.e., YES in step **S560**), the collation ID 'FRID' corresponding to the front-right wheel's pneumatic pressure sensor is read out from the memory **55** and is transmitted to the transmitter **94** provided in the tire house of the rear-right wheel (**S570**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **40** attached to the front-right wheel (step **S580**). When no notice is returned from the sensor **40** within a predetermined period of time (i.e., NO in step **S580**), the control procedure returns to the above step **S570**. When the completion notice of the ID registration is returned from the sensor **40** (i.e., YES in step **S580**), the return trigger signal for returning respective pneumatic pressure sensors **10**, **20**, **30**, and **40** to the ordinary mode is transmitted to respective transmitters **91**, **92**, **93**, and **94** (step **S590**). The monitoring apparatus **50** is also returned to the ordinary mode (step **S600**). Thus, the ID transmission mode processing is accomplished.

The program installed in respective pneumatic pressure sensors **10**, **20**, **30**, and **40** is similar to that of the first embodiment. According to the second embodiment, in addition to the effects of the first embodiment, it becomes possible to register the transmitter ID specifying the wheel position because the receiver IDs of respective sensors **10**, **20**, **30**, and **40** include the lower-bit data representing the wheel position. Accordingly, the monitoring result with respect to the pneumatic tire pressure can be shown together with the wheel position on the monitor. As the receiver ID is simply produced by adding two lower bits, it is possible to suppress the bit number of the data constituting the transmitter ID.

Next, a third embodiment of the present invention will be explained with reference to FIG. **10**. The pneumatic tire pressure monitoring system in accordance with the third embodiment includes an ID registration tool **60** in addition to the pneumatic pressure sensors **10**, **20**, **30**, and **40** and the pneumatic tire pressure monitoring apparatus **50** which are already explained in the first embodiment.

As shown in FIG. **10**, the ID registration tool **60** includes an ID receiving section **61** and an ID transmitting section **62**. The ID receiving section **61** receives the transmitter ID of each wheel produced based on the receiver ID by the pneumatic tire pressure monitoring apparatus **50**. The ID transmitting section **62** transmits the transmitter ID, received by the ID receiving section **61**, to respective pneumatic pressure sensors **10**, **20**, **30**, and **40**. Furthermore, the ID registration tool **60** has connectors **64** and **64***a*–**64***d* of signal lines **63** and **63***a*–**63***d* connecting the ID registration tool **60** to the pneumatic tire pressure monitoring apparatus **50** and to respective pneumatic pressure sensors **10**, **20**, **30**, and **40**. The signal lines **63** and **63***a*–**63***d* have front ends each being configured into an alligator clip which are detachably con-

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nected to the signal line **57** extending from the communication circuit **56** of the pneumatic tire pressure monitoring apparatus **50** to the display unit **81** and to antennas **16**, **26**, **36**, and **46** of the pneumatic pressure sensors **10**, **20**, **30**, and **40**.

Furthermore, the ID registration tool **60** includes a control unit **65**, a memory **66**, a power source battery **67**, an operation panel **68**, and a display unit **69**. The control unit **65**, constituted by a microcomputer including CPU, ROM, and RAM, performs the controls of various processes to be executed through the ID registration tool **60**. The memory **66** is an EEPROM (i.e., electrically erasable and programmable ROM) or a flash memory, and a DRAM (i.e., dynamic RAM). The power source battery **67** is a dry cell, a button cell or the like. The operation panel **68** is equipped with operation keys allowing an operator to instruct the contents of the processing to be executed through the ID registration tool **60**. The display unit **69**, for example constituted by an LCD, displays ID data received by the ID receiving section **61** or displays the operation mode of the ID registration tool **60**.

The contents of the program installed in the ID registration tool **60** in accordance with the third embodiment will be explained with reference to the flowcharts shown in FIGS. **11** and **12**.

Depressing a predetermined button provided on the operation panel **68** of the ID registration tool **60** runs the following program. According to this program, as shown in FIG. **11**, the trigger signal for switching the pneumatic tire pressure monitoring apparatus **50** into the ID transmission mode is transmitted (step S**710**). Furthermore, the trigger signal for switching respective pneumatic pressure sensors **10**, **20**, **30**, and **40** into the ID registration mode is transmitted (step S**720**).

Next, a command instructing transmission of the transmitter ID of the front left wheel (i.e., FLID) is transmitted to the pneumatic tire pressure monitoring apparatus **50** (step S**730**). When the FLID is received from the monitoring apparatus **50** (i.e., YES in step S**740**), the received data (i.e., FLID) is stored in the memory **66** in connection with the corresponding tire position FL (step S**750**). Next, a command instructing transmission of the transmitter ID of the rear left wheel (i.e., RLID) is transmitted to the pneumatic tire pressure monitoring apparatus **50** (step S**760**). When the RLID is received from the monitoring apparatus **50** (i.e., YES in step S**770**), the received data (i.e., RLID) is stored in the memory **66** in connection with the corresponding tire position RL (step S**780**). Next, a command instructing transmission of the transmitter ID of the rear right wheel (i.e., RRID) is transmitted to the pneumatic tire pressure monitoring apparatus **50** (step S**790**). When the RRID is received from the monitoring apparatus **50** (i.e., YES in step S**800**), the received data (i.e., RRID) is stored in the memory **66** in connection with the corresponding tire position RR (step S**810**). Next, a command instructing transmission of the transmitter ID of the front right wheel (i.e., FRID) is transmitted to the pneumatic tire pressure monitoring apparatus **50** (step S**820**). When the FRID is received from the monitoring apparatus **50** (i.e., YES in step S**830**), the received data (i.e., FRID) is stored in the memory **66** in connection with the corresponding tire position FR (step S**840**). Then, the return trigger signal is sent to the pneumatic tire pressure monitoring apparatus **50** to return its operation to the ordinary mode (step S**850**).

Next, as shown in FIG. **12**, the FLID is read out from the memory **66** and is transmitted to the pneumatic pressure sensor **10** of the front left wheel (step S**910**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **10** (step S**920**). When no notice is returned from the sensor **10** within a predetermined period of time (i.e., NO in step S**920**), the control procedure returns to the above step S**910**. When the completion notice of the ID registration is returned from the sensor **10** (i.e., YES in step S**920**), the RLID is read out from the memory **66** and is transmitted to the pneumatic pressure sensor **20** of the rear left wheel (step S**930**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **20** (step S**940**). When no notice is returned from the sensor **20** within a predetermined period of time (i.e., NO in step S**940**), the control procedure returns to the above step S**930**. When the completion notice of the ID registration is returned from the sensor **20** (i.e., YES in step S**940**), the RRID is read out from the memory **66** and is transmitted to the pneumatic pressure sensor **30** of the rear right wheel (step S**950**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **30** (step S**960**). When no notice is returned from the sensor **30** within a predetermined period of time (i.e., NO in step S**960**), the control procedure returns to the above step S**950**. When the completion notice of the ID registration is returned from the sensor **30** (i.e., YES in step S**960**), the FRID is read out from the memory **66** and is transmitted to the pneumatic pressure sensor **40** of the front right wheel (step S**970**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **40** (step S**980**). When no notice is returned from the sensor **40** within a predetermined period of time (i.e., NO in step S**980**), the control procedure returns to the above step S**970**. When the completion notice of the ID registration is returned from the sensor **40** (i.e., YES in step S**980**), the return trigger signal is sent to respective pneumatic pressure sensors **10**, **20**, **30**, and **40** to return their operation to the ordinary mode (step S**990**).

Next, the contents of the control processing executed in the pneumatic tire pressure monitoring apparatus **50** will be explained with reference to the flowcharts shown in FIGS. **13** and **14**. First, it is checked whether or not the trigger signal for switching the operation to the ID transmission mode has been received (step S**1000**). When no trigger signal is not received (i.e., NO in step S**1000**), this processing is terminated. When the trigger signal is received (i.e., YES in step S**1000**), the pneumatic tire pressure monitoring apparatus **50** is switched into the ID transmission mode (step S**1010**). Then, the receiver ID is read out from the memory **55** (step S**1020**). Then, the readout receiver ID is modified into a total of four code data by adding each of lower-bit data of '00', '01', '10', and '11' (step S**1030**). The code data including the lower-bit '00' is registered as front-left wheel collation ID (i.e., FLID) into the memory **55** (step S**1040**). The code data including the lower-bit '01' is registered as rear-left wheel collation ID (i.e., RLID) into the memory **55** (step S**1050**). The code data including the lower-bit '10' is registered as rear-right wheel collation ID (i.e., RRID) into the memory **55** (step S**1060**). And, the code data including the lower-bit '11' is registered as front-right wheel collation ID (i.e., FRID) into the memory **55** (step S**1070**).

Next, it is checked whether or not the command instructing transmission of the front left wheel's transmitter ID 'FLID' has been received (step S**1110**). When this command has been received (i.e., YES in step S**1110**), the FLID is read out from the memory **55** and is transmitted to the ID registration tool **60** (step S**1120**). Next, it is checked whether

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or not the command instructing transmission of the rear left wheel's transmitter ID 'RLID' has been received (step **S1130**). When this command has been received (i.e., YES in step **S1130**), the RLID is read out from the memory **55** and is transmitted to the ID registration tool **60** (step **S1140**). Next, it is checked whether or not the command instructing transmission of the rear right wheel's transmitter ID 'RRID' has been received (step **S1150**). When this command has been received (i.e., YES in step **S1150**), the RRID is read out from the memory **55** and is transmitted to the ID registration tool **60** (step **S1160**). Next, it is checked whether or not the command instructing transmission of the front right wheel's transmitter ID 'FRID' has been received (step **S1170**). When this command has been received (i.e., YES in step **S1170**), the FRID is read out from the memory **55** and is transmitted to the ID registration tool **60** (step **S1180**). Then, it is checked whether or not the return trigger signal for returning the operation to the ordinary mode has been received (step **S1190**). When the return trigger signal is received (i.e., YES in step **S1190**), the pneumatic tire pressure monitoring apparatus **50** is returned to the ordinary mode (step **S1200**). Thus, the ID transmission mode processing is accomplished.

The program installed in respective pneumatic pressure sensors **10**, **20**, **30**, and **40** is similar to that of the first embodiment. According to the third embodiment, in addition to the effects of the first embodiment, it becomes possible to register the ID data of respective pneumatic pressure sensors in connection with their tire positions FL, RL, RR and FR as a result of the above-described control processing executed by the combination of the ID registration tool **60**, the pneumatic tire pressure monitoring apparatus **50**, and respective pneumatic pressure sensors **10**, **20**, **30** and **40**. Thus, it becomes possible to eliminate erroneous registration caused by interference in radio data transmission or prevent other radio waves from interrupting the ID registration. Furthermore, in the case that tires are exchanged, executing the above-described control processing for the exchanged sensor makes it possible to correctly register a collation ID stored in the monitoring apparatus **50** to the sensor of a newly installed tire. Furthermore, in the case of performing the position rotation of the tires, the ID registration can be repetitively and accurately performed in accordance with the changed tire position.

Next, a fourth embodiment of the present invention will be explained. The pneumatic tire pressure monitoring system in accordance with the fourth embodiment is associated with a keyless entry apparatus so as to function as a security control system. The keyless entry apparatus allows a car user carrying an electronic key to lock/unlock the vehicle door without directly touching the door. As shown in FIG. **15**, the security control system of the fourth embodiment includes the pneumatic pressure sensors (transmitters) **10**, **20**, **30**, and **40** attached to respective tires, a security ECU (electronic control unit) **100** installed in the vehicle body, door ECUs **210**, **220**, **230**, and **240** equipped in respective doors, transmitter antennas **250**, **260**, **270**, and **280** provided in respective doors, a receiver antenna **290**, the display unit **81**, and an electronic key **200**. The pneumatic pressure sensors **10**, **20**, **30**, and **40** are identical in arrangement with those disclosed in the first embodiment.

The security ECU **100** includes a transmit/receive circuit **101**, CPU **102**, RPM **103**, RAM **104**, EEPROM **105**, a power source circuit **106**, and an input/output circuit **107**. The display unit **81** and the door ECUs **210**, **220**, **230**, and **240** are connected to the input/output interface **107** of the security ECU **100**. The transmitter antennas **250**, **260**, **270**, and **280** and the receiver antenna **290** are connected to the transmit/receive circuit **101**. An ID assigned inherently to this security ECU **100**, i.e., receiver ID, is stored in the ROM **103**.

The electronic key **200** is, for example, a compact electronic unit installed at the top of a vehicle key to be inserted into a key cylinder. The electronic key **200** incorporates EEPROM, CPU or the like to register its ID and is constituted so as to execute radio (or wireless) transmit/receive operation of information or data.

The security control system not only functions as the pneumatic tire pressure monitoring system which executes the control processing shown in FIG. **3** but also functions as the keyless entry system which executes the control processing shown in FIG. **16**. According to the keyless entry processing shown in FIG. **16**, a request signal having a predetermined frequency is transmitted at predetermined time intervals (step **S1310**). The generation of this request signal is for confirming whether or not the authorized electronic key **200** exists within a predetermined peripheral area of the vehicle. Then, it is checked whether or not the receiver antenna **290** has received an acknowledge signal (ACK) corresponding to this request signal within the predetermined time (step **S1320**). When no ACK is received (i.e., NO in step **S1320**), this processing is terminated. On the other hand, when the ACK is received (i.e., YES in step **S1320**), the receiving processing starts by transmitting a request signal requesting transmission of a key ID used in the key collation (step **S1330**). When the key ID in response to this request signal is received (i.e., YES in step **S1340**), the key collation is executed (step **S1350**). When the detected electronic key **200** is an authorized one (i.e., YES in step **S1350**), predetermined keyless entry operation is executed (step **S1360**). The keyless entry operation includes check of a human sensor provided in the vicinity of a door handgrip, judgment of lock/unlock to be executed, and generation of a control command to the door ECU **210** or others based on the judgment result.

According to this embodiment, the receiver ID assigned inherently to the security ECU **100** is commonly used as collation ID for the pneumatic tire pressure monitoring processing and for the keyless entry processing. Accordingly, the receiver ID of the security ECU **100** is registered as transmitter ID of respective sensors **10**, **20**, **30**, and **40** and of the electronic key **200**. The registration procedure for the pneumatic pressure sensors **10**, **20**, **30**, and **40** is identical with that already explained in the first embodiment. Regarding the electronic key **200**, the transmitter ID is registered in the following manner.

FIG. **17** shows the ID registration procedure for the electronic key **200**. First of all, the security ECU **100** is switched into the ID transmission mode (step **S1410**). Next, the electronic key **200** is switched into the ID registration mode (step **S1420**). Then, the security ECU **100** transmits the receiver ID (step **S1430**). The electronic key **200** receives the receiver ID being thus transmitted from the security ECU **100** (step **S1440**). The electronic key **200** registers the received receiver ID as its transmitter ID and stores the registered transmitter ID into EEPROM (step **S1450**). When the ID registration of the electronic key **200** is accomplished (YES in step **S1460**), the electronic key **200** resumes the ordinary mode (step **S1470**) and the security ECU **100** resumes the ordinary mode (step **S1480**). Thus, the ID registration processing is accomplished.

Next, the program installed in the security ECU **100** for executing the above-described registration processing will be explained with reference to the flowchart shown in FIG. **18**. Depressing a predetermined button provided on an

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operation panel of the security ECU **100** runs the following program. The depression of this button also makes the security ECU **100** change its operation from the ordinary mode to the ID transmission mode.

As shown in FIG. **18**, the ID transmission mode processing for the electronic key **200** includes transmission of a trigger signal for switching the electronic key **200** into the ID registration mode (step **S1510**). The frequency of this trigger signal is identical with that used in the keyless entry processing explained with reference to FIG. **16**. Next, the receiver ID registered in the ROM **103** is read out (step **S1520**). Then, a predetermined bit number of code data is added to the readout receiver ID to produce a transmitter ID 'KEYID' for the electronic key **200** (step **S1530**). The predetermined bit number of code data being thus included in the transmitter ID 'KEYID' is for discriminating the transmitter ID 'KEYID' from the transmitter IDs assigned to respective pneumatic pressure sensors explained in the above-described second embodiment. The transmitter ID 'KEYID' of the electronic key **200** is registered in the EEPROM **105** (step **S1540**). The KEYID is transmitted as a signal having the same frequency as that used in the keyless entry processing (step **S1550**). Then, it is checked whether or not a reply with respect to completion of the ID registration has arrived from the electronic key **200** (step **S1560**). When no reply has arrived during a predetermined period of time (i.e., NO in step **S1560**), the control procedure returns to the above step **S1520**. On the other hand, when the reply with respect to completion of the ID registration has arrived (i.e., YES in step **S1560**), a return trigger signal for returning the electronic key **200** to the ordinary mode is transmitted (step **S1570**). The security ECU **100** is returned to the ordinary mode (step **S1580**). Thus, the ID transmission mode processing for the electronic key **200** is accomplished.

Next, the control processing executed in the electronic key **200** will be explained with reference to FIG. **19**. First of all, it is checked whether or not the trigger signal for switching the operation into the ID registration mode has been received (step **S1610**). When no trigger signal is received (i.e., NO in step **S1610**), this control processing is terminated. When the trigger signal is received (i.e., YES in step **S1610**), the electronic key **200** is changed into the ID registration mode (step **S1620**). Then, it is checked whether or not the KEYID has been received (step **S1630**). When the KEYID is received (i.e., YES in step **S1630**), the received KEYID is registered as key ID, i.e. transmitter ID, in the EEPROM (step **S11640**). Then, the completion notice of the ID registration is returned (step **S1650**). This notice is returned as a signal combined with the KEYID registered in the above step **S1640**. Thereafter, it is checked whether or not the return trigger signal for returning the operation to the ordinary mode has been received (step **S1660**). When the return trigger signal has been received (i.e., YES in step **S1660**), the electronic key **200** is returned to the ordinary mode (step **S1670**). Thus, the control processing of the electronic key **200** is accomplished.

As a result of the above-described control processing executed in the security ECU **100** and the electronic key **200**, the fourth embodiment makes it possible to register the transmitter ID (i.e., KEYID) of the electronic key **200** based on the receiver ID of the security ECU **100**. Furthermore, the KEYID of the electronic key **200** is identical with the receiver ID of the security ECU **100** except for the bit data added to discriminate the type of the transmitter. Thus, it becomes possible to commonly perform the collation processing for the pneumatic tire pressure monitoring system and for the keyless entry system. The software can be simplified. Especially, directly registering the receiver ID to the pneumatic pressure sensors **10**, **20**, **30**, and **40** and to the electronic key **200** is effective in realizing more simplified system. Furthermore, using the common transmitter ID in two different systems is effective in reducing the required bit number of the transmitter ID.

The present invention is not limited to the above-described embodiments and therefore can be modified in various ways without departing from the scope of the invention.

For example, the present invention can be applied to a vehicle equipped with only a keyless entry system. Furthermore, when the ID registration tool **60** is used, it is possible to execute wireless processing for receiving the transmitter ID between the pneumatic tire pressure monitoring apparatus **50** and the ID registration tool **60** without providing the signal line connecting them. In this case, the ID registration tool **60** transmits the transmitter ID to respective pneumatic pressure sensors **10**, **20**, **30**, and **40** by wireless.

Furthermore, when the control processing is performed based on information from a transmitter in a vehicle control other than the pneumatic tire pressure monitoring system or the keyless entry system, the collation ID of a receiver may be equalized with that of the transmitter. In such a case, the present invention is preferably employable as a vehicle control system. Meanwhile, the present invention can be also applied to ID registration for a system other than the vehicle.

Furthermore, the ID registered in the transmitter needs not be based on the receiver ID. For example, the purpose of the present invention is accomplished by transmitting a collation ID registered in the receiver to the transmitter and registering it as transmitter ID. Namely, the present invention differs from the conventional ID registration method according to which the ID of a transmitter is registered in a receiver. According to the present invention, the ID information registered in a receiver is registered in a transmitter. The ID registration according to the present invention is superior to the conventional method in that the ID registration can be accurately performed between the transmitter and the receiver even in the case that an additional transmitter is newly added or the transmitter is modified.

What is claimed is:

1. An ID registration method for an ID collation system which includes a receiver receiving information transmitted from a transmitter, comprising the steps of:

causing said receiver to transmit a collation ID to said transmitter;

causing said transmitter to receive said collation ID transmitted from said receiver and register the received collation ID as a registered ID of said transmitter;

causing said transmitter to produce transmission information including said registered ID of said transmitter and transmit said transmission information to said receiver;

causing said receiver to receive said transmission information and compare said registered ID included in said transmission information with said collation ID stored in said receiver to check whether or not said transmission information is transmitted from said transmitter; and

causing said receiver to perform predetermined processing according to said transmission information when said transmission information is transmitted from said transmitter.

2. An ID collation system comprising:

a transmitter for transmitting information including a registered ID;

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a receiver for receiving the information transmitted from said transmitter;

a control apparatus for checking the registered ID contained in the information received by the receiver and performing predetermined processing according to said information based on a check result of the registered ID;

a transmitter mode switching apparatus for switching said transmitter into an ID registration mode; and

a receiver mode switching apparatus for switching said receiver into an ID transmission mode,

wherein said receiver comprises an ID transmitting apparatus for transmitting a collation ID used in ID checking when the receiver is switched into the ID transmission mode by said receiver mode switching apparatus, and

said transmitter comprises an ID receiving apparatus for receiving the collation ID transmitted from said receiver when said transmitter is switched into the ID registration mode by said transmitter mode switching apparatus, and an ID registration apparatus for registering the collation ID received by said ID receiving apparatus as the registered ID of said transmitter.

3. A vehicle control system comprising:

a transmitter installed in a vehicle for transmitting information including a registered ID which is required to control a device installed in the vehicle;

a receiver installed in the vehicle for receiving the information transmitted from said transmitter;

a control apparatus for checking the registered ID contained in the information received by the receiver with reference to a collation ID and executing control of said device according to said information based on a check result of the registered ID;

a transmitter mode switching apparatus for switching said transmitter into an ID registration mode; and

a receiver mode switching apparatus for switching said receiver into an ID transmission mode,

wherein said receiver comprises an ID transmitting apparatus for transmitting said collation ID used in ID checking when said receiver is switched into the ID transmission mode by said receiver mode switching apparatus, and

said transmitter comprises an ID receiving apparatus for receiving said collation ID transmitted from said receiver when said transmitter is switched into the ID registration mode by said transmitter mode switching apparatus, and an ID registration apparatus for registering the collation ID received by said ID receiving apparatus as the registered ID of said transmitter,

wherein said device is a pneumatic air pressure monitoring apparatus for displaying monitoring result with respect to an air pressure of a tire installed in said vehicle,

said transmitter is incorporated in a pneumatic pressure sensor attached to said tire, and

said control apparatus executes control for the display of monitoring result with respect to the air pressure of the tire installed in said vehicle when the information received by said receiver is confirmed based on the result of ID checking as being transmitted from the pneumatic pressure sensor attached to said tire.

4. The vehicle control system in accordance with claim **3**, wherein said collation ID is transmitted to said transmitter via a transmitter antenna provided in a tire house of said vehicle.

5. A vehicle control system comprising:

a transmitter for transmitting information required to control a device installed in a vehicle;

a receiver installed in a vehicle body for receiving the information transmitted from said transmitter;

a control apparatus installed in the vehicle body for checking an ID contained in the information received by the receiver with reference to a collation ID and executing control of said device according to said information based on check result of ID;

a transmitter mode switching apparatus for switching said transmitter into an ID registration mode; and

a receiver mode switching apparatus for switching said receiver into an ID transmission mode,

wherein said receiver comprises an ID transmitting apparatus for transmitting said collation ID used in ID checking when said receiver is switched into the ID transmission mode by said receiver mode switching apparatus, and

said transmitter comprises an ID receiving apparatus for receiving said collation ID transmitted from said receiver when said transmitter is switched into the ID registration mode by said transmitter mode switching apparatus, and an ID registration apparatus for storing the collation ID received by said ID receiving apparatus as a registered ID of said transmitter,

wherein said device installed in a vehicle is a keyless entry apparatus for executing contactless lock/unlock of a vehicle door,

said transmitter is incorporated in an electronic key, and

said control apparatus executes the contactless lock/unlock of the vehicle door based on checking result of ID of the electronic key contained in the information received by said receiver.

6. A vehicle control system comprising:

a transmitter for transmitting information required to control a device installed in a vehicle;

a receiver installed in a vehicle body for receiving the information transmitted from said transmitter;

a control apparatus installed in the vehicle body for checking an ID contained in the information received by the receiver with reference to a collation ID and executing control of said device according to said information based on check result of ID;

a transmitter mode switching apparatus for switching said transmitter into an ID registration mode; and

a receiver mode switching apparatus for switching said receiver into an ID transmission mode,

wherein said receiver comprises an ID transmitting apparatus for transmitting said collation ID used in ID checking when said receiver is switched into the ID transmission mode by said receiver mode switching apparatus, and

said transmitter comprises an ID receiving apparatus for receiving said collation ID transmitted from said receiver when said transmitter is switched into the ID registration mode by said transmitter mode switching apparatus, and an ID registration apparatus for storing the collation ID received by said ID receiving apparatus as a registered ID of said transmitter,

wherein said device installed in a vehicle includes a pneumatic air pressure monitoring apparatus for displaying monitoring result with respect to an air pressure of a tire installed in said vehicle and a keyless entry apparatus for executing contactless lock/unlock of a vehicle door,

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said transmitter is incorporated in a pneumatic pressure sensor attached to said tire and also in an electronic key, and

said control apparatus executes control for the display of monitoring result with respect to the air pressure of the tire installed in said vehicle when the information received by said receiver is confirmed based on the result of ID checking as being transmitted from the pneumatic pressure sensor attached to said tire, and also executes the contactless lock/unlock of the vehicle door when the information received by said receiver is confirmed based on the result of ID checking as being transmitted from an authorized electronic key.

7. The vehicle control system in accordance with claim **3**, wherein said collation ID is determined based on an ID assigned inherently to said receiver.

8. The vehicle control system in accordance with claim **3**, wherein said collation ID is transmitted to said transmitter via a predetermined external device.

9. The vehicle control system in accordance with claim **8**, wherein said external device is detachably connected via a signal line to said receiver and to said transmitter.

10. The vehicle control system in accordance with claim **9**, wherein

said transmitter mode switching apparatus is provided in said transmitter while said receiver mode switching apparatus is provided in said receiver, and

said external device comprises a trigger signal transmitting apparatus which transmits a trigger signal for causing said transmitter mode switching apparatus to switch said transmitter into the ID registration mode and a trigger signal for causing said receiver mode switching apparatus to switch said receiver into the ID transmission mode.

11. A pneumatic tire pressure monitoring apparatus comprising:

a pneumatic pressure sensor for each tire of a particular vehicle for transmitting an air-pressure signal together with a sensor ID of said pneumatic pressure sensor;

a receiver installed in the particular vehicle for receiving the air-pressure signal together with the sensor ID from one of the pneumatic pressure sensors;

a control apparatus for checking whether or not the received sensor ID agrees with the collation ID determined based on an ID assigned inherently to said receiver, and for executing control for monitoring an air pressure of said tire relating to the pneumatic pressure sensor with reference to said air-pressure signal based on check result of the received sensor ID; and

a receiver mode switching apparatus for switching said receiver into an ID transmission mode,

wherein said receiver comprises an ID transmitting apparatus for transmitting the collation ID used in ID checking when said receiver is switched into the ID transmission mode by said receiver mode switching apparatus,

and wherein each of the pneumatic pressure sensors of the tires of the particular vehicle comprises an ID receiving apparatus for receiving the collation ID transmitted from said receiver, and an ID registration apparatus for registering the collation ID received by said ID receiving apparatus as the sensor ID of the pneumatic pressure sensor.

12. A pneumatic tire pressure sensor comprising:

a pressure sensor installed in a particular vehicle for detecting an air pressure of a tire of the particular vehicle;

a receiving circuit for receiving a collation ID transmitted from a pneumatic tire pressure monitoring apparatus of the particular vehicle;

a transmitter ID registering apparatus for registering said collation ID received via said receiving circuit as a transmitter ID;

an ID memory for storing the transmitter ID registered by said transmitter ID registering apparatus; and

a transmitting circuit for transmitting a signal of the air pressure of the tire detected by said pressure sensor together with the transmitter ID stored in said ID memory to the pneumatic tire pressure monitoring apparatus, the pneumatic tire pressure monitoring apparatus checking whether or not the signal of the air pressure is transmitted from said pressure sensor by comparing the transmitter ID with the collation ID, and performing predetermined processing according to the signal of the air pressure when the signal of the air pressure is transmitted from said pressure sensor.

13. The pneumatic tire pressure sensor in accordance with claim **12**, wherein

said receiving circuit receives a signal via a cable, and

said ID memory is a rewritable memory element having an overwriting function for renewing the data stored therein.

14. An ID registration tool for a pneumatic tire pressure monitoring system including a pneumatic pressure sensor attached to a tire of a vehicle and a pneumatic tire pressure monitoring apparatus installed in a vehicle body

wherein said ID registration tool comprises:

an ID transmission requesting apparatus for requesting said pneumatic tire pressure monitoring apparatus to transmit a collation ID used in ID checking;

an ID receiving circuit for receiving the collation ID transmitted from said pneumatic tire pressure monitoring apparatus in response to a request of said ID transmission requesting apparatus; and

an ID transmitting circuit for transmitting the collation ID received by said ID receiving circuit to said pneumatic pressure sensor, said pneumatic pressure sensor registering the collation ID transmitted by said ID transmitting circuit as a transmitter ID, said pneumatic pressure sensor transmitting an air-pressure signal together with the transmitter ID of said pneumatic pressure sensor to said pneumatic tire pressure monitoring apparatus, said pneumatic tire pressure monitoring apparatus receiving the air-pressure signal together with the transmitter ID, checking whether or not the received air-pressure signal is transmitted from said pneumatic pressure sensor by comparing the received transmitter ID with the collation ID, and monitoring an air pressure of the tire indicated by the air-pressure signal when the air-pressure signal is transmitted from said pneumatic pressure sensor.

15. The vehicle control system in accordance with claim **5**, wherein said collation ID is determined based on an ID assigned inherently to said receiver.

16. The vehicle control system in accordance with claim **6**, wherein said collation ID is determined based on an ID assigned inherently to said receiver.

17. The vehicle control system in accordance with any claim **5**, wherein said collation ID is transmitted to said transmitter via a predetermined external device.

18. The vehicle control system in accordance with claim **6**, wherein said collation ID is transmitted to said transmitter via a predetermined external device.

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19. The ID registration method in accordance with claim 1, wherein said collation ID is determined based on an ID assigned inherently to said receiver.

20. The ID registration method in accordance with claim 1, wherein said receiver is installed in a vehicle in which said transmitter is installed.

21. The ID registration method in accordance with claim 2, wherein said collation ID is determined based on an ID assigned inherently to said receiver.

22. The ID collation system in accordance with claim 2, wherein said receiver is installed in a vehicle in which said transmitter is installed.

23. The ID registration tool in accordance with claim 14, wherein said collation ID is determined based on an ID assigned inherently to said pneumatic tire pressure monitoring apparatus.

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(12) **United States Patent**
Lemense et al.

(10) **Patent No.: US 6,941,801 B2**
(45) **Date of Patent: Sep. 13, 2005**

(54) **TIRE PRESSURE MONITORING SYSTEM**

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(73) Assignee: **Lear Corporation**, Southfield, MI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 107 days.

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(22) Filed: **Dec. 19, 2003**

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(52) **U.S. Cl.** **73/146**; 340/440
(58) **Field of Search** 73/146–146.5; 340/440–444

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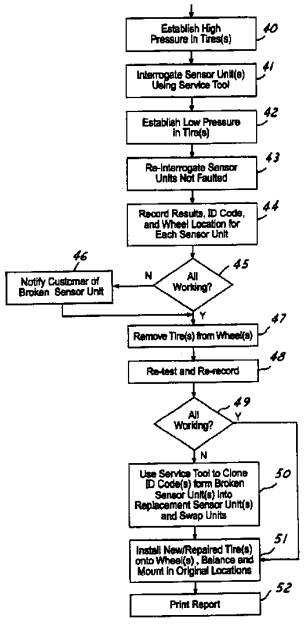
* cited by examiner

Primary Examiner—William Oen
Assistant Examiner—Alandra Ellington
(74) *Attorney, Agent, or Firm*—MacMillan, Sobanski & Todd, LLC

(57) **ABSTRACT**

A method is provided for replacing at least one tire of a vehicle on a first wheel in a first wheel position, the vehicle having a tire pressure monitoring system with a first sensor unit having a first ID code mounted to the first wheel. The first sensor unit is interrogated. Either a nominal result or a faulted result of the interrogation is detected. The at least one tire is removed from the first wheel. If the nominal result is detected during the interrogating step, then the first sensor unit is re-interrogated. Either a nominal result or a faulted result of the re-interrogation is detected. If either of the interrogation or the re-interrogation provide a faulted result then the first ID code is cloned into a replacement sensor unit and then the replacement sensor unit is swapped for the first sensor unit on the first wheel. A new tire is installed onto the first wheel. The first wheel is installed onto the vehicle in the first wheel position.

10 Claims, 2 Drawing Sheets



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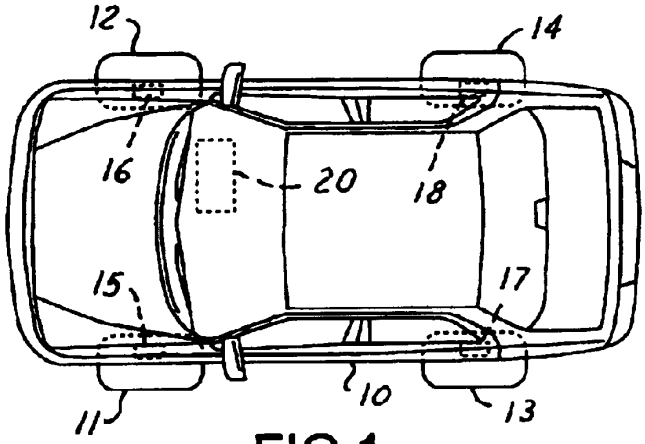


FIG.1

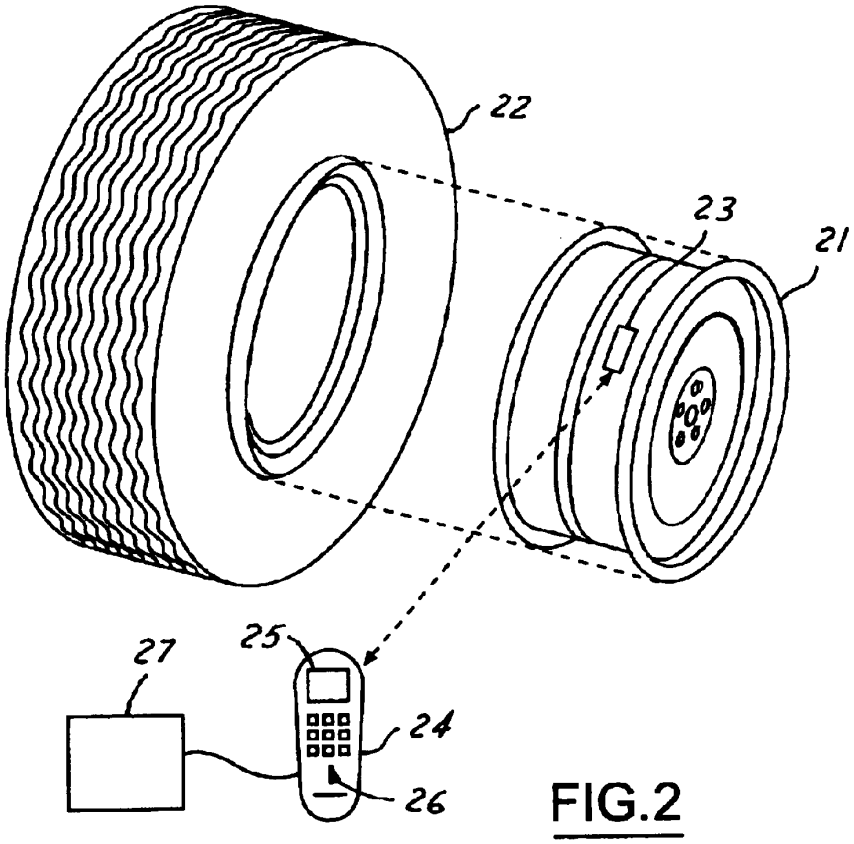


FIG.2

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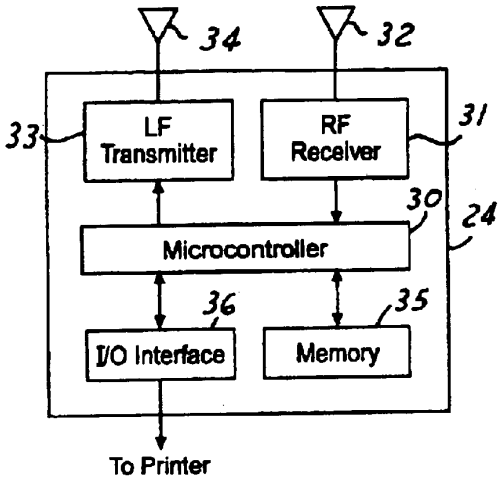


FIG.3

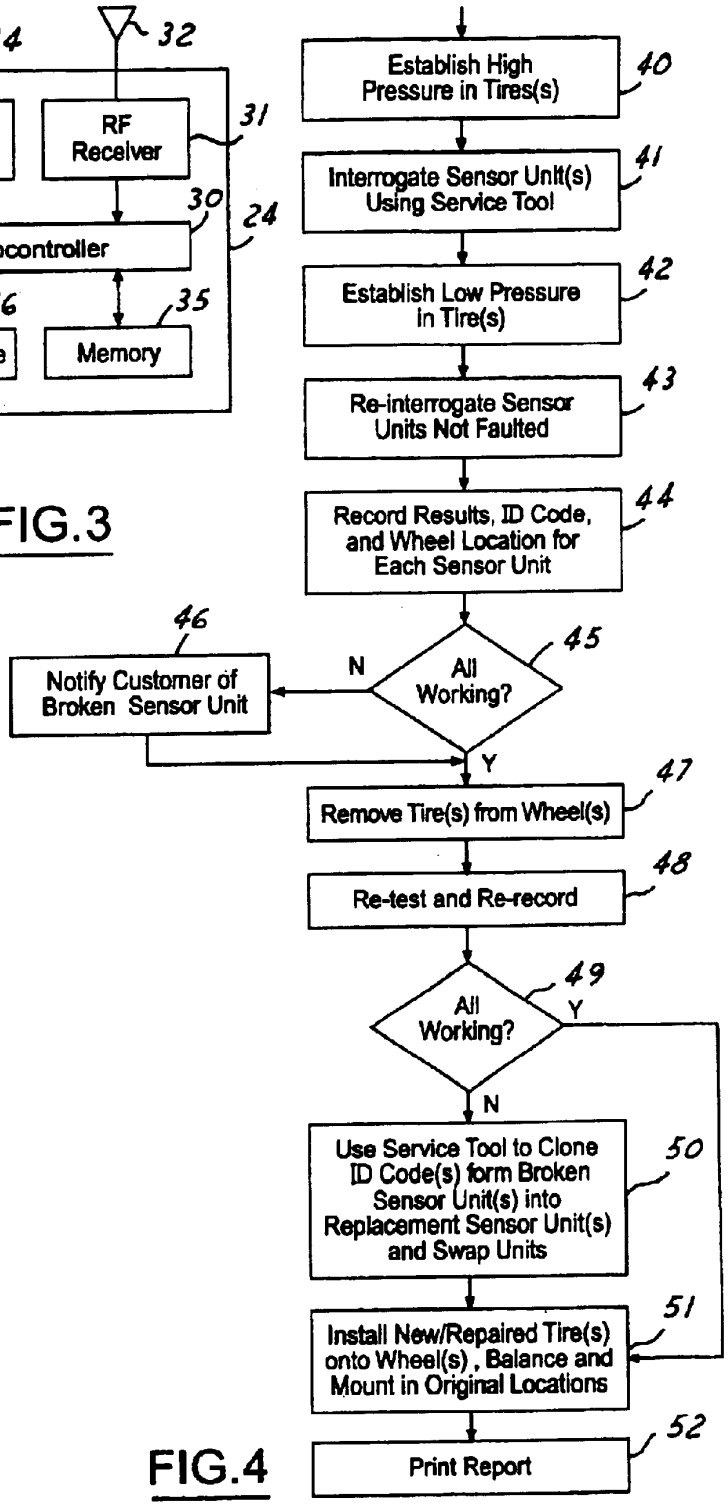


FIG.4

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TIRE PRESSURE MONITORING SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

Not Applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

Not Applicable.

BACKGROUND OF THE INVENTION

The present invention relates in general to vehicular tire pressure monitoring systems, and, more specifically, to replacing or otherwise servicing tires mounted on wheels containing tire pressure sensing units.

Real-time tire pressure monitoring systems (TPMS) can be used for the tires of transportation vehicles such as motor vehicles to alert a driver when proper tire inflation is not being maintained. Proper tire inflation is important to increase tire life, maximize fuel economy, and optimize tire performance in terms of handling, braking distance, and tire integrity.

A self-contained pressure/temperature sensor unit is typically mounted to a wheel in communication with the interior of the tire, e.g., mounted on the wheel spider. Since the wheel and the pressurized interior of a tire are not stationary, the sensor unit usually utilizes a radio transmitter to provide sensor data to a control module in the vehicle. Since each wheel typically has its own respective sensor unit which communicates with a single control module and since nearby vehicles may use the same transmission frequencies and protocols, the sensor transmissions are differentiated by providing a unique ID code within each sensor which is included in the transmissions. The control module must be configured to associate certain ID codes with respective wheel positions on the vehicle (e.g., left-front, right-front, left-rear, and right-rear for a 4-wheel passenger vehicle). Thus, when a particular pressure sensor indicates that an inadequate pressure is being sensed in its respective tire, the control module can alert the driver as to which tire is affected.

The presence of sensor units of tire pressure monitoring systems in or on the wheels of vehicles gives rise to certain difficulties when tires or wheels are repaired or replaced. The act of removing a tire from a wheel may result in inadvertent damage to the sensor unit. If after tire or wheel servicing it is noticed that a sensor unit is inoperative, then it may be difficult or impossible to determine whether the unit was faulty prior to or during servicing. Yet responsibility for assuming the cost of replacing the sensor unit may depend on a determination of when the unit was damaged.

When a sensor unit is replaced, the control module of the prior art has been reconfigured with a new ID code embedded in the replacement sensor so that its transmissions can be associated with the correct wheel position on the vehicle. The control module is typically placed into a "learning mode" and the respective sensor units are made to transmit their ID codes in sequence to the control module. However, this process add time, complexity, and expense when servicing the TPMS system.

SUMMARY OF THE INVENTION

The present invention has the advantage of providing a simple and efficient process for servicing tires in a tire pressure monitoring system so that the time at which a pressure sensing unit was damaged can be determined and reconfiguring of the control module can be avoided.

In one aspect of the invention, a method is provided for replacing at least one tire of a vehicle on a first wheel in a first wheel position, the vehicle having a tire pressure monitoring system with a first sensor unit having a first ID code mounted to the first wheel. The first sensor unit is interrogated. Either a nominal result or a faulted result of the interrogation is detected. The at least one tire is removed from the first wheel. If the nominal result is detected during the interrogating step, then the first sensor unit is re-interrogated. Either a nominal result or a faulted result of the re-interrogation is detected. If either of the interrogation or the re-interrogation provide a faulted result then the first ID code is cloned into a replacement sensor unit and then the replacement sensor unit is swapped for the first sensor unit on the first wheel. A new tire is installed onto the first wheel. The first wheel is installed onto the vehicle in the first wheel position.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view of a vehicle having a tire pressure monitoring system.

FIG. **2** shows a tire pressure sensing unit mounted to a wheel and being interrogated by a service tool.

FIG. **3** shows the service tool in greater detail.

FIG. **4** is a flowchart showing a preferred method of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIG. **1**, a vehicle **10** includes wheels **11–14** having pressure sensor units **15–18**, respectively, mounted thereon. Each sensor unit preferably includes a sensing and signal processing section (for generating a data signal indicative of the tire inflation pressure—either a pressure measurement or an indication of pressure being above or below a threshold) and a communication section for transmitting the data signal and an ID code to a control module **20**. Sensor units are known in the art, and may comprise commercially available, specialized components such as the MPXY8000 Series pressure and temperature sensor from Motorola, Inc. The RF link between the sensor units and control module **20** may utilize the same RF channel as is commonly used for remote keyless entry (RKE) systems for automobiles (e.g., a UHF channel at 315 MHz). As known in the art, control module **20** may integrate both the RKE and TPMS functions. Thus, the sensor units may include a commercially available microcontroller/transmitter component such as the MC68HC908RF2 MCU/transmitter chip, also from Motorola, for establishing a communication link from the sensor unit to the control module. For diagnostic and servicing purposes, the sensor unit may also include a wake-up receiver responsive to a low frequency (LF) signal to initiate execution of a sensing/transmission cycle or other predetermined routines. The LF receiver may be comprised of the ATA5283 wake-up receiver IC available from Amtel Corporation, for example, which responds to a 125 kHz wake-up signal.

As shown in FIG. **2**, a sensor unit **23** is mounted to a wheel **21** so that it is exposed to the interior of a tire **22** when it is installed on wheel **21**. A service tool **24** is utilized in the present invention for interacting with sensor unit **23** using the UHF radio link. It preferably includes a display **25** and

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a control keypad **26**. It may further be coupled to a printer **27** in order to create written records showing the results of testing of the sensor units during tire servicing.

FIG. **3** shows service tool **24** in greater detail. A microcontroller **30** is coupled to an RF receiver **31** and to an LF transmitter **33**. RF receiver **31** receives transmissions from a sensor unit via an antenna **32**. LF transmitter **33** sends a wake-up signal under control of microcontroller **30** to a sensor unit via an antenna **34**. Microcontroller **30** is coupled to a memory **35** for storing the results of testing (e.g., interrogating a sensor unit and evaluating the validity of its response) and to an I/O interface **36** which includes display **25**, keypad **26**, and a printing port for connecting to a printer.

Microcontroller **30** is programmed to perform various functions in order to interrogate a sensor unit that is placed within a close proximity (i.e., within the short range of the LF wake-up signal). An overall method of tire servicing according to the present invention is shown in FIG. **4**. In order to establish a known pressure condition for testing a sensor unit, a full (i.e., high) pressure is established in a tire or tires to be serviced in step **40**. The sensor unit(s) is (are) interrogated in step **41** using the service tool to send a wake-up command and to receive a data signal and ID code from each sensor unit involved in the tire replacement or repair. By comparing the data signal (i.e., pressure measurement or pressure range indication) with that expected in view of the full pressure present in the tire, the result of each interrogation can be classified by the service tool as a nominal result of a faulted result. A below normal (i.e., low) pressure is established in the tire or tires being serviced in step **42**. The sensor unit(s) is (are) re-interrogated in step **41** again using the service tool and the result(s) of the re-interrogation(s) are classified. In step **44**, the nominal or faulted results are recorded in memory by the service tool along with the respective ID codes and wheel locations (i.e., left-front, right-front, left-rear, right-rear).

In step **45**, either a tire service technician or the service tool itself makes a determination whether all sensor units for all tires being serviced are working properly. If not, then a vehicle owner or customer is notified of the broken sensor unit in step **46**, prior to actually beginning to service the tire. Thus, it can be clearly established that breakage of the sensor unit was not caused during servicing of the tire. The notification may include a printed report of the results stored in the memory of the service tool.

In step **47**, the tire service technician proceeds to remove the tire(s) from the wheel(s). During time removal, inadvertent damage may occur to the sensor unit because of the prying or jarring that may be required to break the tire seal and clear the tire over the wheel rims. After tire removal, the sensor unit(s) are re-tested and the corresponding results are recorded in step **48**. A check is made in step **49** to determine whether all the sensor units on wheels being serviced are working properly.

In step **50**, any non-working sensor units are replaced. Preferably, the service tool is used to replicate or clone the ID code of a broken sensor unit into a replacement sensor unit over a LF communication link between the service tool and the replacement sensor unit. The replacement sensor unit is swapped with the original (faulted) sensor unit by mounting the replacement to the corresponding wheel prior to re-installing a tire. If sensor unit damage prevents RF communication, then the corresponding ID code may be determined by other means (e.g., reading from a printed label on the sensor unit or obtaining the stored ID code from the control unit) and may then be programmed into the replacement sensor by the service tool. The sensor units may preferably be comprised of a universal replacement sensor of the type described in co-pending U.S. application serial number (Lear attorney docket 4056).

In step **51**, a new or repaired tire is installed onto each wheel being serviced. The wheels are balanced and then mounted in their original locations. Consequently, there is no need to reconfigure the correlation of ID codes with wheel locations stored in the control unit since these have not changed even if a sensor unit has been replaced. It may be desirable to retest each sensor after mounting to ensure that each is still functioning using the same test procedure shown in steps **40** through **43**. If desired, a final-report describing the results of the testing and replacement of sensor units can be printed in step **52**.

What is claimed is:

1. A method of replacing at least one tire of a vehicle on a first wheel in a first wheel position, said vehicle having a tire pressure monitoring system with a first sensor unit having a first ID code mounted to said first wheel, said method comprising the steps of:

interrogating said first sensor unit;

detecting either a nominal result or a faulted result of said interrogation;

removing said one tire from said first wheel;

if said nominal result is detected during said interrogating step, then re-interrogating said first sensor unit;

detecting either a nominal result or a faulted result of said re-interrogation;

if either of said interrogation or said re-interrogation provide a faulted result then cloning said first ID code into a replacement sensor unit and swapping said replacement sensor unit for said first sensor unit on said first wheel;

installing a new tire onto said first wheel; and

installing said first wheel onto said vehicle in said first wheel position.

2. The method of claim **1** wherein said interrogating step and said re-interrogating step each comprises the steps of:

transmitting a low-frequency command from a service tool to said first sensor unit;

said first sensor unit transmitting a radio-frequency response message including sensor data and said first ID code; and

said service tool receiving said radio-frequency response message.

3. The method of claim **1** wherein said interrogating step comprises the steps of:

establishing a high pressure in said one tire;

transmitting a low-frequency command from a service tool to said first sensor unit;

said first sensor unit transmitting a first radio-frequency response message including sensor data and said first ID code;

said service tool receiving said first radio-frequency response message;

establishing a low pressure in said one tire;

transmitting a low-frequency command from said service tool to said first sensor unit;

said first sensor unit transmitting a second radio-frequency response message including sensor data and said first ID code; and

said service tool receiving said second radio-frequency response message.

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4. The method of claim 3 wherein said first detecting step comprises comparing said sensor data in said first and second radio-frequency response messages with predetermined data.

5. The method of claim 1 further comprising the step of:

recording said results of said interrogation and said re-interrogation to establish involvement of said removing step in any faulted result.

6. A method of replacing a plurality of tires of a vehicle on respective wheel in respective wheel positions, said vehicle having a tire pressure monitoring system with respective sensor units having respective ID codes mounted to said respective wheels, said method comprising the steps of:

sequentially interrogating said respective sensor units;

detecting either a nominal result or a faulted result of each of said interrogations;

removing said plurality of tires from said respective wheels;

re-interrogating said respective sensor units for which a nominal result was detected during said respective interrogations;

detecting either a nominal result or a faulted result of each of said re-interrogations;

if either of said interrogation or said re-interrogation for a respective sensor unit provide a faulted result then cloning said respective ID code of said respective sensor unit into a replacement sensor unit and swapping said replacement sensor unit for said respective sensor unit on said respective wheel;

installing a respective new tire onto each of said respective wheels; and

installing said respective wheels onto said vehicle in their respective wheel positions.

7. The method of claim 6 wherein said interrogating steps and said re-interrogating steps each comprise the steps of:

transmitting a low-frequency command from a service tool to a respective sensor unit;

said respective sensor unit transmitting a radio-frequency response message including sensor data and said respective ID code; and

said service tool receiving said radio-frequency response message.

8. The method of claim 6 wherein said interrogating steps each comprise the steps of:

establishing a high pressure in a respective tire;

transmitting a low-frequency command from a service tool to said respective sensor unit;

said respective sensor unit transmitting a first radio-frequency response message including sensor data and said respective ID code;

said service tool receiving said first radio-frequency response message;

establishing a low pressure in said respective tire;

transmitting a low-frequency command from said service tool to said respective sensor unit;

said respective sensor unit transmitting a second radio-frequency response message including sensor data and said respective ID code; and

said service tool receiving said second radio-frequency response message.

9. The method of claim 8 wherein said first detecting step comprises comparing said sensor data in said first and second radio-frequency response messages with predetermined data.

10. The method of claim 6 further comprising the step of:

recording said results of said interrogation and said re-interrogation to establish involvement of said removing step in any faulted result.

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US007079033B2

(12) **United States Patent**
Itou

(10) **Patent No.: US 7,079,033 B2**
(45) **Date of Patent: Jul. 18, 2006**

(54) **ID REGISTRATION METHOD FOR TIRE PRESSURE SENSOR, ID REGISTRATION APPARATUS, ID REGISTRATION TOOL FOR TIRE PRESSURE MONITORING SYSTEM, AND TIRE WITH AIR PRESSURE SENSOR**

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(73) Assignee: **Denso Corporation**, Kariya (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 19 days.

(21) Appl. No.: **10/453,638**

(22) Filed: **Jun. 4, 2003**

(65) **Prior Publication Data**

US 2003/0227379 A1 Dec. 11, 2003

(30) **Foreign Application Priority Data**

Jun. 5, 2002 (JP) 2002-164985
Jun. 19, 2002 (JP) 2002-179149

(51) **Int. Cl.**
G08B 13/14 (2006.01)

(52) **U.S. Cl.** **340/572.3**; 340/442; 340/572.1; 340/10.51; 340/10.52; 340/557; 73/146

(58) **Field of Classification Search** ..... 340/572.3, 340/572.1, 442, 445, 447, 443, 461, 525, 340/825.69, 825.72, 10.51, 10.52, 572.8, 340/555–557; 73/146.5, 146.2, 146; 116/34 R; 152/510; 301/95.101; 428/195.1

See application file for complete search history.

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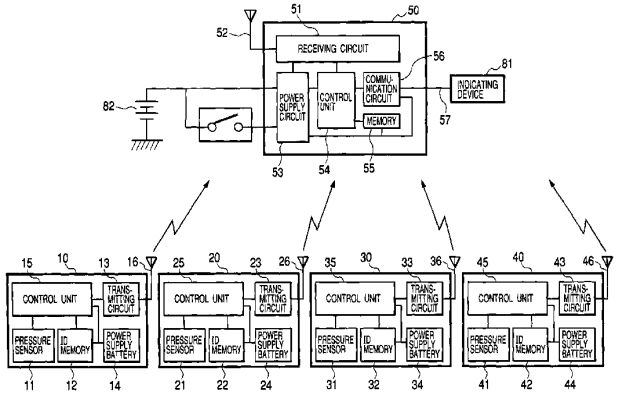
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Primary Examiner—Davetta W. Goins
(74) *Attorney, Agent, or Firm*—Posz Law Group, PLC

(57) **ABSTRACT**

Provided is a tire pressure monitoring system capable of preventing mistaken registration of ID due to radio interference. In the system, a tire pressure monitoring apparatus is switched into an ID registration mode while an ID is read out from a bar code or the like and is transmitted to the tire pressure monitoring apparatus. The tire pressure monitoring apparatus registers the received ID in a memory. After the completion of the registration of a necessary number of IDs, the tire pressure monitoring apparatus is switched into a normal mode, before the ID registration operation comes to an end. On the other hand, in the case of tire replacement, through the use of an ID registration tool, an ID is read out from a bar code adhered onto a tire detached and is transmitted to the tire pressure monitoring apparatus. The tire pressure monitoring apparatus removes an ID corresponding to this ID from the memory, and through the use of the ID registration tool, an ID is read out from a bar code adhered onto a tire to be newly mounted and is transmitted to the tire pressure monitoring apparatus to be registered therein.

40 Claims, 79 Drawing Sheets



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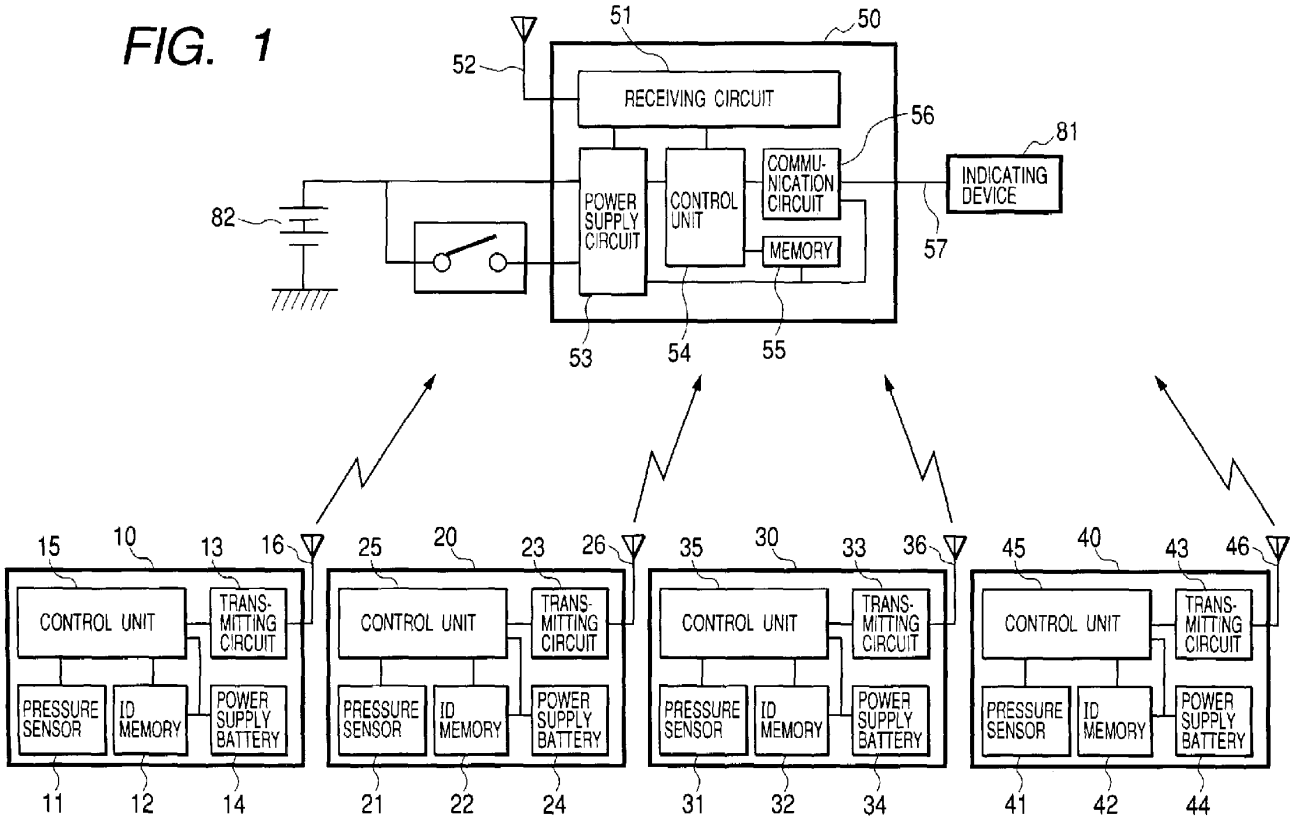
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* cited by examiner

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FIG. 1



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FIG. 2

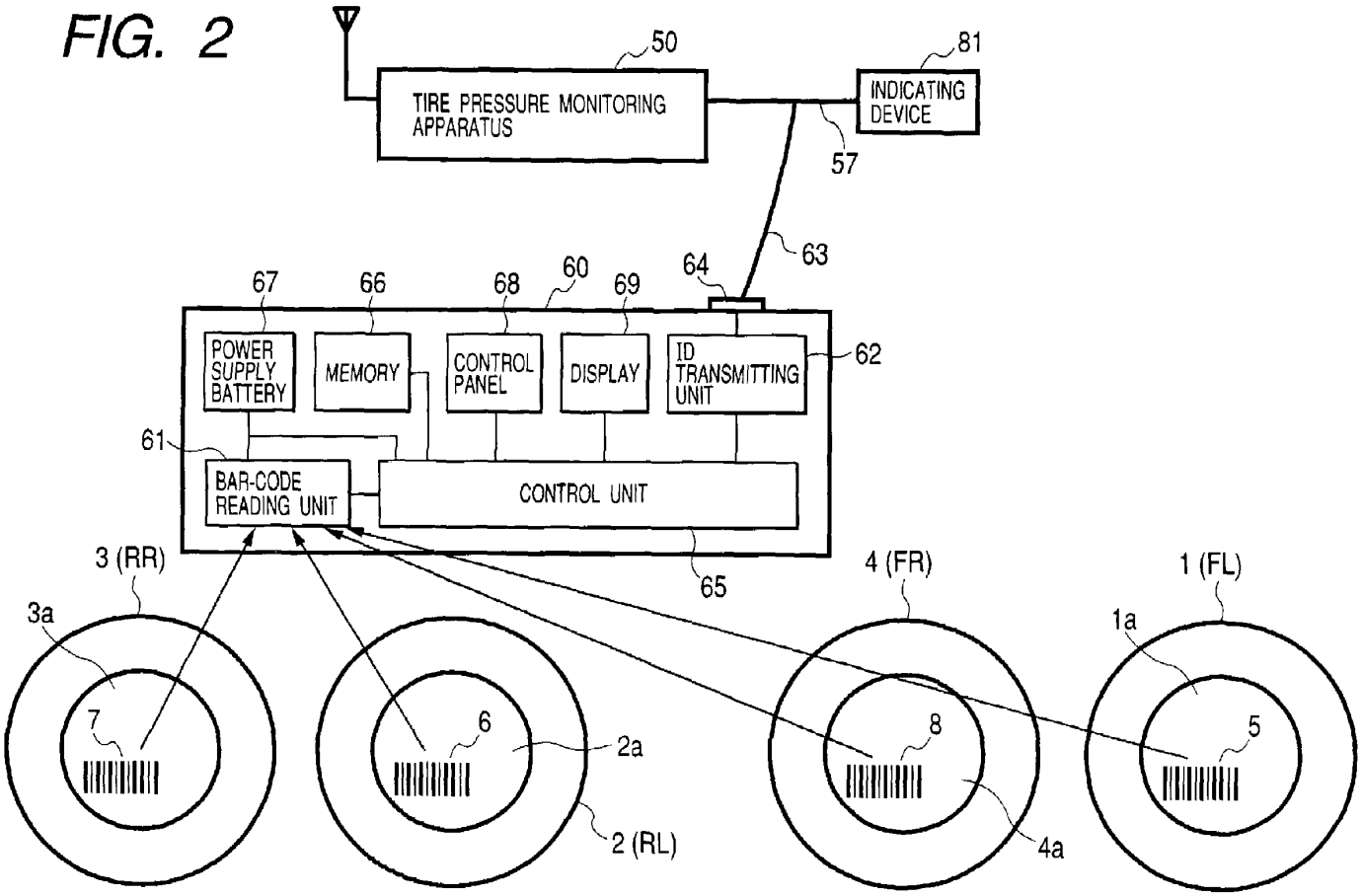
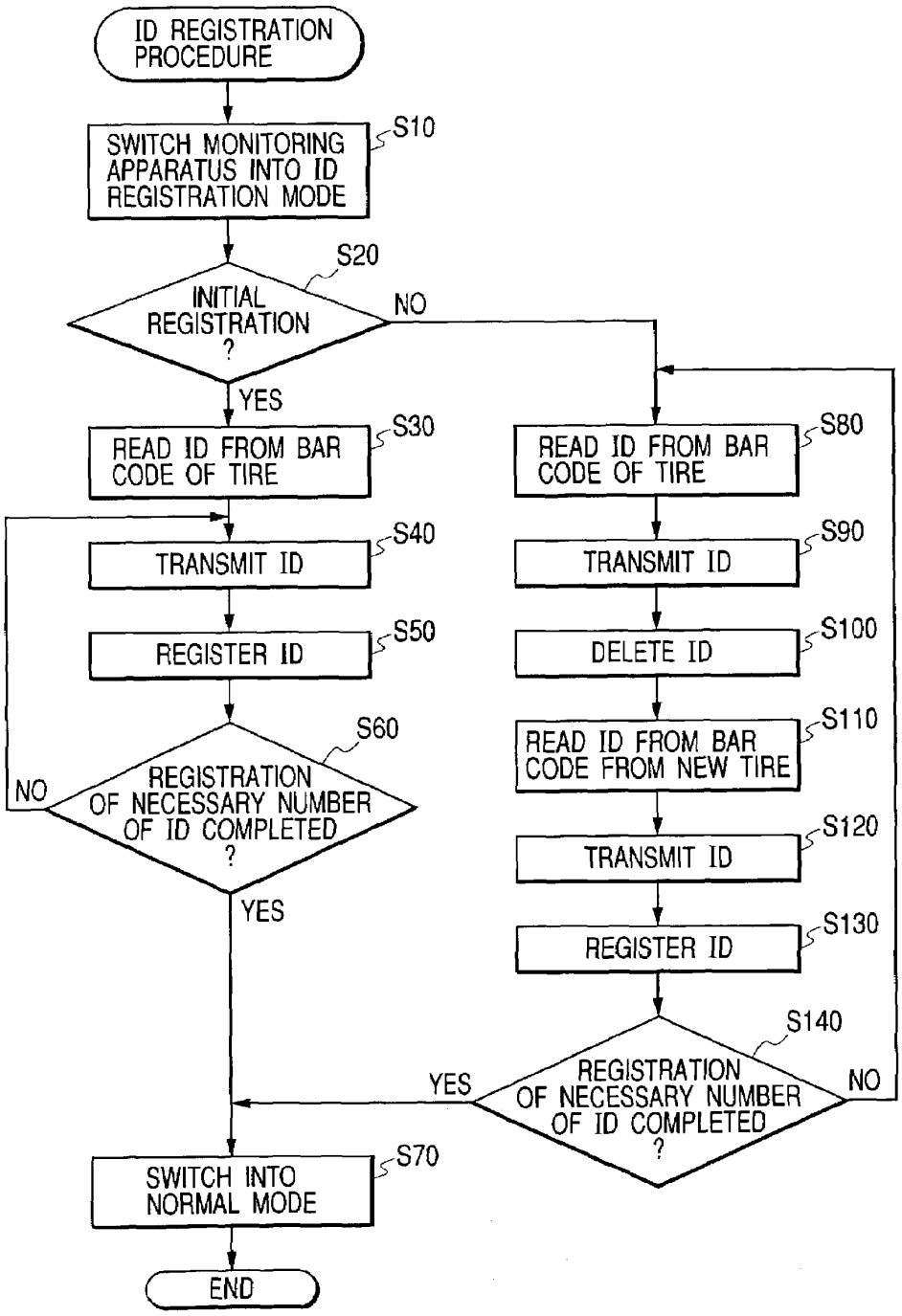
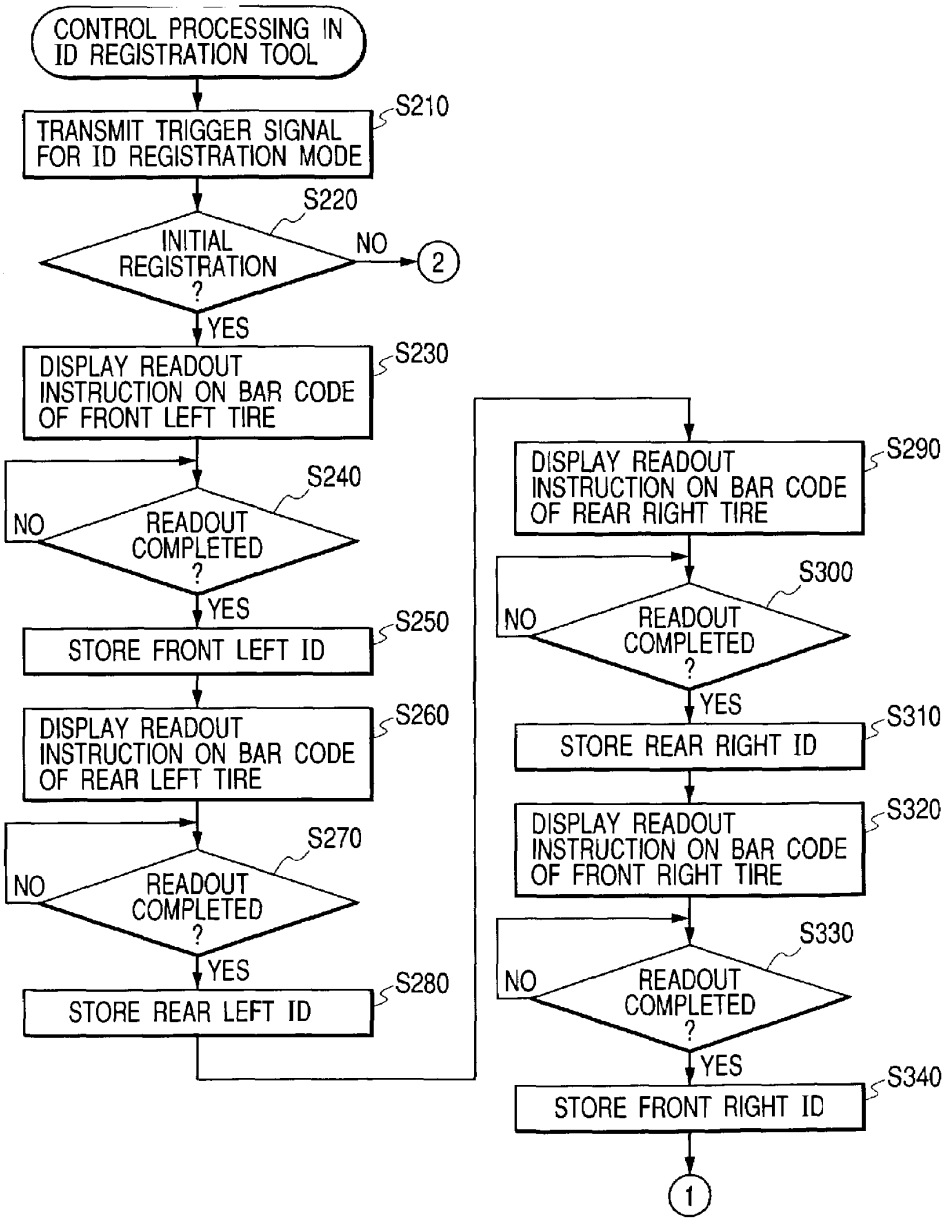

50
TIRE PRESSURE MONITORING APPARATUS
81
INDICATING DEVICE
57
63
64
60
67
66
68
69
POWER SUPPLY BATTERY
MEMORY
CONTROL PANEL
DISPLAY
ID TRANSMITTING UNIT
62
61
BAR-CODE READING UNIT
CONTROL UNIT
65
3 (RR)
3a
7
6
2a
2 (RL)
4 (FR)
8
4a
1 (FL)
1a
5

FIG. 3



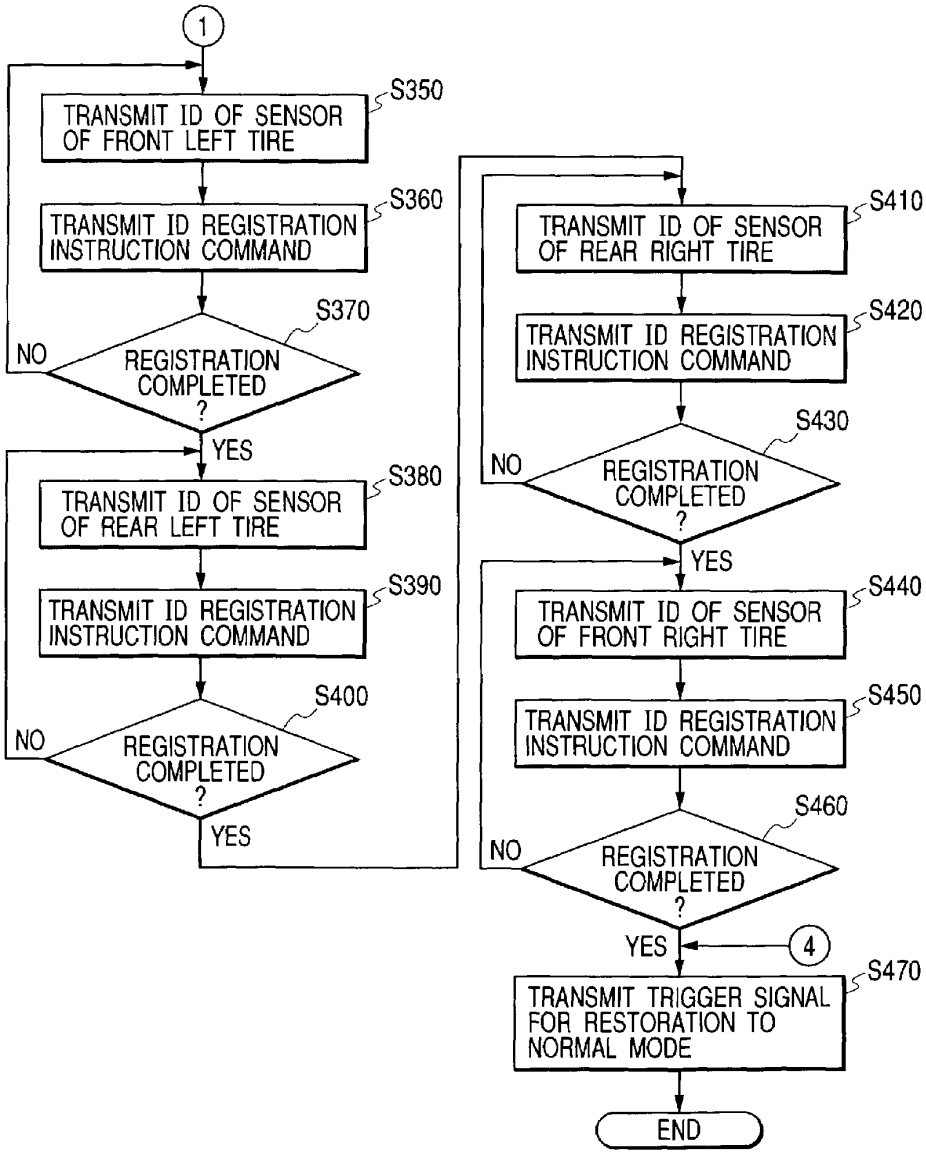
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FIG. 4



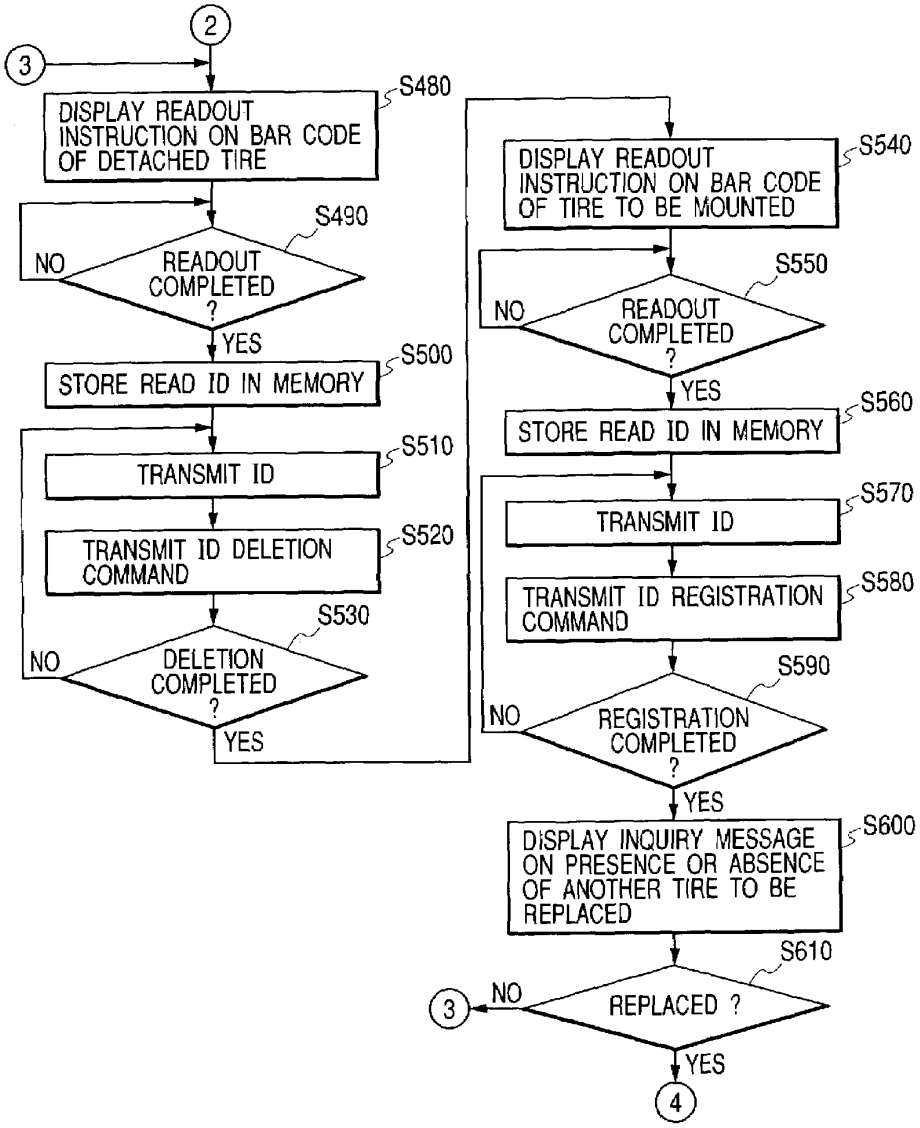
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FIG. 5



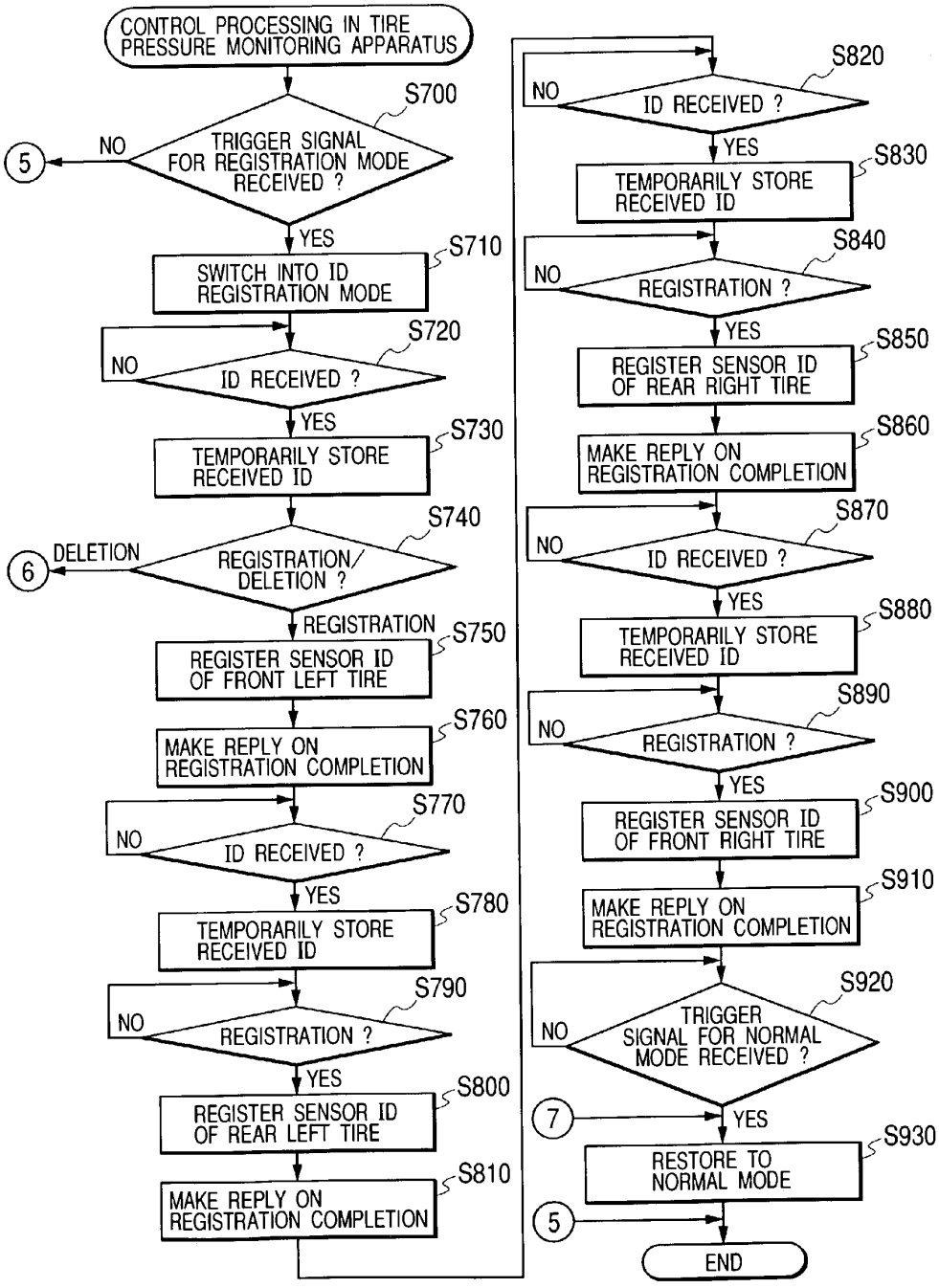
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FIG. 6



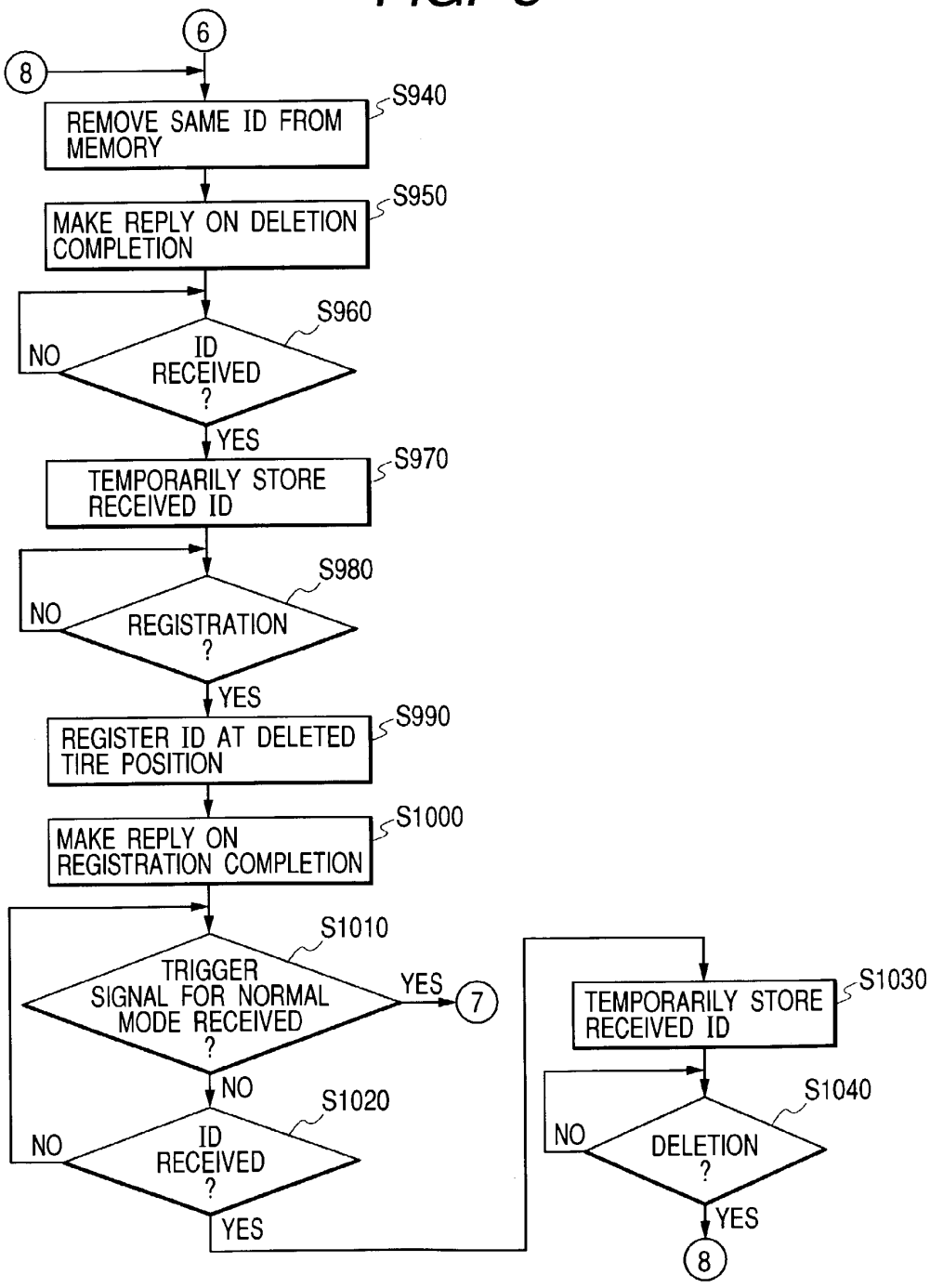
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FIG. 7



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FIG. 8



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FIG. 9

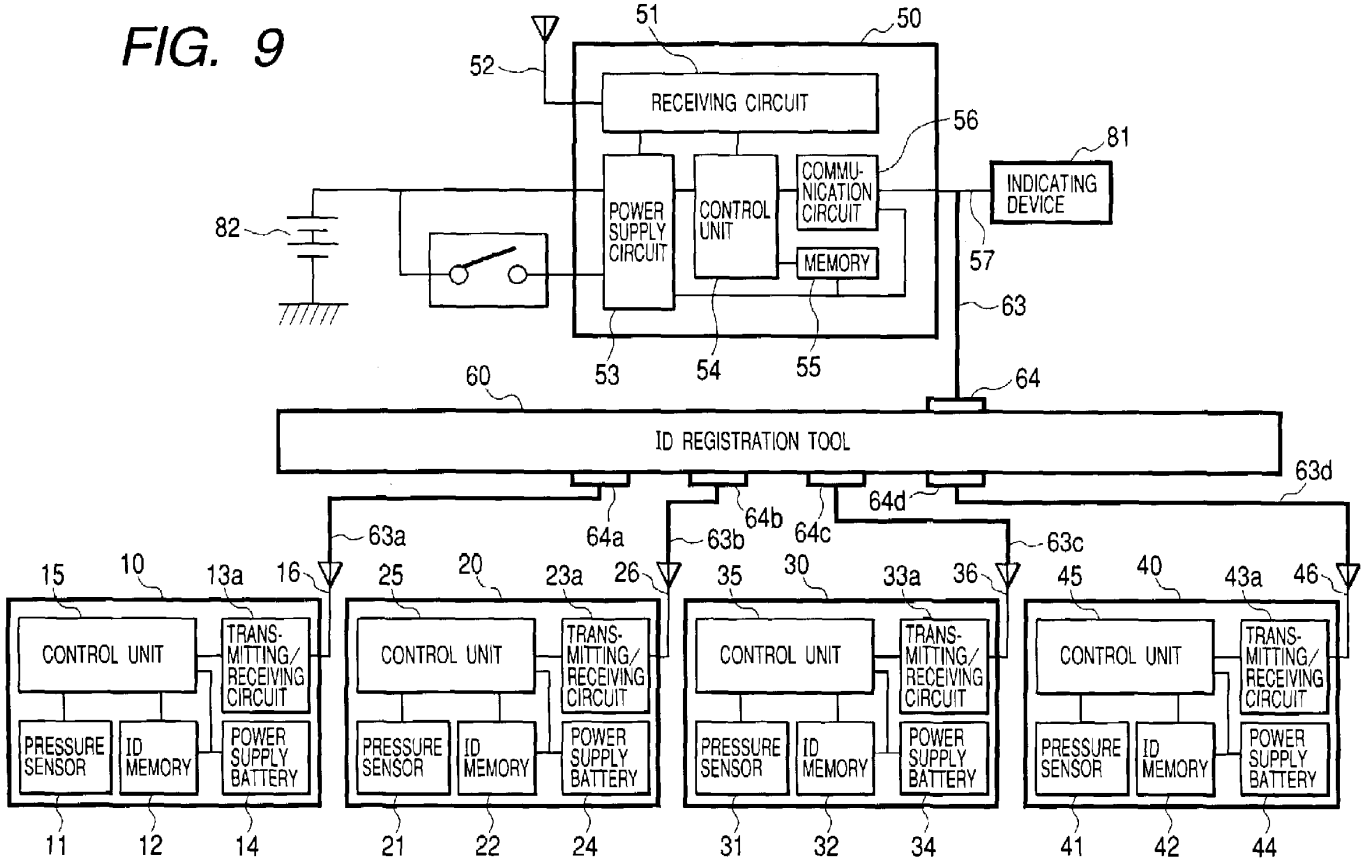
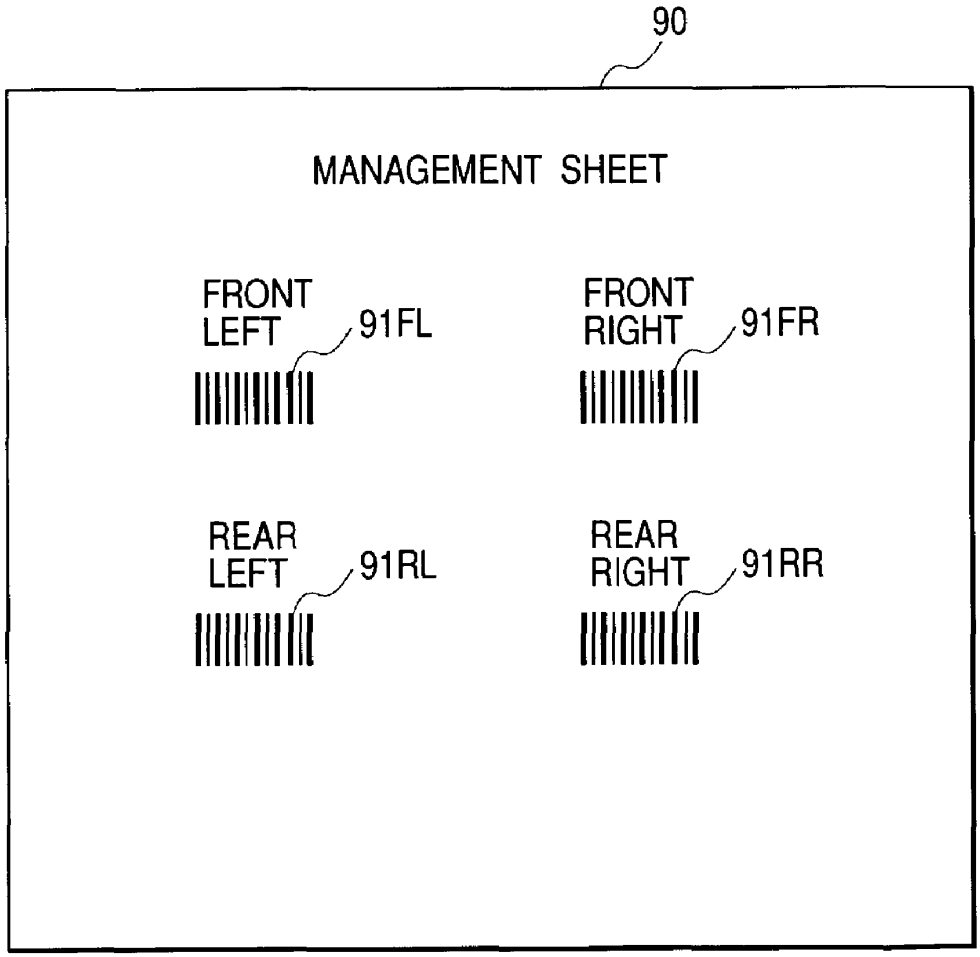
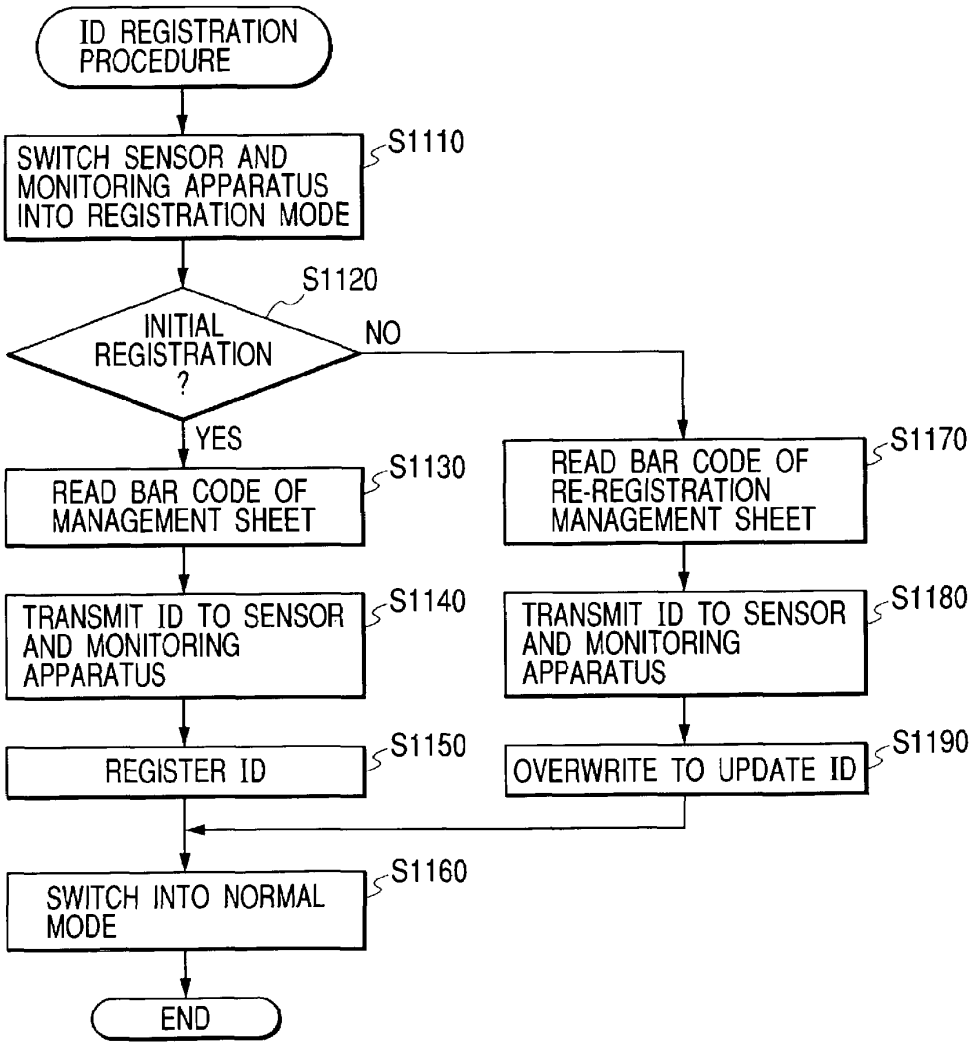

51
50
52
RECEIVING CIRCUIT
56
81
INDICATING DEVICE
82
POWER SUPPLY CIRCUIT
CONTROL UNIT
COMMU-NICATION CIRCUIT
MEMORY
57
63
53
54
55
60
64
ID REGISTRATION TOOL
63d
64d
64b
64c
63a
64a
63b
63c
15
10
13a
16
25
20
23a
26
35
30
33a
36
45
40
43a
46
CONTROL UNIT
TRANS-MITTING/ RECEIVING CIRCUIT
PRESSURE SENSOR
ID MEMORY
POWER SUPPLY BATTERY
11
12
14
21
22
24
31
32
34
41
42
44

FIG. 10



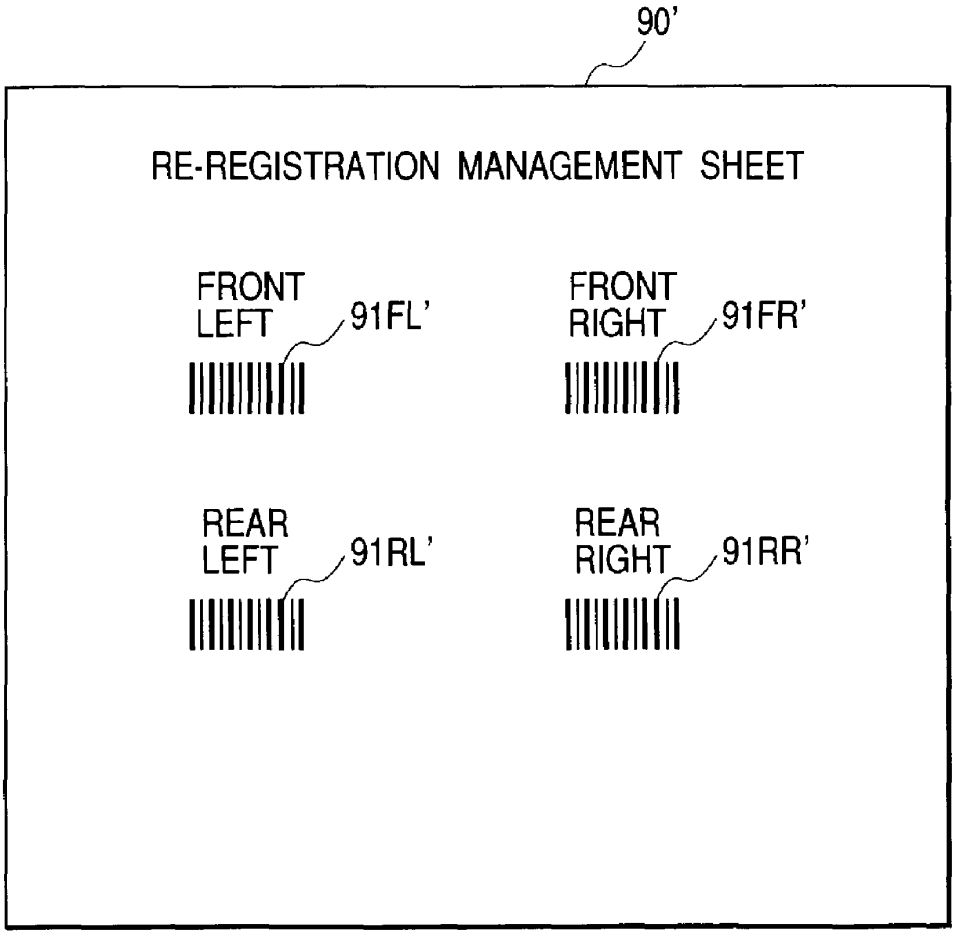
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FIG. 11



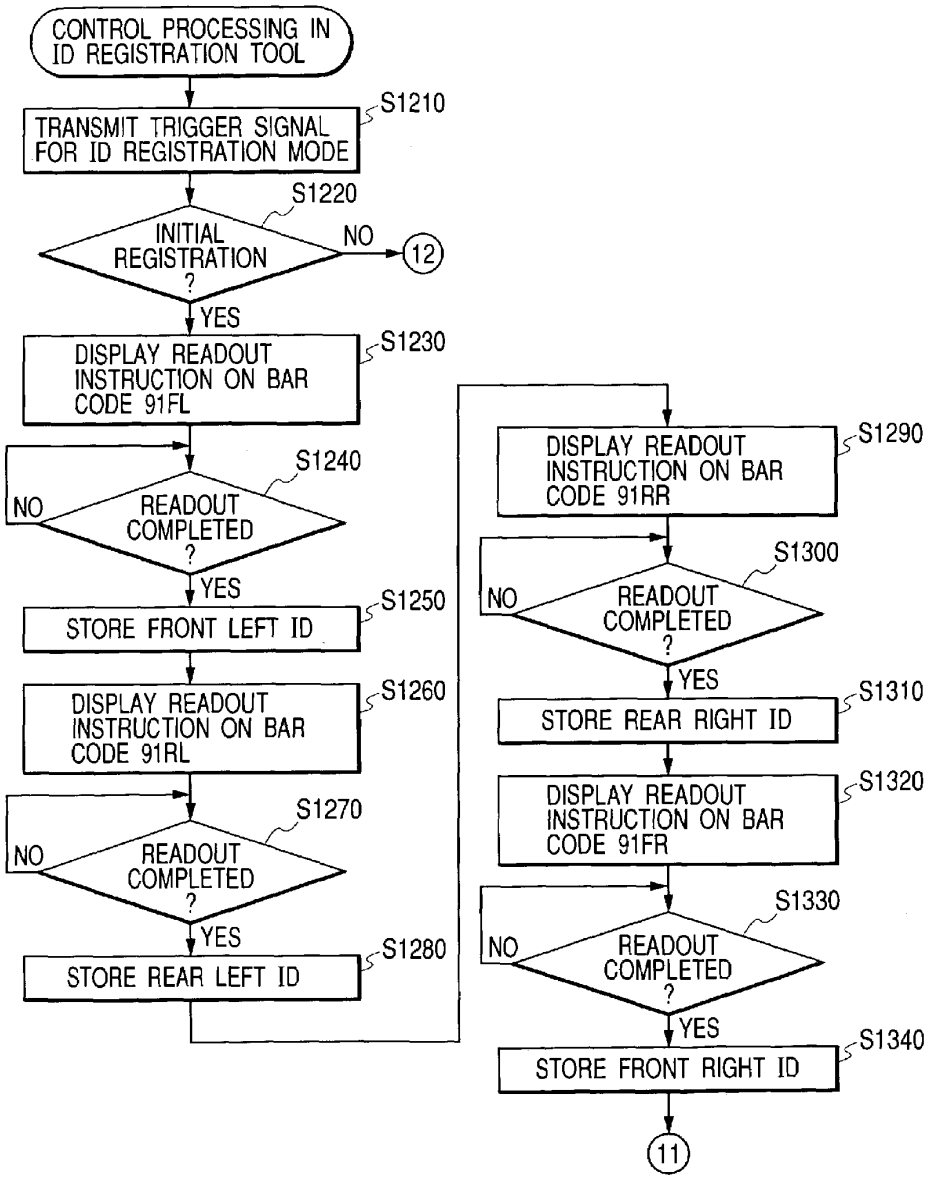
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FIG. 12



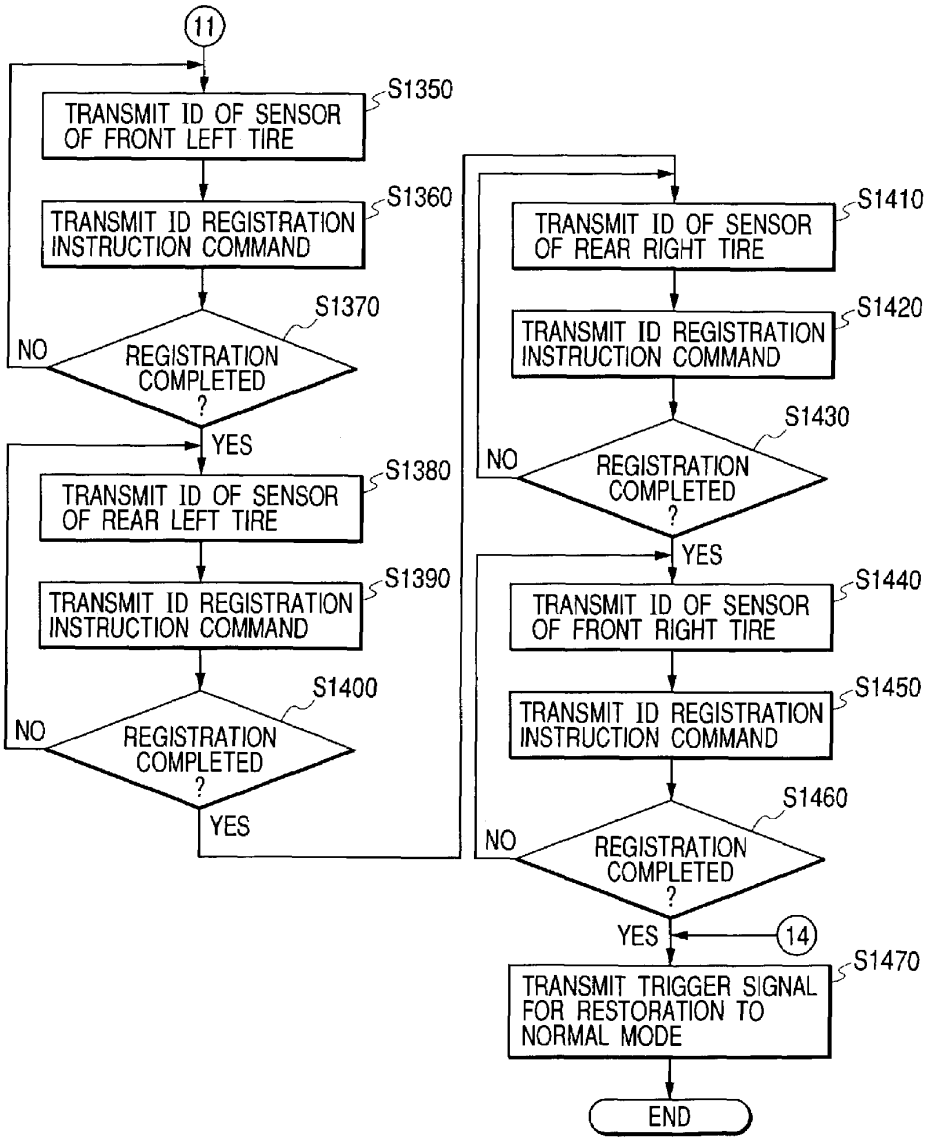
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FIG. 13



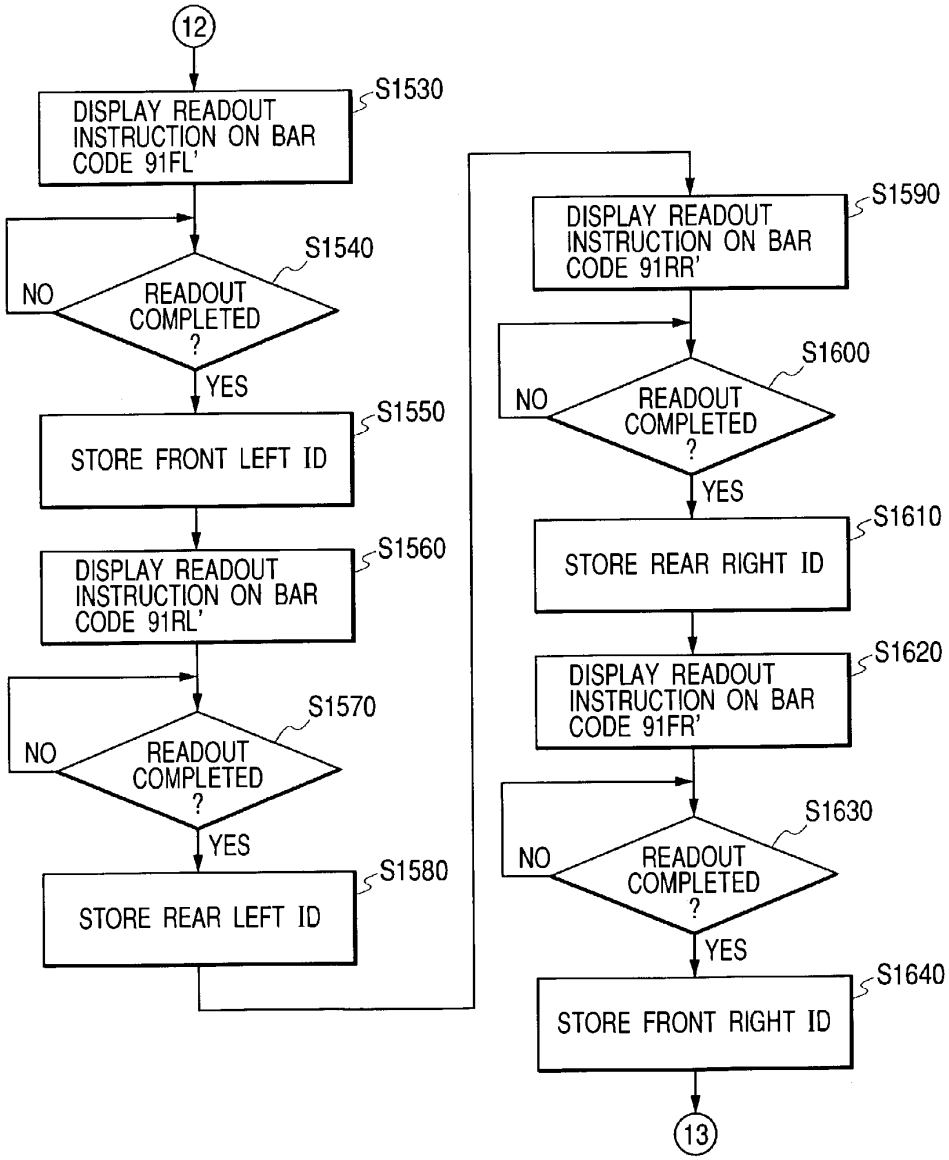
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FIG. 14



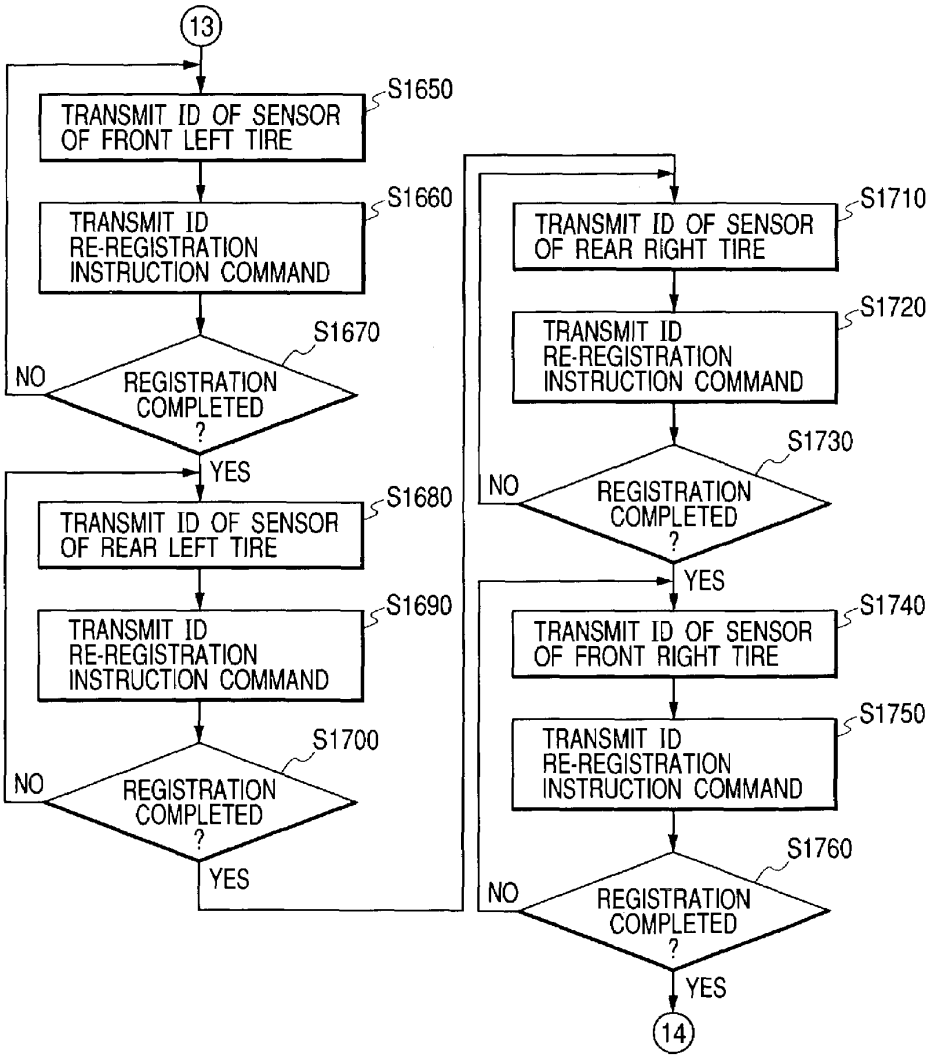
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FIG. 15



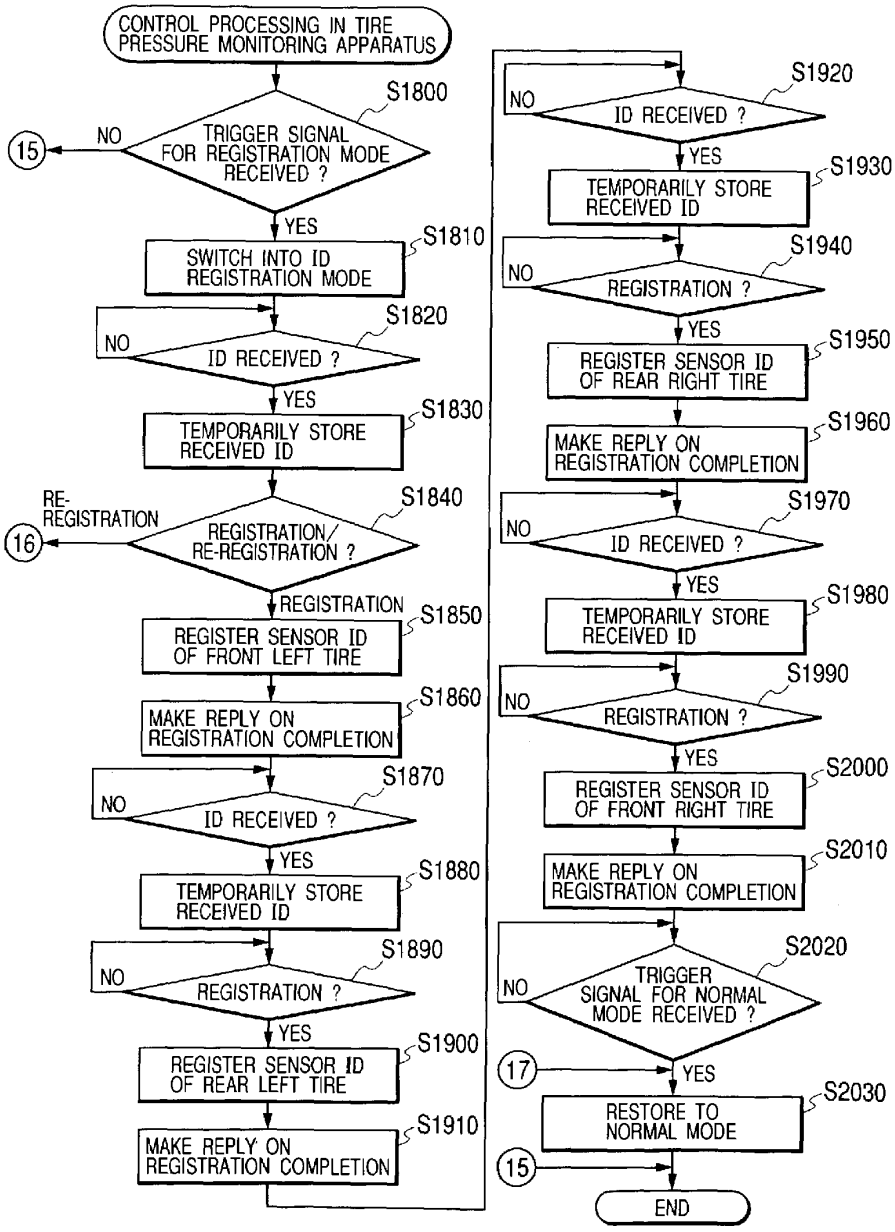
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FIG. 16



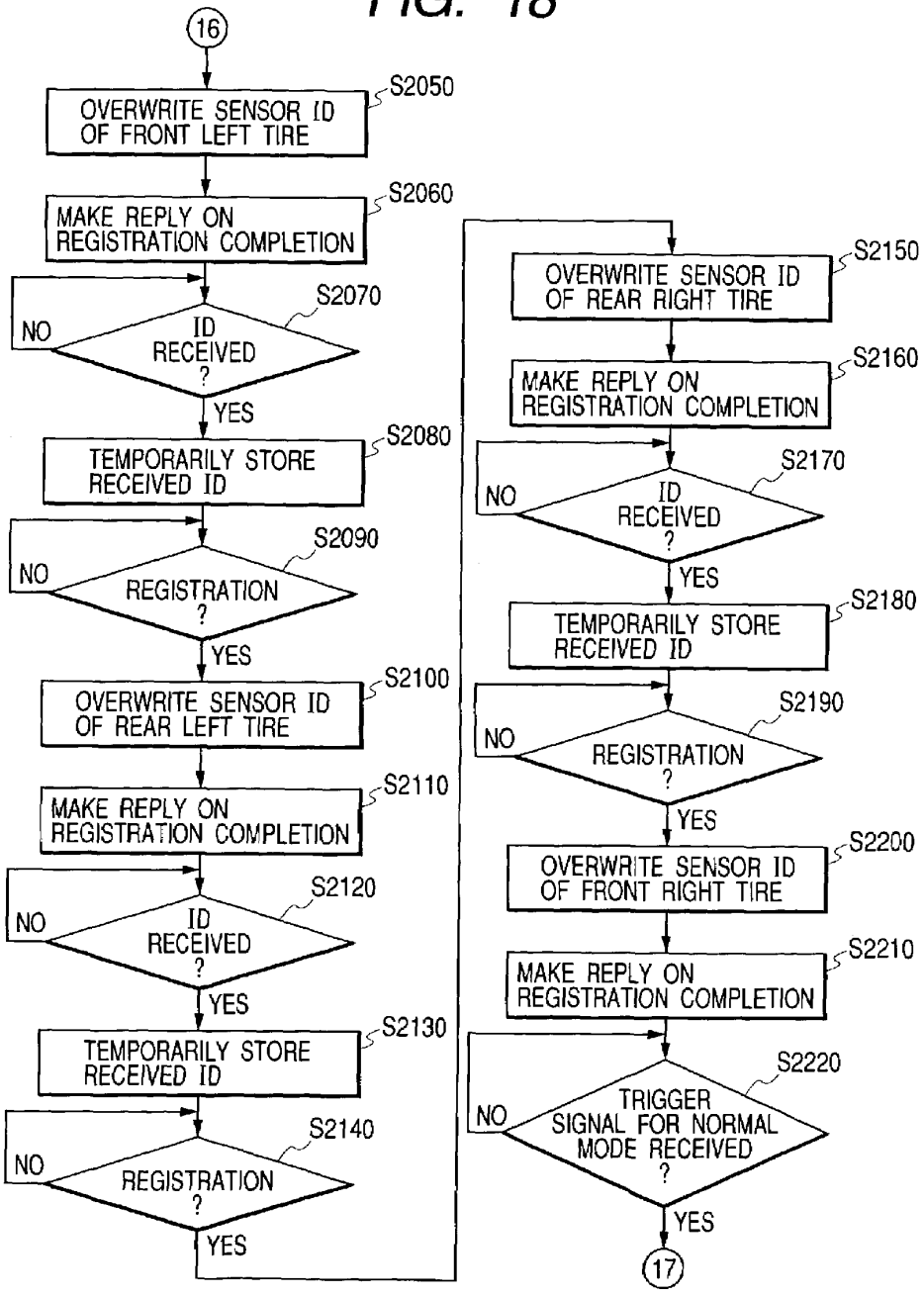
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FIG. 17



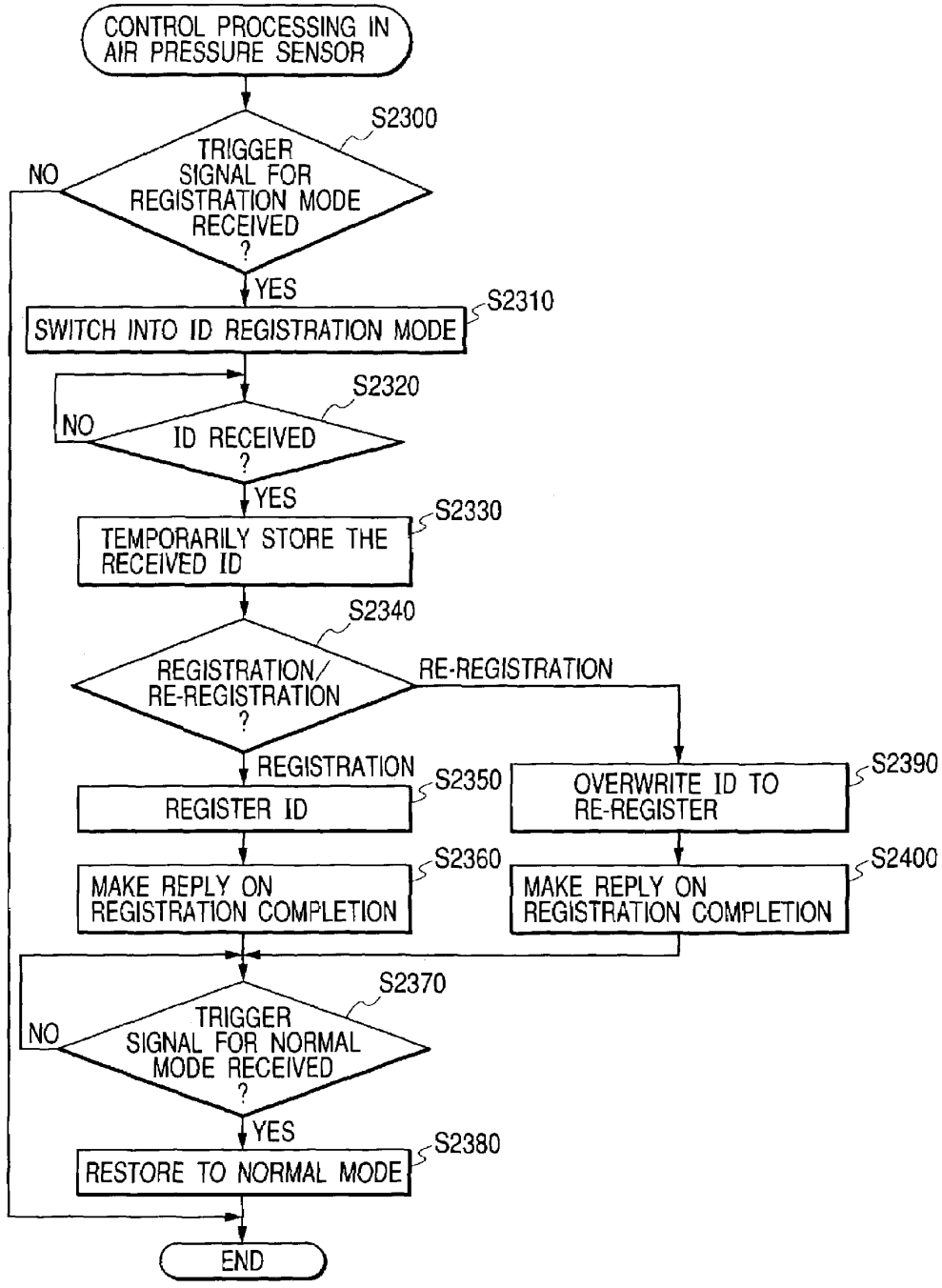
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FIG. 18



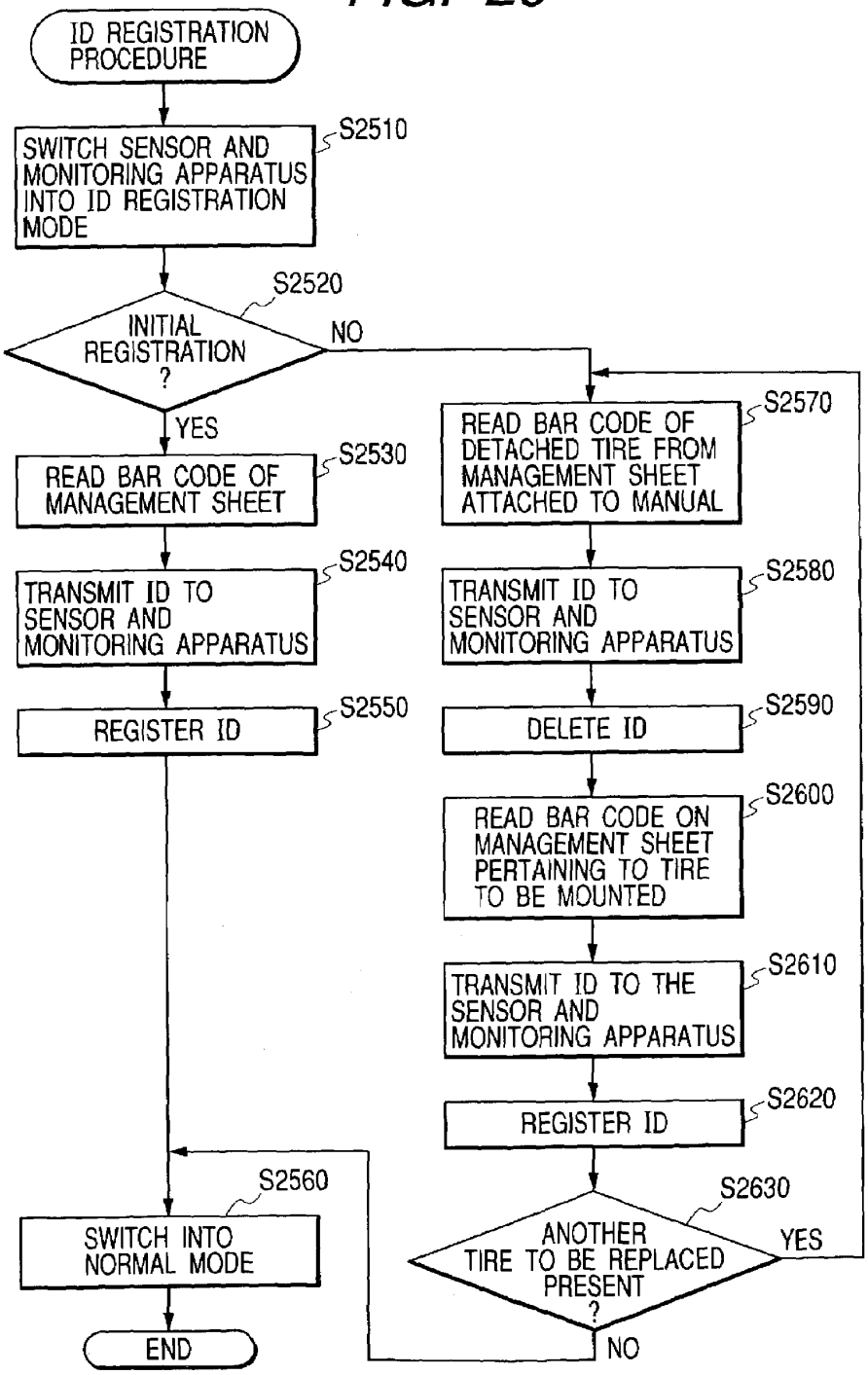
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FIG. 19



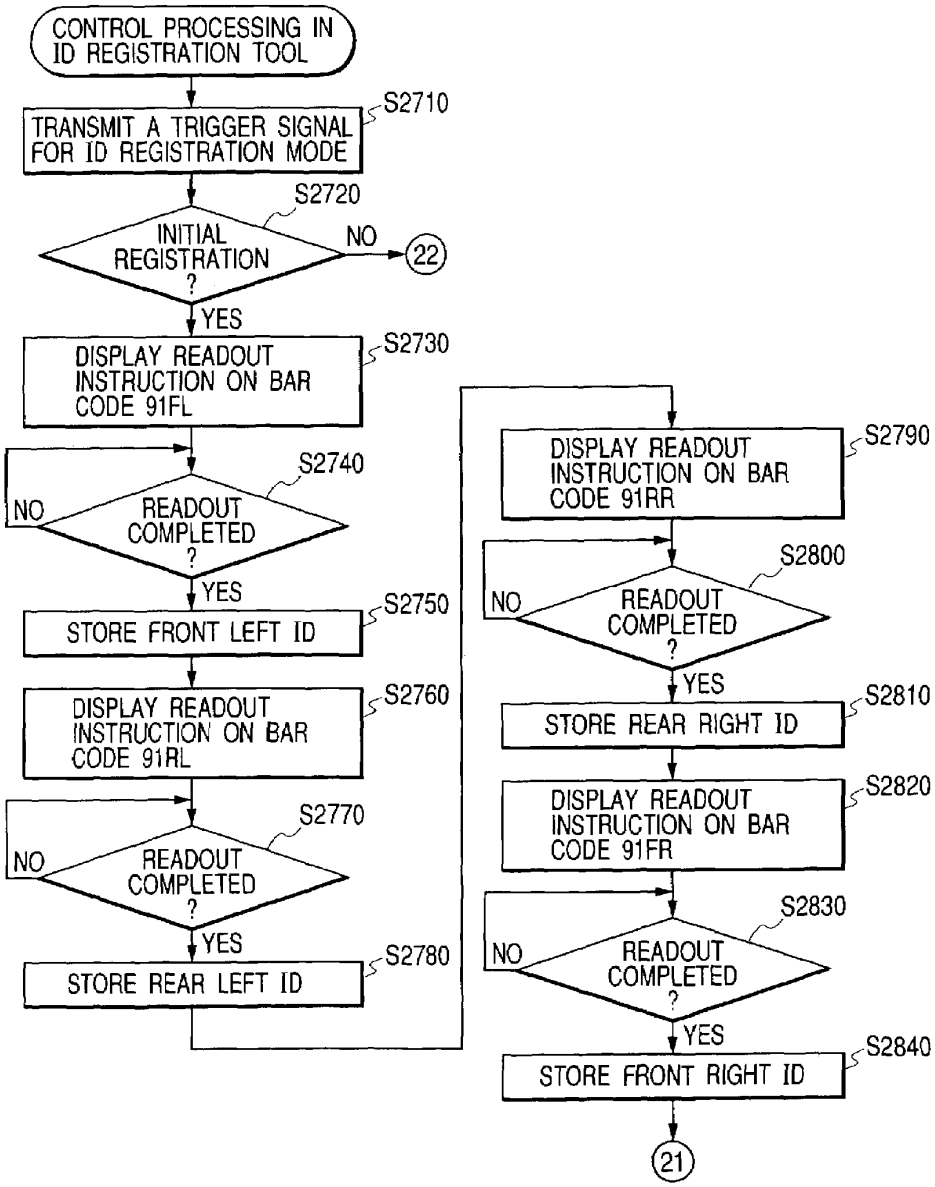
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FIG. 20



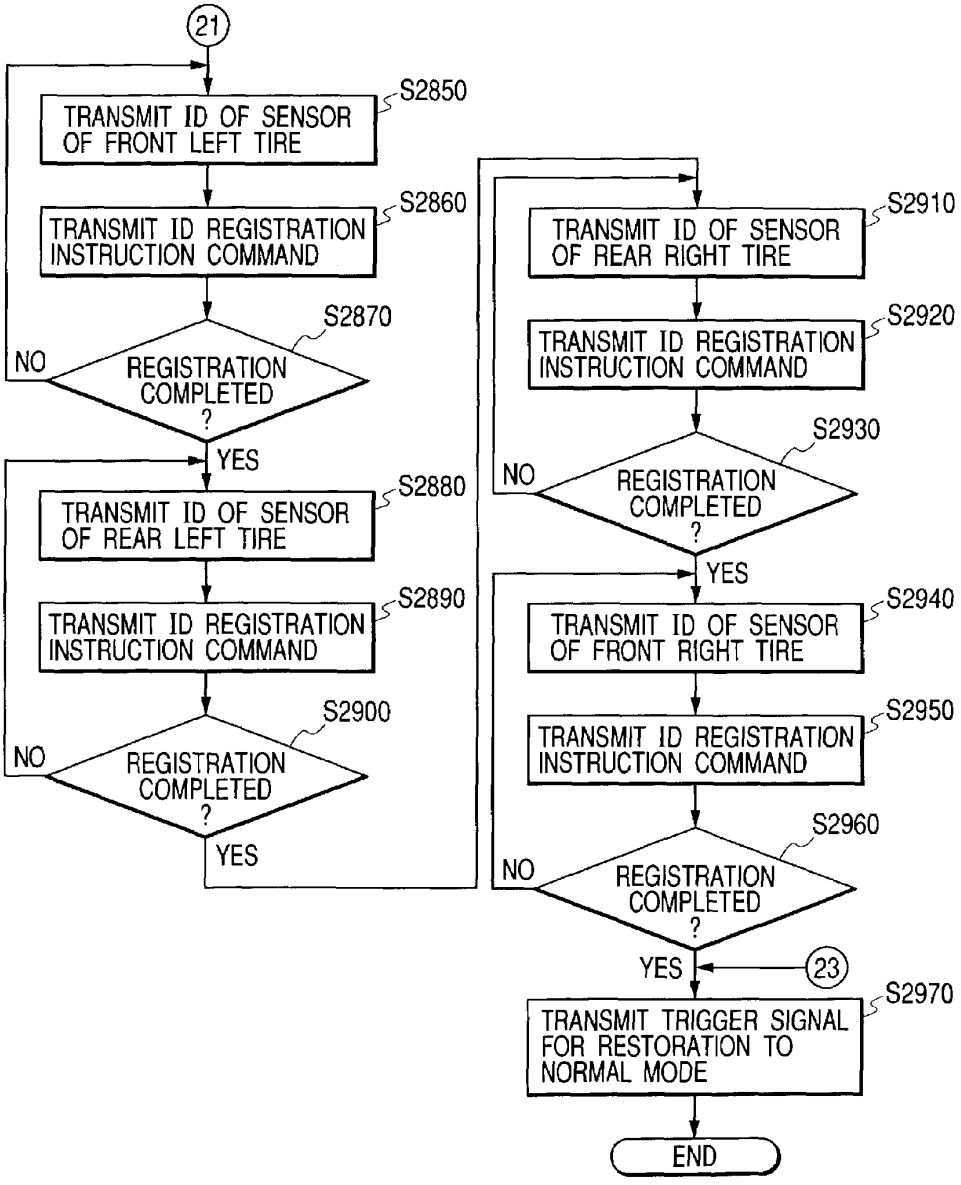
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FIG. 21



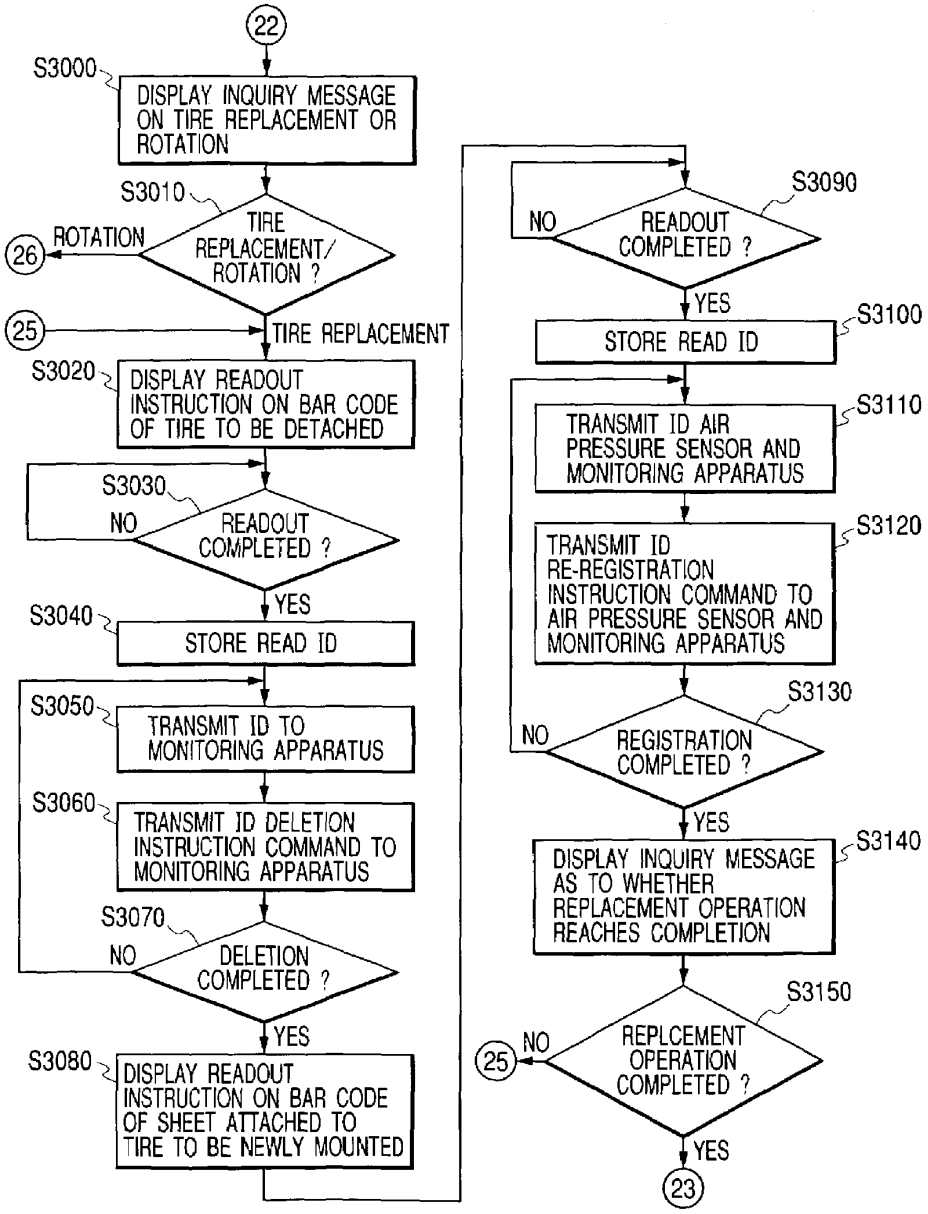
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FIG. 22



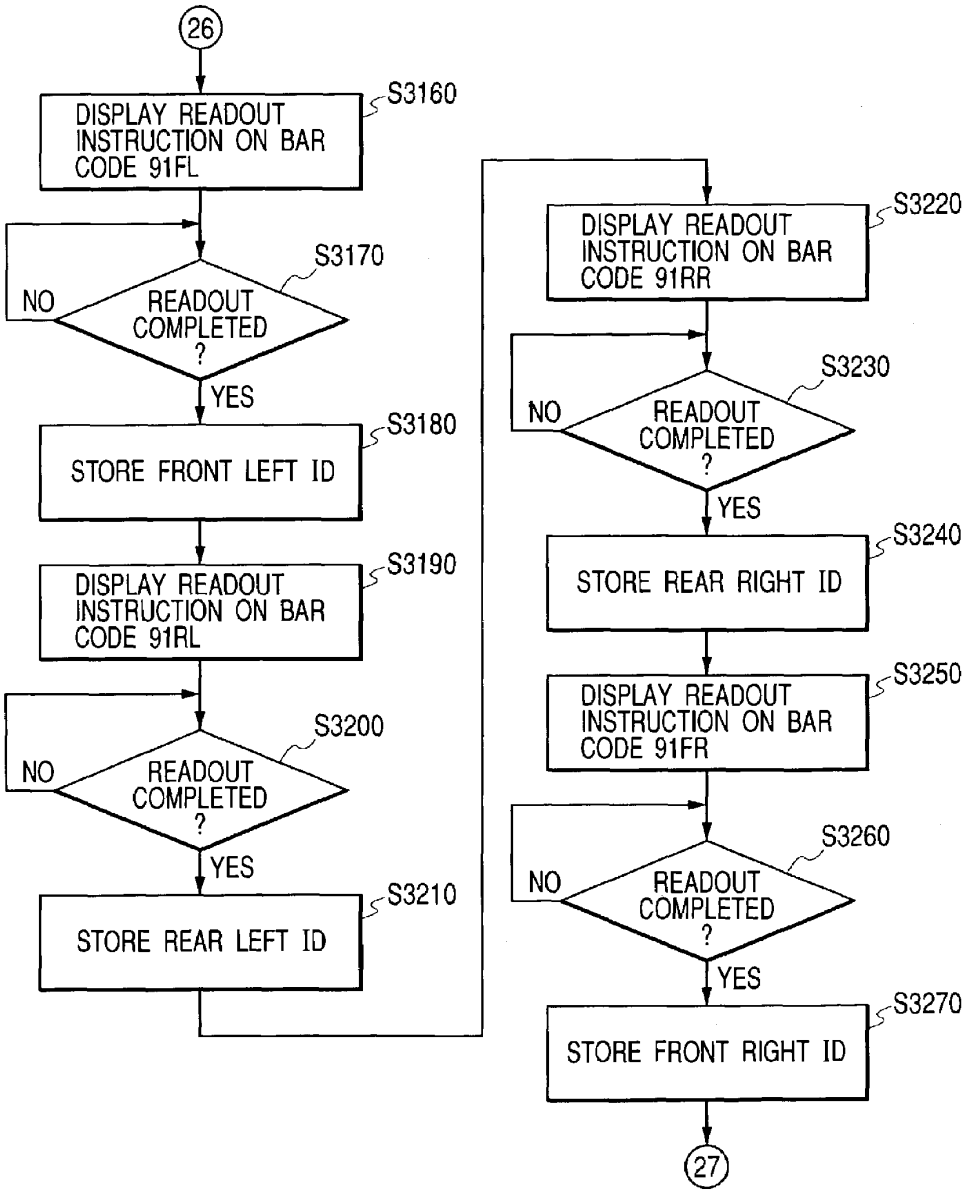
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FIG. 23



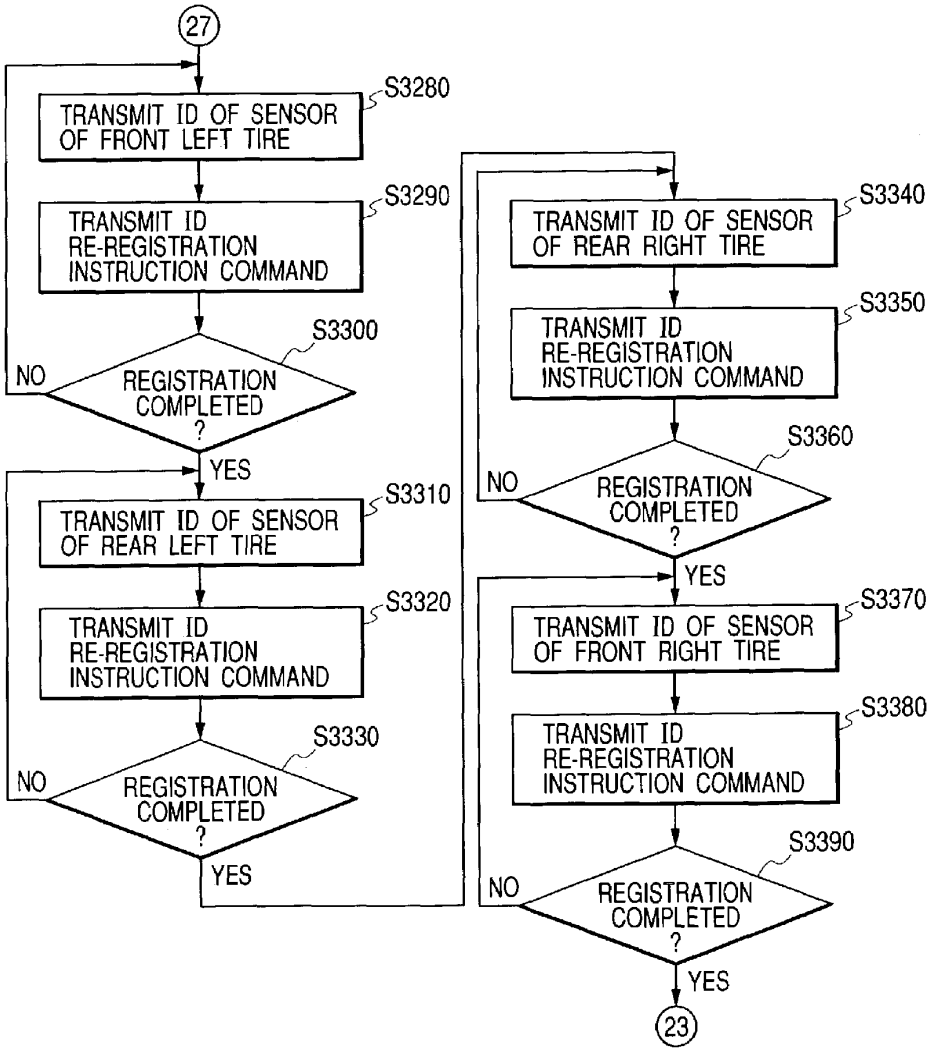
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FIG. 24



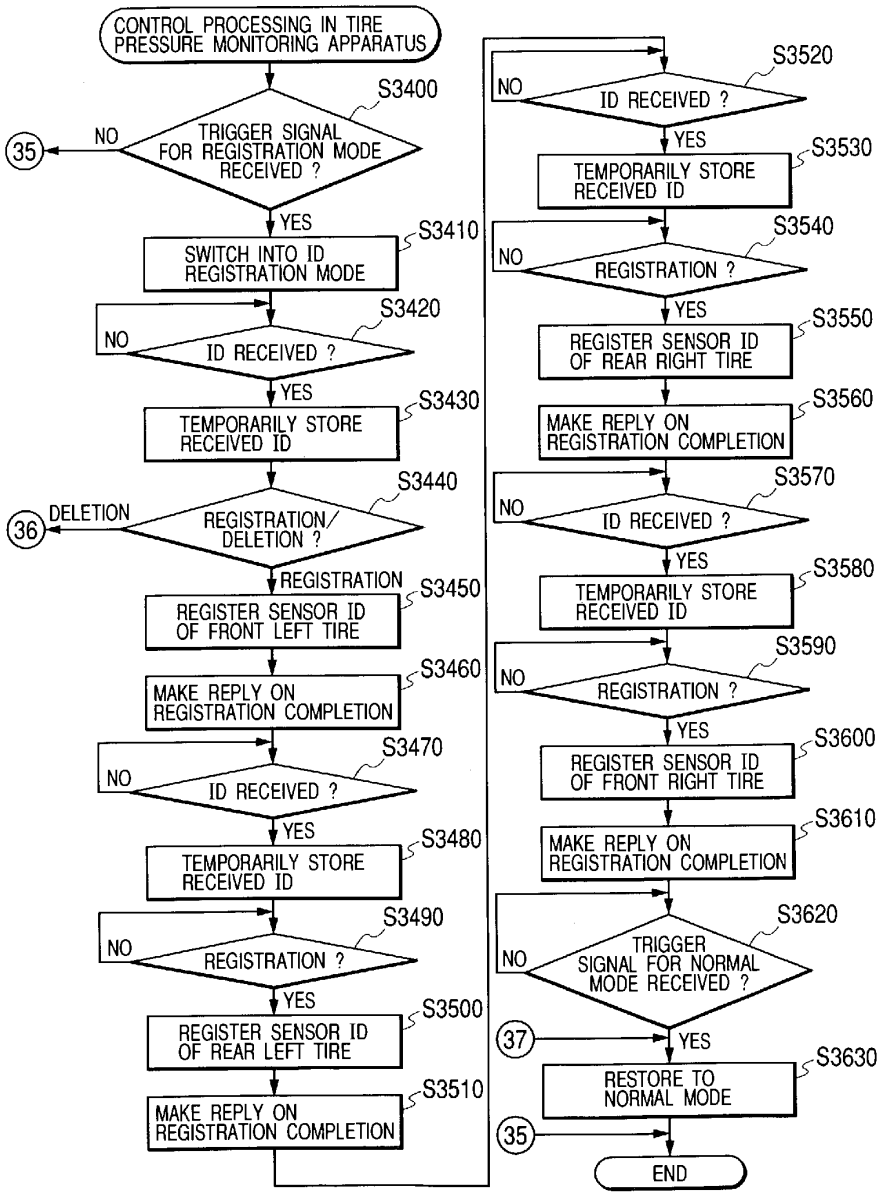
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FIG. 25



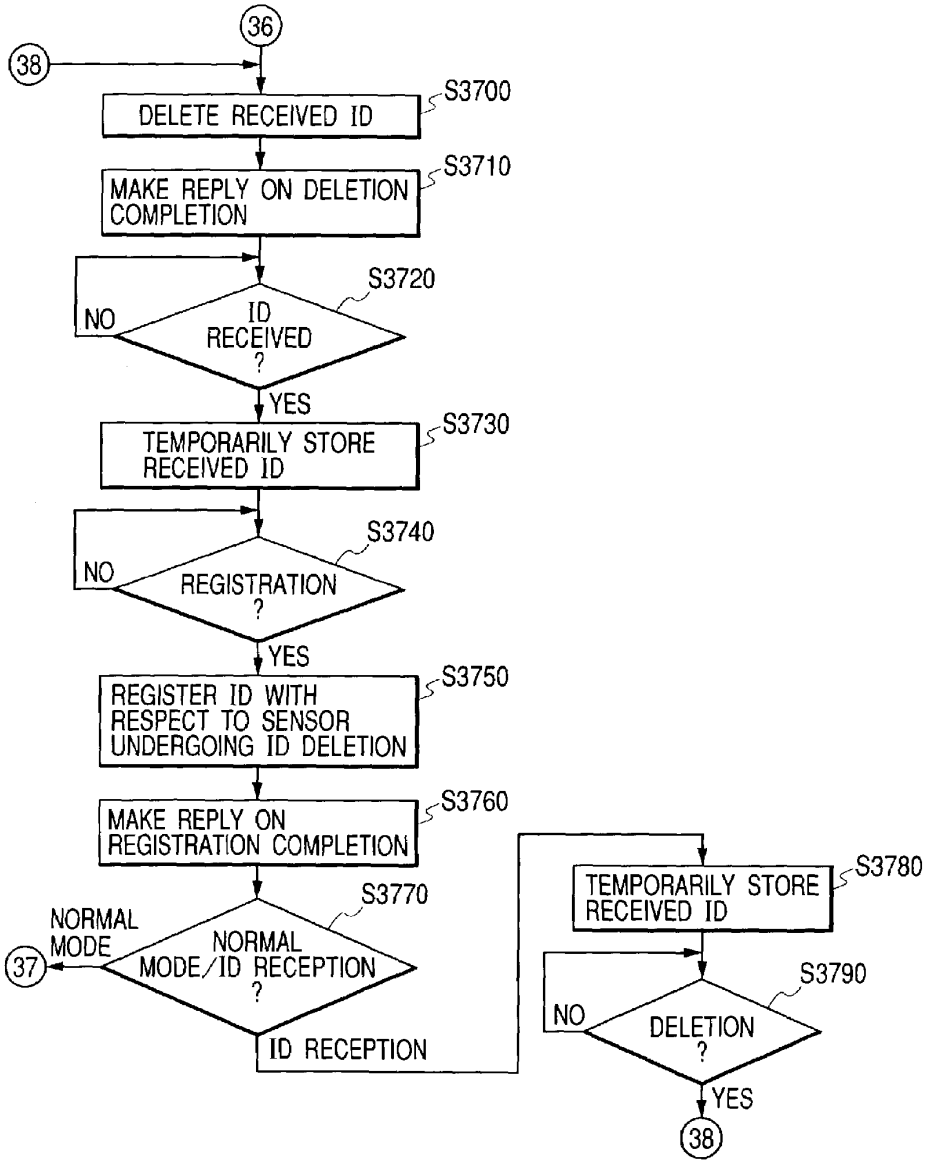
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FIG. 26



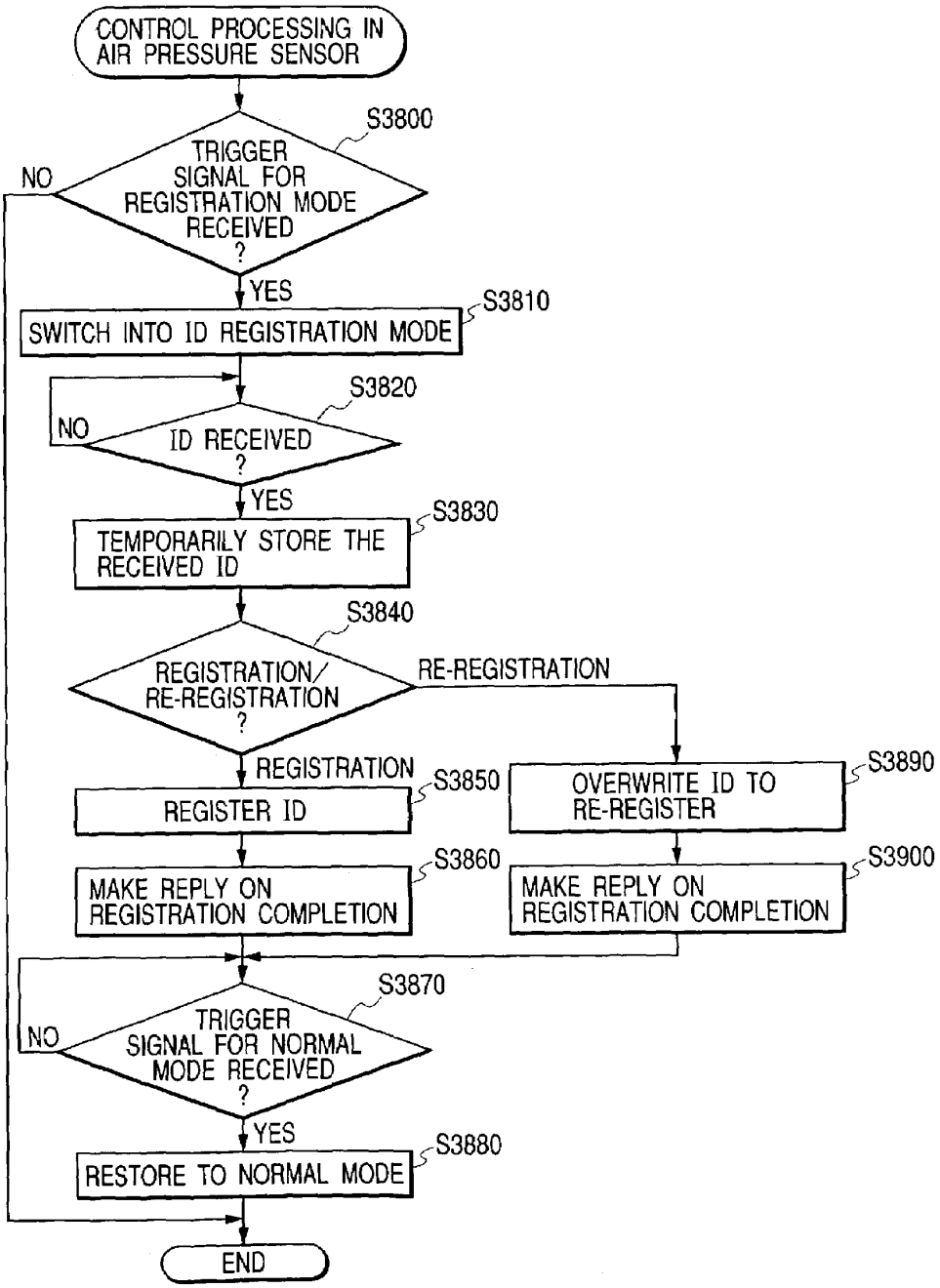
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FIG. 27



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FIG. 28



Orange Exhibit No. 2003
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FIG. 29A

DATA CODE

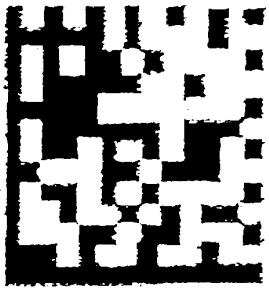


FIG. 29B

QR CODE

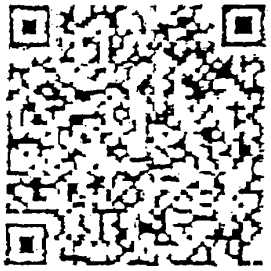


FIG. 29C

MAXI CODE

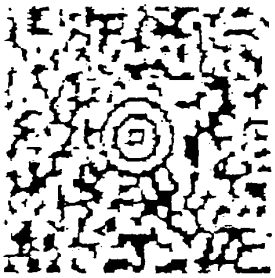
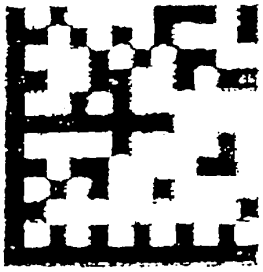


FIG. 29D

CP CODE



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FIG. 30A

EXAMPLE OF TWO-DIMENSIONAL BAR CODE

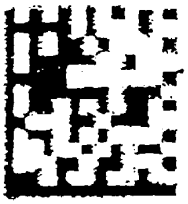


FIG. 30B

EXAMPLE OF TWO-DIMENSIONAL BAR CODE



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IPR2024-00744

FIG. 31A

PDF 417

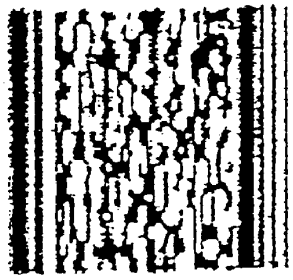


FIG. 31B

CODE 49

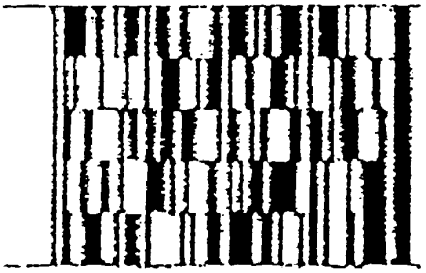


FIG. 31C

CODE 16K

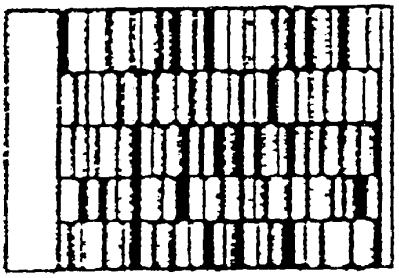
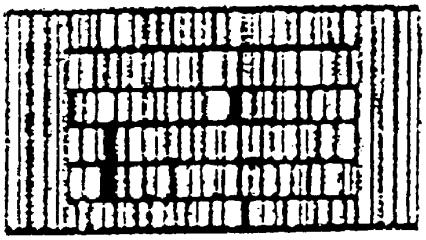


FIG. 31D

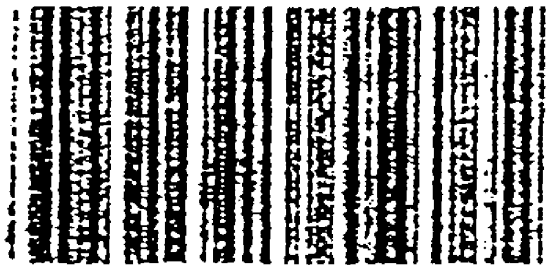
CODER BLOCK



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IPR2024-00744

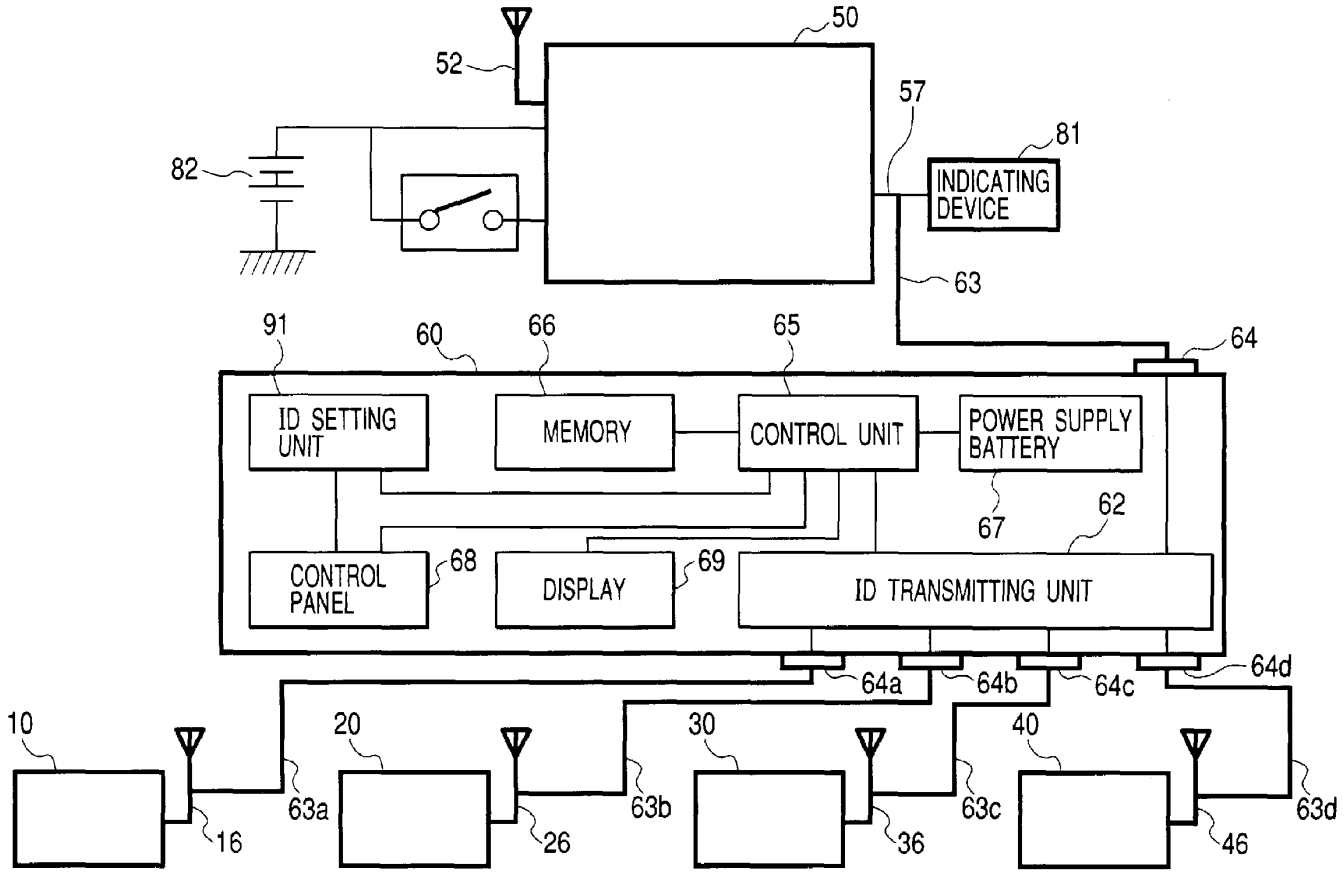
FIG. 32

EXAMPLE OF ONE-DIMENSIONAL BAR CODE



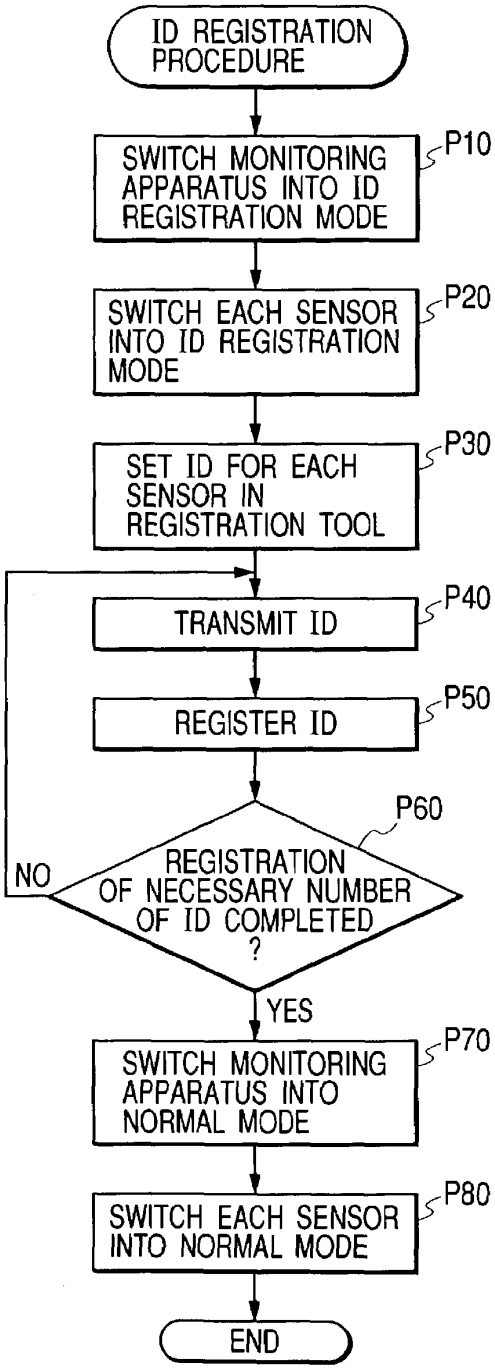
Orange Exhibit No. 2003
IPR2024-00744

FIG. 33



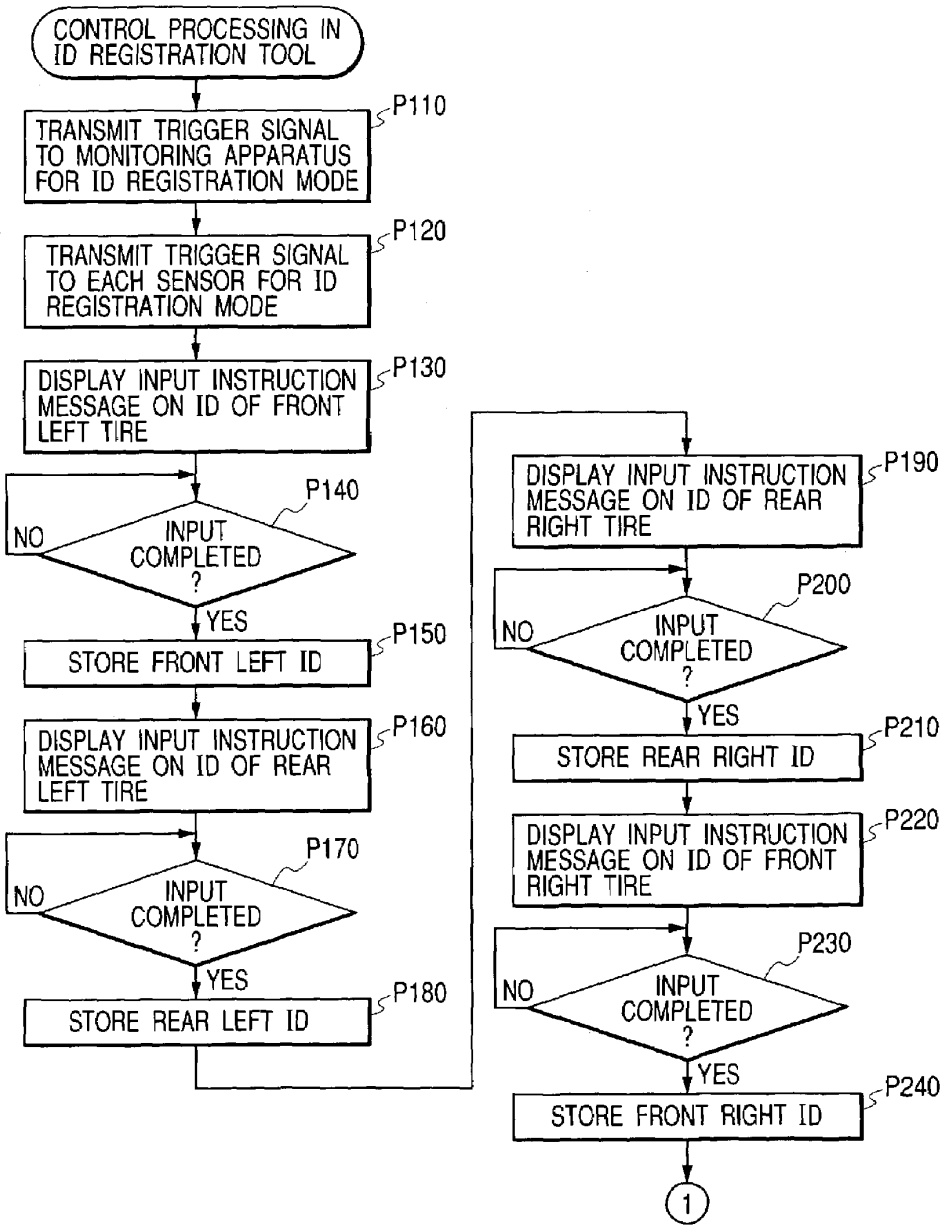
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IPR2024-00744

FIG. 34



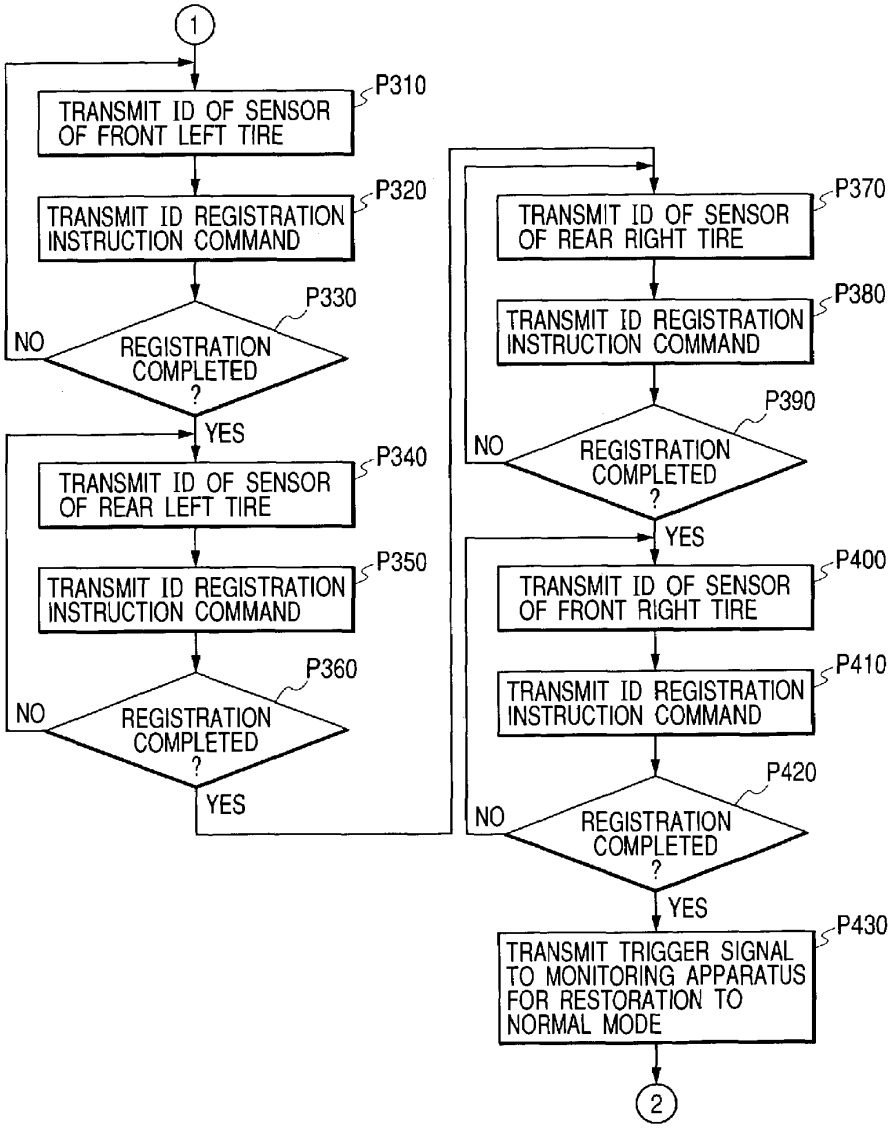
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FIG. 35



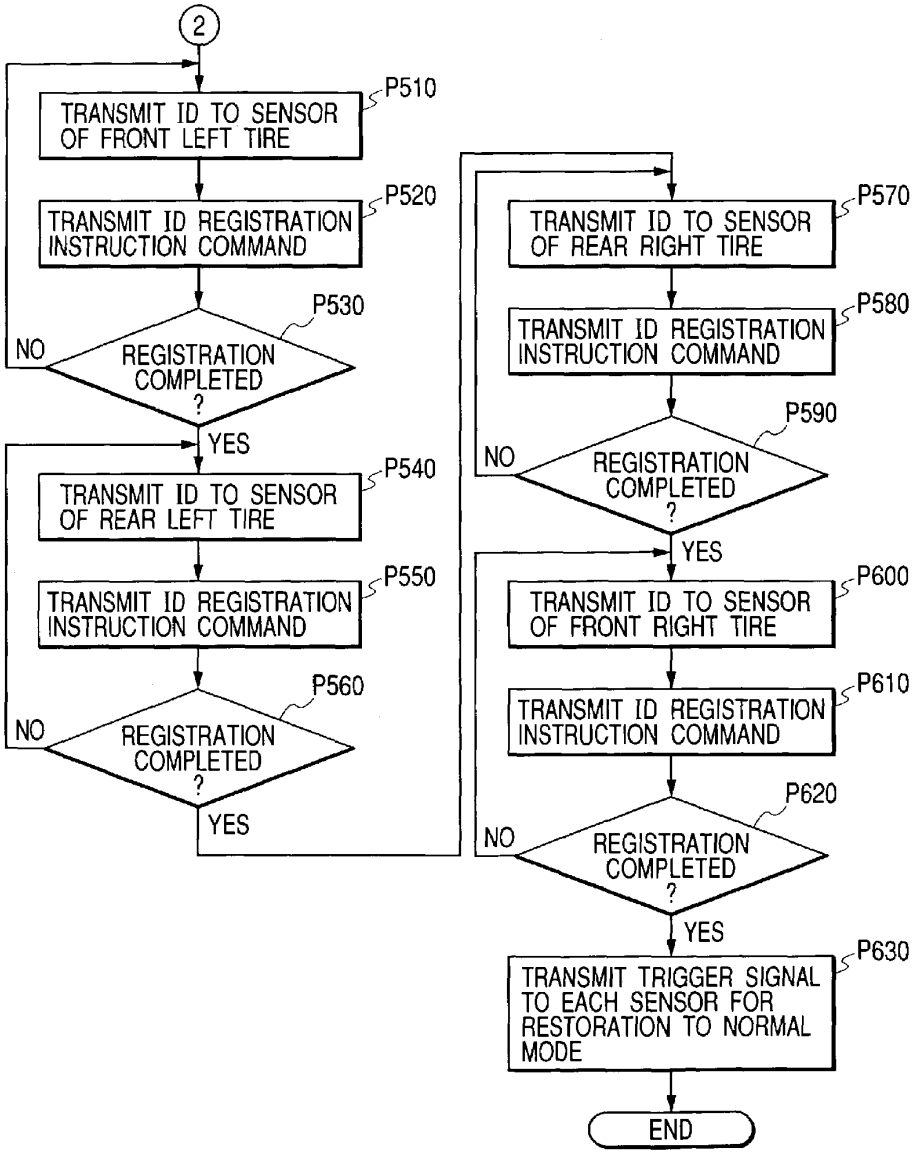
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FIG. 36



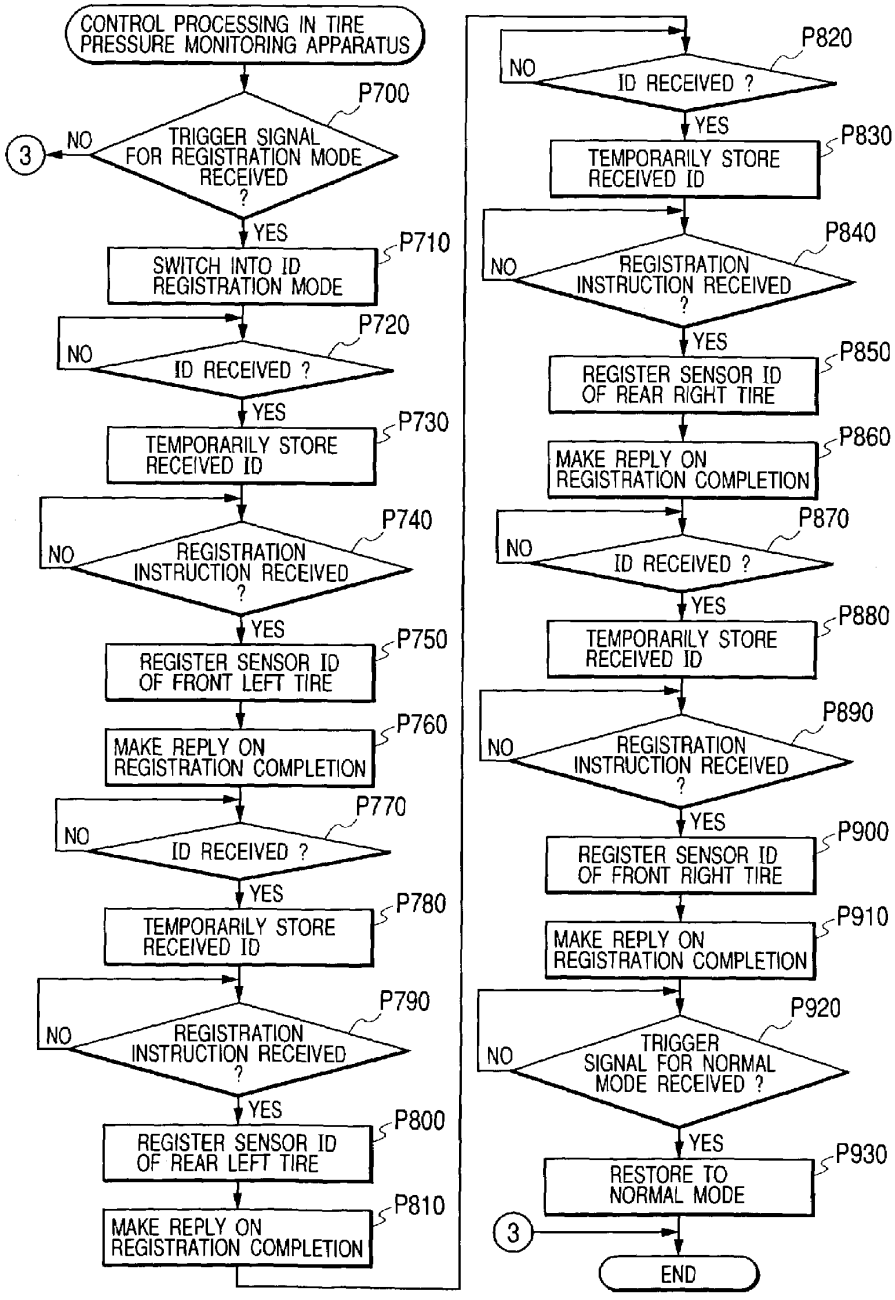
Orange Exhibit No. 2003
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FIG. 37



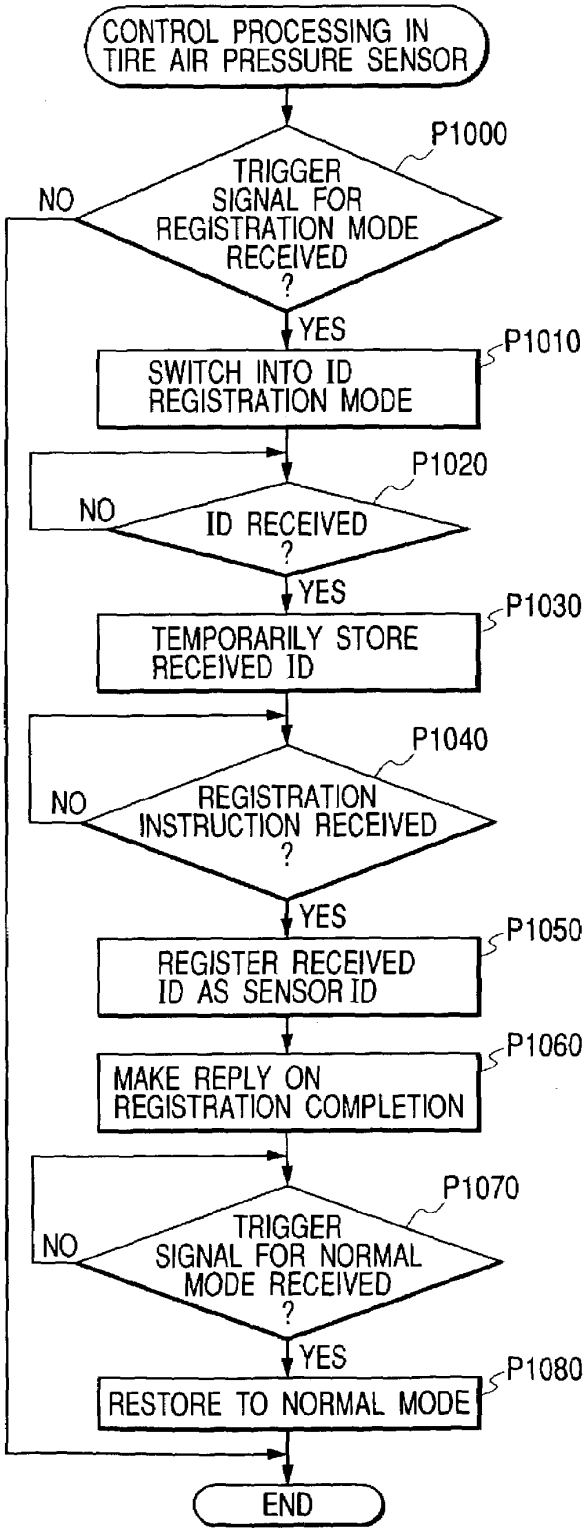
Orange Exhibit No. 2003
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FIG. 38



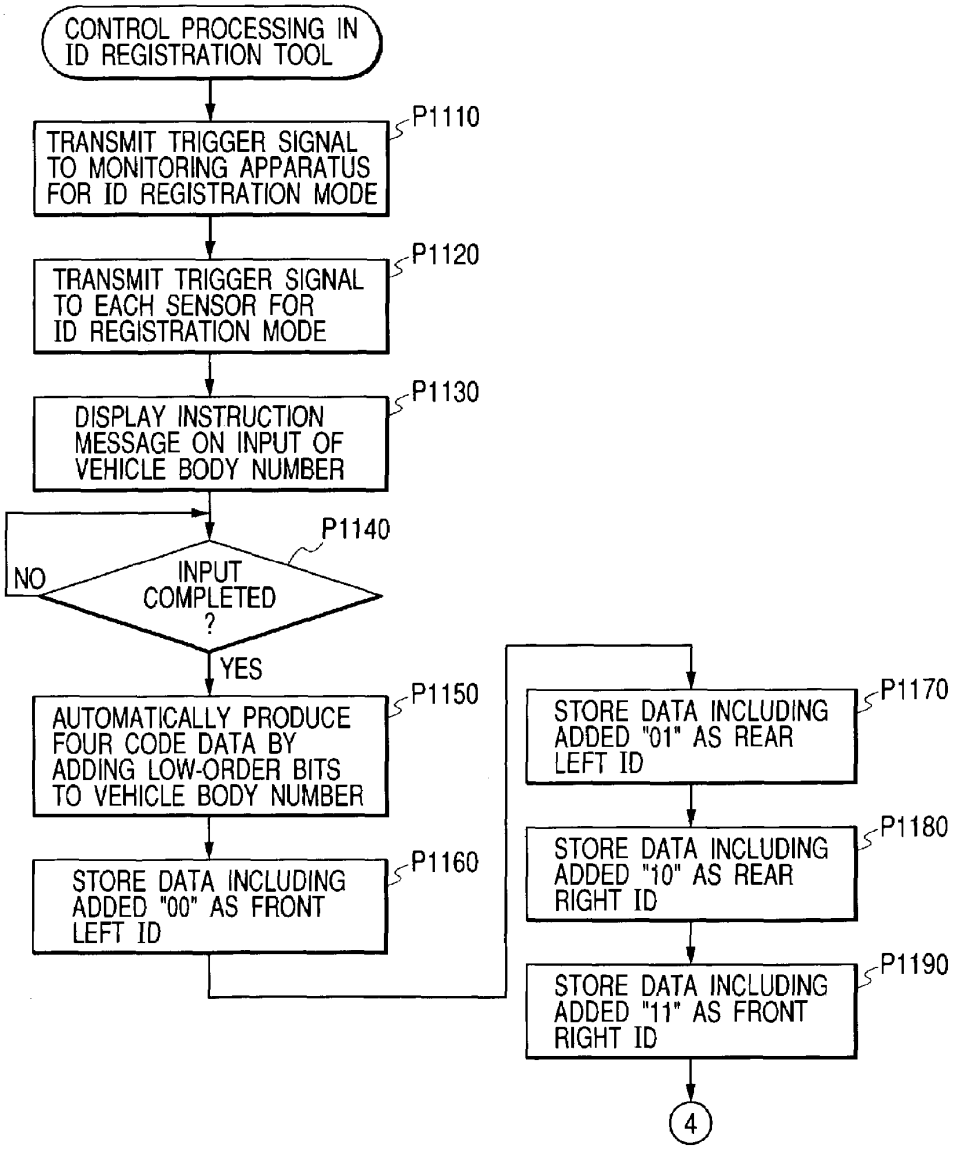
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FIG. 39



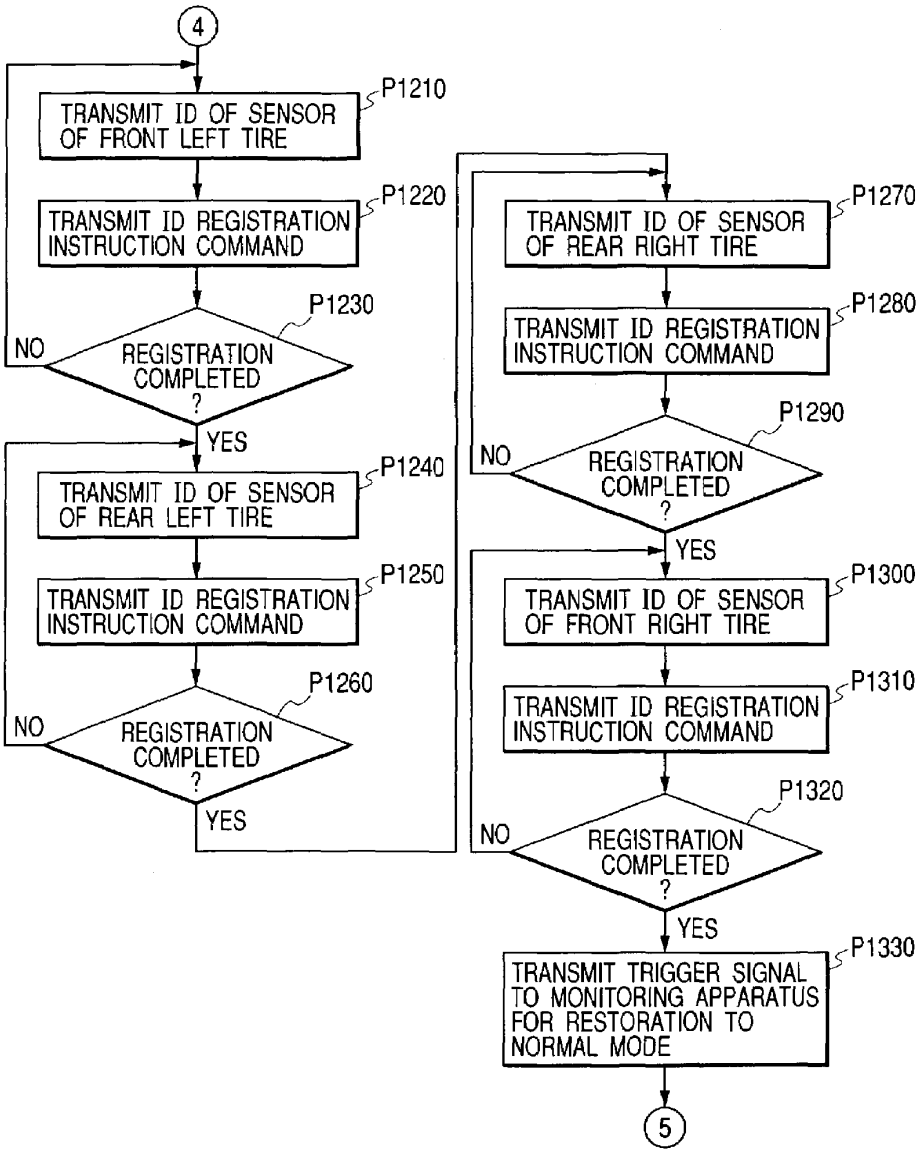
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FIG. 40



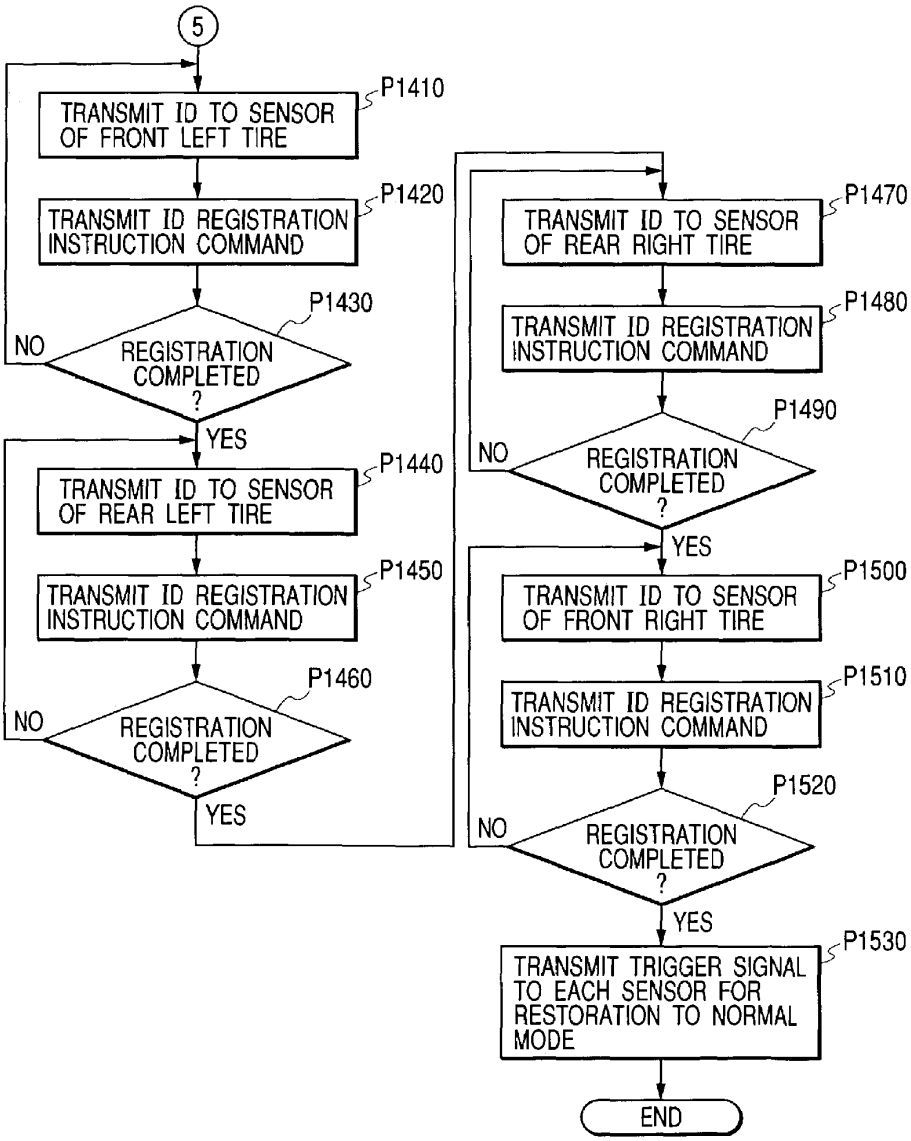
Orange Exhibit No. 2003
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FIG. 41



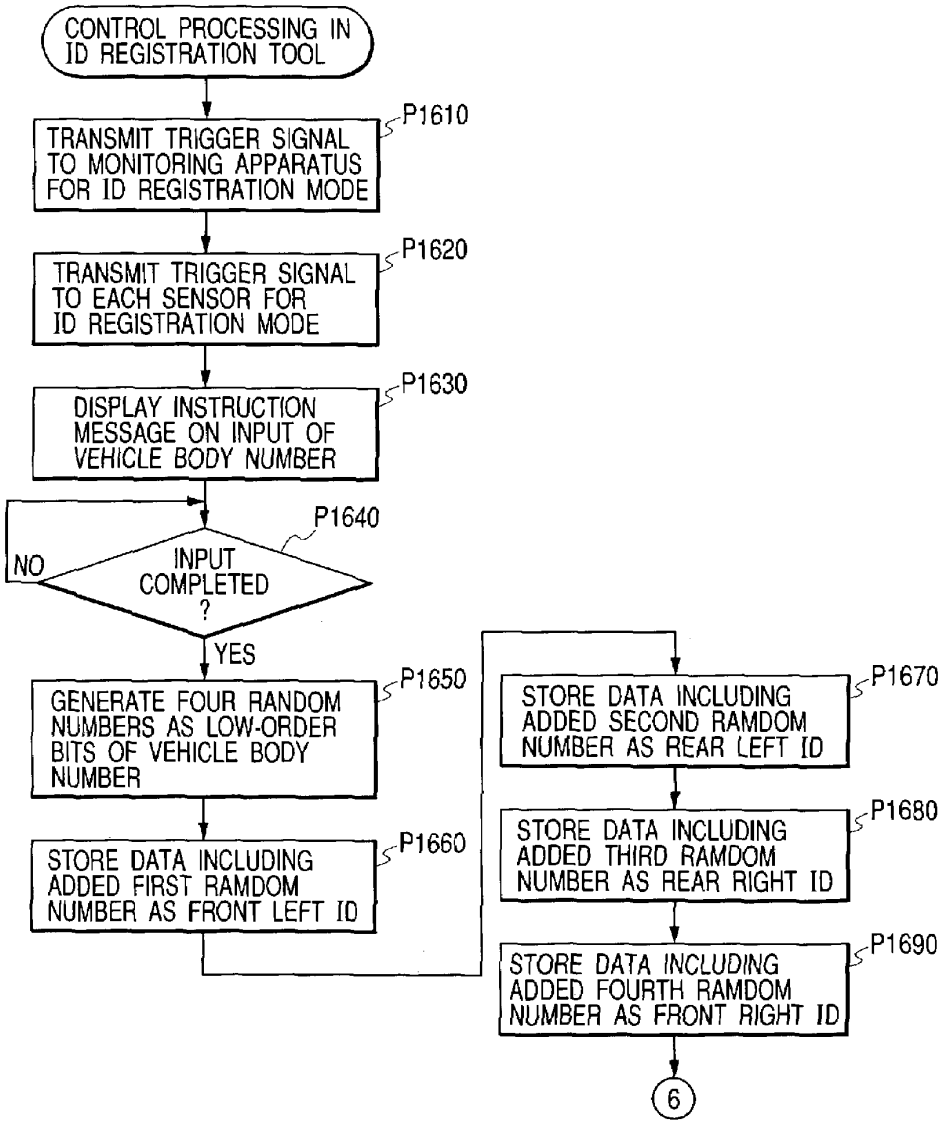
Orange Exhibit No. 2003
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FIG. 42



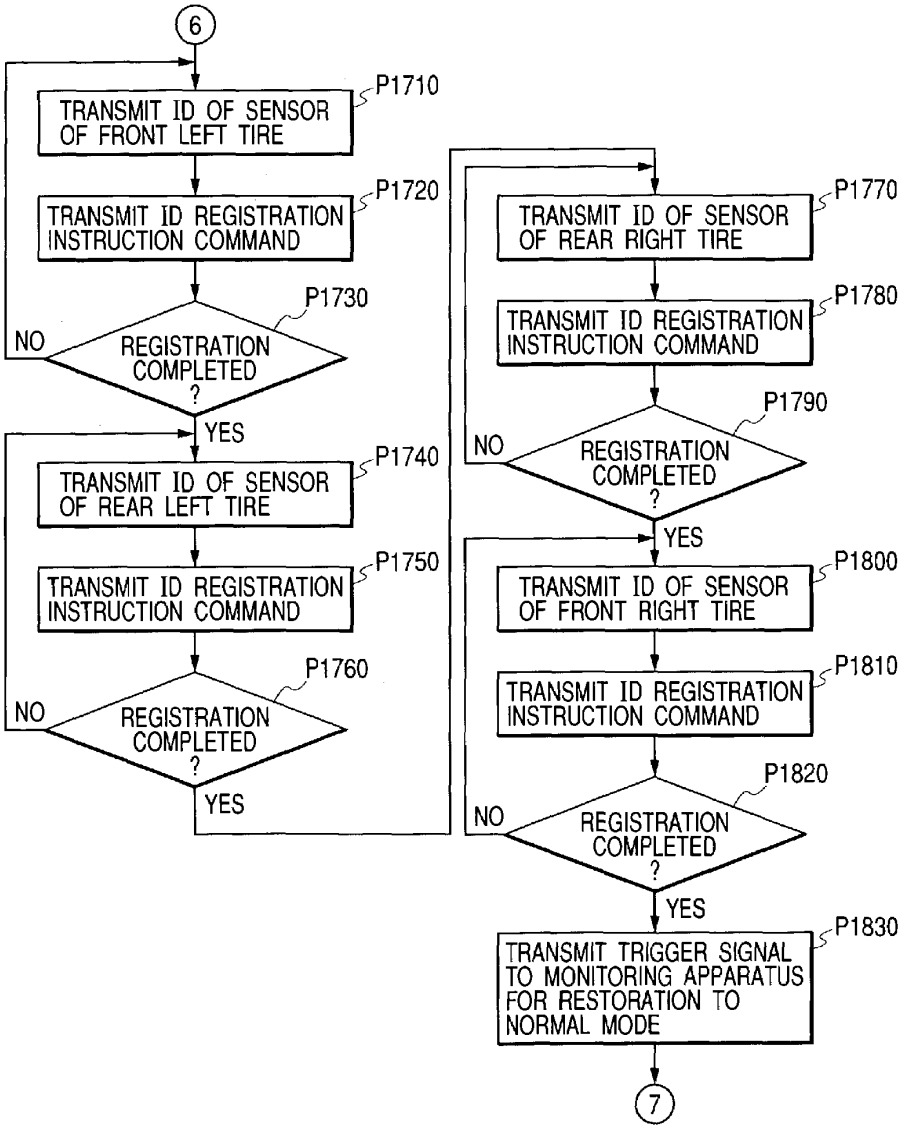
Orange Exhibit No. 2003
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FIG. 43



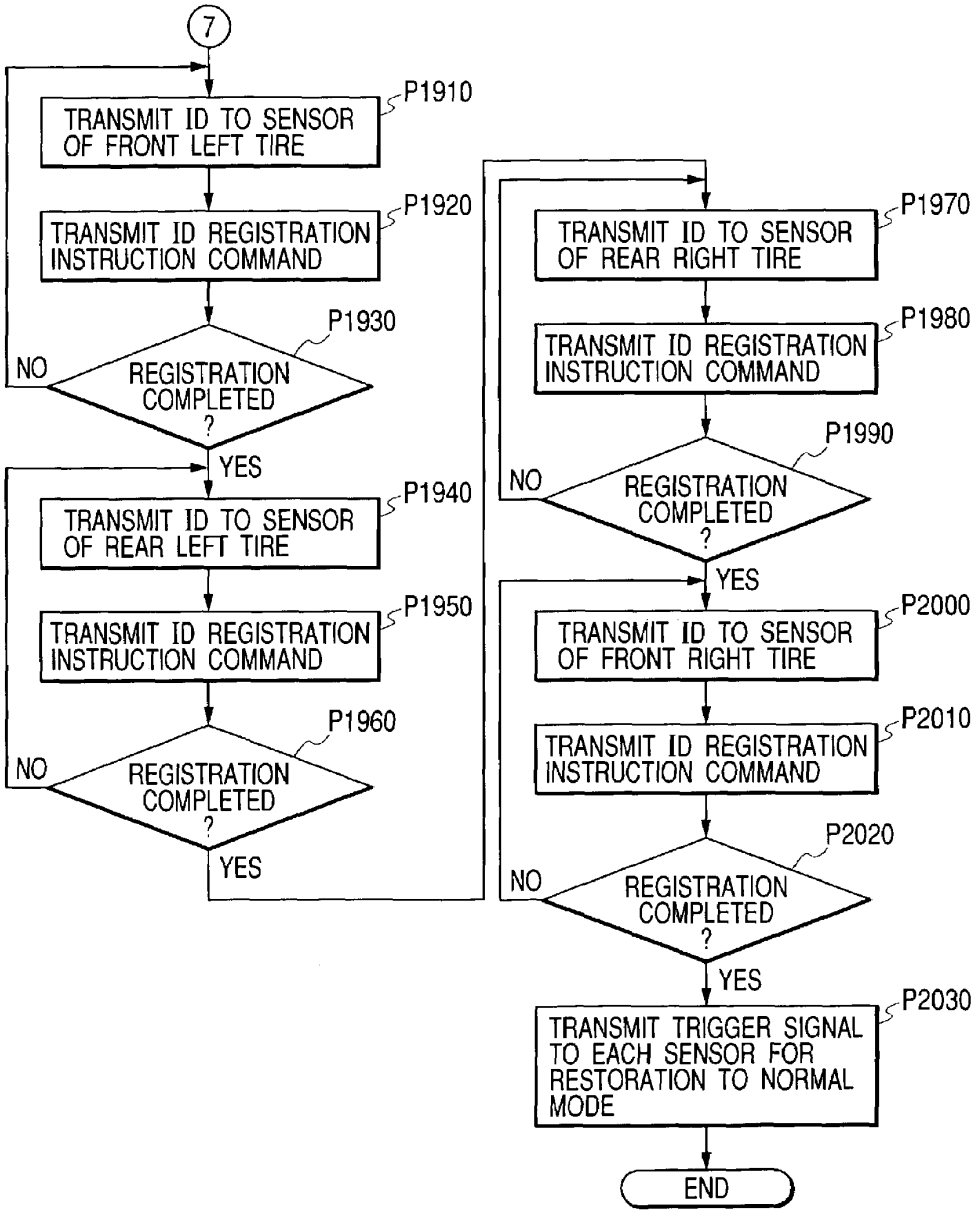
Orange Exhibit No. 2003
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FIG. 44



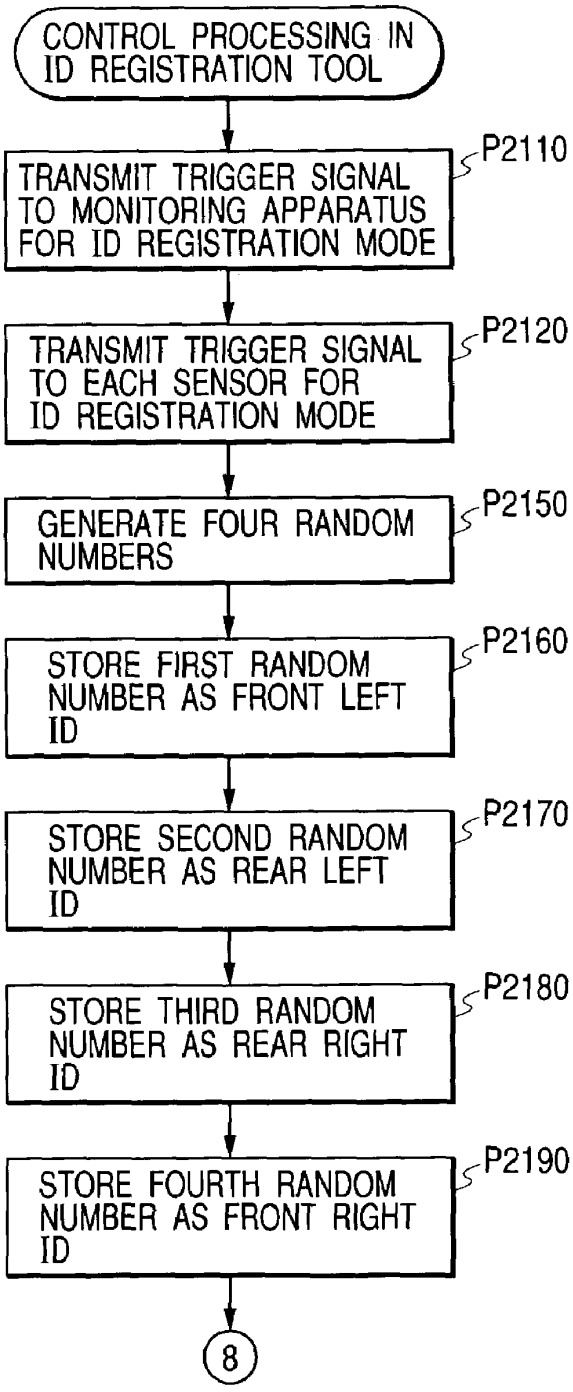
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FIG. 45



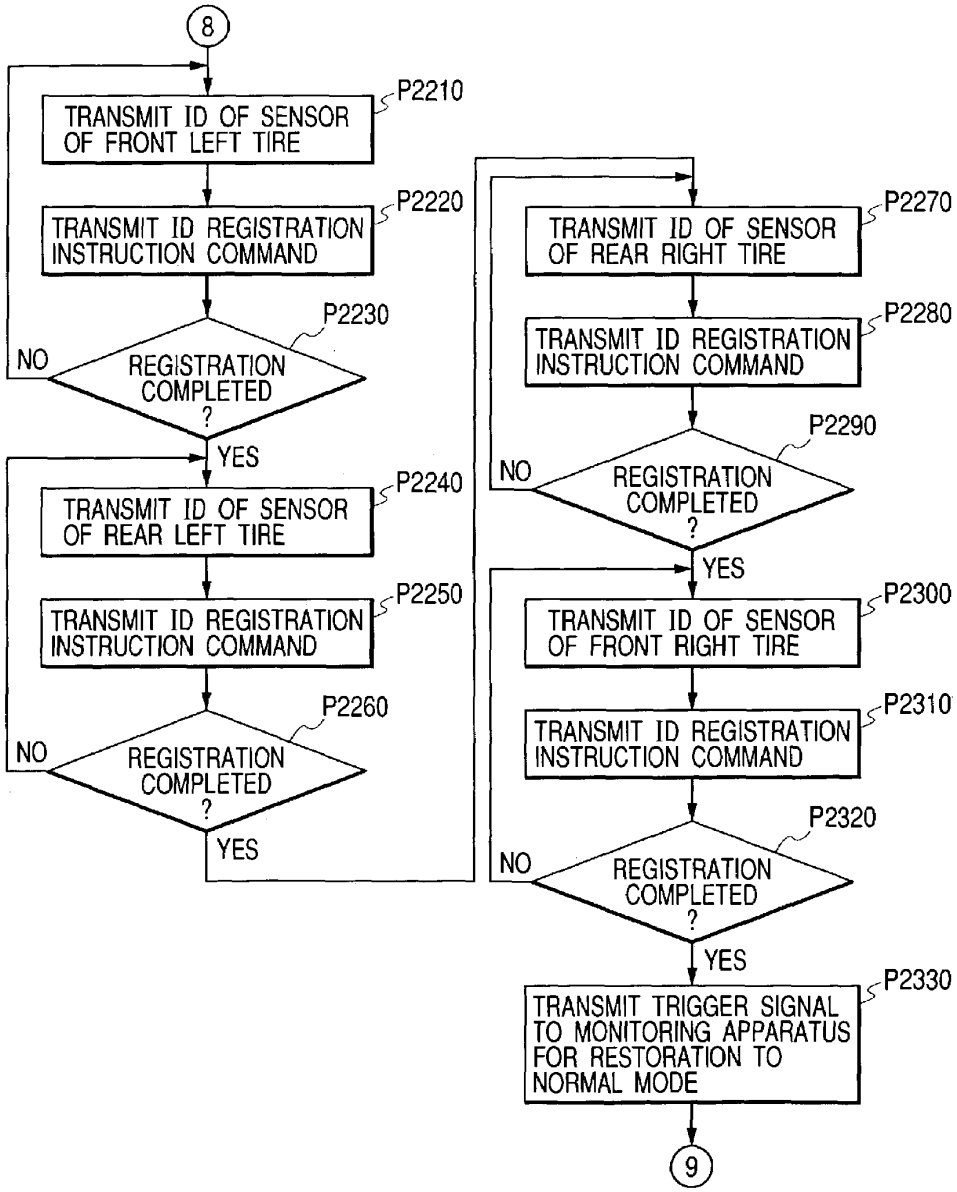
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FIG. 46



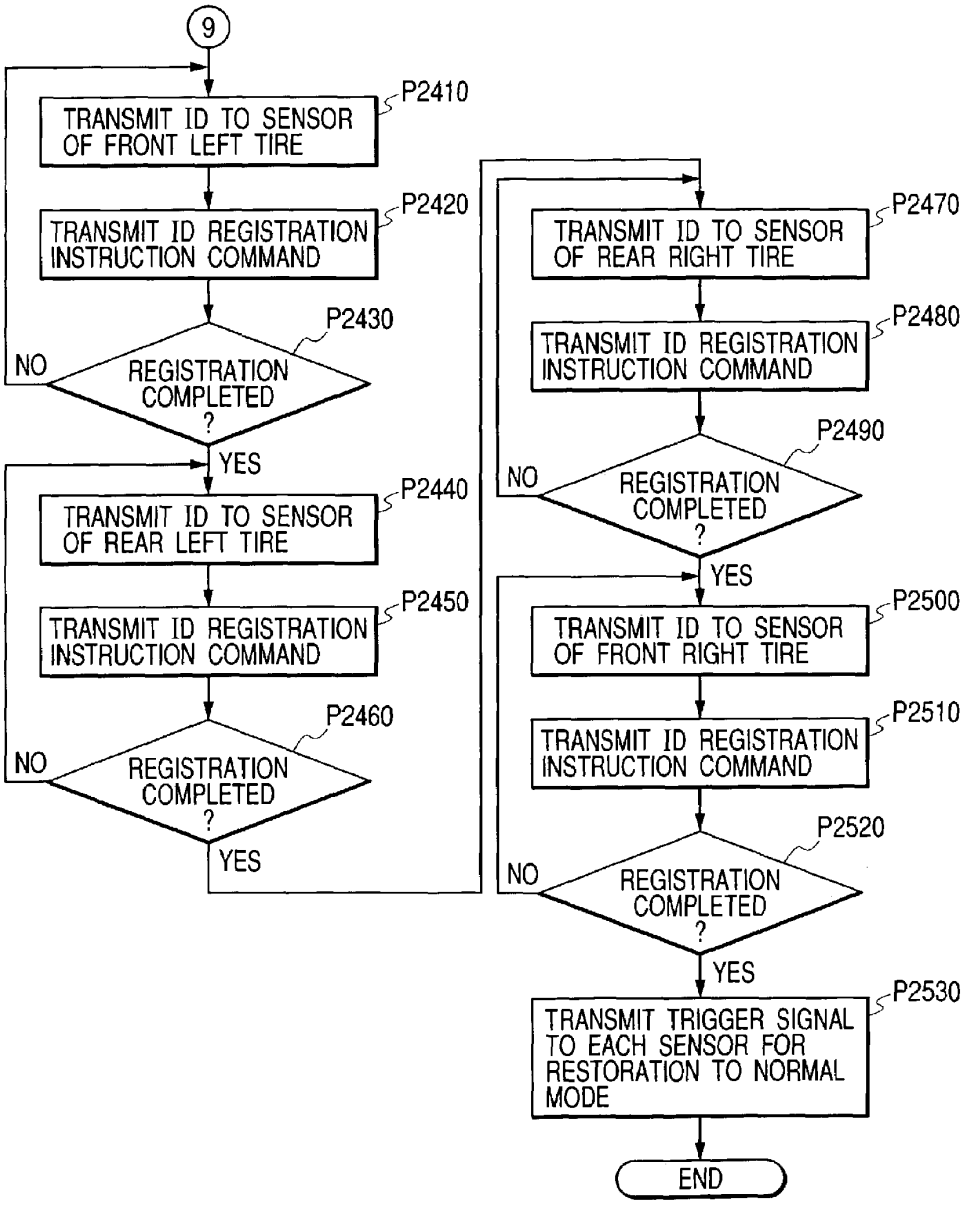
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FIG. 47



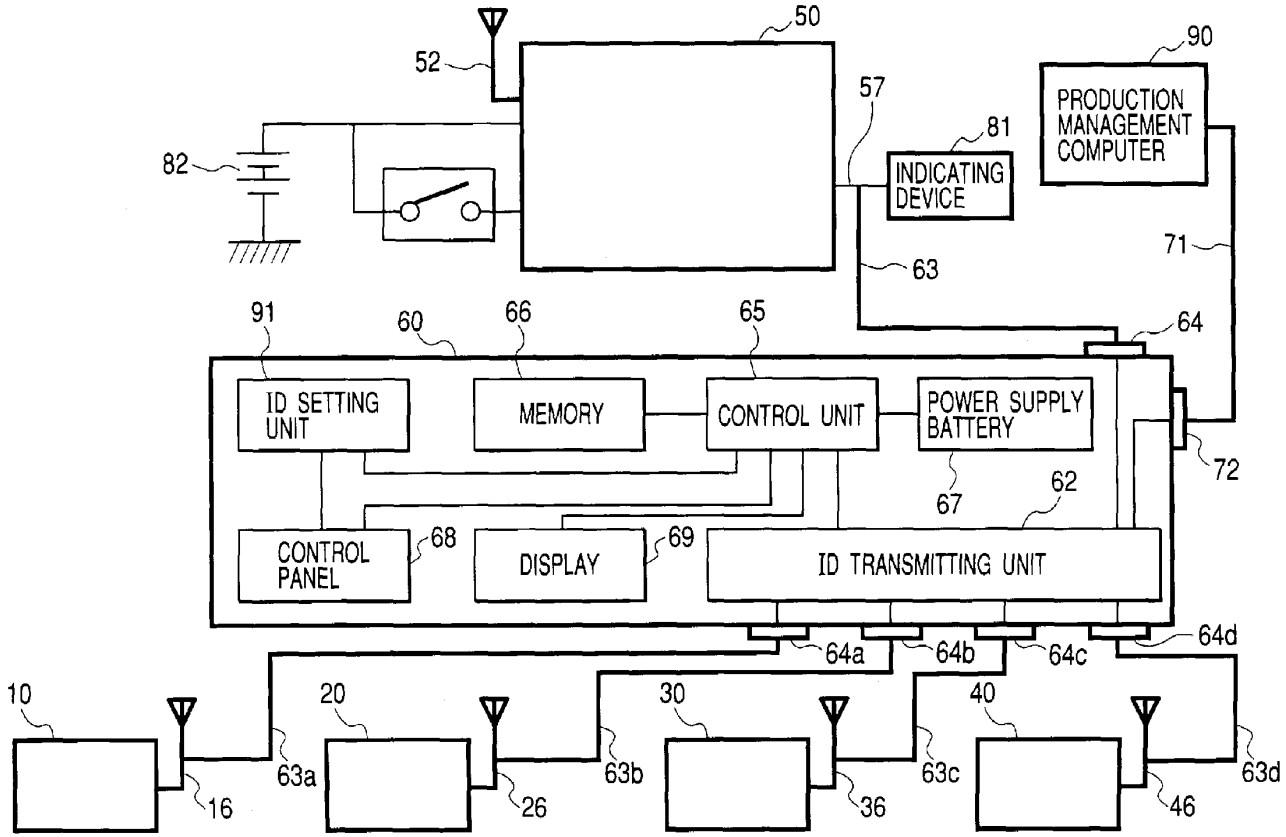
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FIG. 48



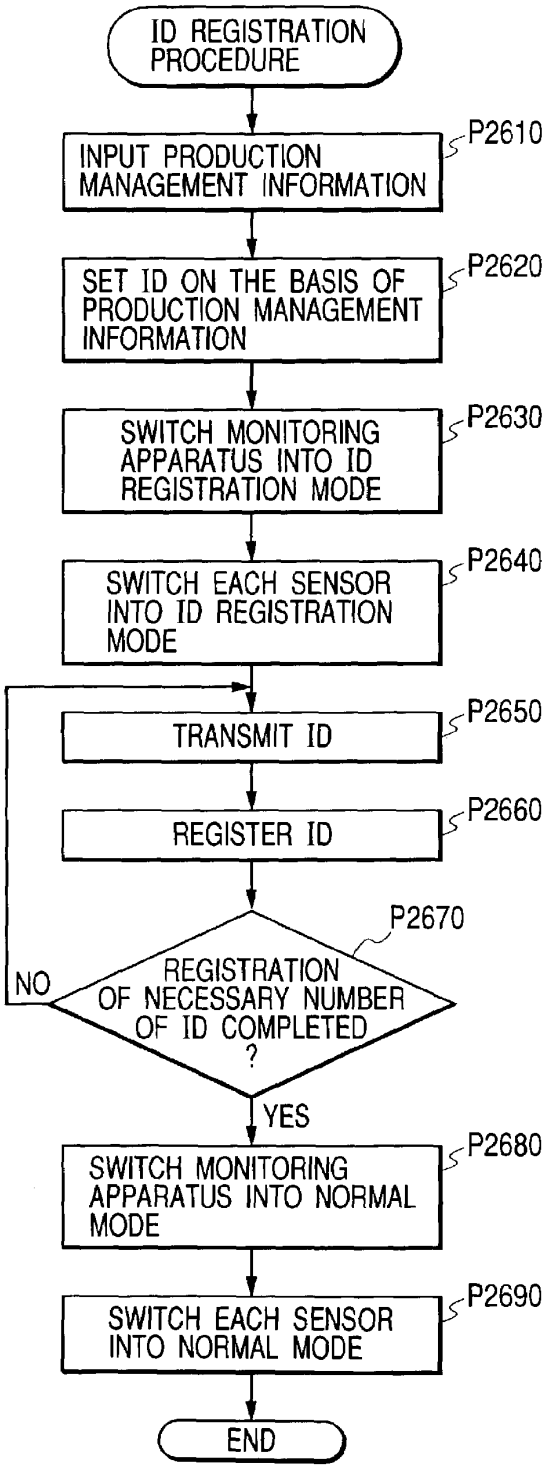
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FIG. 49



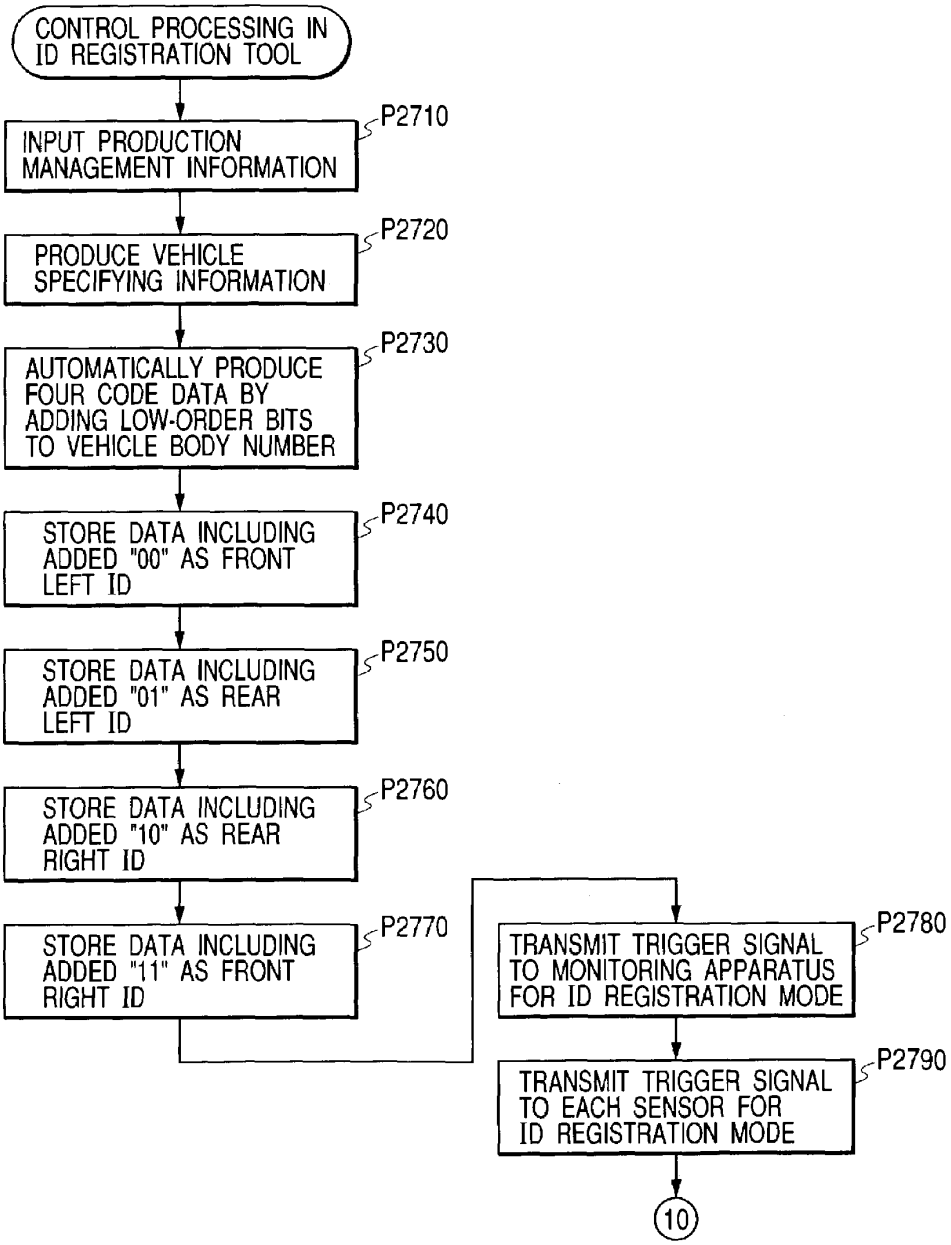
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FIG. 50



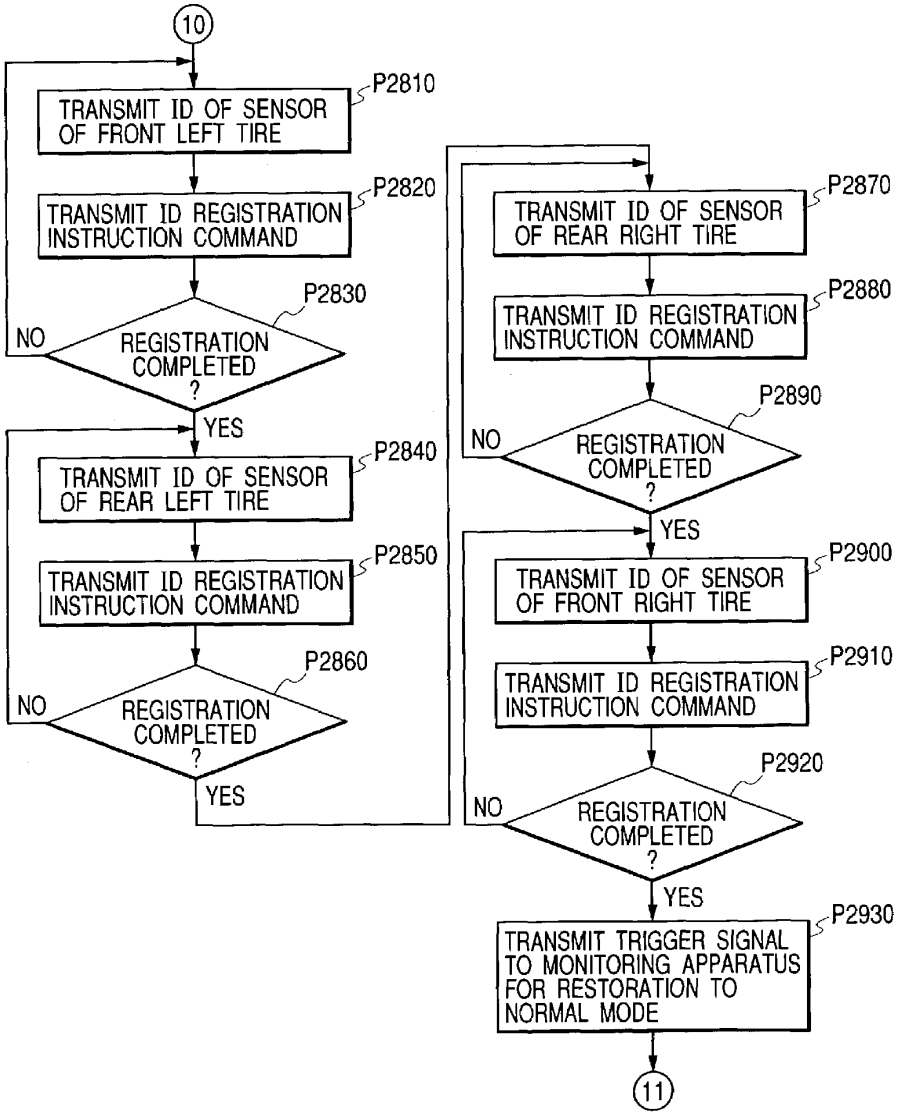
Orange Exhibit No. 2003
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FIG. 51



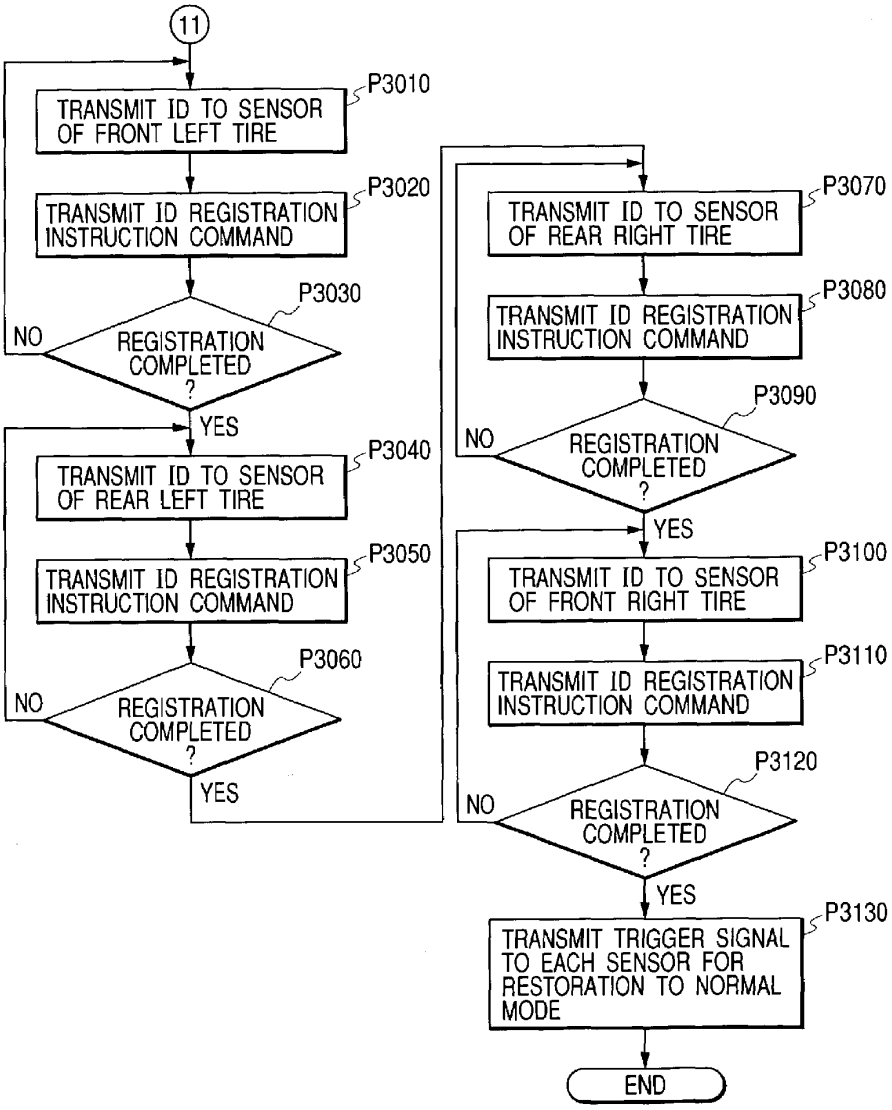
Orange Exhibit No. 2003
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FIG. 52



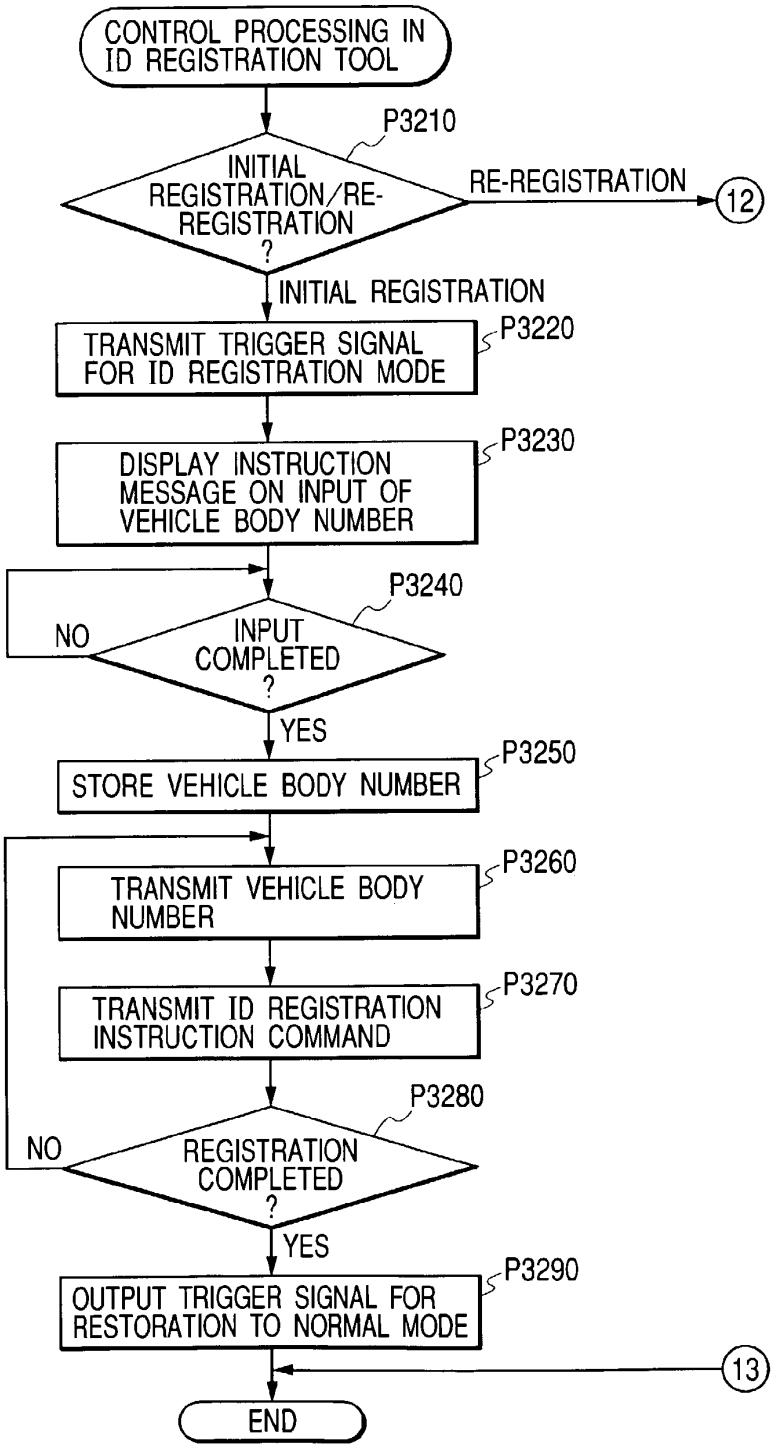
Orange Exhibit No. 2003
IPR2024-00744

FIG. 53



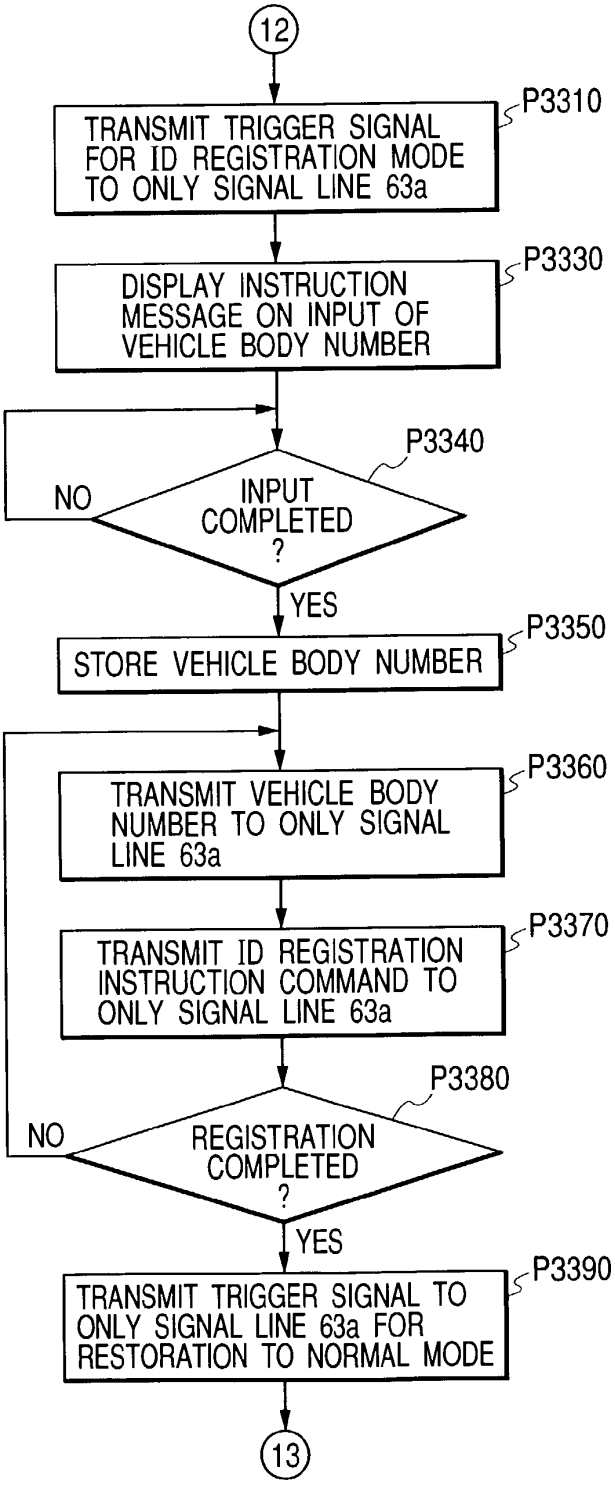
Orange Exhibit No. 2003
IPR2024-00744

FIG. 54



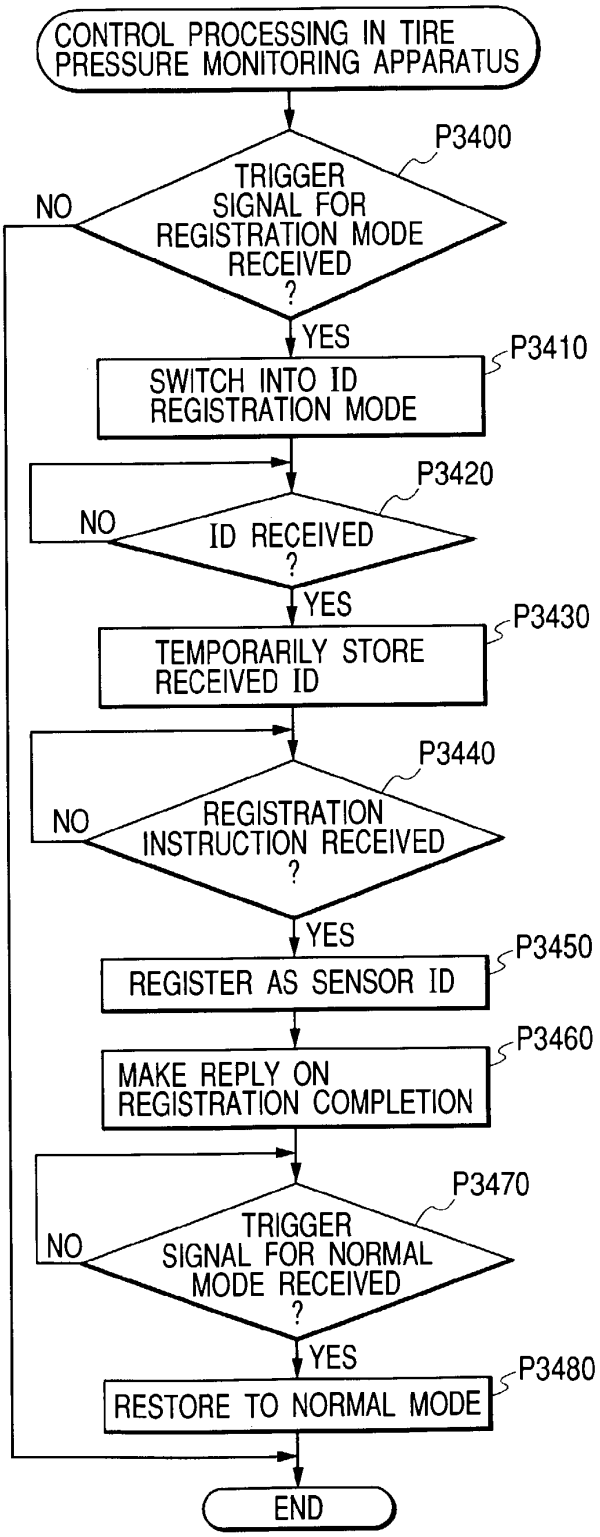
Orange Exhibit No. 2003
IPR2024-00744

FIG. 55



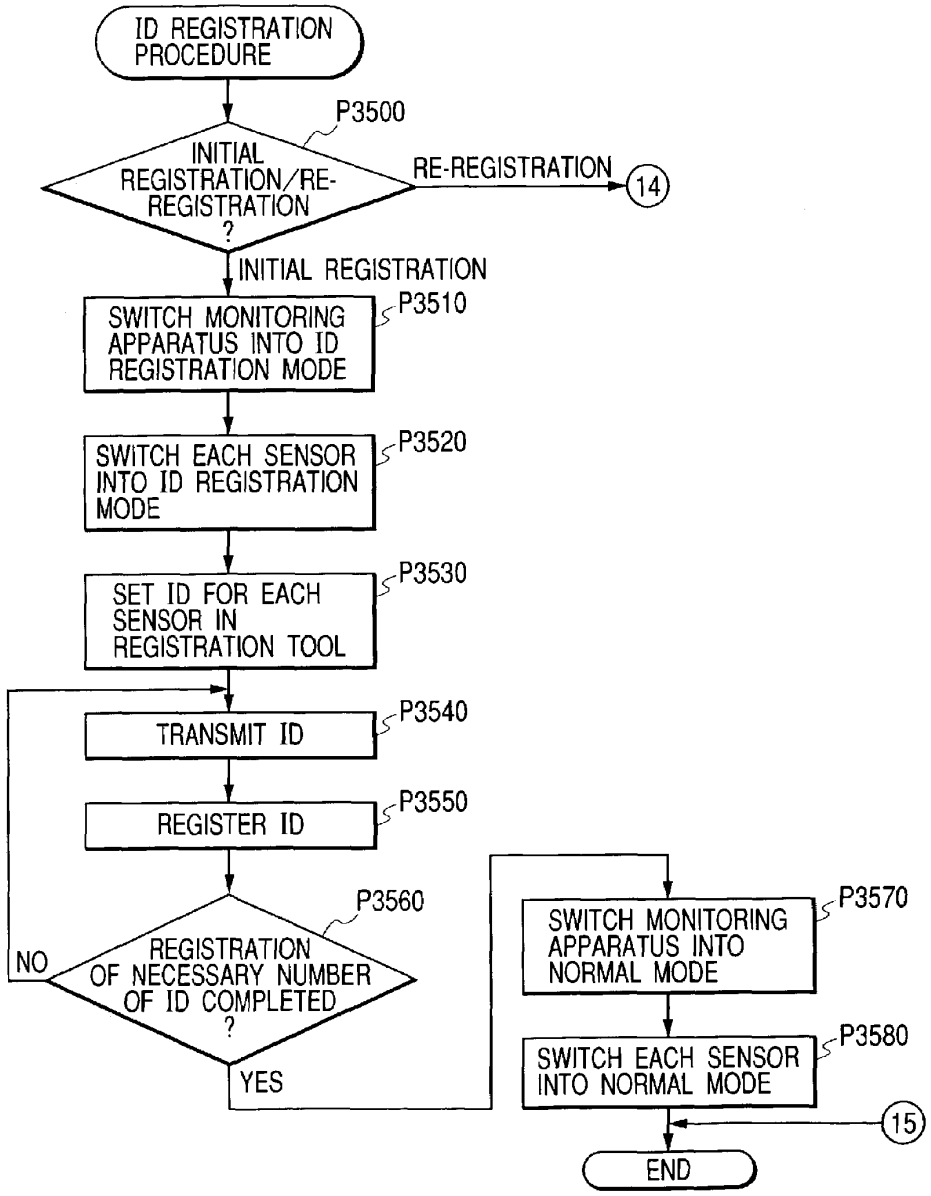
Orange Exhibit No. 2003
IPR2024-00744

FIG. 56



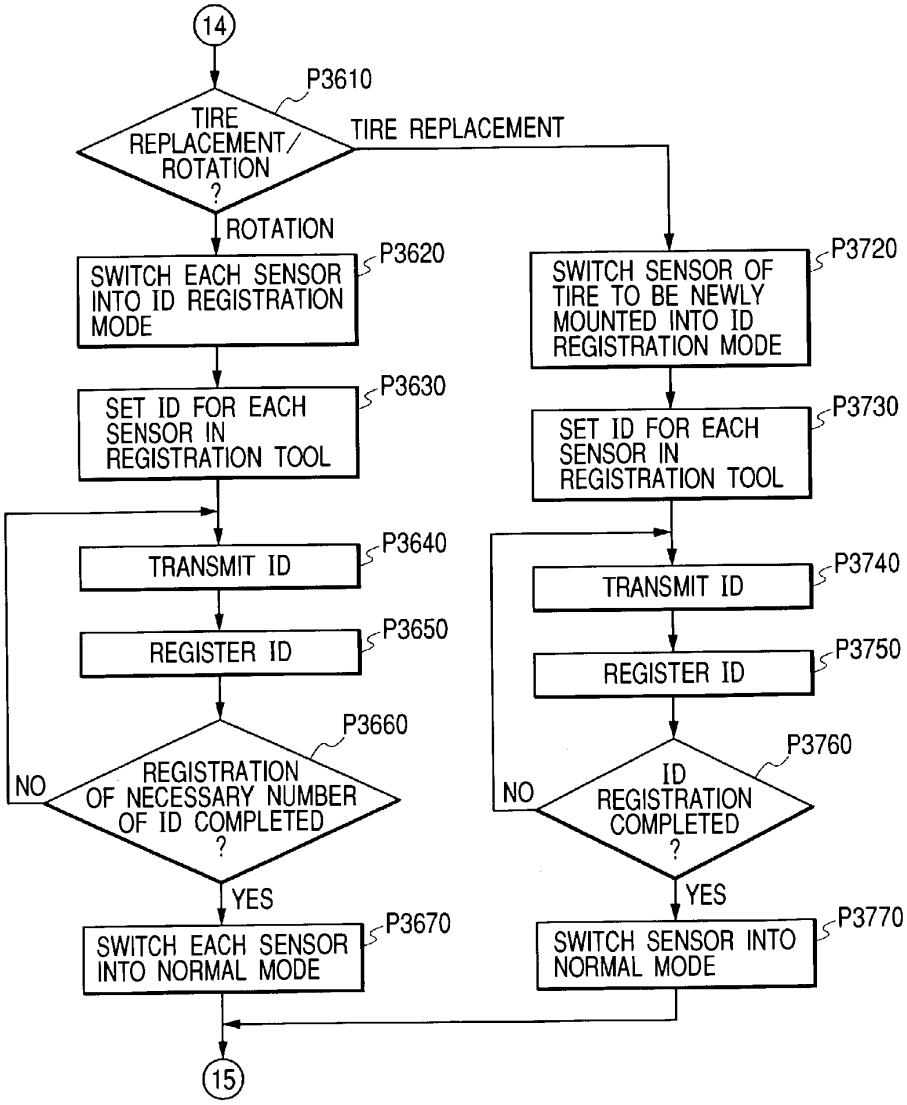
Orange Exhibit No. 2003
IPR2024-00744

FIG. 57



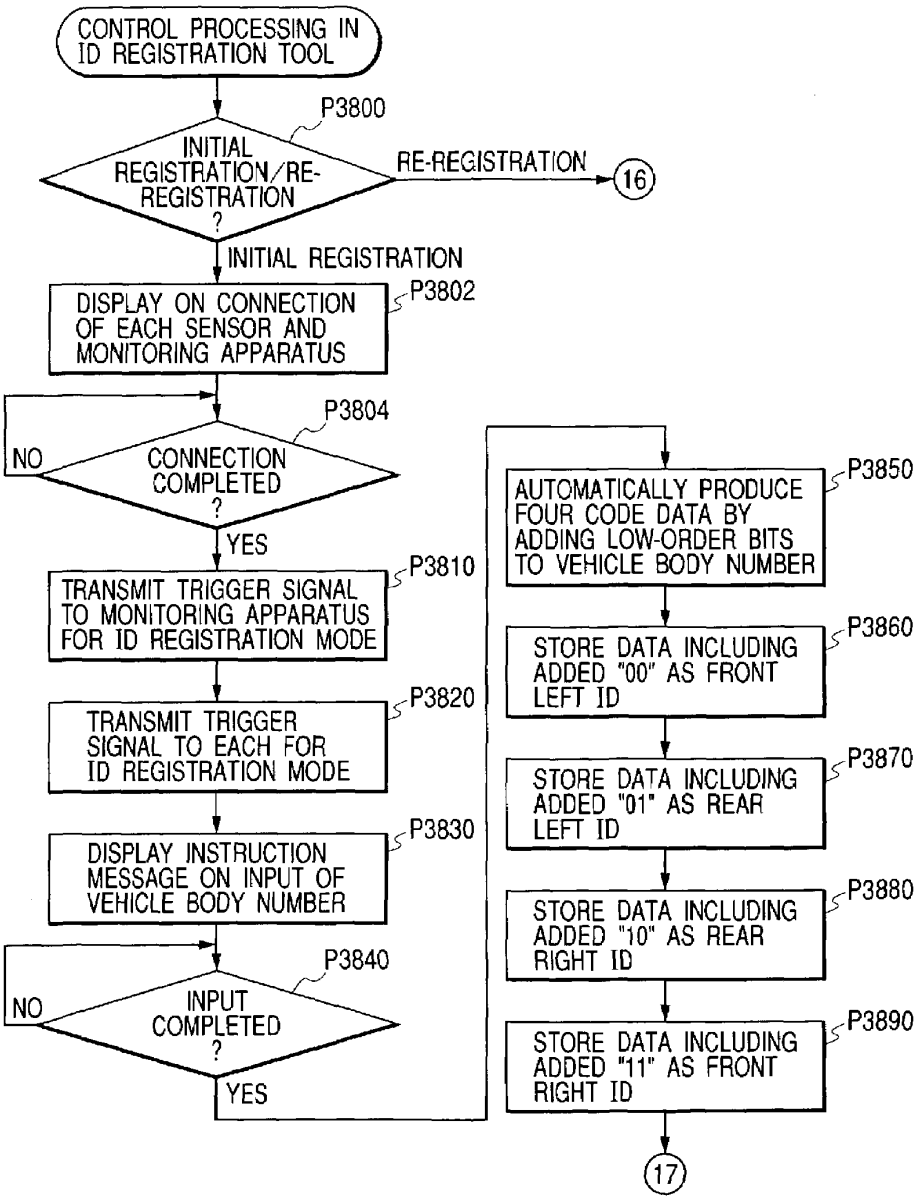
Orange Exhibit No. 2003
IPR2024-00744

FIG. 58



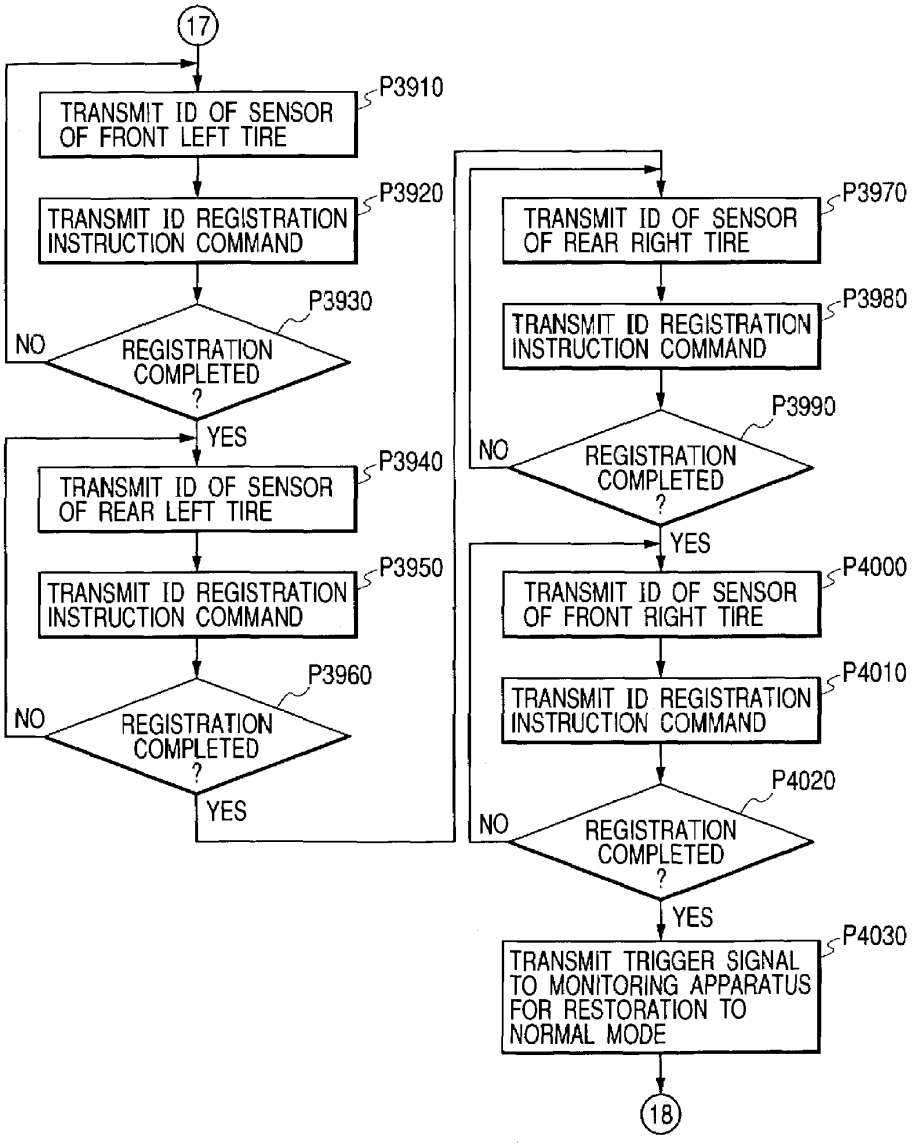
Orange Exhibit No. 2003
IPR2024-00744

FIG. 59



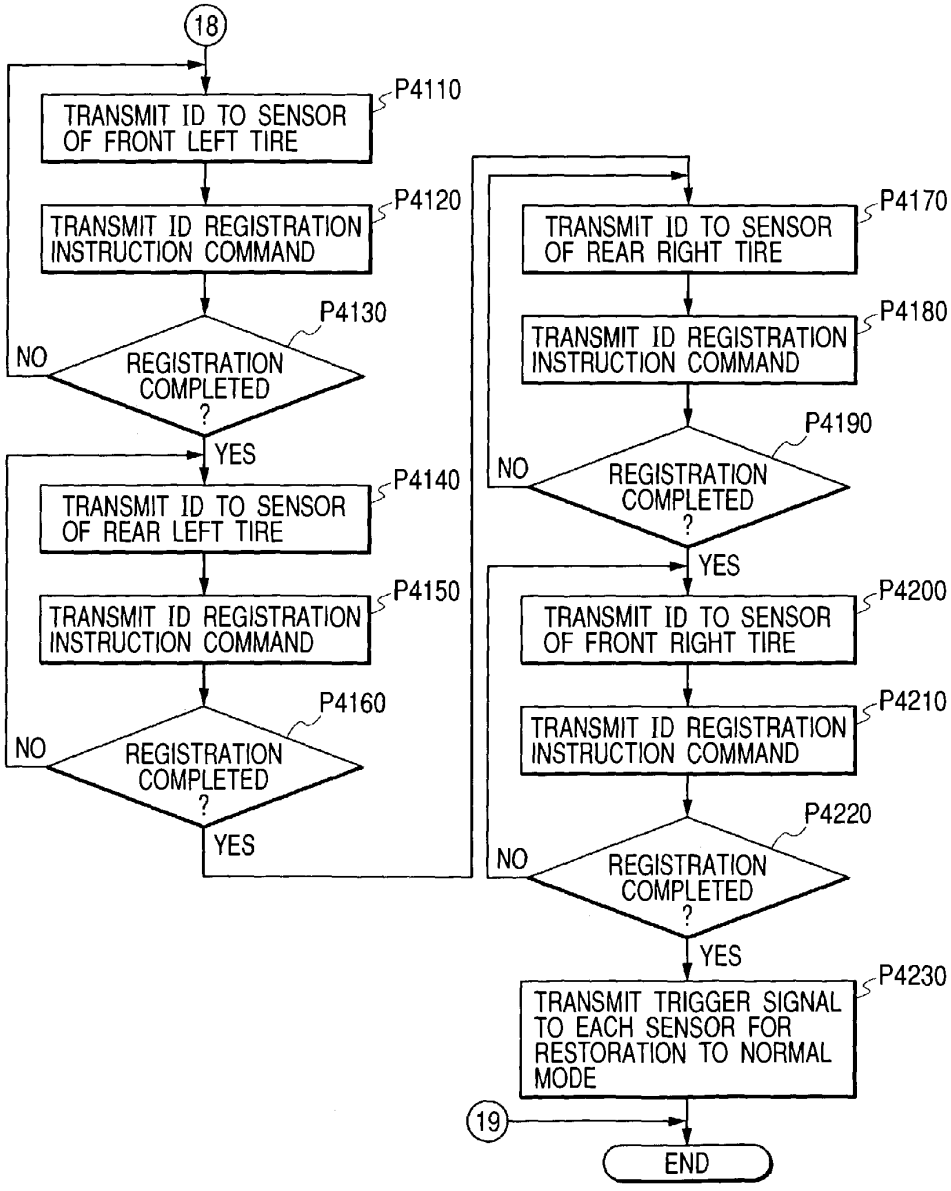
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IPR2024-00744

FIG. 60



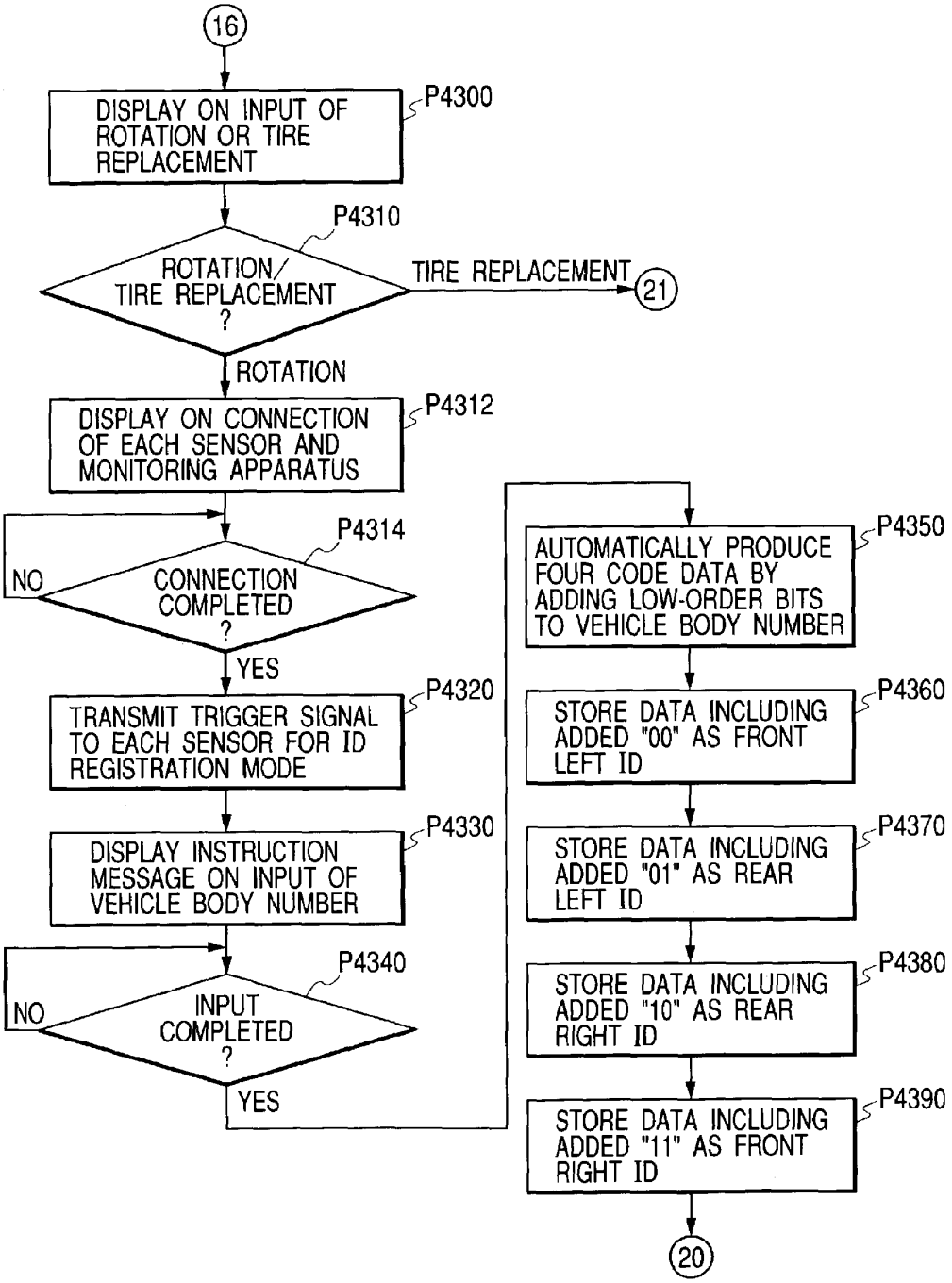
Orange Exhibit No. 2003
IPR2024-00744

FIG. 61



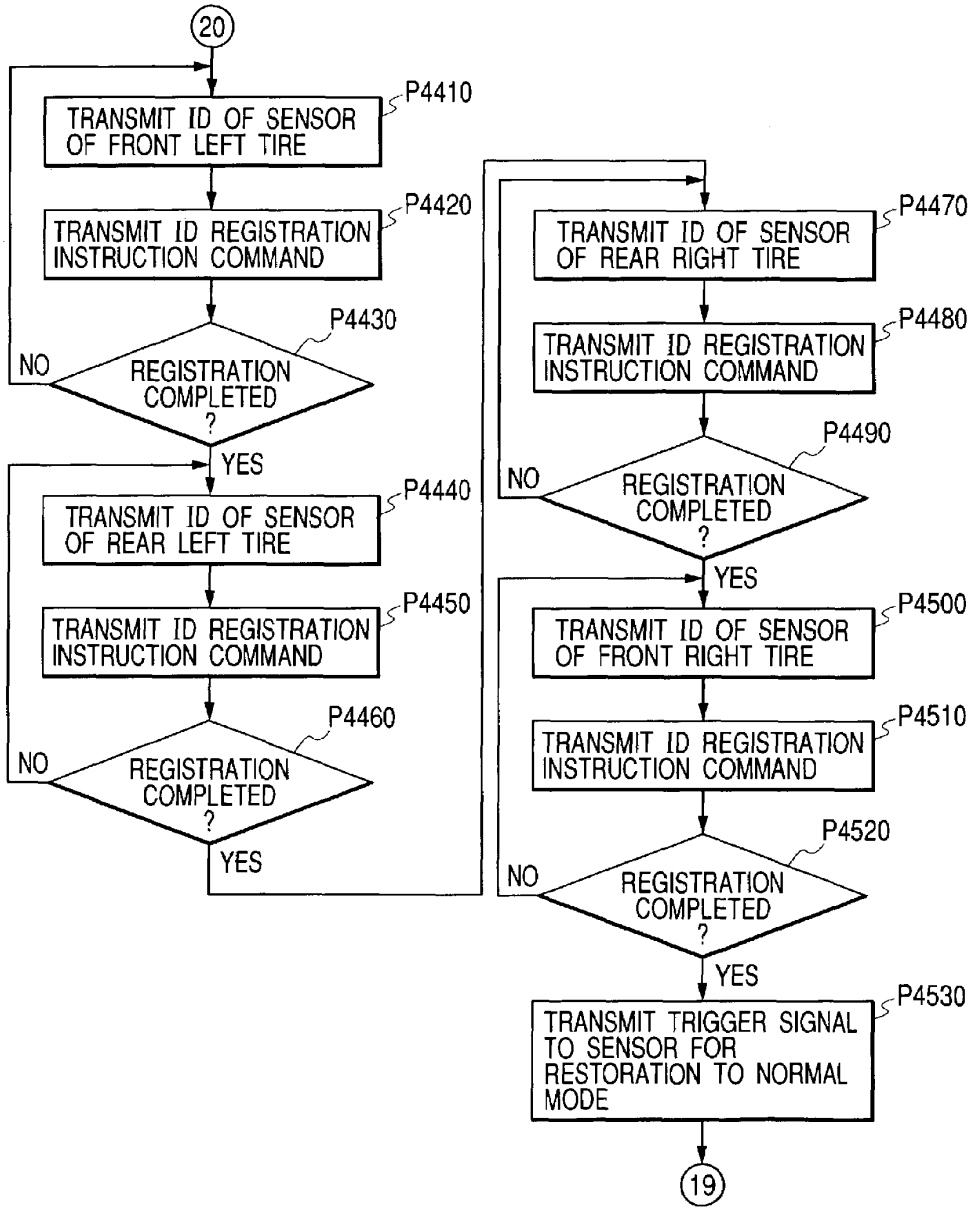
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IPR2024-00744

FIG. 62



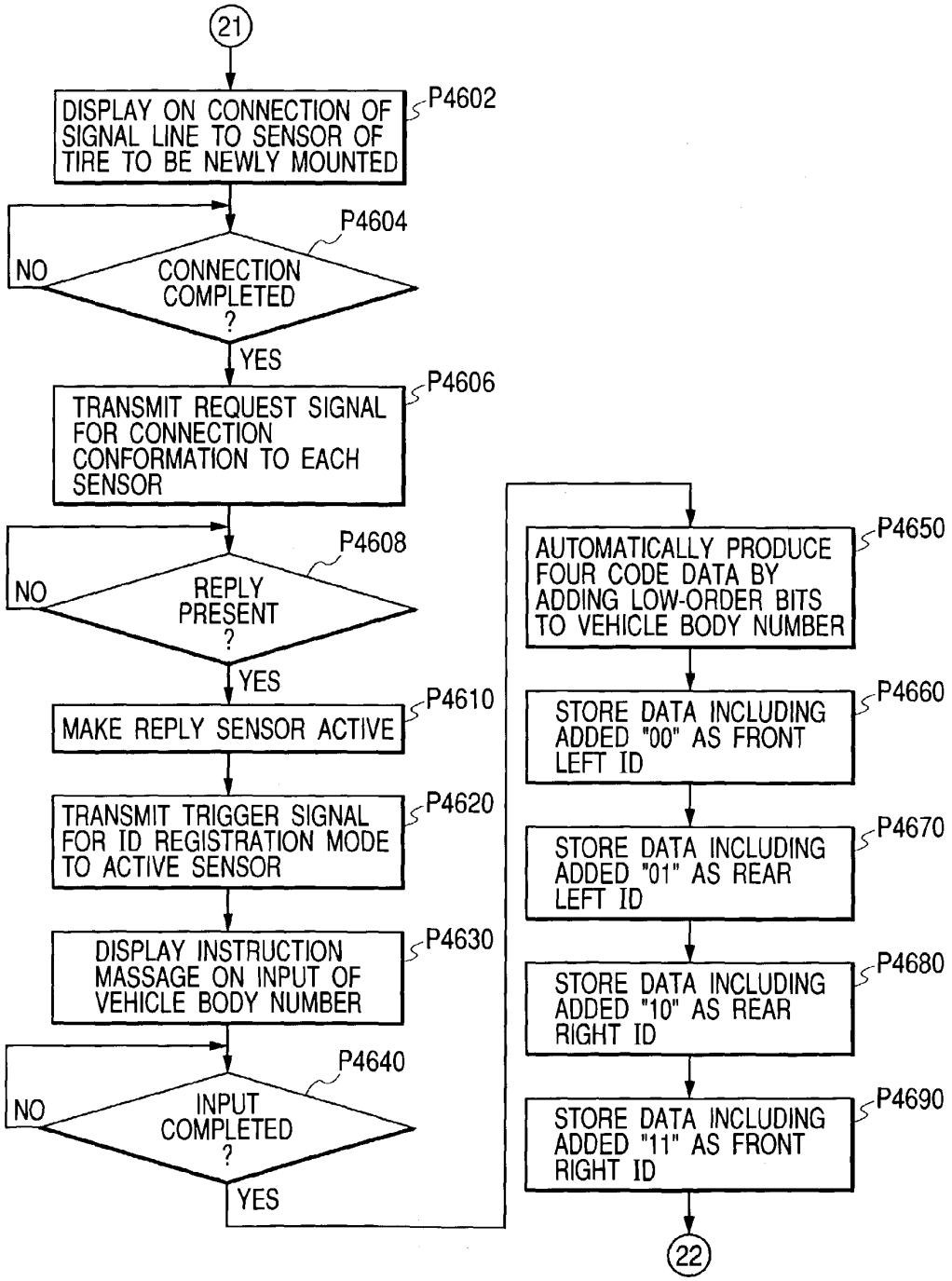
Orange Exhibit No. 2003
IPR2024-00744

FIG. 63



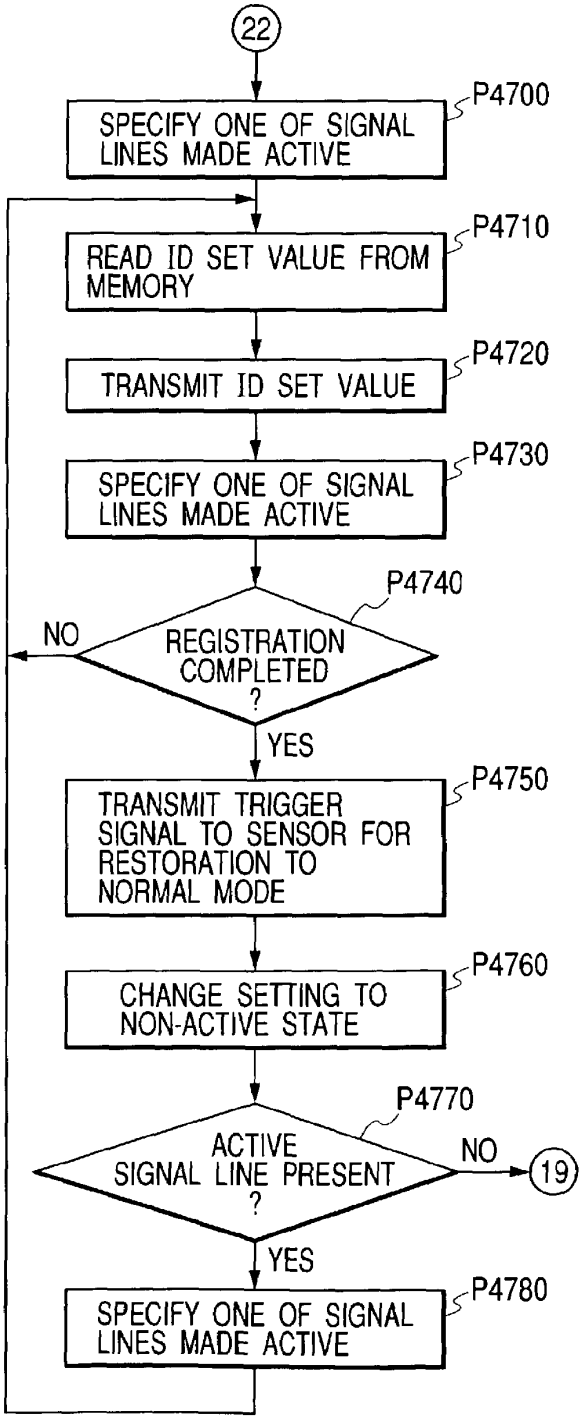
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IPR2024-00744

FIG. 64



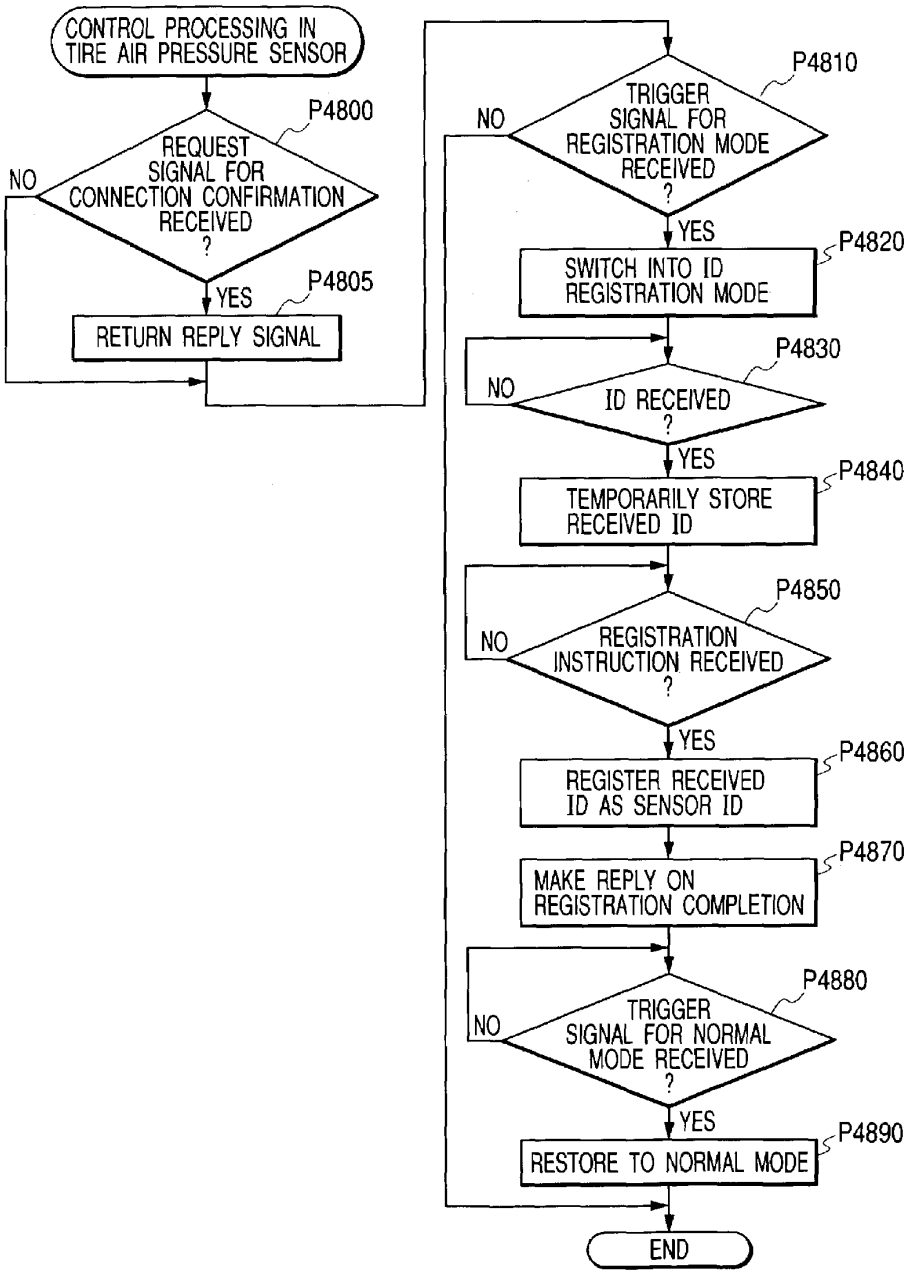
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IPR2024-00744

FIG. 65



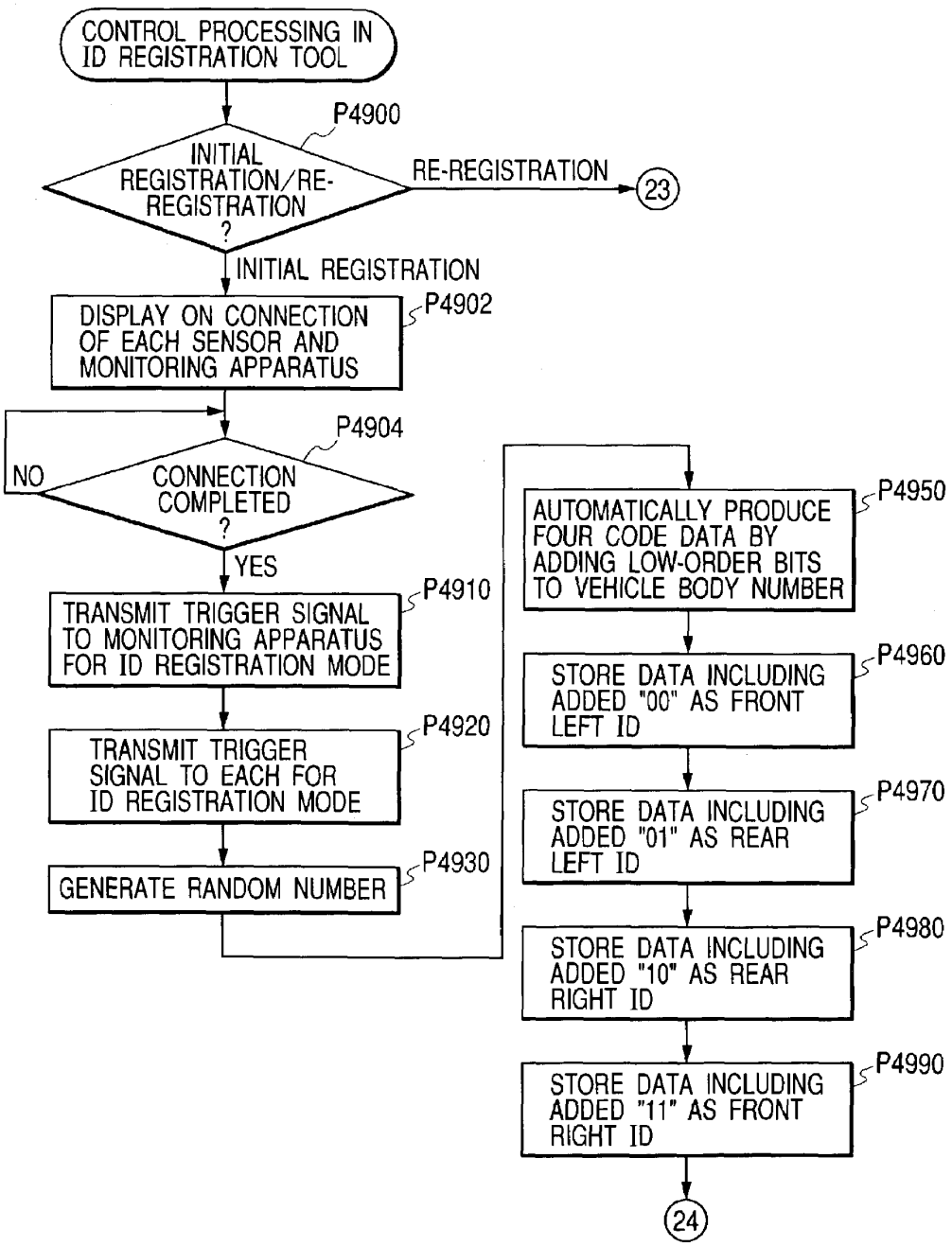
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FIG. 66



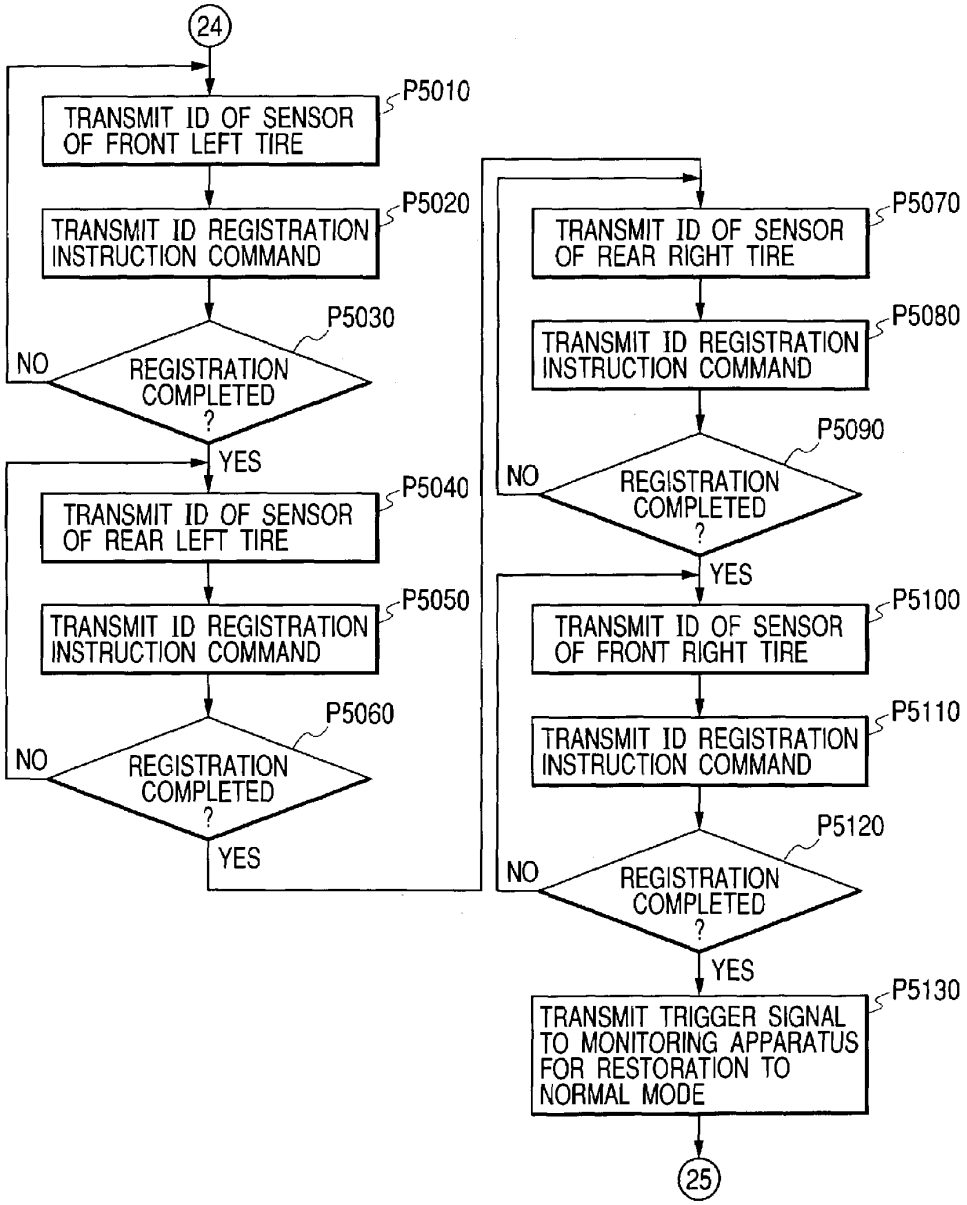
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FIG. 67



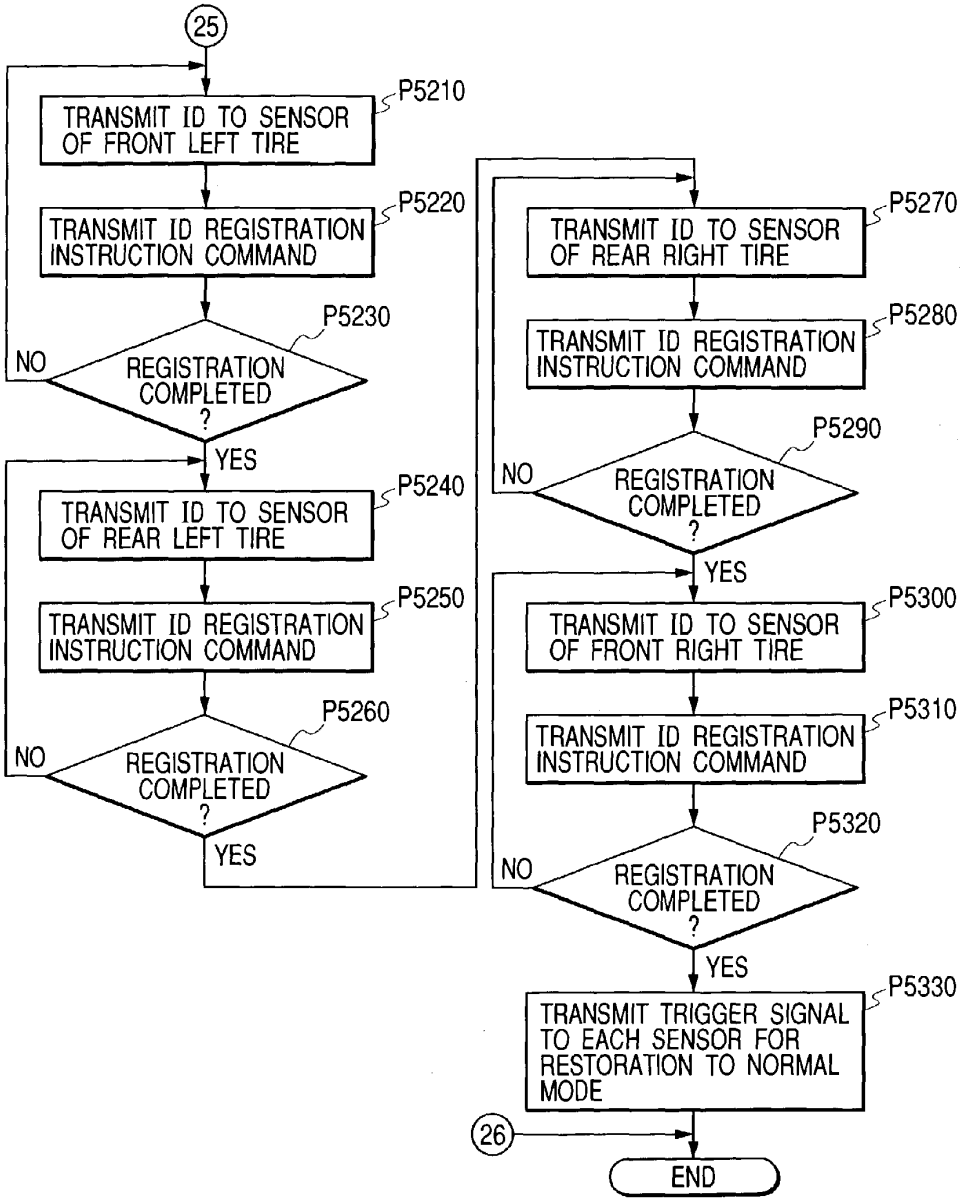
Orange Exhibit No. 2003
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FIG. 68



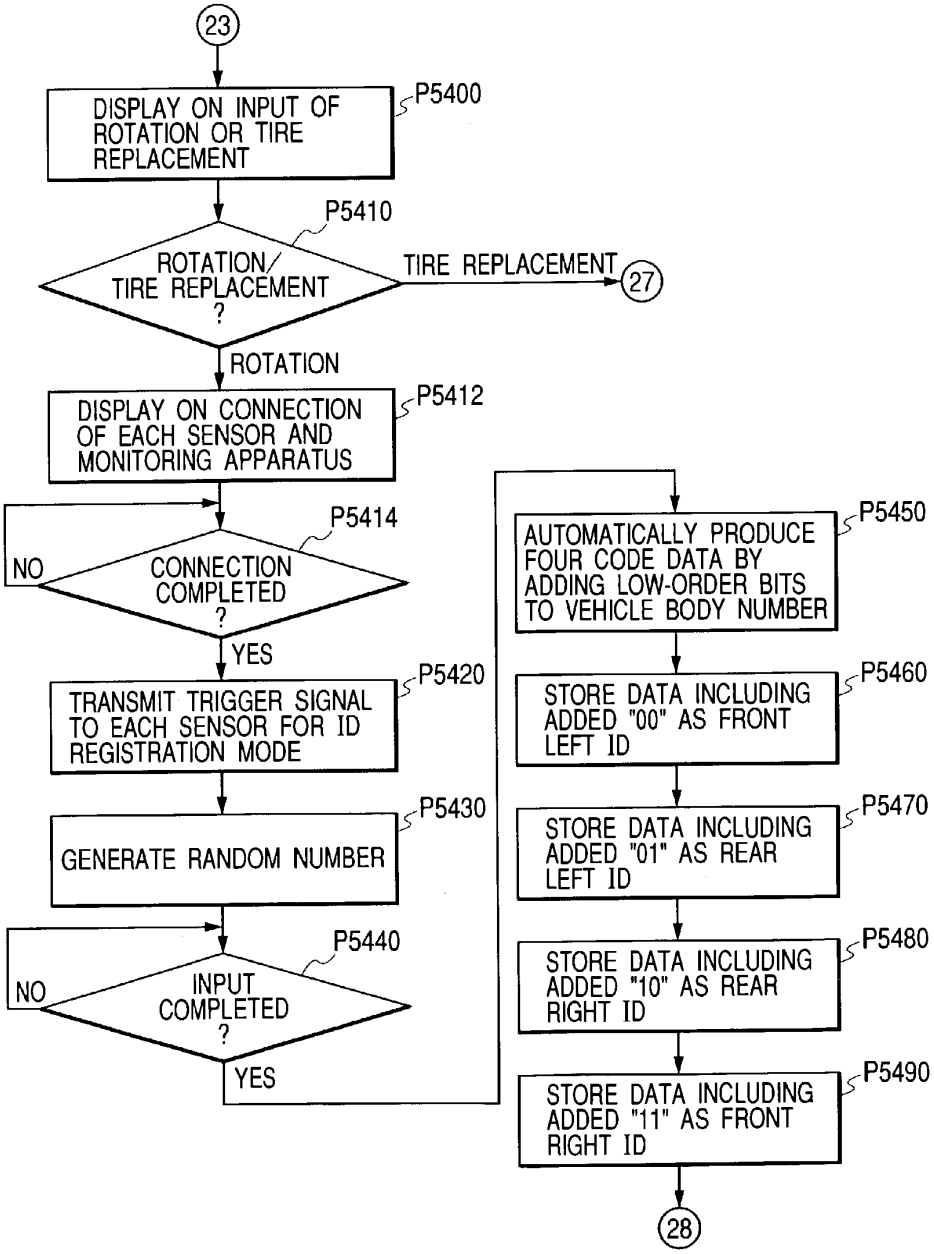
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FIG. 69



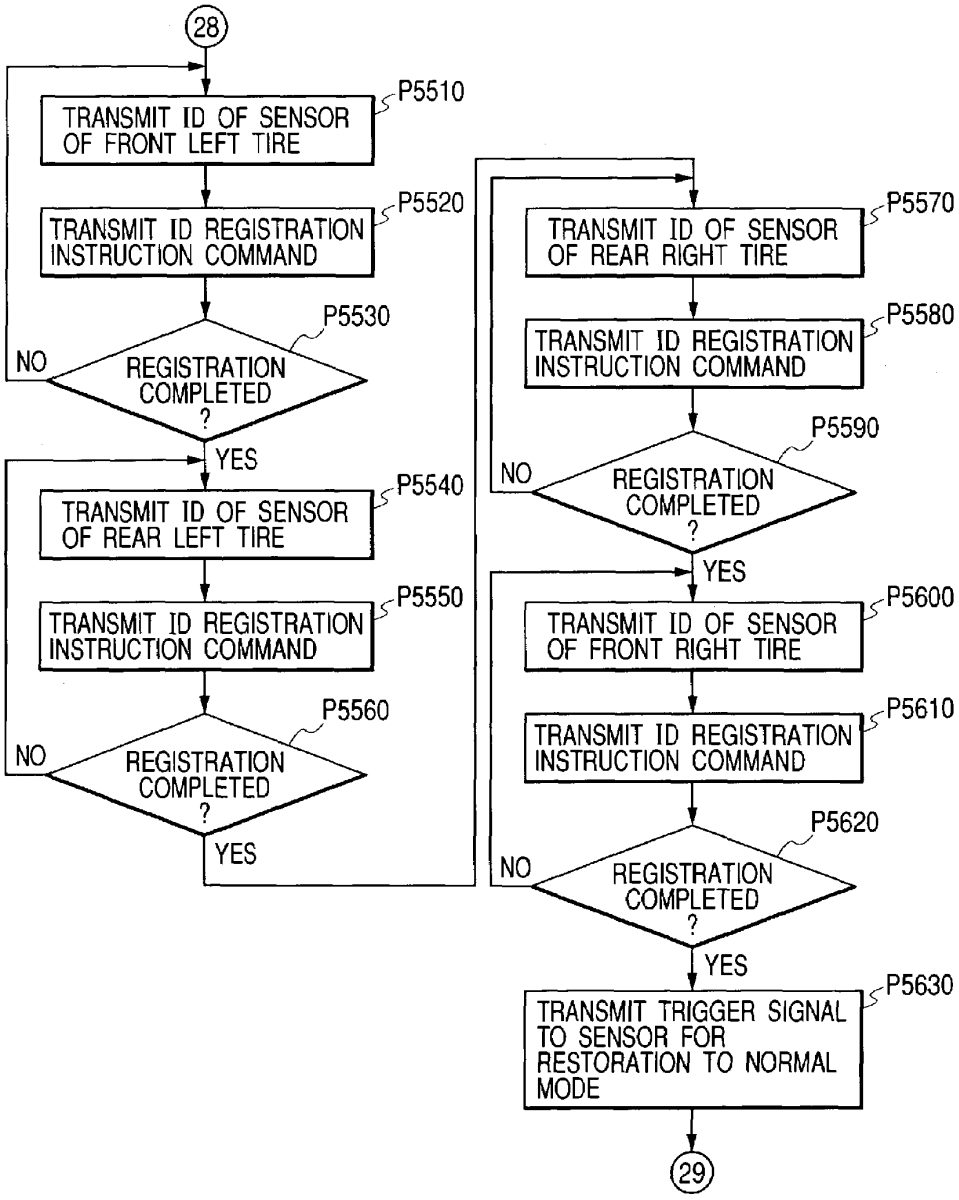
Orange Exhibit No. 2003
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FIG. 70



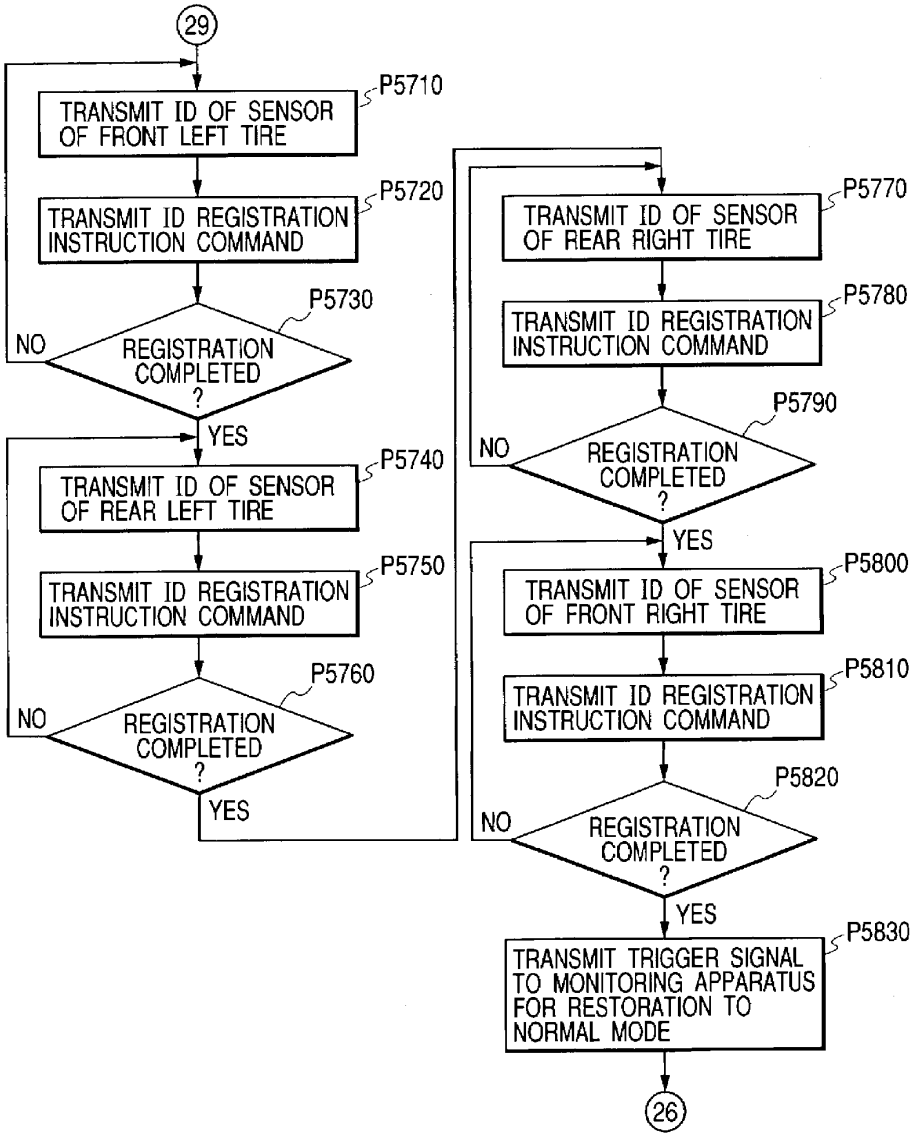
Orange Exhibit No. 2003
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FIG. 71



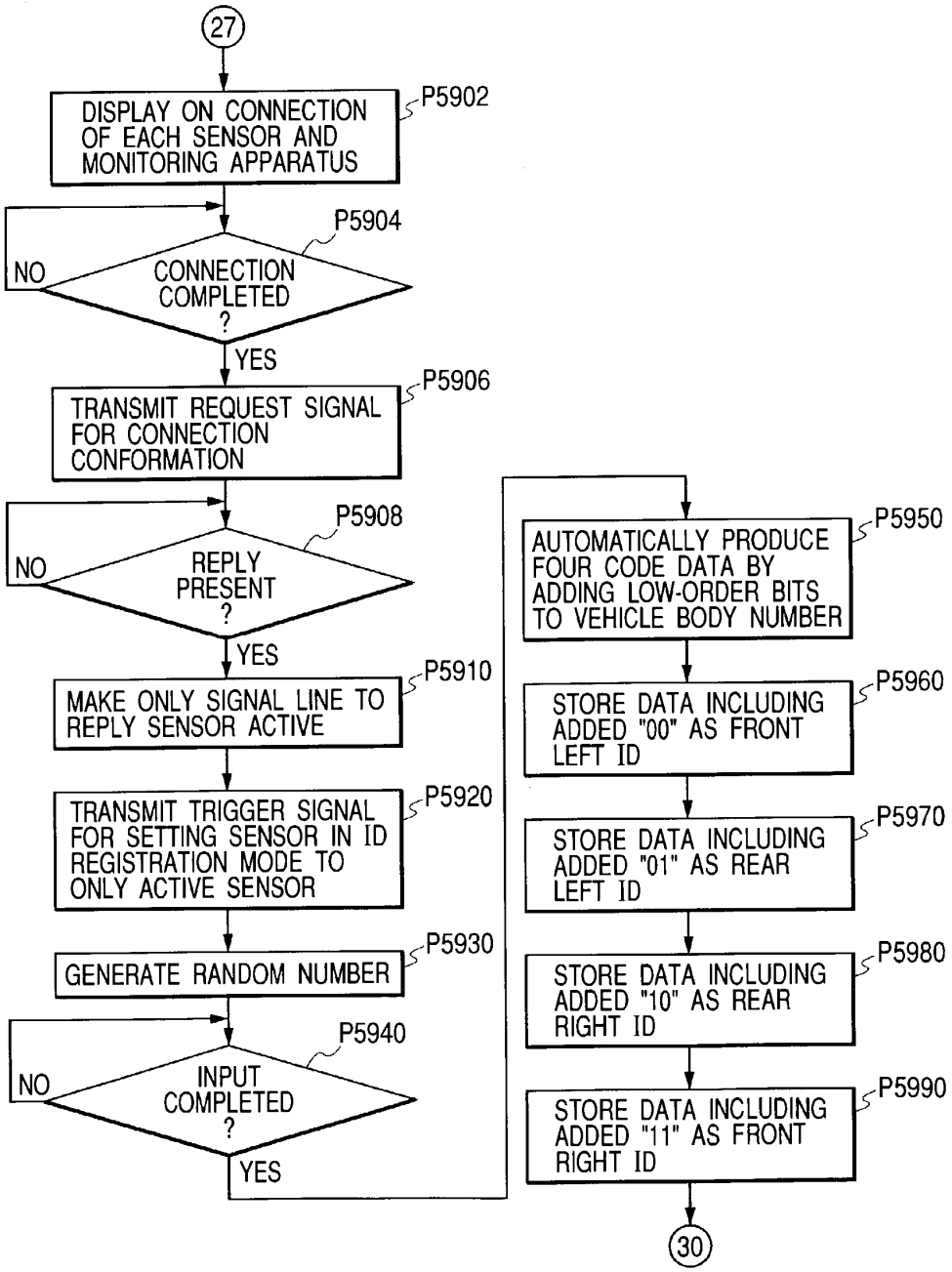
Orange Exhibit No. 2003
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FIG. 72



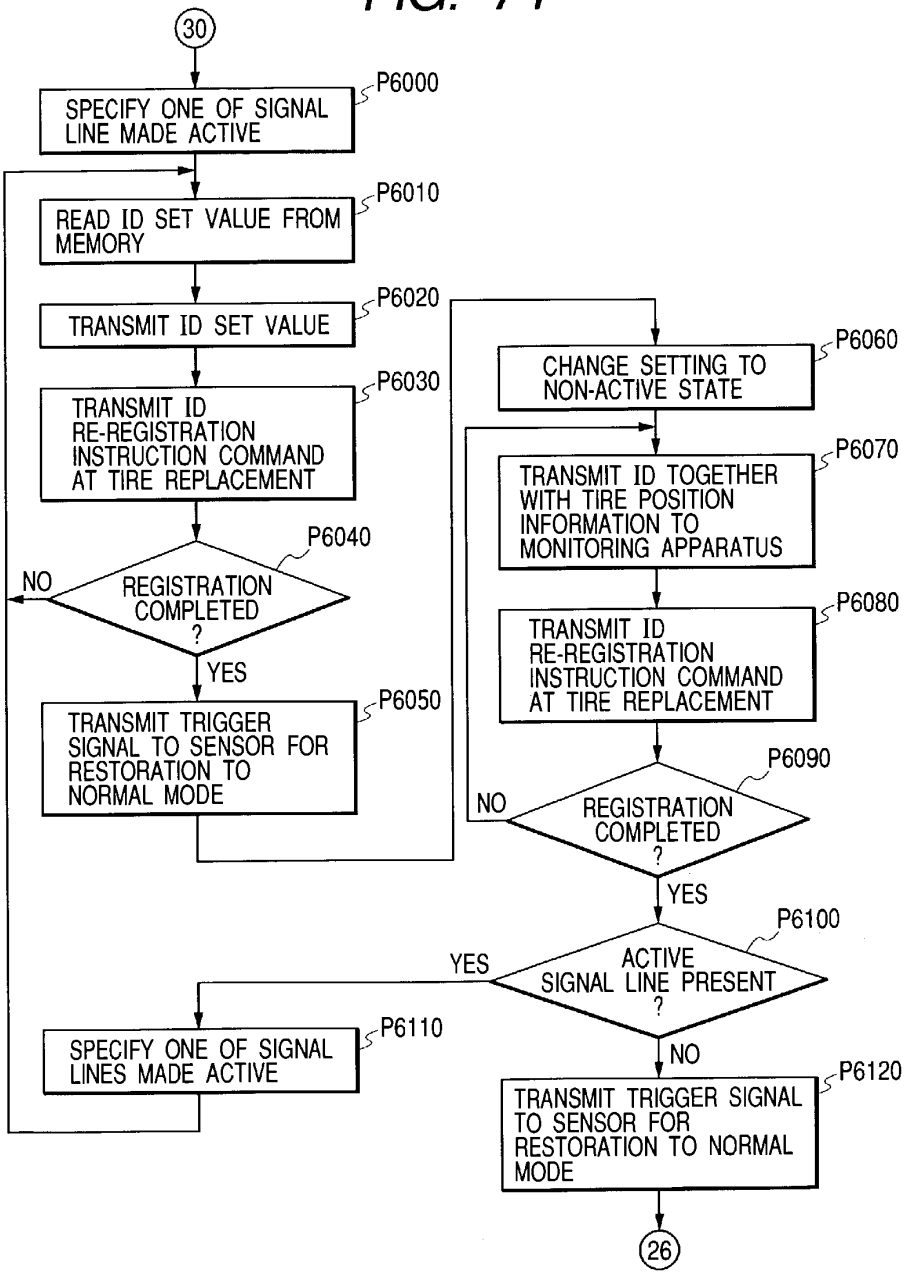
Orange Exhibit No. 2003
IPR2024-00744

FIG. 73



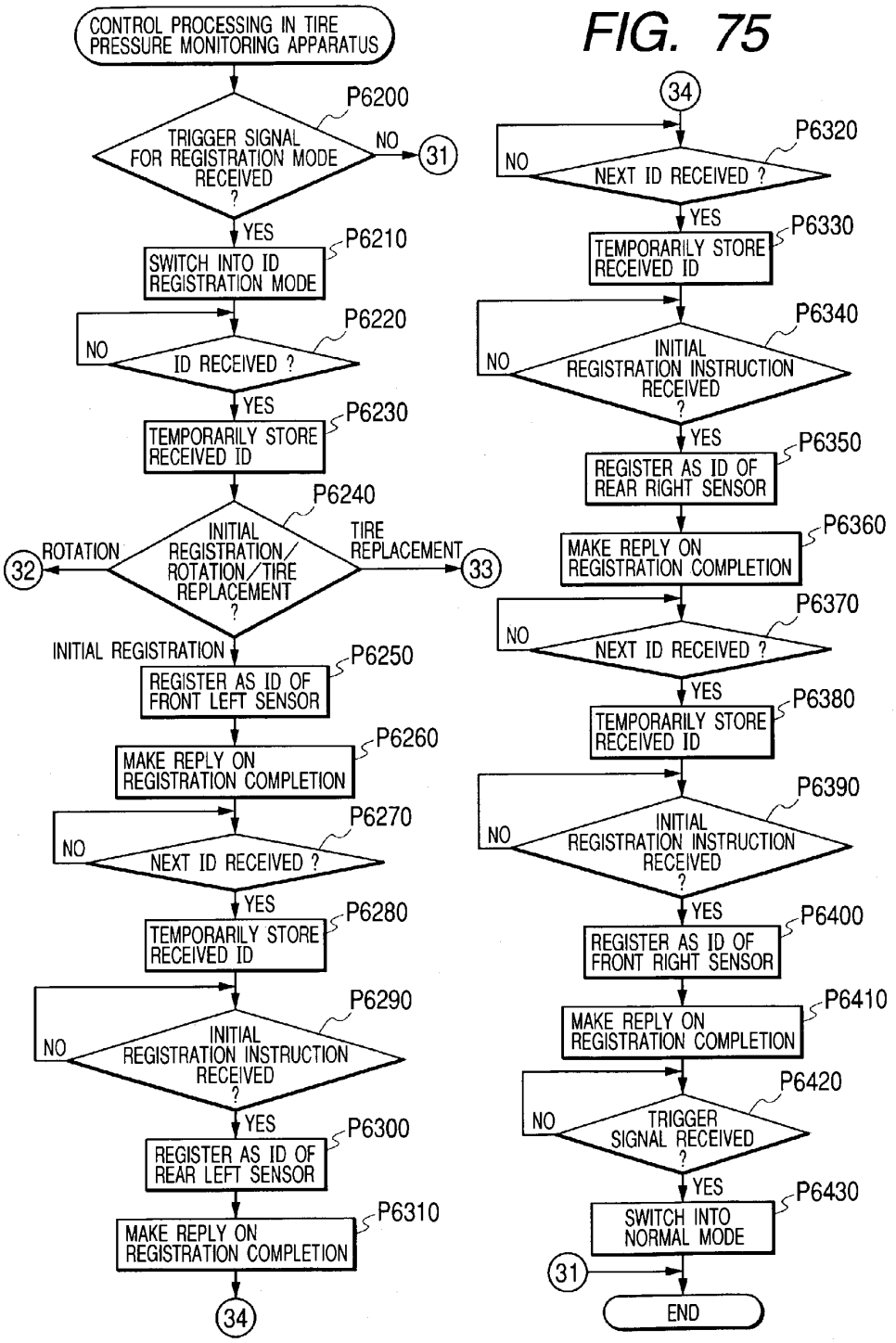
Orange Exhibit No. 2003
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FIG. 74



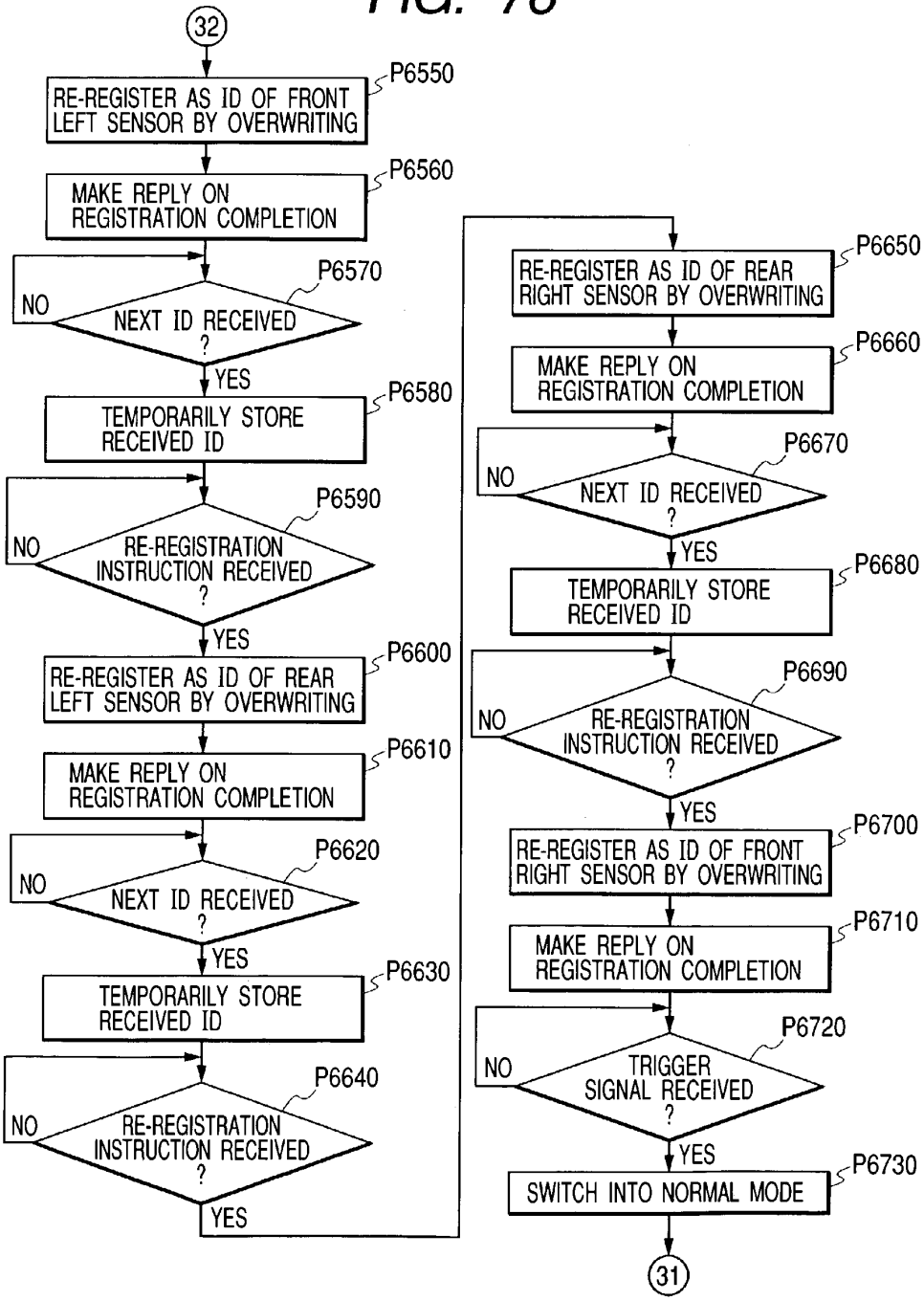
Orange Exhibit No. 2003
IPR2024-00744

FIG. 75



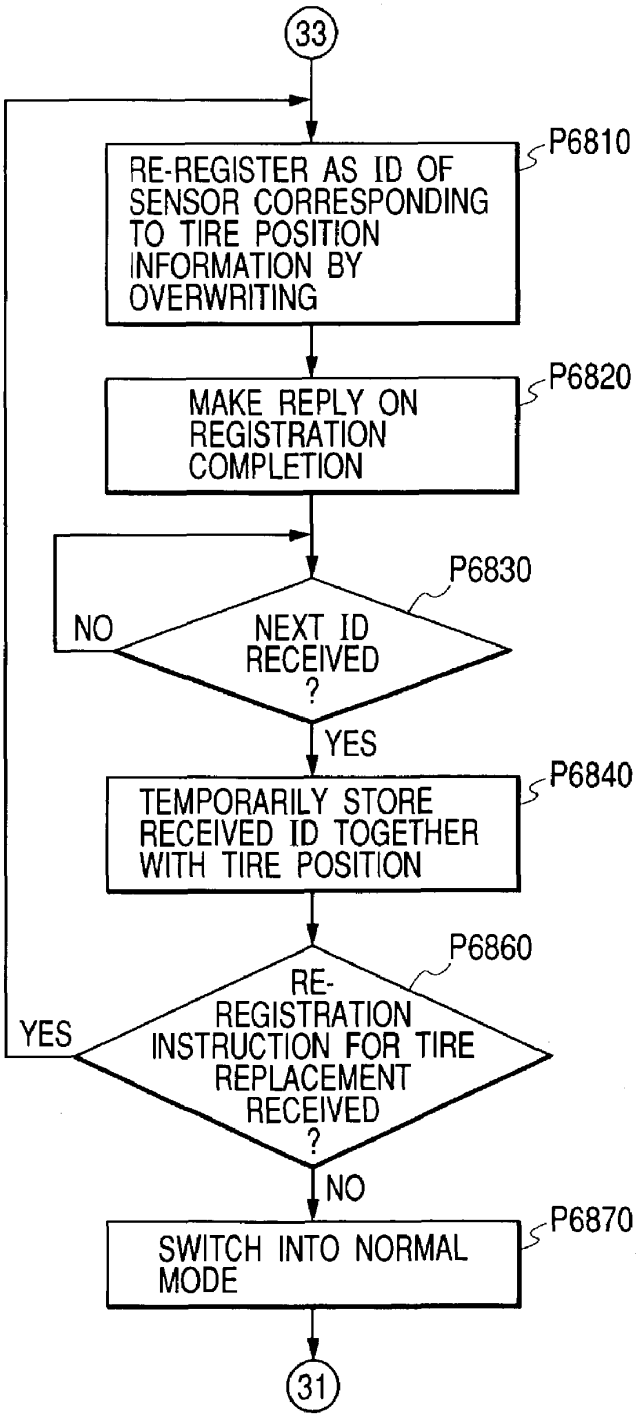
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FIG. 76



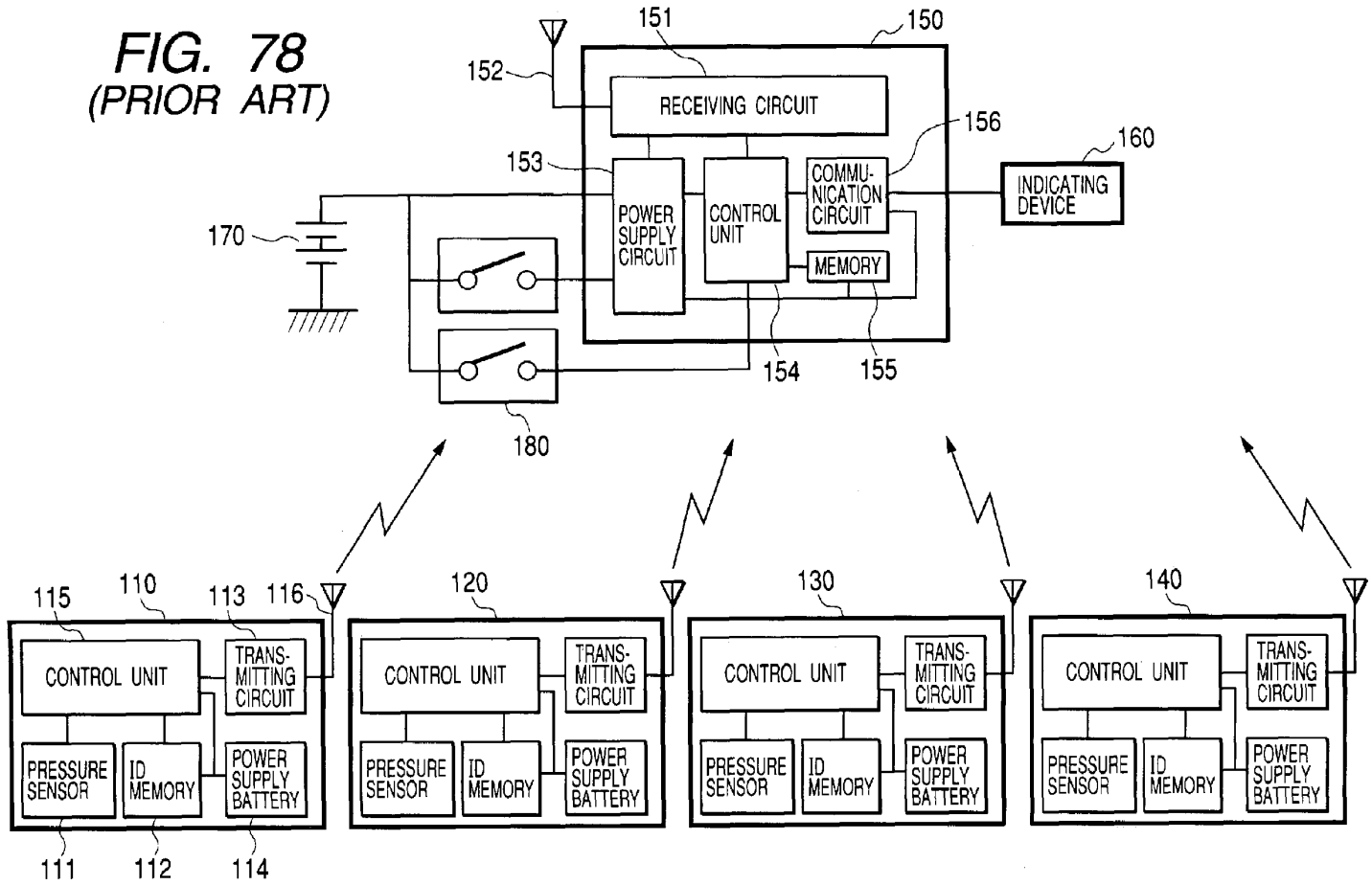
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FIG. 77



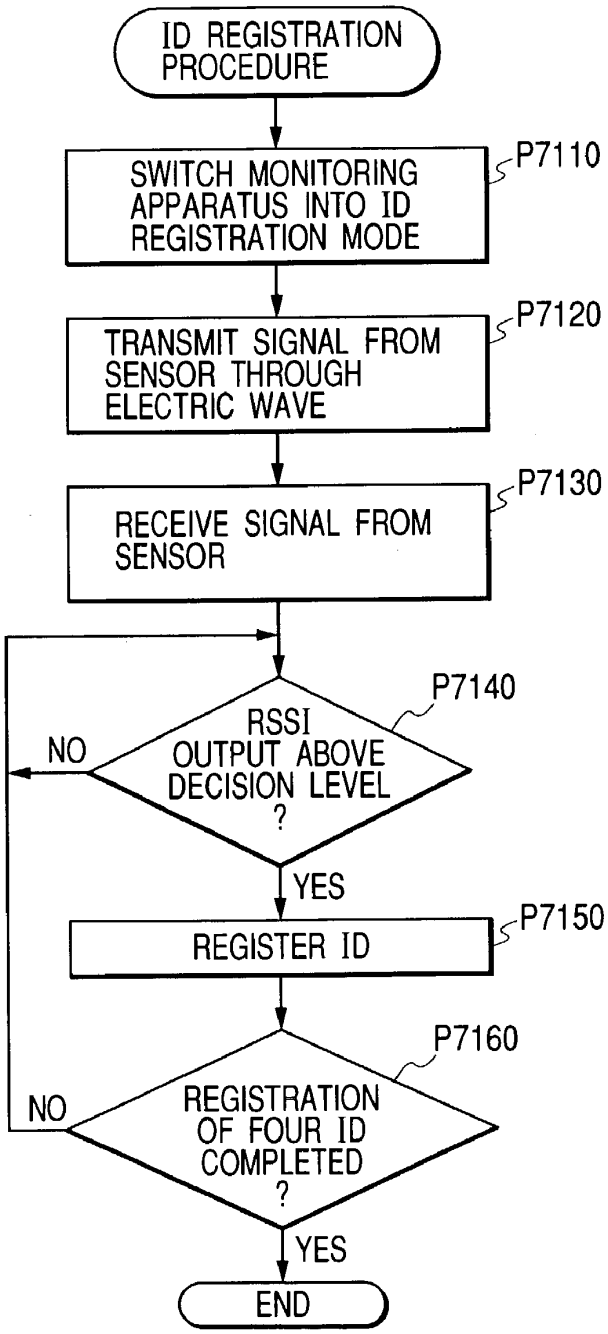
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FIG. 78
(PRIOR ART)



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FIG. 79
(PRIOR ART)



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ID REGISTRATION METHOD FOR TIRE PRESSURE SENSOR, ID REGISTRATION APPARATUS, ID REGISTRATION TOOL FOR TIRE PRESSURE MONITORING SYSTEM, AND TIRE WITH AIR PRESSURE SENSOR

BACKGROUND OF THE INVENTION

1) Field of the Invention

The present invention relates to an ID (identification information or identification means) registration method for a tire pressure sensor, and further to an ID registration apparatus for implementing this method, an ID registration tool for a tire pressure monitoring system, a tire with an air pressure sensor, and a tire pressure monitoring apparatus.

2) Description of the Related Art

So far, as a tire pressure monitoring system, there has been known a system disclosed in Japanese Patent No. 3212311.

In such a type of conventional tire pressure monitoring system, an air pressure sensor with a transmitter is mounted on each tire, and an air pressure detection signal, together with the corresponding sensor ID, is transmitted from the air pressure sensor to be received by a tire pressure monitoring apparatus mounted on a vehicle body side so that, when there is, at least, a tire unusual in air pressure, an indication appears on an indicator to issue an alarm.

In this system, the ID for each sensor is also registered (put) in the tire pressure monitoring apparatus, and checking this ID, a decision can be made as to whether or not the received detection signal belongs to an air pressure sensor of a tire of his/her own vehicle.

In a conventional system, this sensor ID is allocated to each sensor by a sensor maker at the stage of shipping, while in a car maker, a tire pressure monitoring apparatus of a vehicle body is set to an ID registration mode in assembling a vehicle to receive an ID transmitted from each sensor for registering it in the tire pressure monitoring apparatus.

More concretely, as shown in a block diagram of FIG. **78**, a conventional tire pressure monitoring system is made up of air pressure sensors **110**, **120**, **130** and **140** mounted on the corresponding tires and a tire pressure monitoring apparatus **150** mounted on a vehicle body. The air pressure sensor **110** includes a pressure sensor **111** for detecting an air pressure in a tire, an ID memory **112** for storing a sensor ID in advance, and a transmitting circuit **113**, a power supply battery **114**, a control unit **115** and a transmitting antenna **116**. The other air pressure sensors **120**, **130** and **140** have the same configuration.

The tire pressure monitoring apparatus **150** includes a receiving circuit **151**, a receiving antenna **152**, a power supply circuit **153**, a control unit **154**, a memory **155** and a communication circuit **156** for transmitting indication data to an indicating device **160** such as an indicator or an LED. Moreover, the power supply to this tire pressure monitoring apparatus **150** is from a vehicle-mounted battery **170**, and as various types of switches, in particular, to the control unit **154**, there is connected a mode switch **180** made to carry out the switching between a normal operating mode and an ID registration mode.

The ID registration in a vehicle manufacturing line is conducted in accordance with a procedure shown in a flow chart of FIG. **79**. That is, the control unit **154** registers a sensor ID included in a received signal in the memory **155** when the receive signal level satisfies a predetermined condition (decision level) (P**7140**, P**7150**). In this way, in the conventional system, the ID of an air pressure sensor actually mounted on each tire of a vehicle is registered in the monitoring apparatus side, and a decision is made as to whether an ID included in a signal received through the receiving antenna **152** agrees with an ID registered in the memory **155** and, if it agrees therewith, a decision is made on a tire pressure state on the basis of a pressure signal received together with that ID and an indication apparatus on the indicating device **160** on the basis of the decision result. In this case, the ID registration is for preventing an indication from being made in error on the basis of a signal from an air pressure sensor of a tire of a vehicle running nearby.

However, in a vehicle assembling process, since an air pressure sensor ID registration work is done in a state where many vehicles flows on the line, a radio interference problem arises in which one vehicle receives an ID signal from an air pressure sensor of other vehicles to conduct mistaken registration. This problem also applies to a case in which a sensor ID is re-registered in a repair shop or the like.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to prevent mistaken ID registration in a tire pressure monitoring system.

For this purpose, in accordance with an aspect of the present invention, there is provided a tire pressure sensor ID registration method of reading ID information readable through some device or through human's eye to write the ID information in an ID storage unit of each of air pressure sensors and in an ID storage unit of a tire pressure monitoring apparatus.

More concretely, in the present invention, for example, an ID, being expressed by a bar code, is read to be written in each ID storage unit of each of the air pressure sensors and the tire pressure monitoring system. With this concrete manner, an ID of an air pressure sensor is stored in the tire pressure monitoring apparatus on the basis of the bar code, which eliminates the conventional problem in that mistaken registration occurs due to the radio interference.

As employable optically-readable information other than the bar code, there are data code, QR code, maxi code, CP code, PDF417, code 49, code 16K, coder block, and others. In the case of the employment of optically-readable information (information holding means) such as a bar code, an optical information reader such as a bar-code reader may be used for the readout of the ID.

In addition, in the case of the bar code, since code information is expressed by numerals or figures, it is also appropriate that an operator reads these numerals and manually inputs them in some tool so that the manually inputted data is forwarded through radio transmission or wired transmission to an air pressure sensor and a tire pressure monitoring apparatus to be put in ID storage units thereof. In the case of the employment of a bar-code reader, the bar-code reader and the air pressure sensor/tire pressure monitoring apparatus can be connected to each other through a signal line (wired means) so that an ID read out from the bar code is transmitted from the bar-code read to the air pressure sensor and the tire pressure monitoring apparatus to be put in the ID storage units thereof. In a case in which an ID is written by means of wired transmission, the radio interference problem is completely solvable.

Still additionally, in a conventional method using electric wave, since other electric waves, such as aeronautical radio waves, are stronger, it is considered that there is a case the reception of an electric wave from a sensor for the ID registration becomes difficult to disenable the ID registra-

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tion. However, the connection between a tool and a sensor/monitoring apparatus through a signal line for the ID registration can solve such a problem at a stroke.

Yet additionally, when an ID read out from a bar code or the like through the use of such a tool is written in any one of tire air pressure sensors connected thereto through a signal line and is further written in the tire pressure monitoring apparatus likewise connected thereto through a signal line, if information on a position of the tire air pressure sensor is also written in the tire pressure monitoring apparatus, in addition to the registration of the ID of the tire pressure sensor, set on the vehicle, in the tire pressure monitoring apparatus, the registration of the position of the tire air pressure sensor is feasible.

Moreover, when the ID read out from the bar code or the like is written in such an air pressure sensor, for example, in the case of a four-wheel vehicle, if it is previously prescribed that the IDs are written in the sensors in the order of a front right wheel, a rear right wheel, a rear left wheel and a front left wheel and the IDs are also written in the tire pressure monitoring apparatus in this order, the registration of the sensor IDs becomes feasible together with the registration of the tire position information.

In this connection, such registration of ID, additionally specifying position, is also possible even if the ID registration is made not only by the wired transmission but also by radio transmission. For example, in a case in which electric waves are used in registering ID from a bar-code reader or the like in each tire pressure sensor, it is sufficiently achievable by means of, for example, the directivity of the electric wave being enhanced. Incidentally, as the information transmission medium in the case of the radio ID registration, in addition to the electric wave, infrared ray, ultrasonic wave or the like is also employable.

In a vehicle which has presently been put into practical use, four receiving antennas are provided in vicinity of the four wheels, respectively, on the monitoring apparatus side to allow the ID registration and the monitoring of the tire air pressure to be done while specifying the tire positions. On the other hand, with the method according to the present invention, as mentioned above, the ID registration is feasible while specifying the one of the four wheels, without increasing the number of receiving antennas in the monitoring apparatus side, and since each of the tire air pressure sensors can be made to have a unique ID, even if only one receiving antenna is provided for the monitoring of the air pressure, a judgment can easily be made as to which of the tires is in what air pressure state. Therefore, the method according to the present invention enables monitoring the air pressures while specifying the tire positions, through the use of a simpler apparatus configuration as compared with a system which has presently been put into practical use.

In addition, the method according to the present invention can exhibit the following effects. For example, let it be assumed that a transmitting unit of an air pressure sensor of any one of tires is broken. In this case, a dealer or a repair shop replaces the air pressure sensor of that tire with new one. At this time, a new bar code is read out by a bar-code reader and a new ID indicated by the read bar code is written in an ID storage unit of an air pressure sensor attached newly. In addition to this, that ID is written in the monitoring apparatus. In this way, through only the registration procedure on the renewed sensor, the ID registration can be completed, thus improving the workability of the ID re-registration incidental to the renewal of a sensor.

In this connection, as a judgment method on a broken sensor, the ID of the sensor from which an air pressure detection signal has not been received within a predetermined period of time when the vehicle is running can be specified through the use of a software or the like on the tire pressure monitoring apparatus side. Accordingly, the specified sensor ID can also be removed from the ID storage unit of the monitoring apparatus in a renewing operation. Incidentally, it is also acceptable that the broken sensor ID is left without removed. This is because the air pressure signal including the ID of the broken sensor is not received eventually and the IDs for the sensors corresponding to the four wheels are correctly registered through the re-registration operation so that any trouble does not occur in the monitoring of the tire air pressure.

As described above, with the method according to the present invention, in a case in which an air pressure sensor breaks down, only the operation for the ID registration in the renewed sensor and the operation for the registration of the ID of the renewed sensor in the monitoring apparatus are required, thus considerably improving the working efficiency. This effect is valuable. That is, in a conventional manner, an requirement exists that, in a case in which an air pressure sensor of any one of tires is replaced with new one, in a state where the monitoring apparatus is placed into an ID registration mode and the ID registration contents of this apparatus are reset, the IDs transmitted from the air pressure sensors of all the tires are again received to be registered in the monitoring apparatus side.

Still additionally, in a case in which any one of sensors breaks down and is replaced with a new one, or when a tire bursts and the entire tire is replaced so that the sensor is replaced with another, the method according to the present invention enables the ID re-registration to be implemented with respect to the air pressure sensors of all the tires and the tire pressure monitoring apparatus through the use of an ID registration tool such as a bar-code reader in a repair shop. In this case, at the re-registration, if the ID registration is done in the form of including information on the implementation of the re-registration, a judgment can thereafter be made easily as to whether or not the sensor or tire replacement has taken place due to the sensor failure or the tire burst, which contributes to the history management on the tires of the vehicle.

Aside from the above-mentioned sensor failure, in the case of the tire burst, for further effectiveness, with respect to a tire to be replaced due to the burst, the ID re-registration in the sensor and monitoring apparatus is implemented on the basis of a bar code or the like including its ID and the information on that fact. This additionally enables the tire history management by reading out the ID registered in the tire pressure monitoring apparatus or the air pressure sensor.

For achieving the above-mentioned purpose, in accordance with a second aspect of the present invention, there is provided a tire air pressure sensor ID registration method in which sensor ID information is placed or indicated as readable information on each tire pressure sensor, each tire, each tire wheel or each tire wheel cover and an ID is read out from the readable information and the readout result is written in an ID storage unit of a tire pressure monitoring apparatus.

More concretely, in the present invention, for example, a bar code indicating the ID registered in a sensor is adhered onto the sensor itself, a tire, a wheel or a wheel cover and this bar code is read through the use of a bar-code reader so that the read information is written in an ID storage unit of a tire pressure monitoring apparatus. According to this concrete method, the ID stored in the air pressure sensor is not transmitted from the air pressure sensor, but the air

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pressure sensor ID is stored in the tire pressure monitoring apparatus on the basis of the bar code, which eliminates a conventional problem such a mistaken registration due to the radio interference which exists in a conventional technique.

Moreover, with this method, in addition to the ID, information indicative of a sensor manufacturing factory or production time can be placed in the bar code. In a state where this information is included therein, the ID information is stored in the monitoring apparatus. In monitoring the air pressure, the sensor collation is made on the basis of only the ID portion. In the meantime, for example, in a case in which the sensor breaks down, the information is read out from the monitoring apparatus side, thereby deriving information representative of a lot offering broken sensors frequently. As effects, this allows a vehicle maker to attain effective information for the management of the in-house vehicles.

Also in this method, in addition to a bar code, various types of optically-readable information, such as data code, QR code, maxi code, CP code, PDF417, code 49, code 16K, coder block, and others are also employable, and an optical information reading device corresponding to the optically-readable information is employable for reading.

In addition, also in this method, in the case of the bar code, since code information is expressed by numerals or figures, it is also appropriate that an operator reads these numerals and manually inputs them in some tool so that the manually inputted data is forwarded through radio transmission or wired transmission to a tire pressure monitoring apparatus to be put in an ID storage unit thereof. In the case of the employment of a bar-code reader, the bar-code reader and the tire pressure monitoring apparatus can be connected to each other through a signal line so that an ID read out from the bar code is transmitted from the bar-code read to the tire pressure monitoring apparatus to be put in the ID storage unit thereof. In a case in which an ID is written by means of wired transmission, the radio interference problem is completely solvable.

Still additionally, in a conventional method using electric wave, since other electric waves, such as aeronautical radio, are stronger, it is considered that there is a case the reception of an electric wave from a sensor for the ID registration becomes difficult to disenable the ID registration. However, the connection between a tool and a monitoring apparatus through a signal line for the ID registration can solve such a problem at a stroke.

Yet additionally, when an ID read out from a bar code or the like through the use of such a tool is written in the tire pressure monitoring apparatus, if information on a position of a tire air pressure sensor is also written in the tire pressure monitoring apparatus, in addition to the registration of the ID of the tire pressure sensor, set on the vehicle, in the tire pressure monitoring apparatus, the registration of the position of the tire air pressure sensor is also feasible.

Moreover, when the ID is read out from the bar code, for example, in the case of a four-wheel vehicle, if it is previously prescribed that the bar codes are read in the order of a front right wheel, a rear right wheel, a rear left wheel and a front left wheel and the bar codes adhered onto sensors, tires, wheels or wheel covers are read in this order, the sensor IDs, together with tire position information, can be registered in the monitoring apparatus side.

In a vehicle which has presently been put into practical use, four antennas are required for the implementation of the ID registration specifying the tire positions. On the other hand, with the method according to the present invention, the ID registration is feasible while specifying any one of the four wheels, without increasing the number of receiving antennas in the monitoring apparatus side, and since each of the tire air pressure sensors can be made to have a unique ID, even if only one receiving antenna is provided for the monitoring of the air pressures, a judgment can easily be made as to which of the tires is in what air pressure state. Therefore, the method according to the present invention enables monitoring the air pressures while specifying the tire positions, through the use of a simpler apparatus configuration as compared with a system which has presently been put into practical use.

In this method, an ID can be read out from the aforesaid readable information and inputted to the aforesaid tire pressure monitoring apparatus, and the ID inputted this time can be removed from the IDs already written in the ID storage unit of the tire pressure monitoring apparatus.

This is effective in the case of the replacement of a sensor or a tire. That is, if an ID is read out from readable information, such as a bar code, adhered onto a detached sensor or tire and this ID is removed from the ID storage unit of the tire pressure monitoring apparatus, then it is possible to prevent useless information from being left in a state registered in the ID storage unit of the monitoring apparatus.

Furthermore, for achieving the above-mentioned purpose, in accordance with a further aspect of the present invention, there is provided a tire air pressure sensor ID registration apparatus comprising an ID indication unit for indicating readable information including an ID, a reading unit for reading the ID from the readable information indicated on the ID indication unit, and an ID writing unit for writing the ID, read by the reading unit, in an ID storage unit of each of air pressure sensors and an ID storage unit of a tire pressure monitoring apparatus. This ID registration apparatus can easily implement the above-described method according to the present invention.

In this configuration, as the ID indication unit, for example, there may be a manufacturing instruction in which each of bar codes indicating IDs to be registered in sensors of four wheels is produced for each vehicle and then put in order for each vehicle, more preferably for each tire, and adhered thereonto. In this case, a bar-code reader can be used as the reading unit, and a handy type is more effective. Moreover, as the writing unit, a manufacture management computer to be connected to the handy type bar-code reader is acceptable, and it is also possible that the bar-code reader itself is used as the writing unit.

Furthermore, in accordance with a further aspect of the present invention, there is provided an ID registration apparatus comprising a readable information indication label, including a sensor ID, adhered onto each air pressure sensor, each tire, each tire wheel or each tire wheel cover, a reading unit for reading the ID from the readable information indication label, and a writing unit for writing the ID, read by the reading unit, in an ID storage unit of the tire pressure monitoring apparatus.

According to this ID registration apparatus, a readable information indication label, including a sensor ID, is previously adhered onto each air pressure sensor, each tire, each tire wheel or each tire wheel cover, and the ID is read from the readable information indication label by the reading unit and the ID read in this way is written in the ID storage unit of the tire pressure monitoring apparatus by the ID writing unit. This can carry out the above-described method according to the present invention.

This ID registration apparatus can be equipped with an ID deletion unit for, when an ID read by the reading unit is inputted in the tire pressure monitoring apparatus, deleting

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the ID, inputted this time, from IDs already written in the ID storage unit of the tire pressure monitoring apparatus.

Thus, for example, in the case of the replacement of a tire, the ID deletion unit reads a bar code adhered onto the tire to be detached and inputs the ID indicated by the bar code in the tire pressure monitoring apparatus to delete the ID, inputted this time, of the IDs already written in the ID storage unit of the tire pressure monitoring apparatus, thereby removing the ID of the sensor mounted on the detached tire.

In this connection, as examples of the readable information employable for the ID registration apparatus according to the present invention, there are bar code, data code, QR code, maxi code, CP code, PDF417, code 49, code 16K, coder block, and others. In the case of the employment of these optically-readable information, an optical information reading unit can be used for the readout of the ID.

In addition, in the ID registration apparatus according to the present invention, the ID writing unit can be connected through a signal line to the tire pressure monitoring apparatus so that the ID to be stored in the tire pressure monitoring apparatus is transmitted through the signal line. The effects of the transmission made through a wire are as mentioned above.

Furthermore, for achieving the above-mentioned purpose, in accordance with a further aspect of the present invention, there is provided an ID registration tool for a tire pressure monitoring system, comprising a reading unit for reading an ID from a readable information indication label, including the ID of a sensor, adhered onto each air pressure sensor, each tire, each tire wheel or each tire wheel cover, an ID transmitting unit for transmitting the ID, read by the reading unit, to a tire pressure monitoring apparatus, and a storage state instruction unit for giving instruction on the registration or deletion of the ID transmitted from the ID transmitting unit.

In the ID registration tool according to the present invention, at the ID registration, the reading unit reads an ID from a readable information indication label, including the ID of a sensor, adhered onto each air pressure sensor, each tire, each tire wheel or each tire wheel cover mounted on a vehicle, and the ID transmitting unit transmits the ID, read out by the reading unit, to the tire pressure monitoring apparatus. Moreover, the storage state instruction unit gives instruction about the registration or deletion of the ID transmitted from the ID transmitting unit. Thus, an air pressure sensor ID of each of the tires mounted on a vehicle carrying the monitoring apparatus is correctly written in the monitoring apparatus.

In this case, the reading unit can be constructed as an optical information reading unit made to optically read optically-readable information, such as bar code, data code, QR code, maxi code, CP code, PDF417, code 49, code 16K, coder block, and others.

In addition, the ID registration tool for use in a tire pressure monitoring system can be equipped with a signal line for making a connection with respect to the tire pressure monitoring apparatus or a connector for the connection of the signal line. When the ID transmission is made through a wire in this way, it is possible to solve the radio interference problem completely and further to prevent a registration-impossible state from being incurred due to electric wave troubles.

Still additionally, the ID registration tool for use in a tire pressure monitoring system can be equipped with a trigger signal transmitting unit for transmitting a trigger signal for an ID registration mode to the tire pressure monitoring apparatus. The trigger signal transmitting unit is provided in this way and, at the implementation of the ID registration, the trigger signal is first transmitted so that the tire pressure monitoring apparatus falls into an ID registration mode before the ID read out by the reading unit is transmitted thereto, thereby enabling the smooth ID registration.

Moreover, for achieving the above-mentioned purpose, in accordance with a further aspect of the present invention, there is provided a tire with an air pressure sensor in which an optically-readable information label indicating information including an ID of an air pressure sensor is adhered onto the air pressure sensor, the tire itself, a tire wheel or a tire wheel cover. In this case, as the optically-readable information labels employable, there are listed a bar code label, a data code label, a QR code label, a maxi code label, a CP code label, a PDF417 label, a code 49 label, a code 16K label, and a coder block label.

In addition, for achieving the above-mentioned purpose, in accordance with a further aspect of the present invention, there is provided a tire air pressure sensor ID registration method in which each of air pressure sensors and a tire pressure monitoring apparatus are together placed into an ID registration mode, and an ID is transmitted to each of the sensors to be stored therein and the same ID is also transmitted to the tire pressure monitoring apparatus to be stored therein.

That is, instead of an ID previously stored in the sensor side being stored in the tire pressure monitoring apparatus, when an ID is initially registered or re-registered in each of air pressure sensors, the ID pertaining to the air pressure sensor of each of tires to be mounted on a vehicle is also initial-registered or re-registered in the tire pressure monitoring apparatus. For this operation, an ID registration tool is used in a more concrete method proposed as one example of the present invention.

As will be described later, preferably, a basic configuration of this ID registration tool includes an ID setting unit and an ID transmitting unit. This ID setting unit can be achieved through the use of such a key-manipulated putting manner that a field operator inputs and sets an ID according to an operating instruction each time. As another mode, it is also appropriate that a body number of a vehicle, or the like, is read out through the use of an optical reading unit or the like and an ID of an air pressure sensor to be mounted on each of tires is automatically produced and set on the basis of the read body number, or that production management data (vehicle body number, vehicle production number, or the like) for the manufacture of the vehicle is putted to the ID registration tool and an ID of each of air pressure sensors of tires of the vehicle is automatically input or automatically produced and set on the basis of the production management data. Moreover, it is also acceptable that a code is produced at random in the tool and a sensor ID is set on the basis of the produced code. In any case, a sensor ID set in the ID registration tool is transmitted from the ID registration tool to each of sensors and a tire pressure monitoring apparatus in one vehicle to be stored therein, thus solving the problem that an ID of an air pressure sensor of a tire of a different vehicle is registered in error.

In this connection, in a case in which the ID registration is made according to the method according to the present invention, considering the vehicle production stages, as the tire air pressure sensor, there may be employed a sensor in which nothing is stored in its ID storage unit or a meaningless code is stored therein. For this reason, the problem of the sensor ID mistaken registration, occurring due to radio interference with a signal transmitted periodically from a tire

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air pressure sensor mounted on a vehicle flowing immediately after the vehicle undergoing the ID registration in a manufacturing line, can naturally be solved.

Although the method according to the present invention may be an easy manner apparently, unlike a conventional technique in which an ID previously registered in the sensor side is transmitted from the sensor by means of the radio transmission and is received in the monitoring apparatus side to be registered therein, since an ID previously set is registered in a sensor and in a monitoring apparatus, it is possible to eliminate the problem incidental to the conventional method at a stroke, thus providing extremely noticeable effects. Moreover, as one example, the employment of a dedicated ID registration tool is proposed for the registration.

In this case, the connections among the ID registration tool, each of the sensors and the monitoring apparatus are made through signal lines so that the ID registration is carried out through these signal lines, thus eliminating the radio interference problem. In addition, in a conventional method using electric wave, since other electric waves, such as aeronautical radio waves, are stronger, it is considered that there is a case the reception of an electric wave from a sensor for the ID registration becomes difficult to disenable the ID registration. However, since the connections among the tool, the sensor and the monitoring apparatus are made through signal lines for the ID registration, such a problem is solvable at a stroke. Still additionally, if the signal lines are correctly connected thereto, for example, in a four-wheel vehicle, in addition to the IDs of the four wheels being registered in the monitoring apparatus side, the ID registration can be done while specifying their positions. This also applies to a case in which the ID registration is carried out through radio transmission instead of the wired transmission and is sufficiently achievable by means of a design, such as enhancing the radio directivity in registering an ID in an air pressure sensor of each tire. Incidentally, as the information transmission medium in the case of the radio ID registration, in addition to the electric wave, infrared ray, ultrasonic wave or the like is also employable. Moreover, as mentioned above, also with the method according to present invention, the ID registration is feasible while recognizing the specified one of the four wheels, without increasing the number of receiving antennas in the monitoring apparatus side, and since each of the tire air pressure sensors has a unique ID, even if only one receiving antenna exists for monitoring the air pressure, a judgment can easily be made as to which of the tires is in what air pressure state. Therefore, likewise, the method according to the present invention enables the use of a simpler apparatus configuration as compared with a system which has presently been put into practical use.

Furthermore, the method according to this aspect of the present invention can exhibit the following effects. For example, as well as the above-described aspect of the invention, let it be assumed that a transmitting unit of an air pressure sensor of any one of tires is broken. In this case, a dealer or a repair shop replaces the air pressure sensor of that tire with new one. At this time, with respect to new air pressure sensor, it is possible that the air pressure sensor ID at the corresponding tire position registered in the tire pressure monitoring apparatus in the vehicle body side is read out through the use of the ID registration tool and is transmitted as a set value to the newly replacing air pressure sensor to be stored therein. In this connection, as a judgment method on a broken sensor, the ID of the sensor from which an air pressure detection signal has not been received within a predetermined period of time when the vehicle is running can be specified through the use of a software or the like on the tire pressure monitoring apparatus side. Accordingly, only the operation for the ID registration in the broken air pressure sensor is required, thus considerably improving the workability. Incidentally, if a rule is made such that the condition of the ID registration at the replacement of a sensor is determined on the basis of some code information, such as a vehicle body number or a production number, peculiar to the vehicle, the ID setting can easily be made by key-inputting the vehicle body number or the like in the ID registration tool or by automatically reading and inputting it through the use of an optical reading unit or the like, without reading out the storage contents on the tire pressure monitoring apparatus side of the vehicle body, thereby further improving the workability.

Still furthermore, as well as the above-described aspect of the invention, in a case in which any one of sensors breaks down and is replaced with a new one, or when a tire bursts and the entire tire is replaced so that the sensor is replaced with another, the method according to the present invention enables the ID re-registration to be implemented with respect to the air pressure sensors of all the tires and the tire pressure monitoring apparatus on the vehicle body side through the use of the ID registration tool in a repair shop. Also in this case, if the ID re-registration is done in the form of including information on the implementation of the re-registration, the history management is feasible with respect to the tires of the vehicle. Moreover, in the case of the tire burst, for further effectiveness, with respect to a tire to be replaced due to the burst, that fact is inputted to the ID registration tool and the ID re-registration is made in the form of including the replacement history information. This additionally enables the tire history management by reading out the registered ID from the tire pressure monitoring apparatus or in the air pressure sensor.

In addition, according to the conventional method, at the ID registration, the tire pressure monitoring apparatus of the vehicle body is set in an ID registration mode and receives an ID signal transmitted periodically (for example, at an interval of 10 minutes) from an air pressure sensor of each of tires to register it as a sensor ID and, hence, the ID registration process takes time. However, with the method according to the present invention, since the ID registration is accomplished by the positive ID transmission from the ID registration tool, it is possible to considerably shorten the time required for the ID registration. That is, the conventional technique waits for the reception of an ID signal-transmitted from a sensor and registers it, whereas, according to the present invention, in the ID registration mode, the ID registration tool positively transmits a sensor ID to register in each sensor and in the monitoring apparatus, thus exhibiting an additional effect of considerably shortening the time needed for the ID registration process.

The above-mentioned various effects also apply not only to the vehicle production process but also to the repair of a vehicle in a dealer or a repair shop.

The above-described method according to the present invention which exhibits the distinguished effects is achievable through the use of the following tire air pressure sensor ID registration apparatus. This tire air pressure sensor ID registration apparatus is made up of a receiver mode switching unit for switching a tire pressure monitoring apparatus, mounted on a vehicle body, into an ID registration mode, a transmitter mode switching unit for switching an air pressure sensor of each of tires, mounted on a vehicle, into an ID registration mode, an ID setting unit for setting a registration ID to be stored in the air pressure sensor, and an ID

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registration tool including an ID transmitting unit for transmitting the set registration ID to the air pressure sensor switched into the ID registration mode by the transmitter mode switching unit and further to the tire pressure monitoring apparatus switched into the ID registration mode by the receiver mode switching unit. This ID registration apparatus can easily realize the method according to the present invention.

In this case, in the tire air pressure sensor ID registration apparatus according to the present invention, the ID registration tool can be connected through signal lines to the air pressure sensor of each of the tires and the tire pressure monitoring apparatus, and the ID to be stored in the air pressure sensor and the tire pressure monitoring apparatus is transmitted thereto through the signal lines. The effects of the signal transmission/reception using the wires are as mentioned above.

In addition, in the tire air pressure sensor ID registration apparatus according to the present invention, the ID registration tool can be made to be connectable to a production management computer, and the ID setting unit can be made to set an ID on the basis of production management information pertaining to each vehicle, such as a vehicle body number or a vehicle production number, given from the production management computer. This configuration enables the sensor ID registration based on the information on the production management peculiar to each vehicle.

Still additionally, for implementing the method according to the present invention, the following ID registration tool for use in a tire pressure monitoring system is employable. This ID registration tool for the tire pressure monitoring system is composed of an ID setting unit for setting a peculiar ID to be stored in an air pressure sensor of each of tires to be mounted on a vehicle and an ID transmitting unit for transmitting the ID, set in the ID setting unit, to the air pressure sensor of each of the tires and further to the tire pressure monitoring apparatus. The employment of this ID registration tool facilitates the realization of the method according to the present invention.

In this case, the ID registration tool for the tire pressure monitoring system according to the present invention can be equipped with signal lines for making connections with respect to the air pressure sensor of each of the tires and the tire pressure monitoring apparatus or a connector for the connections of the signal lines. The effects of the signal transmission/reception using wires are as mentioned above.

Moreover, the ID registration tool for the tire pressure monitoring system can include a trigger signal transmitting unit for transmitting a trigger signal to the air pressure sensor and the tire pressure monitoring apparatus for setting the air pressure sensor and the tire pressure monitoring apparatus in an ID registration mode. At the ID registration, this configuration can switch the air pressure sensor and the tire pressure monitoring apparatus into the ID registration mode through the use of the trigger signal from the ID registration tool. Accordingly, the IF registration tool with this configuration can eliminate the need for the operations such as switch manipulations of the air pressure sensor and the tire pressure monitoring apparatus at the ID registration, thereby improving the working efficiency.

Still moreover, in the ID registration tool for the tire pressure monitoring system, the ID setting unit can be made to include a sensor-peculiar ID producing unit for producing an ID, peculiar to each sensor, on the basis of peculiar vehicle information on production management, such as a vehicle number or a vehicle production number. Alternatively, in the ID registration tool for the tire pressure monitoring system, the ID setting unit can include a random-number generating unit for generating a random number and a sensor-peculiar ID producing unit for producing an ID, peculiar to each sensor, on the basis of the random number generated by the random-number generating unit. In addition, it is also possible that the ID registration tool for the tire pressure monitoring system is made to be connectable to a production management computer, and the ID setting unit can be made to set an ID including a portion of or all of production management information, peculiar to each vehicle, such as a vehicle body number or a vehicle production number, given by the production management computer.

Furthermore, for implementing the method according to the present invention, the following tire air pressure sensor is employable. This tire air pressure sensor is composed of an air pressure detecting unit, an ID storage unit, a transmitting circuit, and a receiving circuit, and when an ID to be stored in the ID storage unit is received through the receiving circuit, the ID is stored in the ID storage unit. That is, although a conventional tire air pressure sensor is not provided with a receiving circuit because of no requirement, for realizing the method according to the present invention, the receiving circuit is essential and, hence, the inventor of this application further invented a novel tire air pressure sensor with the receiving circuit. In this connection, it is also acceptable that the receiving circuit is constructed as a transmitting/receiving circuit integrated with a transmitting circuit, instead of being constructed as a single circuit.

In this case, in the tire air pressure sensor according to the present invention, the receiving circuit can be made to have a circuit arrangement in which the reception of a signal is made through a wired means. The effects of the signal transmission/reception using wires are as mentioned above.

Still furthermore, in the tire air pressure sensor according to the present invention, the ID storage unit can be constructed using a storage element which allows rewriting through overwriting. Thus, in the case of the implementation of the re-registration of a sensor ID in a repair shop or of the ID registration through radio means on a production line, when a sensor ID of the preceding vehicle is registered in the next vehicle on the production line, the registration of the normal sensor ID can easily be done at the ID registration in this next vehicle.

For realizing the method according to the present invention, an air pressure sensor mounted tire is equipped with the above-mentioned tire air pressure sensor according to the invention.

In addition, a tire pressure monitoring apparatus according to the present invention is made up of a signal line connecting unit for making a connection through a signal line to a predetermined ID registration tool, an ID registration mode activating unit for activating an ID registration mode, a tire position judging unit for making a judgment on a tire position on the basis of registration ID data received through the signal line in a state where the ID registration mode is activated, an ID registration unit for registering an ID of each of air pressure sensors in the form of specifying a tire position on the basis of a result of the judgment in the tire position judging unit, a re-registration judging unit for making a judgment on the basis of a command received from the ID registration tool as to whether or not the present registration is re-registration, and a re-registration unit for, when the judgment in the re-registration judging unit indicates the re-registration, re-registering an air pressure sensor ID in a memory on the basis of a result of the judgment in the tire position judging unit so that an ID already registered

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with respect to an air pressure sensor existing at the tire position undergoing the tire position judgment is effectively replaced with the air pressure sensor ID.

With this tire pressure monitoring apparatus according to the present invention, the sensor ID is based on a registration ID received from the ID registration tool through the signal line connecting unit and, hence, the mistaken registration due to the radio interference or the like is preventable. Moreover, at the ID registration, the tire position judging means makes a judgment on a tire position on the basis of the registration ID data, and on the basis of the judgment result, the ID registration unit makes the registration of the sensor ID to permit specifying the tire position. Accordingly, it is possible to easily carry out the monitoring of the tire air pressure while specifying the tire position, which offers the effects of eliminating the need for an increase in number of antennas. Moreover, if the re-registration judging unit makes a judgment that it is the re-registration, the ID re-registration unit re-registers an air pressure sensor ID in the memory so as to substitute it effectively for the already registered ID of an air pressure sensor at the subject tire position. Accordingly, for example, in a case in which only a portion of tires or sensors is replaced, the re-registration operation can be done with respect to only the replacing tire. Incidentally, as the employable registration methods for the effective replacement, for example, there are 1) the subject already registered ID being overwritten by a registration ID newly received and 2) the subject already registered ID being made void through the use of a flag so that a registration ID newly received is separately registered. In addition, in the case of the initial registration or the rotation, the tire position judging unit can also make a judgment on the tire position on the basis of the order of the data reception.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and features of the present invention will become more readily apparent from the following detailed description of the preferred embodiments taken in conjunction with the accompanying drawings in which:

FIG. **1** is a block diagram showing a configuration of a tire pressure monitoring system according to a first embodiment of the present invention;

FIG. **2** is an illustrative view showing a configuration of an apparatus for ID registration according to the first embodiment;

FIG. **3** is a flow chart showing an ID registration procedure according to the first embodiment;

FIG. **4** is a flow chart showing the contents of control processing in an ID registration tool for realizing the ID registration procedure shown in FIG. **3**;

FIG. **5** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **3**;

FIG. **6** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **3**;

FIG. **7** is a flow chart showing the contents of control processing in an tire pressure monitoring apparatus for realizing the ID registration procedure shown in FIG. **3**;

FIG. **8** is a flow chart showing the contents of control processing in an tire pressure monitoring apparatus for realizing the ID registration procedure shown in FIG. **3**;

FIG. **9** is an illustrative view showing a configuration of an apparatus for ID registration according to a second embodiment of the present invention;

FIG. **10** is a plan view showing a management sheet to be used in the second embodiment;

FIG. **11** is a flow chart showing an ID registration procedure according to the second embodiment;

FIG. **12** is a plan view showing a re-registration management sheet to be used in the second embodiment;

FIG. **13** is a flow chart showing the contents of control processing in an ID registration tool for realizing the ID registration procedure shown in FIG. **11**;

FIG. **14** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **11**;

FIG. **15** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **11**;

FIG. **16** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **11**;

FIG. **17** is a flow chart showing the contents of control processing in a tire pressure monitoring apparatus for realizing the ID registration procedure shown in FIG. **11**;

FIG. **18** is a flow chart showing the contents of the control processing in the tire pressure monitoring apparatus for realizing the ID registration procedure shown in FIG. **11**;

FIG. **19** is a flow chart showing the contents of control processing in an air pressure sensor for realizing the ID registration procedure shown in FIG. **11**;

FIG. **20** is a flow chart showing an ID registration procedure according to a third embodiment of the present invention;

FIG. **21** is a flow chart showing the contents of control processing in an ID registration tool for realizing the ID registration procedure shown in FIG. **20**;

FIG. **22** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **20**;

FIG. **23** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **20**;

FIG. **24** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **20**;

FIG. **25** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **20**;

FIG. **26** is a flow chart showing the contents of control processing in a tire pressure monitoring apparatus for realizing the ID registration procedure shown in FIG. **20**;

FIG. **27** is a flow chart showing the contents of the control processing in the tire pressure monitoring apparatus for realizing the ID registration procedure shown in FIG. **20**;

FIG. **28** is a flow chart showing the contents of control processing in an air pressure sensor for realizing the ID registration procedure shown in FIG. **20**;

FIG. **29** is a plan view showing examples of optically-readable information;

FIG. **30** is a plan view showing examples of optically-readable information;

FIG. **31** is a plan view showing examples of optically-readable information;

FIG. **32** is a plan view showing examples of optically-readable information;

FIG. **33** is an illustrative view showing an apparatus configuration for ID registration according to a fourth embodiment of the present invention;

FIG. **34** is a flow chart showing an ID registration procedure according to the fourth embodiment;

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FIG. **35** is a flow chart showing the contents of control processing in an ID registration tool for realizing the ID registration procedure shown in FIG. **34**;

FIG. **36** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **34**;

FIG. **37** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **34**;

FIG. **38** is a flow chart showing the contents of the control processing in the ID registration tool for realizing the ID registration procedure shown in FIG. **34**;

FIG. **39** is a flow chart showing the contents of control processing in a tire air pressure sensor for realizing the ID registration procedure shown in FIG. **34**;

FIG. **40** is a flow chart showing the contents of control processing in an ID registration tool according to a fifth embodiment of the present invention;

FIG. **41** is a flow chart showing the contents of the control processing in the ID registration tool according to the fifth embodiment;

FIG. **42** is a flow chart showing the contents of the control processing in the ID registration tool according to the fifth embodiment;

FIG. **43** is a flow chart showing the contents of control processing in an ID registration tool according to a sixth embodiment of the present invention;

FIG. **44** is a flow chart showing the contents of the control processing in the ID registration tool according to the sixth embodiment;

FIG. **45** is a flow chart showing the contents of the control processing in the ID registration tool according to the sixth embodiment;

FIG. **46** is a flow chart showing the contents of control processing in an ID registration tool according to a seventh embodiment of the present invention;

FIG. **47** is a flow chart showing the contents of the control processing in the ID registration tool according to the seventh embodiment;

FIG. **48** is a flow chart showing the contents of the control processing in the ID registration tool according to the seventh embodiment;

FIG. **49** is an illustrative view showing an apparatus configuration for ID registration according to an eighth embodiment of the present invention;

FIG. **50** is a flow chart showing an ID registration procedure according to the eighth embodiment;

FIG. **51** is a flow chart showing the contents of control processing in an ID registration tool according to the eighth embodiment;

FIG. **52** is a flow chart showing the contents of the control processing in the ID registration tool according to the eighth embodiment;

FIG. **53** is a flow chart showing the contents of the control processing in the ID registration tool according to the eighth embodiment;

FIG. **54** is a flow chart showing the contents of control processing in an ID registration tool according to a ninth embodiment of the present invention;

FIG. **55** is a flow chart showing the contents of the control processing in the ID registration tool according to the ninth embodiment;

FIG. **56** is a flow chart showing the contents of control processing in a tire pressure monitoring apparatus according to the ninth embodiment;

FIG. **57** is a flow chart showing an ID registration procedure according to a tenth embodiment of the present invention;

FIG. **58** is a flow chart showing the ID registration procedure according to the tenth embodiment;

FIG. **59** is a flow chart showing the contents of control processing in an ID registration tool according to the tenth embodiment;

FIG. **60** is a flow chart showing the contents of the control processing in the ID registration tool according to the tenth embodiment;

FIG. **61** is a flow chart showing the contents of the control processing in the ID registration tool according to the tenth embodiment;

FIG. **62** is a flow chart showing the contents of the control processing in the ID registration tool according to the tenth embodiment;

FIG. **63** is a flow chart showing the contents of the control processing in the ID registration tool according to the tenth embodiment;

FIG. **64** is a flow chart showing the contents of the control processing in the ID registration tool according to the tenth embodiment;

FIG. **65** is a flow chart showing the contents of the control processing in the ID registration tool according to the tenth embodiment;

FIG. **66** is a flow chart showing the contents of control processing in a tire air pressure sensor according to the tenth embodiment;

FIG. **67** is a flow chart showing the contents of control processing in an ID registration tool according to an eleventh embodiment of the present invention;

FIG. **68** is a flow chart showing the contents of the control processing in the ID registration tool according to the eleventh embodiment;

FIG. **69** is a flow chart showing the contents of the control processing in the ID registration tool according to the eleventh embodiment;

FIG. **70** is a flow chart showing the contents of the control processing in the ID registration tool according to the eleventh embodiment;

FIG. **71** is a flow chart showing the contents of the control processing in the ID registration tool according to the eleventh embodiment;

FIG. **72** is a flow chart showing the contents of the control processing in the ID registration tool according to the eleventh embodiment;

FIG. **73** is a flow chart showing the contents of the control processing in the ID registration tool according to the eleventh embodiment;

FIG. **74** is a flow chart showing the contents of the control processing in the ID registration tool according to the eleventh embodiment;

FIG. **75** is a flow chart showing the contents of control processing in a tire pressure monitoring apparatus according to the eleventh embodiment;

FIG. **76** is a flow chart showing the contents of the control processing in the tire pressure monitoring apparatus according to the eleventh embodiment;

FIG. **77** is a flow chart showing the contents of the control processing in the tire pressure monitoring apparatus according to the eleventh embodiment;

FIG. **78** is a block diagram showing a configuration of a conventional tire pressure monitoring system; and

FIG. **79** is a flow chart showing an ID registration procedure in the conventional system.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

Embodiments of the present invention will be described hereinbelow with reference to the drawings.

First Embodiment

FIG. **1** is a block diagram schematically showing a configuration of a tire pressure monitoring system according to a first embodiment of the present invention. As FIG. **1** shows, the tire pressure monitoring system according to this embodiment is made up of air pressure sensors **10**, **20**, **30** and **40** mounted on tires and a tire pressure monitoring apparatus **50** mounted on a body of a vehicle. The air pressure sensor **10** is composed of a pressure sensor **11** for detecting an air pressure in the interior of a tire, an ID memory **12** for storing a sensor ID in advance, a transmitting circuit **13**, a power supply battery **14**, a control unit **15** and a transmitting antenna **16**. The other air pressure sensors **20**, **30** and **40** have the same configuration.

On the other hand, the tire pressure monitoring apparatus **50** is composed of a receiving circuit **51**, a receiving antenna **52**, a power supply circuit **53**, a control unit **54**, a memory **55**, and a communication circuit **56** for transmitting indication data to an indicating device **81** such as an indicator or LED. This communication circuit **56** is also designed to receive a signal representative of an indication state and others from the indicating device **81**. The power supply to the tire pressure monitoring apparatus **50** is made from a vehicle-mounted battery **82**.

The ID memories **12**, **22**, **32** and **42** of the air pressure sensors **10**, **20**, **30** and **40** store the corresponding IDs (**123456**, **234567**, **345678**, **45678**), respectively. In the tire pressure monitoring system according to this embodiment, the ID of each air pressure sensor is required to be registered in the memory **55** of the tire pressure monitoring apparatus **50**. Therefore, as shown in FIG. **2**, bar codes **5**, **6**, **7** and **8** representative of the IDs of the air pressure sensors **10**, **20**, **30** and **40** are adhered onto wheels **1***a*, **2***a*, **3***a* and **4***a* of tires **1**, **2**, **3**, and **4**. In this embodiment, an ID registration tool **60** is used in order to read the IDs from these bar codes **5**, **6**, **7** and **8** for writing them in the tire pressure monitoring apparatus **50**.

The ID registration tool **60** is composed of a bar-code reading unit **61** and an ID transmitting unit **62** for transmitting the IDs, read by the bar-code reading unit **61**, to the tire pressure monitoring apparatus **50**. Moreover, the ID registration tool **60** is equipped with a connector **64** for the connection of a signal line **63** for making a connection with respect to the tire pressure monitoring apparatus **50**. Incidentally, the signal line **63** has a crocodile clip its tip portion which allows the connection of the signal line **63** to a signal line **57** extending from the communication circuit **56** of the tire pressure monitoring apparatus **50** to the indicating device **81**.

In addition, the ID registration tool **60** includes a control unit **65**, a memory **66**, a power supply battery **67**, a control panel **68** and a display **69**. The control unit **65** is for implementing various processing through the use of the ID registration tool **60**, and comprises a microcomputer including a CPU, ROM, a RAM and other components. The memory **66** comprises a rewritable EEPROM, flash memory, DRAM, or the like. As the power supply battery **67**, there is used a dry cell, a button-like cell, or the like. The control panel **68** has control keys for indicating the contents of processing to be implemented through the use of the ID registration tool **60**. The display **69** is for indicating a numeral of the bar code read by the bar-code reading unit **61**, or for displaying a control mode of the ID registration tool **60**, and for example, comprises an LCD.

Secondly, a description will be given hereinbelow of a method of registering the IDs of the air pressure sensors **10**, **20**, **30** and **40** in the tire pressure monitoring apparatus **50**. For implementing this method, the signal line **63** of the ID registration tool **60** is connected to the connector **64** and the crocodile clip at the tip portion of the signal line **63** is connected to the signal line **57** extending from the communication circuit **56** of the tire pressure monitoring apparatus **50** to the indicating device **81**. The registration operation is made according to a procedure described below.

In the registration operation, as shown in a flow chart of FIG. **3**, first, the monitoring apparatus **50** is switched into an ID registration mode (S**10**), and a decision is made as to whether or not it is the initial registration (S**20**). In the case of the initial registration (S**20**: YES), the IDs are read from the bar codes **5**, **6**, **7** and **8** through the use of the ID registration tool **60** (S**30**), and are transmitted from the ID registration tool **60** to the tire pressure monitoring apparatus **50** (S**40**). The tire pressure monitoring apparatus **50** registers the received IDs in the memory **55** (S**50**). Moreover, it makes a decision as to whether or not the necessary number of IDs are put in its memory **55** (S**60**). If the registration of the necessary number of IDs does not reach completion (S**60**: NO), the step S**40** and subsequent steps are implemented repeatedly. If the registration of the necessary number of IDs has reached completion (S**60**: YES), the monitoring apparatus **50** is switched into a normal mode, then terminating the ID registration operation (S**70**).

On the other hand, in the case of no initial registration, that is, for example, in a case in which a tire(s) is replaced in a repair shop or the like (S**20**: NO), the ID is read out from the bar code adhered onto the detached tire through the use of the ID registration tool **60** (S**80**), and is transmitted from the ID registration tool **60** to the tire pressure monitoring apparatus **50** (S**90**). Upon receipt of this ID, the tire pressure monitoring apparatus **50** deletes an ID corresponding to the received ID from the memory **55** (S**100**). Subsequently, an ID is read out from a bar code adhered onto a tire to be attached newly, through the use of the ID registration tool **60** (S**110**), and is transmitted from the ID registration tool **60** to the tire pressure monitoring apparatus **50** (S**120**). The tire pressure monitoring apparatus **50** registers the received ID in the memory **55** (S**130**). Following this, a decision is made as to whether or not the ID re-registration in the tire pressure monitoring apparatus **50** reaches completion (S**140**). If the ID re-registration does not come to an end (S**140**: NO), the step S**80** and subsequent steps are executed repeatedly. On the other hand, if the ID registration of the necessary number of IDs reaches completion (S**140**: YES), the monitoring apparatus **50** is switched into a normal mode (S**70**), and the ID registration operation comes to an end.

Furthermore, referring to flow charts of FIGS. **4** to **6**, a description will be given hereinbelow of the contents of a program installed in the ID registration tool **60** for the implementation of the above-mentioned registration operation. The following program starts by pushing a predetermined button on the control panel **68** of the ID registration tool **60**. In this program, first of all, a trigger signal is transmitted to place the tire pressure monitoring apparatus **50** into an ID registration mode (S**210**), and after a manipulation of the control panel **68**, a decision is then made as to whether or not it is the initial registration in the tire pressure monitoring apparatus **50** (S**220**).

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In the case of the initial registration (S220: NO), a readout instruction message on a bar code of a front left tire of a vehicle is displayed on the display 69 (S230), and a decision is made on whether or not the readout reaches completion (S240). If the decision shows the completion of the readout (S240: YES), the readout result in a state associated with the tire position (front left) is stored in the memory 66 (S250). Moreover, a readout instruction message on the bar code of the rear left tire is displayed (S260), and a decision is made as to whether or not the readout reaches completion (S270). If the decision shows that the readout reaches completion (S270: YES), the readout result is stored in the memory 66 in a state associated with the tire position (rear left) (S280). Still moreover, a readout instruction message on the bar code of the rear right tire is displayed (S290), and a decision is made as to whether or not the readout reaches completion (S300). If the decision indicates that the readout reaches completion (S300: YES), the readout result in a state associated with the tire position (rear right) is stored in the memory 66 (S310). Yet moreover, a readout instruction message on the bar code of the front right tire is displayed (S320), and a decision is made as to whether or not the readout reaches completion (S330). If the decision indicates the completion of the readout therefrom (S330: YES), the readout result is put in the memory 66 in a state associated with the tire position (front right) (S340).

Thereafter, the ID corresponding to the air pressure sensor of the front left tire is first read out from the memory 66 and is transmitted to the tire pressure monitoring apparatus 50 (S350), and an instruction command for ID registration is transmitted to the tire pressure monitoring apparatus 50 (S360). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus 50 (S370). In a case in which the reply does not come within a predetermined period of time (S370: NO), the operational flow returns to the step S350. On the other hand, in the case of the arrival of the reply indicative of the completion of the registration (S370: YES), the ID corresponding to the air pressure sensor of the rear left tire is read out from the memory 66 and is transmitted to the tire pressure monitoring apparatus 50(S380). Moreover, an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus 50 (S390), and a decision is made as to whether or not a replay indicative of the registration completion comes from the tire pressure monitoring apparatus 50 (S400). If the relay does not come within a predetermined period of time (S400: NO), the operational flow returns to the step S380. On the other hand, in the case of the arrival of the replay indicative of the registration completion (S400: YES), the ID corresponding to the air pressure sensor of the rear right tire is read out from the memory 66 and is transmitted to the tire pressure monitoring apparatus 50 (S410). Still moreover, an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus 50 (S420), and a decision is made as to whether or not a reply indicative of the registration completion comes from the tire pressure monitoring apparatus 50 (S430). If the reply does not come within a predetermined period of time (S430: NO), the operational flow returns to the step S410. On the other hand, in the case of the arrival of the reply indicative of the registration completion (S430: YES), the ID corresponding to the air pressure sensor of the front right tire is read out from the memory 66 and is transmitted to the tire pressure monitoring apparatus 50 (S440). Yet moreover, an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus 50 (S450), and a decision is made as to whether or not a reply indicative of the registration completion comes from the tire pressure monitoring apparatus 50 (S460). If the reply does not come within a predetermined period of time (S460: NO), the operational flow returns to the step S440. On the other hand, in the case of the arrival of the reply indicative of the registration completion (S460: YES), a trigger signal calling for the restoration (return) to the normal mode is outputted to the tire pressure monitoring apparatus 50, before terminating the processing (S470).

Meanwhile, in the case other than the initial registration, that is, in the case of the occurrence of re-registration related to the tire replacement (S220: YES), an instruction message on the readout from the bar code of the detached tire is displayed on the display 69 (S480), and a decision is made as to whether or not the readout comes to an end (S490). If the decision indicates the completion of the readout (S490: YES), the readout result is stored in the memory 66 (S500). Moreover, the ID stored in S500 is read out from the memory 66 and is transmitted to the monitoring apparatus 50(S510). Subsequently, an instruction command for ID deletion is transmitted to the tire pressure monitoring apparatus 50 (S520), and a decision is made as to whether or not a reply indicative of the completion of the deletion comes from the tire pressure monitoring apparatus 50 (S530). If the reply does not within a predetermined period of time (S530: NO), the operational flow returns to the step S510. On the other hand, in the case of the arrival of the reply indicative of the deletion completion (S530: YES), an instruction message to the effect of reading a bar code of a tire to be attached newly is put on the display 69 (S540), and a decision is made on whether or not the readout from the bar code reaches completion (S550). If the decision indicates the completion of the readout (S550: YES), the readout result is put in the memory 66 (S560). Subsequently, the ID stored in S540 is read out from the memory 66 and is transmitted to the tire pressure monitoring apparatus 50 (S570). Moreover, an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus 50 (S580), and a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus 50 (S590). If the relay does not come within a predetermined period of time (S590: NO), the operational flow returns to the step S570. On the other hand, in the case of the arrival of the reply indicative of the registration completion (S590: YES), an inquiry message as to whether or not there is another tire to be subjected to the re-registration is displayed on the display 69, and the control waits for a result of a panel manipulation (S600, S610). If input of an instruction indicative of the presence of another tire to be re-registered takes place through the panel manipulation (S610: YES), the step 480 and subsequent processing are implemented repeatedly. On the other hand, in the case of the occurrence of instruction input indicative of the completion of the re-registration (S610: NO), a trigger signal indicating the restoration to the normal mode is outputted to the tire pressure monitoring apparatus 50, before terminating the processing (S470).

Furthermore, a description will be given hereinbelow of the contents of control processing to be executed in the tire pressure monitoring apparatus 50. In this control processing, as shown in FIGS. 7 and 8, first of all, a decision is made as to whether or not the reception of a trigger signal calling for the switching into an ID registration mode takes place (S700). In the case of the reception of the trigger signal indicating the switching into the ID registration mode (S700: YES), the switching into the ID registration mode is carried

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out (S710), and a decision is made as to whether or not the reception of the ID takes place (S720). In the case of the ID reception (S720: YES), this ID is temporarily stored in a work area of the RAM (S730). Moreover, a decision is made as to which of the ID registration instruction and the ID deletion instruction is received (S740). In the case of the reception of the ID registration instruction (S740: Registration), the ID temporarily stored in S730 is registered as the ID of the air pressure sensor of the front left tire in the memory 55 (S750), and a reply indicative of the ID registration completion is then made (S760). Subsequently, a decision is made as to whether the reception of an ID takes place or not (S770). In the case of the ID reception (S770: YES), this ID is temporarily stored in a work area of the RAM (S780). Moreover, a decision is made about the reception of an ID registration instruction (S790). In the case of the reception of the ID registration instruction (S790: YES), the ID stored in S780 is registered as the ID of the air pressure sensor of the rear left tire in the memory 55 (S800), and a reply indicative of the ID registration completion is made (S810). Still moreover, a decision is made about the reception of an ID (S820). In the case of the ID reception (S820: YES), this ID is temporarily stored in a work area of the RAM (S830). Yet moreover, a decision is made as to the reception of an ID registration instruction (S840). In the case of the reception of the ID registration instruction (S840: YES), the ID temporarily stored in S830 is registered as the ID of the air pressure sensor of the rear right tire in the memory 55 (S850), and a reply indicative of the ID registration completion is made (S860). In addition, a decision is made on the reception of an ID (S870). For the reception of the ID (S870: YES), this ID is temporarily stored in a work area of the RAM (S880). Subsequently, a decision is made about the reception of an ID registration instruction (S890). For the reception of the ID registration instruction (S890: YES), the ID temporarily stored in S880 is registered as the ID of the air pressure sensor of the front right tire in the memory 55 (S900), and a reply indicative of the ID registration completion is carried out (S910). Following this, a decision is made about the reception of a trigger signal to the effect that the mode is switched into the normal mode (S920). If received is the trigger signal calling for the switching into the normal mode (S920: YES), the switching into the normal mode is made (S930), and then the processing comes to an end.

On the other hand, after the ID is received in S720 and is temporarily stored in the RAM in S730, if the reception of an ID deletion instruction takes place (S740: deletion), the same ID as the ID temporarily stored in S730 is removed from the memory 55 (S940), and a reply is made which is indicative of the ID deletion completion (S950). Subsequently, a decision is made about the reception of an ID (S960). For the reception of the ID (S960: YES), this ID is temporarily stored in a work area of the RAM (S970). Following this, a decision is made about the reception of an ID registration instruction (S980). For the reception of the ID registration instruction (S980: YES), the ID temporarily stored in S970 is registered in the-memory 55 as the ID of the air pressure sensor of the tire at the position corresponding to the ID deleted in S940 (S990), and a reply indicative of the ID registration completion is made (S1000). Thereafter, a decision is made as to whether received is a trigger signal calling for the switching into the normal mode or a new ID (S1010, S1020). In the case of the reception of the new ID (S1010: No, S1020: YES), this ID is temporarily stored in a work area of the RAM (S1030). Moreover, a decision is made on the reception of an ID deletion instruction (S1040). In the case of the reception of the ID deletion instruction (S1040: YES), the operational flow proceeds to the step S940 and subsequent processing. On the other hand, if the decision in S1010 shows the reception of the trigger signal indicting the switching into the normal mode, the operational flow advances to the step S930, where the switching into the normal mode is made, and the processing then comes to an end.

The above-described control processing is conducted in the ID registration tool 60 and the tire pressure monitoring apparatus 50 and, as a result, at the initial registration, the air pressure sensor IDs can be registered in a state associated with the tire positions: front left, rear left, rear right and front right. At this time, mistaken registration due to radio interference or the registration-impossible state due to other electric waves does not occur, unlike the conventional technique. In addition, at the tire replacement or at the tire rotation, through the above-described control processing, the sensor IDs can be registered in a state associated with the tire positions after the replacement. In the case of the tire replacement, the re-registration operation can be conducted with respect to only the replacement tire, thus achieving the reduction of the number of steps. Still additionally, also in the case of rotation, the ID re-registration reflecting a change of position is feasible. Yet additionally, also in this re-registration operation, the problem of the mistaken registration due to the radio interference is solvable.

Second Embodiment

Secondly, a description will be given hereinbelow of a second embodiment of the present invention. In the second embodiment, as shown in FIG. 9, an ID registration tool 60 is connected to a tire pressure monitoring apparatus 50 and further to tire air pressure sensors 10, 20, 30 and 40 through signal lines 63*a*, 63*b*, 63*c* and 63*d*, respectively. The ID registration tool 60 is equipped with connectors 64*a*, 64*b*, 64*c* and 64*d* for connecting these signal lines 63*a*, 63*b*, 63*c* and 63*d* to the tool body. Moreover, each of these signal lines 63*a*, 63*b*, 63*c* and 63*d* has a crocodile clip at its tip portion to be connectable to antennas 16, 26, 36 and 46 of the respective sensors 10, 20, 30 and 40. Still moreover, the sensors 10, 20, 30 and 40 respectively include transmitting/receiving circuits 13*a*, 23*a*, 33*a* and 43*a* made to enable not only the transmission but also the reception. Therefore, the antennas 16, 26, 36 and 46 are also made to perform not only the transmission but also the reception. In addition, the antennas 16, 26, 36 and 46 also act as a connector of a valve for injecting air into tires. Still additionally, ID memories 12, 22, 32 and 42 of the air pressure sensors 10, 20, 30 and 40 may be a non-volatile storage element, such as EEPROM, which allows the rewriting of data by overwriting.

In the second embodiment, as shown in FIG. 10, registration IDs are given in the form of a management sheet 90 for each vehicle. In this management sheet 90, the registration IDs for each vehicle are indicated by bar codes 91FL, 91RL, 91RR and 91FR. The registration operation is conducted in accordance with the following procedure.

For the registration operation, the signal lines 63, 63*a*, 63*b*, 63*c* and 63*d* of the ID registration tool 60 are connected to the respective sensors 10, 20, 30, 40 and the monitoring apparatus 50, and the operation is implemented in accordance with a procedure shown in FIG. 11. First of all, the respective sensors 10, 20, 30, 40 and the monitoring apparatus 50 are switched into an ID registration mode (S1110). Subsequently, a decision is made as to whether or not it is the initial registration (S1120). In the case of the initial

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registration (S1120: YES), the bar codes 91FL, 91RL, 91RR and 91FR on the management sheet 90 are read through the use of the ID registration tool 60 (S1130). The IDs read out from these bar codes 91FL, 91RL, 91RR and 91FR are transmitted from the ID registration tool 60 to the respective air pressure sensors 10, 20, 30, 40 and the tire pressure monitoring apparatus 50 (S1140). The respective air pressure sensors 10, 20, 30, 40 and the tire pressure monitoring apparatus 50 register the received IDs in ID memories 12, 22, 32, 42 and in a memory 55 (S1150).

At this time, the signal lines 63*a*, 63*b*, 63*c* and 63*d* are correctly connected to the air pressure sensors 10, 20, 30 and 40 and the readout by the ID registration tool 60 is made in the order of the bar code 91FL, the bar code 91RL, the bar code 91RR and the bar code 91FR so that the ID indicated by the bar code 91FL is registered in the air pressure sensor 10, the ID indicated by the bar code 91RL is registered in the air pressure sensor 20, the ID of the bar code 91RR is put in the air pressure sensor 30, and the ID of the bar code 91FR is put in the air pressure sensor 40. Moreover, in the memory 55 of the monitoring apparatus 50, the ID of the bar code 91FL is registered as that of the front left tire, the ID of the bar code 91RL is registered as that of the rear left tire, the ID of the bar code 91RR is placed as that of the rear right tire, and the ID of the bar code 91FR is placed as that of the front right tire.

When the initial ID registrations in the air pressure sensors 10, 20, 30, 40 and the monitoring apparatus 50 reach completion in this way, the air pressure sensors 10, 20, 30, 40 and the monitoring apparatus 50 are switched into a normal mode (S1160), and the ID registration operation comes to an end.

On the other hand, if it is not the initial registration, that is, in the case of the replacement of a tire in a repair shop or the like (S1120: YES), the ID registration tool 60 reads bar codes 91FL', 91RL', 91RR' and 91FR' on a re-registration management sheet 90' shown in FIG. 12 (S1170). The IDs read out from these bar codes 91FL', 91RL', 91RR' and 91FR' are transmitted from the ID registration tool 60 to the respective air pressure sensors 10, 20, 30, 40 and the tire pressure monitoring apparatus 50 (S1180).

In the case of rotation, the signal line 63*a* is connected to the air pressure sensor of the front left tire after the rotation, the signal line 63*b* is connected to the air pressure sensor of the rear left tire after the rotation, the signal line 63*c* is connected to the air pressure sensor of the rear right tire after the rotation, and the signal line 63*d* is connected to the air pressure sensor of the front right tire after the rotation. Moreover, in the case of the tire replacement, a signal line is connected to an air pressure sensor of a tire, being mounted newly, in accordance with the mounting position. That is, the signal line 63*a* is connected to the new tire air pressure sensor for the front left position, the signal line 63*b* is connected thereto for the rear left, the signal line 63*c* is connected thereto for the rear right, and the signal line 63*d* is connected thereto for the front right. Likewise, with respect to the air pressure sensors of the tires which do not undergo the replacement, the signal line 63*a* is connected for the front left, the signal line 63*b* for the rear left, the signal line 63*c* for the rear right, and the signal line 63*d* for the front right.

In the respective air pressure sensors 10, 20, 30, 40 and the tire pressure monitoring apparatus 50, the received ID is overwritten in the ID memories 12, 22, 32, 42 and the memory 55 for the re-registration, thereby implementing the ID updating (S190).

Also in this case, the ID registration tool 60 implements the readout in the order of the bar code 91FL', the bar code 91RL', the bar code 91RR' and the bar code 91FR', after the rotation or the time replacement, the ID of the bar code 91FL' is registered in the front left air pressure sensor 10, the ID of the bar code 91RL' in the rear left air pressure sensor 20, the ID of the bar code 91RR' in the rear right air pressure sensor 30, and the ID of the bar code 91FR' in the front right air pressure sensor 40. Moreover, in the memory 55 of the monitoring apparatus 50, the ID of the bar code 91FL' is registered as that of the front left tire, the ID of the bar code 91RL' as that of the rear left tire, the ID of the bar code 91RR' as that of the rear right tire, and the ID of the bar code 91FR' as that of the front right tire.

In this way, after the completion of the re-registration of the IDs in the air pressure sensors 10, 20, 30, 40 and the monitoring apparatus 50, the air pressure sensors 10, 20, 30, 40 and the monitoring apparatus 50 are switched into a normal mode (S160), and the ID registration operation comes to an end.

Furthermore, referring to flow charts of FIGS. 13 to 16, a description will be given hereinbelow of the contents of a program installed in the ID registration tool 60 for the above-described registration operation. The following program starts by pressing a predetermined button of the control panel 68 of the ID registration tool 60. In this program, first of all, a trigger signal is transmitted for the purpose of placing the air pressure sensors 10, 20, 30, 40 and the tire pressure monitoring apparatus 50 into an ID registration mode (S1210). Then, a decision is made as to whether or not it is the initial registration after a manipulation of the control panel 68 (S1220).

In the case of the initial registration (S1220: YES), an instruction message on the readout of the bar code 91FL of the registration sheet 90 is displayed on the display 69 (S1230), and a decision is made as to the completion of the readout (S1240). If the decision shows the completion of the readout (S1240: YES), the readout result is stored in the memory 66 in a state associated with the tire position (front left) (S1250). Subsequently, an instruction message on the readout of the bar code 91RL of the registration sheet 90 is displayed thereon (S1260), and a decision is made as to the completion of the readout (S1270). If the decision shows the completion of the readout (S1270: YES), the readout result is stored in the memory 66 in a state associated with the tire position (rear left) (S1280). Moreover, an instruction message on the readout of the bar code 91RR thereof is displayed thereon (S1290), and a decision is made as to the completion of the readout (S1300). If the decision shows the completion of the readout (S1300: YES), the readout result is stored in the memory 66 in a state associated with the tire position (rear right) (S1310). Still moreover, an instruction message on the readout of the bar code 91FR thereof is displayed thereon (S1320), and a decision is made as to the completion of the readout (S1330). If the decision shows the completion of the readout (S1330: YES), the readout result is stored in the memory 66 in a state associated with the tire position (front right) (S1340).

Following this, the ID corresponding to the air pressure sensor of the front left tire is first read out from the memory 66 and is transmitted to the air pressure sensor 10 and the tire pressure monitoring apparatus 50 (S1350), and an instruction command for the ID registration is transmitted to the air pressure sensor 10 and the tire pressure monitoring apparatus 50(S1360). A decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor 10 and the tire pressure moni-

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toring apparatus **50**(S**1370**). If the reply does not come within a predetermined period of time (S**1370**:NO), the operational flow returns to the step S**1350**. On the other hand, if the registration completion reply comes (S**1370**: YES), the ID corresponding to the air pressure sensor of the rear left tire is read out from the memory **66** and is transmitted to the air pressure sensor **20** and the monitoring apparatus **50** (S**1380**), and an instruction command for the ID registration is then transmitted to the air pressure sensor **20** and the monitoring apparatus **50**(S**1390**). A decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **20** and the tire pressure monitoring apparatus **50** (S**1400**). If the reply does not come within a predetermined period of time (S**1400**:NO), the operational flow returns to the step S**1380**. On the other hand, if the registration completion reply comes (S**1400**: YES), the ID corresponding to the air pressure sensor of the rear right tire is read out from the memory **66** and is transmitted to the air pressure sensor **30** and the monitoring apparatus **50** (S**1410**), and an instruction command for the ID registration is then transmitted to the air pressure sensor **30** and the monitoring apparatus **50** (S**1420**). A decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **30** and the tire pressure monitoring apparatus **50** (S**1430**). If the reply does not come within a predetermined period of time (S**1430**:NO), the operational flow returns to the step S**1410**. On the other hand, if the registration completion reply comes (S**1430**: YES), the ID corresponding to the air pressure sensor of the front right tire is read out from the memory **66** and is transmitted to the air pressure sensor **40** and the monitoring apparatus **50** (S**1440**), and an instruction command for the ID registration is then transmitted to the air pressure sensor **40** and the monitoring apparatus **50**(S**1450**). A decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **40** and the tire pressure monitoring apparatus **50** (S**1460**). If the reply does not come within a predetermined period of time (S**1460**: NO), the operational flow returns to the step S**1440**. On the other hand, if the registration completion reply comes (S**1460**: YES), a trigger signal calling for the restoration to the normal mode is outputted to the air pressure sensors **10**, **20**, **30**, **40** and the tire pressure monitoring apparatus **50** (S**1470**), and the processing comes to an end.

Furthermore, if it is not the initial registration, that is, in the case of the re-registration due to the tire replacement (S**1220**: YES), an instruction message on the readout of the bar code **91**FL' indicated on the re-registration sheet **90'** is displayed on the display **69** (S**1530**), and a decision is made as to the completion of the readout (S**1540**). If the decision shows the completion of the readout (S**1540**: YES), the readout result is stored in the memory **66** in a state associated with the tire position (front left) (S**1550**). Subsequently, an instruction message on the readout of the bar code **91**RL' thereon is displayed (S**1560**), and a decision is made as to the completion of the readout (S**1570**). If the decision shows the completion of the readout (S**1570**: YES), the readout result is stored in the memory **66** in a state associated with the tire position (rear left) (S**1580**). Moreover, an instruction message on the readout of the bar code **91**RR' thereon is displayed (S**1590**), and a decision is made as to the completion of the readout (S**1600**). If the decision shows the completion of the readout (S**1600**: YES), the readout result is stored in the memory **66** in a state associated with the tire position (rear right) (S**1610**). Still moreover, an instruction message on the readout of the bar code **91**FR' thereon is displayed (S**1620**), and a decision is made as to the completion of the readout (S**1630**). If the decision shows the completion of the readout (S**1630**: YES), the readout result is stored in the memory **66** in a state associated with the tire position (front right) (S**1640**).

Following this, the ID corresponding to the air pressure sensor of the front left tire is read out from the memory **66** and is transmitted to the air pressure sensor **10** and the tire pressure monitoring apparatus **50** (S**1650**), and an instruction command for the ID re-registration is then transmitted to the air pressure sensor **10** and the monitoring apparatus **50** (S**1660**). A decision is made as to whether or not a reply indicative of the registration completion comes from the air pressure sensor **10** and the monitoring apparatus **50** (S**1670**). If the reply does not come within a predetermined period of time (S**1670**: NO), the operational flow returns to the step S**1650**. On the other hand, if the registration completion reply comes (S**1670**: YES), the ID corresponding to the air pressure sensor of the rear left tire is read out from the memory **66** and is transmitted to the air pressure sensor **20** and the monitoring apparatus **50** (S**1680**). An instruction command for the ID re-registration is then transmitted to the air pressure sensor **20** and the monitoring apparatus **50** (S**1690**). A decision is made as to whether or not a reply indicative of the registration completion comes from the air pressure sensor **20** and the monitoring apparatus **50** (S**1700**). If the reply does not come within a predetermined period of time (S**1700**: NO), the operational flow returns to the step S**1680**. On the other hand, if the registration completion reply comes (S**1700**: YES), the ID corresponding to the air pressure sensor of the rear right tire is read out from the memory **66** and is transmitted to the air pressure sensor **30** and the monitoring apparatus **50** (S**1710**). An instruction command for the ID re-registration is then transmitted to the air pressure sensor **30** and the monitoring apparatus **50** (S**1720**). A decision is made as to whether or not a reply indicative of the registration completion comes from the air pressure sensor **30** and the monitoring apparatus **50** (S**1730**). If the reply does not come within a predetermined period of time (S**1730**: NO), the operational flow returns to the step S**1710**. On the other hand, if the registration completion reply comes (S**1730**: YES), the ID corresponding to the air pressure sensor of the front right tire is read out from the memory **66** and is transmitted to the air pressure sensor **40** and the monitoring apparatus **50** (S**1740**). An instruction command for the ID re-registration is then transmitted to the air pressure sensor **40** and the monitoring apparatus **50** (S**1750**). A decision is made as to whether or not a reply indicative of the registration completion comes from the air pressure sensor **40** and the monitoring apparatus **50** (S**1760**). If the reply does not come within a predetermined period of time (S**1760**: NO), the operational flow returns to the step S**1740**. On the other hand, if the registration completion reply comes (S**1760**: YES), a trigger signal calling for the restoration to the normal mode is outputted to the air pressure sensors **10**, **20**, **30**, **40** and the monitoring apparatus **50** (S**1470**), and the processing comes to an end.

Furthermore, a description will be given hereinbelow of the contents of control processing to be conducted in the tire pressure monitoring apparatus **50**. In this control processing, as shown in FIGS. **17** and **18**, first of all, a decision is made as to whether or not the reception of a trigger signal calling for the switching into an ID registration mode takes place (S**1800**). In the case of the reception of the trigger signal indicating the switching into the ID registration mode (S**1800**: YES), the switching into the ID registration mode is carried out (S**1810**), and a decision is made as to whether or

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not the reception of an ID takes place (S1820). In the case of the ID reception (S1820: YES), this ID is temporarily stored in a work area of the RAM (S1830). Moreover, a decision is made as to which of the ID registration instruction and the ID deletion instruction is received (S1840). In the case of the reception of the ID registration instruction (S1840: Registration), the ID temporarily stored in S1830 is registered as the ID of the air pressure sensor of the front left tire in the memory 55 (S1850), and a reply indicative of the ID registration completion is then made (S1860). Subsequently, a decision is made as to whether the reception of an ID takes place or not (S1870). In the case of the ID reception (S1870: YES), this ID is temporarily stored in a work area of the RAM (S1880). Moreover, a decision is made about the reception of an ID registration instruction (S1890). In the case of the reception of the ID registration instruction (S1890: YES), the ID stored in S1880 is registered as the ID of the air pressure sensor of the rear left tire in the memory 55 (S1900), and a reply indicative of the ID registration completion is made (S1910). Still moreover, a decision is made about the reception of an ID (S1920). In the case of the ID reception (S1920: YES), this ID is temporarily stored in a work area of the RAM (S1930). Yet moreover, a decision is made as to the reception of an ID registration instruction (S1940). In the case of the reception of the ID registration instruction (S1940: YES), the ID temporarily stored in S1930 is registered as the ID of the air pressure sensor of the rear right tire in the memory 55 (S1950), and a reply indicative of the ID registration completion is made (S1960). In addition, a decision is made on the reception of an ID (S1970). For the reception of the ID (S1970: YES), this ID is temporarily stored in a work area of the RAM (S1980). Subsequently, a decision is made about the reception of an ID registration instruction (S1990). For the reception of the ID registration instruction (S1990: YES), the ID temporarily stored in S1980 is registered as the ID of the air pressure sensor of the front right tire in the memory 55 (S2000), and a reply indicative of the ID registration completion is carried out (S2010). Following this, a decision is made about the reception of a trigger signal to the effect that the mode is switched into the normal mode (S2020). If received is the trigger signal calling for the switching into the normal mode (S2020: YES), the switching into the normal mode is made (S2030), and then the processing comes to an end.

On the other hand, after the ID is received in S1820 and is temporarily stored in the RAM in S1830, if the reception of an ID re-registration instruction takes place (S2040: re-registration), the ID temporarily stored in S1830 is overwritten as the ID of the air pressure sensor of the front left tire in the memory 55 (S2050). Subsequently, a reply is made which is indicative of the ID registration completion (S2060). Then, a decision is made about the reception of an ID (S2070). For the reception of the ID (S2070: YES); this ID is temporarily stored in a work area of the RAM (S2080). Following this, a decision is made about the reception of an ID re-registration instruction (S2090). For the reception of the ID re-registration instruction (S2090: YES), the ID temporarily stored in S2080 is overwritten and re-registered in the memory 55 as the ID of the air pressure sensor of the rear left tire (S2100), and a reply indicative of the ID registration completion is made (S2110). Thereafter, a decision is made as to the reception of an ID (S2120). In the case of the ID reception (S2120: YES), this ID is temporarily stored in a work area of the RAM (S2130). Moreover, a decision is made on the reception of an ID registration instruction (S2140). In the case of the reception of the ID registration instruction (S2140: YES), the ID temporarily stored in S2130 is overwritten and re-registered in the memory 55 as the ID of the air pressure sensor of the rear right tire (S2150), and a reply indicative of the ID registration completion is made (S2160). In addition, a decision is made as to the reception of an ID (S2170). In the case of the ID reception (S2170: YES), this ID is temporarily stored in a work area of the RAM (S2180). Still additionally, a decision is made as to the reception of an ID re-registration instruction (S2190). In the case of the reception of the ID re-registration instruction (S2190: YES), the ID temporarily stored in S2180 is overwritten and re-registered in the memory 55 as the ID of the air pressure sensor of the front right tire (S2200), and a reply indicative of the ID registration completion is made (S2210). Following this, a decision is made about the reception of a trigger signal to the effect that the mode is switched into the normal mode (S2220). If received is the trigger signal calling for the switching into the normal mode (S2220: YES), the switching into the normal mode is made (S2030), and the processing then comes to an end.

Furthermore, a description will be given hereinbelow of the contents of the control processing to be implemented in the air pressure sensors 10, 20, 30 and 40. In this control processing, as shown in FIG. 19, first of all, a decision is made as to the reception of a trigger signal calling for the switching into the ID registration mode (S2300). If received is the trigger signal calling for the switching into the ID registration mode (S2300: YES), the switching into the ID registration mode is made (S2310), and a decision is made as to whether an ID is received or not (S2320). In the case of the ID reception (S2320: YES), this ID is temporarily stored in a work area of the RAM (S2330). Moreover, a decision is made as to which of the ID registration instruction and the ID re-registration instruction is received (S2340). In the case of the reception of the ID registration instruction (S2340: registration), the ID temporarily stored in S2330 is registered in the ID memories 12, 22, 32 and 42 (S2350), and a reply indicative of the ID registration completion is then made (S2360). Subsequently, a decision is made as to the reception of a trigger signal to the effect that the mode is switched into the normal mode (S2370). If the reception of the trigger signal calling for the switching into the normal mode takes place (S2370: YES), the mode is switched into the normal mode (S2380), and the processing comes to an end. On the other hand, in the case of the reception of the ID re-registration instruction (S2340: re-registration), the ID temporarily stored in S2330 is overwritten to be re-registered in the ID memories 12, 22, 32 and 42 (S2390), and the operational flow shifts to the step S2370 after the implementation of a reply indicative of the ID registration completion (S2400).

When the above-described control processing is conducted in the ID registration tool 60, the tire pressure monitoring apparatus 50 and the respective air pressure sensors 10, 20, 30 and 40, at the initial registration, the air pressure sensor IDs can be registered in a state associated with the tire positions: front left, rear left, rear right and front right. Moreover, at this time, the mistaken registration due to radio interference or the registration-impossible state due to other electric waves does not occur unlike the conventional technique. Still moreover, at the tire replacement or tire rotation, through the above-described control processing, the sensor IDs can be registered in a state associated with the tire positions after the replacement. In the case of the tire replacement, the re-registration operation can be conducted with respect to only the replacement tire, thus achieving the

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reduction of the number of steps. Still additionally, also in the case of the rotation, the ID re-registration reflecting a change of position is feasible. Yet additionally, also in this re-registration operation, the problem of the mistaken registration due to the radio interference is solvable.

Third Embodiment

Furthermore, a description will be given hereinbelow of a third embodiment of the present invention. In the third embodiment, as well as the second embodiment, IDs are registered in the air pressure sensors **10**, **20**, **30**, **40** and the monitoring apparatus **50** through the use of a management sheet, but the re-registration method is different therefrom. The registration operation is conducted in accordance with the following procedure.

For the registration operation, the signal lines **63**, **63***a*, **63***b*, **63***c* and **63***d* of the ID registration tool **60** are connected to the respective sensors **10**, **20**, **30**, **40** and the monitoring apparatus **50**, and the operation is implemented in accordance with a procedure shown in FIG. **20**. First of all, the respective sensors **10**, **20**, **30**, **40** and the monitoring apparatus **50** are switched into an ID registration mode (S**2510**). Subsequently, a decision is made as to whether or not it is the initial registration (S**2520**). In the case of the initial registration (S**2520**: YES), the bar codes **91**FL, **91**RL, **91**RR and **91**FR on the management sheet **90** are read through the use of the ID registration tool **60** (S**2530**). The IDs read out from these bar codes **91**FL, **91**RL, **91**RR and **91**FR are transmitted from the ID registration tool **60** to the respective air pressure sensors **10**, **20**, **30**, **40** and the monitoring apparatus **50** (S**2540**). The respective air pressure sensors **10**, **20**, **30**, **40** and the monitoring apparatus **50** register the received IDs in the ID memories **12**, **22**, **32**, **42** and in a memory **55** (S**2550**).

At this time, the signal lines **63***a*, **63***b*, **63***c* and **63***d* are correctly connected to the air pressure sensors **10**, **20**, **30** and **40** and the readout by the ID registration tool **60** is made in the order of the bar code **91**FL, the bar code **91**RL, the bar code **91**RR and the bar code **91**FR so that the ID indicated by the bar code **91**FL is registered in the air pressure sensor **10**, the ID of the bar code **91**RL in the air pressure sensor **20**, the ID of the bar code **91**RR in the air pressure sensor **30**, and the ID of the bar code **91**FR in the air pressure sensor **40**. Moreover, in the memory **55** of the monitoring apparatus **50**, the ID of the bar code **91**FL is registered as that of the front left tire, the ID of the bar code **91**RL as that of the rear left tire, the ID of the bar code **91**RR as that of the rear right tire, and the ID of the bar code **91**FR as that of the front right tire. The management sheet **90** used at the initial registration is attached to the manual of the vehicle.

When the initial ID registrations in the air pressure sensors **10**, **20**, **30**, **40** and the monitoring apparatus **50** reach completion in this way, the air pressure sensors **10**, **20**, **30**, **40** and the monitoring apparatus **50** are switched into a normal mode (S**2560**), and the ID registration operation comes to an end.

On the other hand, if it is not the initial registration, that is, in the case of the replacement of a tire in a repair shop or the like (S**2520**: YES), the ID registration tool **60** reads, of the bar codes on the management sheet **90** at the initial registration, attached to the manual, the bar code corresponding to the tire to be detached this time (S**2570**). The ID read out in this way is transmitted from the ID registration tool **60** to the tire pressure monitoring apparatus **50** (S**2580**). The tire pressure monitoring apparatus **50** removes the received ID from the memory **55** (S**2590**). Then, a bar code expressed on a sheet pertaining to a tire to be mounted newly is read through the use of the ID registration tool **60** (S**2600**), and the ID thus read out is transmitted from the ID registration tool **60** to the air pressure sensor of the tire to be mounted newly and the tire pressure monitoring apparatus **50** (S**2610**). The air pressure sensor of the tire to be mounted newly registers the received ID in its ID memory, while the tire pressure monitoring apparatus **50** re-registers the received ID at the tire position, deleted in S**2590**, in the memory **55** (S**2620**).

In addition, a decision is made as to whether or not there is another tire to be replaced (S**2630**). If there is another tire to be replaced (S**2630**: YES), the step S**2570** and subsequent processing are conducted repeatedly. On the other hand, if there exists no tire to be replaced (S**2630**: NO), the air pressure sensors **10**, **20**, **30**, **40** and the monitoring apparatus **50** are switched into a normal mode (S**2560**), and the ID registration operation comes to an end.

Furthermore, referring to flow charts of FIGS. **21** to **24**, a description will be given hereinbelow of the contents of a program installed in the ID registration tool **60** for the implementation of the above-mentioned registration operation. The following program starts by pushing a predetermined button on the control panel **68** of the ID registration tool **60**. In this program, first of all, a trigger signal is transmitted to place the tire air pressure sensors **10**, **20**, **30**, **40** and the tire pressure monitoring apparatus **50** into an ID registration mode (S**2710**), and after a manipulation of the control panel **68**, a decision is then made as to whether or not it is the initial registration (S**2720**).

In the case of the initial registration (S**2720**: NO), a readout instruction message on a bar code **91**FL of the registration sheet **90** is displayed on the display **69** (S**2730**), and a decision is made on whether or not the readout reaches completion (S**2740**). If the decision shows the completion of the readout (S**2740**: YES), the readout result is stored in the memory **66** in a state associated with the tire position (front left) (S**2750**). Moreover, a readout instruction message on the bar code **91**RL thereof is displayed (S**2760**), and a decision is made as to whether or not the readout reaches completion (S**2770**). If the decision shows that the readout reaches completion (S**2770**: YES), the readout result is stored in the memory **66** in a state associated with the tire position (rear left) (S**2780**). Still moreover, a readout instruction message on the bar code **91**RR thereof is displayed (S**2790**), and a decision is made as to whether or not the readout reaches completion (S**2800**). If the decision indicates that the readout reaches completion (S**2800**: YES), the readout result is stored in the memory **66** in a state associated with the tire position (rear right) (S**2810**). Yet moreover, a readout instruction message on the bar code **91**FR is displayed (S**2820**), and a decision is made as to whether or not the readout reaches completion (S**2830**). If the decision indicates the completion of the readout therefrom (S**2830**: YES), the readout result is put in the memory **66** in a state associated with the tire position (front right) (S**2840**).

Thereafter, the ID corresponding to the air pressure sensor of the front left tire is first read out from the memory **66** and is transmitted to the air pressure sensor **10** and the tire pressure monitoring apparatus **50** (S**2850**), and an instruction command for ID registration is transmitted to the air pressure sensor **10** and the tire pressure monitoring apparatus **50** (S**2860**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **10** and the tire pressure monitoring apparatus **50** (S**2870**). In a case in

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which the reply does not come within a predetermined period of time (S2870: NO), the operational flow returns to the step S2850. On the other hand, in the case of the arrival of the reply indicative of the completion of the registration (S2870: YES), the ID corresponding to the air pressure sensor of the rear left tire is read out from the memory 66 and is transmitted to the air pressure sensor 20 and the tire pressure monitoring apparatus 50 (S2880). Moreover, an instruction command for the ID registration is transmitted to the air pressure sensor 20 and the tire pressure monitoring apparatus 50 (S2890), and a decision is made as to whether or not a replay indicative of the registration completion comes from the air pressure sensor 20 and the tire pressure monitoring apparatus 50 (S2900). If the relay does not come within a predetermined period of time (S2900: NO), the operational flow returns to the step S2880. On the other hand, in the case of the arrival of the replay indicative of the registration completion (S2900: YES), the ID corresponding to the air pressure sensor of the rear right tire is read out from the memory 66 and is transmitted to the air pressure sensor 30 and the tire pressure monitoring apparatus 50(S2910). Still moreover, an instruction command for the ID registration is transmitted to the air pressure sensor 30 and the tire pressure monitoring apparatus 50 (S2920), and a decision is made as to whether or not a reply indicative of the registration completion comes from the air pressure sensor 30 and the tire pressure monitoring apparatus 50 (S2930). If the reply does not come within a predetermined period of time (S2930: NO), the operational flow returns to the step S2910. On the other hand, in the case of the arrival of the reply indicative of the registration completion (S2930: YES), the ID corresponding to the air pressure sensor of the front right tire is read out from the memory 66 and is transmitted to the air pressure sensor 40 and the tire pressure monitoring apparatus 50 (S2940). Yet moreover, an instruction command for the ID registration is transmitted to the air pressure sensor 40 and the tire pressure monitoring apparatus 50 (S2950), and a decision is made as to whether or not a reply indicative of the registration completion comes from the air pressure sensor 40 and the tire pressure monitoring apparatus 50 (S2960). If the reply does not come within a predetermined period of time (S2960: NO), the operational flow returns to the step S2940. On the other hand, in the case of the arrival of the reply indicative of the registration completion (S2960: YES), a trigger signal calling for the restoration to the normal mode is outputted to the air pressure sensors 10, 20, 30, 40 and the tire pressure monitoring apparatus 50 (S2970), and the processing comes to an end.

Meanwhile, in the case of no initial registration, an message on inquiry about tire replacement or rotation is displayed on the display 69 (S3000), and the control waits for the corresponding panel manipulation (S3010). In the case of the tire replacement (S3010: tire replacement), a message to the effect that the ID of the air pressure sensor of the tire to be detached is read out from the bar codes 91FL, 91RL, 91RR and 91FR shown on the management sheet 90 attached to the manual is displayed on the display 69 (S3020), and a decision is made as to whether or not the readout comes to an end (S3030). If the decision indicates the completion of the readout (S3030: YES), the readout result is stored in the memory 66 (S3040).

Moreover, the ID stored in S3040 is read out from the memory 66 and is transmitted to the tire pressure monitoring apparatus 50 (S3050). Subsequently, an instruction command for ID deletion is transmitted to the tire pressure monitoring apparatus 50 (S3060), and a decision is made as to whether or not a reply indicative of the completion of the deletion comes from the tire pressure monitoring apparatus 50 (S3070). If the reply does not within a predetermined period of time (S3070: NO), the operational flow returns to the step S3050. On the other hand, in the case of the arrival of the reply indicative of the deletion completion (S3070: YES), a message to the effect of reading a bar code 91" shown on a re-registration sheet 90" attached to the tire to be mounted newly is displayed on the display 69 (S3080), and a decision is made on whether or not the readout reaches completion (S3090). If the decision indicates the completion of the readout (S3090: YES), the readout result is put in the memory 66 (S3100). Subsequently, the ID of the air pressure sensor of the tire to be mounted newly is read out from the memory 66 and is transmitted to the corresponding air pressure sensor and the monitoring apparatus 50(S3110). Moreover, an instruction command for the ID re-registration is transmitted to this air pressure sensor and the tire pressure monitoring apparatus 50 (S3120), and a decision is made as to whether or not a reply indicative of the registration completion comes from this air pressure sensor and the tire pressure monitoring apparatus 50 (S3130). If the relay does not come within a predetermined period of time (S3130: NO), the operational flow returns to the step S3110. On the other hand, in the case of the arrival of the reply indicative of the registration completion (S3130: YES), an inquiry message as to whether or not all the replacement operations are completed is displayed on the display 69 (S3140), and the control waits for a result of a panel manipulation (S3150). If the panel manipulation is done which is for indicating the completion of all the replacement operations (S3150: YES), a trigger signal calling for the restoration to the normal mode is outputted to the air pressure sensor connected thereto and the tire pressure monitoring apparatus 50 (S2970, and the processing comes to an end. On the other hand, in the case of the panel manipulation indicating that the replacement does not reach completion yet (S3150: NO), the operational flow returns to the step S3020.

Moreover, in the case of the rotation (S3010: rotation), an instruction message on the readout of the bar code 91FL of the registration sheet 90 attached to the manual is displayed on the display 69 (S3160), and a decision is made as to the completion of the readout (S3170). If the decision shows the completion of the readout (S3170: YES), the readout result is stored in the memory 66 in a state associated with the tire position (front left) (S3180). Subsequently, an instruction message on the readout of the bar code 91RL thereof is displayed thereon (S3190), and a decision is made as to the completion of the readout (S3200). If the decision shows the completion of the readout (S3200: YES), the readout result is stored in the memory 66 in a state associated with the tire position (rear left) (S3210). Moreover, an instruction message on the readout of the bar code 91RR thereof is displayed thereon (S13220), and a decision is made as to the completion of the readout (S3230). If the decision shows the completion of the readout (S3230: YES), the readout result is stored in the memory 66 in a state associated with the tire position (rear right) (S3240). Still moreover, an instruction message on the readout of the bar code 91FR thereof is displayed thereon (S3250), and a decision is made as to the completion of the readout (S3260). If the decision shows the completion of the readout (S3260: YES), the readout result is stored in the memory 66 in a state associated with the tire position (front right) (S3270).

Following this, the ID corresponding to the air pressure sensor of the front left tire is first read out from the memory 66 and is transmitted to the air pressure sensor of a tire to be mounted at the front left position after the rotation (S3280),

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and an instruction command for the ID re-registration is transmitted to this air pressure sensor (S3290). A decision is made as to whether or not a reply indicative of the completion of the registration comes from this air pressure sensor (S3300). If the reply does not come within a predetermined period of time (S3300: NO), the operational flow returns to the step S3280. On the other hand, if the registration completion reply comes (S3300: YES), the ID corresponding to the air pressure sensor of the rear left tire is read out from the memory **66** and is transmitted to an air pressure sensor of a tire to be mounted at the rear left position after the rotation (S3310), and an instruction command for the ID re-registration is then transmitted to this air pressure sensor (S3320). A decision is made as to whether or not a reply indicative of the completion of the registration comes from this air pressure sensor (S3330). If the reply does not come within a predetermined period of time (S3330: NO), the operational flow returns to the step S3310. On the other hand, if the registration completion reply comes (S3330: YES), the ID corresponding to the air pressure sensor of the rear right tire is read out from the memory **66** and is transmitted to the air pressure sensor of a tire to be mounted at the rear right position after the rotation (S3340), and an instruction command for the ID re-registration is then transmitted to this air pressure sensor (S3350). A decision is made as to whether or not a reply indicative of the completion of the registration comes from this air pressure sensor (S3360). If the reply does not come within a predetermined period of time (S3360: NO), the operational flow returns to the step S3340. On the other hand, if the registration completion reply comes (S3360: YES), the ID corresponding to the air pressure sensor of the front right tire is read out from the memory **66** and is transmitted to the air pressure sensor of a tire to be mounted at the front right position after the rotation (S3370), and an instruction command for the ID re-registration is then transmitted to this air pressure sensor (S3380). A decision is made as to whether or not a reply indicative of the completion of the registration comes from this air pressure sensor (S3390). If the reply does not come within a predetermined period of time (S3390: NO), the operational flow returns to the step S3370. On the other hand, if the registration completion reply comes (S3390: YES), a trigger signal calling for the restoration to the normal mode is outputted to the air pressure sensors connected thereto and the tire pressure monitoring apparatus **50** (S2970), and the processing comes to an end.

Furthermore, a description will be given hereinbelow of the contents of control processing to be conducted in the tire pressure monitoring apparatus **50**. In this control processing, as shown in FIGS. **26** and **27**, first of all, a decision is made as to whether or not the reception of a trigger signal calling for the switching into an ID registration mode takes place (S3400). In the case of the reception of the trigger signal indicating the switching into the ID registration mode (S3400: YES), the switching into the ID registration mode is carried out (S3410), and a decision is made as to the reception of an ID (S3420). In the case of the ID reception (S3420: YES), this ID is temporarily stored in a work area of the RAM (S3430). Moreover, a decision is made as to which of the ID registration instruction and the ID deletion instruction is received (S3440). In the case of the reception of the ID registration instruction (S3440: registration), the ID temporarily stored in S3430 is registered as the ID of the air pressure sensor of the front left tire in the memory **55** (S3450), and a reply is then made which is indicative of the ID registration completion (S3460). Subsequently, a decision is made as to whether the reception of an ID takes place or not (S3470). In the case of the ID reception (S3470: YES), this ID is temporarily stored in a work area of the RAM (S3480). Moreover, a decision is made about the reception of an ID registration instruction (S3490). In the case of the reception of the ID registration instruction (S3490: YES), the ID temporarily stored in S3480 is registered as the ID of the air pressure sensor of the rear left tire in the memory **55** (S3500), and a reply is made which is indicative of the ID registration completion (S3510). Still moreover, a decision is made about the reception of an ID (S3520). In the case of the ID reception (S3520: YES), this ID is temporarily stored in a work area of the RAM (S3530). Yet moreover, a decision is made as to the reception of an ID registration instruction (S3540). In the case of the reception of the ID registration instruction (S3540: YES), the ID temporarily stored in S3530 is registered as the ID of the air pressure sensor of the rear right tire in the memory **55** (S3550), and a reply is made which is indicative of the ID registration completion (S3560). In addition, a decision is made on the reception of an ID (S3570). For the reception of the ID (S3570: YES), this ID is temporarily stored in a work area of the RAM (S3580). Subsequently, a decision is made about the reception of an ID registration instruction (S3590). For the reception of the ID registration instruction (S3590: YES), the ID temporarily stored in S3580 is registered as the ID of the air pressure sensor of the front right tire in the memory **55** (S3600), and a reply is made which is indicative of the ID registration completion (S3610). Following this, a decision is made about the reception of a trigger signal to the effect that the mode is switched into the normal mode (S3620). If received is the trigger signal calling for the switching into the normal mode (S3620: YES), the switching into the normal mode is made (S3630), and then the processing comes to an end.

On the other hand, after the ID is received in S3420 and is temporarily stored in the RAM in S3430, if the reception of an ID deletion instruction takes place (S3440: deletion), the same ID as the ID temporarily stored in S3430 is removed from the memory **55** (S3700). Subsequently, a reply is made which is indicative of the ID-deletion completion (S3710). Then, a decision is made about the reception of an ID (S3720). For the reception of the ID (S3720: YES), this ID is temporarily stored in a work area of the RAM (S3730). Following this, a decision is made about the reception of an ID registration instruction (S3740). For the reception of the ID registration instruction (S3740: YES), the ID temporarily stored in S3730 is registered as the ID of the air pressure sensor of the tire existing at the position corresponding to the ID, deleted in S3710, in the memory **55** (S3750). Then, a reply is made which is indicative of the ID registration completion (S3760). Thereafter, a decision is made as to which of a switching instruction command to the normal mode and a new ID is received (S3770). In the case of the reception of the new ID (S3770: YES), this ID is temporarily stored in a work area of the RAM (S3780). Moreover, a decision is made on the reception of an ID deletion instruction (S3790). In the case of the reception of the ID deletion instruction (S3790: YES), the operational flow advances to the step S3700 and subsequent processing. On the other hand, if the decision in S3770 shows the reception of the switching instruction command for the normal mode, the operational flow proceeds to the step S3630 to carry out the switching into the normal mode, and the processing comes to an end.

Furthermore, a description will be given hereinbelow of the contents of the control processing to be implemented in the air pressure sensors **10**, **20**, **30** and **40**. In this control

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processing, as shown in FIG. **28**, first of all, a decision is made as to the reception of a trigger signal calling for the switching into the ID registration mode (S**3800**). If received is the trigger signal calling for the switching into the ID registration mode (S**3800**: YES), the switching into the ID registration mode is carried out (S**3810**), and a decision is made as to the reception of an ID (S**3820**). In the case of the ID reception (S**3820**: YES), this ID is temporarily stored in a work area of the RAM (S**3830**). Moreover, a decision is made as to which of the ID registration instruction and the ID re-registration instruction is received (S**3840**). In the case of the reception of the ID registration instruction (S**3840**: registration), the ID temporarily stored in S**3830** is registered in the ID memories **12**, **22**, **32** and **42** (S**3850**), and a reply is then made which is indicative of the ID registration completion (S**3860**). On the other hand, in the case of the reception of the ID re-registration instruction (S**3840**: re-registration), the ID temporarily stored in S**3830** is overwritten to be re-registered in the ID memories **12**, **22**, **32** and **42** (S**3890**), and a reply is made which is indicative of the ID registration completion (S**3880**). Thereafter, a decision is made about the reception of a trigger signal to the effect of switching the mode into the normal mode (S**3890**). In response to the reception of the trigger signal calling for the switching into the normal mode (S**3890**: YES), the switching into the normal mode is made (S**3900**), and the processing comes to an end.

When the above-described control processing is conducted in the ID registration tool **60**, the tire pressure monitoring apparatus **50** and the respective air pressure sensors **10**, **20**, **30** and **40**, at the initial registration, the air pressure sensor IDs can be registered in a state associated with the tire positions: front left, rear left, rear right and front right. Moreover, at this time, the mistaken registration due to radio interference or the registration-impossible state due to other electric waves does not occur unlike the conventional technique. Still moreover, at the tire replacement or tire rotation, through the above-described control processing, the sensor IDs can be registered in a state associated with the tire positions after the replacement. In the case of the tire replacement, the re-registration operation can be conducted with respect to only the replacement tire, thus achieving the reduction of the number of steps. Still additionally, also in the case of the rotation, the ID re-registration reflecting a change of position is feasible. Yet additionally, also in this re-registration operation, the problem of the mistaken registration due to the radio interference is solvable.

In the above-described embodiments, as the optically-readable information employable, there are various types of information, such as matrix type bar codes including data code, QR code, maxi code and CP code shown in FIGS. **29**A to **29**D, two-dimensional bar codes shown in FIGS. **30**A and **30**B, stack type bar codes including PDF417, code 49, code 16K and coder block shown in FIGS. **31**A to **31**D, one-dimensional bar codes shown in FIG. **32**, and others.

In addition, the bar code can also be adhered onto a sensor itself instead of a tire wheel. Alternatively, it is also appropriate that a bar-code label corresponding to an ID registered in a sensor and the sensor are made to be supplied in a state paired and, in mounting the sensor on a tire in a vehicle manufacturing line, this label is adhered onto a tire wheel or a wheel cover.

Fourth Embodiment

Referring to FIGS. **9** and **33**, a description will be given hereinbelow of a fourth embodiment of the present invention. FIG. **33** is an illustrative view showing an apparatus configuration for ID registration according to the fourth embodiment.

In FIG. **33**, an ID registration tool **60** is composed of an ID setting unit **91** for setting a registration ID to be stored in each of air pressure sensors **10**, **20**, **30** and **40** to be mounted on a vehicle, and an ID transmitting unit **62** for transmitting the registration ID, set in the ID setting unit **91**, to each of the air pressure sensors **10**, **20**, **30** and **40** and further for transmitting it to an air pressure monitoring apparatus **50**. Moreover, the ID registration tool **60** is equipped with connectors **64** and **64***a* to **64***d* for making connections of signal lines **63** and **63***a* to **63***d* for making connections with respect to the air pressure sensors **10**, **20**, **30**, **40** and the tire pressure monitoring apparatus **50**. Incidentally, the signal lines **63** and **63***a* to **63***d* have crocodile clips at their tip portions, respectively. These crocodile clips enable the connection to the antennas **16**, **26**, **36** and **46** of the air pressure sensors **10**, **20**, **30** and **40**, and further to a signal line **57** extending from a communication circuit **56** of the tire pressure monitoring apparatus **50** to an indicating device **81**.

Furthermore, the ID registration tool **60** includes a control unit **65**, a memory **66**, a power supply battery **67**, a control panel **68** and a display **69**. The control unit **65** is for controlling various types of processing to be executed through the use of the ID registration tool **60**, and comprises a microcomputer composed of a CPU, a ROM, a RAM and others. The memory **66** comprises an EEPROM, a flash memory, a DRAM or the like, which is of a rewritable type. As the power supply battery **67**, there is used a dry cell, a button-like cell, or the like. The control panel **68** has control keys for indicating the contents of processing to be implemented through the use of the ID registration tool **60**. The display **69** is for displaying an ID set in the ID setting unit **91** or for indicating a control mode in the ID registration tool **60**, and for example, comprises an LCD.

Secondly, a description will be given hereinbelow of a method of registering the IDs of the air pressure sensors **10**, **20**, **30** and **40** in the tire pressure monitoring apparatus **50**. For implementing this method, the signal lines **63**, **63***a*, **63***b*, **63***c* and **63***d* of the ID registration tool **60** is connected to the connectors **64**, **64***a*, **64***b*, **64***c* and **64***d* and the crocodile clips at the tip portions of the signal lines **63**, **63***a*, **63***b*, **63***c* and **63***d* are connected to the signal line **57** extending from the communication circuit **56** of the tire pressure monitoring apparatus **50** to the indicating device **81** and further to the antennas **16**, **26**, **36** and **46** of the air pressure sensors **10**, **20**, **30** and **40**. The registration operation is made according to a procedure described below.

In the registration operation, as shown in a flow chart of FIG. **34**, first, the monitoring apparatus **50** is switched into an ID registration mode (step P**10**), and each of the sensors **10**, **20**, **30** and **40** is also switched into an ID registration mode (P**20**). Moreover, an ID is set in the registration tool **60** for each sensor (P**30**), and the IDs are transmitted to the monitoring apparatus **50** and the sensors **10**, **20**, **30** and **40** (P**40**). In this case, all the IDs of the four sensors are transmitted to the monitoring apparatus **50**, while the corresponding ID is transmitted to each of the sensors **10**, **20**, **30** and **40** to be stored therein. Upon receipt of the IDs, the monitoring apparatus **50** and the respective sensors **10**, **20**, **30** and **40** carry out the ID registration (P**50**). A decision is made as to the completion of the ID registration in the monitoring apparatus **50** and the sensors **10**, **20**, **30** and **40** (P**60**). In the case of no completion of the ID registration (P**60**: NO), the step P**40** and subsequent processing are implemented repeatedly. In the case of the completion of the

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ID registration (P60: YES), the monitoring apparatus **50** is switched into a normal mode (P70), and each of the sensors **10**, **20**, **30** and **40** is also switched into a normal mode (P80), and the ID registration operation then comes to an end.

Referring to flow charts of FIGS. **35** to **37**, a description will be given hereinbelow of the contents of a program to be installed in the ID registration tool **60** for implementing the above-mentioned registration operation. The following program starts in response to the depression of a predetermined button on the control panel **68** of the ID registration tool **60**. According to this program, first of all, as shown in FIG. **35**, trigger signals are transmitted in order to place the tire pressure monitoring apparatus **50** and each of the sensors **10**, **20**, **30** and **40** into an ID registration mode (P110, P120).

Subsequently, an instruction message to the effect of inputting an ID of the front left tire of the vehicle is displayed on the display **69** (P130), and a decision is made as to whether or not the input from the control panel **68** reaches completion (P140). If the decision shows the completion of the input (P140: YES), the input result is put in the memory **66** in a state associated with the tire position (front left) (P150). Then, an instruction message on the input of the ID of the rear left tire is displayed thereon (P160). A decision is made as to the completion of the input (P170). If the decision shows the completion of the input (P170: YES), the input result is put in the memory **66** in a state associated with the tire position (rear left) (P180). Moreover, an ID input instruction message on the rear right tire is displayed thereon (P190). A decision is made on the completion of the input (P200). If the decision shows the completion of the input (P200: YES), the input result is put in the memory **66** in a state associated with the tire position (rear right) (P210). Still moreover, an ID input instruction message on the front right tire is displayed thereon (P220). A decision is made on the completion of the input (P230). If the decision shows the completion of the input (P230: YES), the input result is put in the memory **66** in a state associated with the tire position (front right) (P240).

In addition, as shown in FIG. **36**, an ID corresponding to the air pressure sensor **10** of the front left tire is read out from the memory **66** and transmitted to the tire pressure monitoring apparatus **50**(P310). Subsequently, an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus **50** (P320). Then, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P330). If the reply does not come within a predetermined period of time (P330: NO), the operational flow returns to the step P310. On the other hand, if the registration completion reply comes therefrom (P330: YES), an ID corresponding to the air pressure sensor **20** of the rear left tire is read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P340). Following this, an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus (P350). A decision is then made whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P360). If the reply does not come within a predetermined period of time (P360: NO), the operational flow returns to the step P340. On the other hand, if the registration completion reply comes therefrom (P360: YES), an ID corresponding to the air pressure sensor **30** of the rear right tire is read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P370). Following this, an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus (P380). A decision is then made whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P390). If the reply does not come within a predetermined period of time (P390: NO), the operational flow returns to the step P370. On the other hand, if the registration completion reply comes therefrom (P390: YES), an ID corresponding to the air pressure sensor **40** of the front right tire is read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P400). Following this, an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus (P410). A decision is then made whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P420). If the reply does not come within a predetermined period of time (P420: NO), the operational flow returns to the step P400. On the other hand, if the registration completion reply comes therefrom (P420: YES), a trigger signal calling for the restoration to the normal mode is outputted to the tire pressure monitoring apparatus **50** (P430).

Still additionally, as shown in FIG. **37**, an ID corresponding to the air pressure sensor **10** of the front left tire is read out from the memory **66** and is transmitted to the air pressure sensor **10** (P510). Subsequently, an instruction command for the ID registration is transmitted to the air pressure sensor **10** (P520), and a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **10** (P530). If the reply does not come within a predetermined period of time (P530: NO), the operational flow returns to the step P510. On the other hand, if the registration completion reply comes therefrom (P530: YES), an ID corresponding to the air pressure sensor **20** of the rear left tire is read out from the memory **66** and is transmitted to the air pressure sensor **20** (P540). Subsequently, an instruction command for the ID registration is transmitted to the air pressure sensor **20** (P550), and a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **20** (P560). If the reply does not come within a predetermined period of time (P560: NO), the operational flow returns to the step P540. On the other hand, if the registration completion reply comes therefrom (P560: YES), an ID corresponding to the air pressure sensor **30** of the rear right tire is read out from the memory **66** and is transmitted to the air pressure sensor **30** (P570). Subsequently, an instruction command for the ID registration is transmitted to the air pressure sensor **30** (P580), and a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **30** (P590). If the reply does not come within a predetermined period of time (P590: NO), the operational flow returns to the step P570. On the other hand, if the registration completion reply comes therefrom (P590: YES), an ID corresponding to the air pressure sensor **40** of the front right tire is read out from the memory **66** and is transmitted to the air pressure sensor **40** (P600). Subsequently, an instruction command for the ID registration is transmitted to the air pressure sensor **40** (P610), and a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **40** (P620). If the reply does not come within a predetermined period of time (P620: NO), the operational flow returns to the step P600. On the other hand, if the registration completion reply comes therefrom (P620: YES), a trigger signal calling for the restoration to the normal mode is outputted to each of the air pressure sensors **10**, **20**, **30** and **40** (P630), and the processing comes to an end.

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Furthermore, a description will be given hereinbelow of the contents of control processing to be implemented in the tire pressure monitoring apparatus **50**. In this control processing, as shown in FIG. **38**, a decision is made as to the reception of a trigger signal giving instruction for the switching into the ID registration mode (P**700**). In the case of the reception of the trigger signal calling for the switching into the ID registration mode (P**700**: YES), the switching into the ID registration mode is made (P**710**), and a decision is made on the reception of an ID (P**720**). In the case of the reception of the ID (S**720**: YES), this ID is temporarily stored in a work area of the RAM (P**730**). Then, a decision is made on the reception of an instruction for the ID registration (P**740**). In the case of the reception of the ID registration instruction (P**740**: YES), the ID temporarily stored in the step S**730** is registered as the ID of the air pressure sensor of the front left tire in the memory **55** (P**750**), and a reply is made which is indicative of the completion of the ID registration (P**760**). Subsequently, a decision is made on the reception of an ID (P**770**). In the case of the reception of the ID (S**770**: YES), this ID is temporarily stored in a work area of the RAM (P**780**). Then, a decision is made on the reception of an instruction for the ID registration (P**790**). In the case of the reception of the ID registration instruction (P**790**: YES), the ID temporarily stored in S**780** is registered as the ID of the air pressure sensor of the rear left tire in the memory **55** (P**800**), and a reply is made which is indicative of the completion of the ID registration (P**820**). Following this, a decision is made on the reception of an ID (P**820**). In the case of the reception of the ID (S**820**: YES), this ID is temporarily stored in a work area of the RAM (P**830**). Then, a decision is made on the reception of an instruction for the ID registration (P**840**). In the case of the reception of the ID registration instruction (P**840**: YES), the ID temporarily stored in S**830** is registered as the ID of the air pressure sensor of the rear right tire in the memory **55** (P**850**), and a reply is made which is indicative of the completion of the ID registration (P**860**). Moreover, a decision is made on the reception of an ID (P**870**). In the case of the reception of the ID (S**870**: YES), this ID is temporarily stored in a work area of the RAM (P**880**). Then, a decision is made on the reception of an instruction for the ID registration (P**890**). In the case of the reception of the ID registration instruction (P**890**: YES), the ID temporarily stored in S**880** is registered as the ID of the air pressure sensor of the front right tire in the memory **55** (P**900**), and a reply is made which is indicative of the completion of the ID registration (P**910**). Thereafter, a decision is made as to the reception of a trigger signal to the effect that the mode is switched into the normal mode (P**920**). In the case of the reception of the trigger signal calling for the switching into the normal mode (P**920**: YES), the mode is switched into the normal mode (P**930**), and the processing comes to an end.

In addition, a description will be given hereinbelow of the contents of the control processing to be executed in each of the air pressure sensors **10**, **20**, **30** and **40**. In this control processing, as shown in FIG. **39**, a decision is made as to the reception of a trigger signal giving instruction for the switching into the ID registration mode (P**1000**). In the case of the reception of the trigger signal calling for the switching into the ID registration mode (P**1000**: YES), the switching into the ID registration mode is made (P**1010**), and a decision is made on the reception of an ID (P**1020**). In the case of the reception of the ID (S**1020**: YES), this ID is temporarily stored in a work area of the RAM (P**1030**). Then, a decision is made on the reception of an instruction for the ID registration (P**1040**). In the case of the reception of the ID registration instruction (P**1040**: YES), the ID temporarily stored in S**1030** is registered in the ID memories **12**, **22**, **32** and **42** (P**1050**), and a reply is made which is indicative of the completion of the ID registration (P**1060**). Following this, a decision is made as to the reception of a trigger signal to the effect that the mode is switched into the normal mode (P**1070**). In the case of the reception of the trigger signal calling for the switching into the normal mode (P**1070**: YES), the switching into the normal mode is made (P**1080**), and the processing comes to an end.

In this processing, in the steps P**750**, P**800**, P**850** and P**900**, if an ID has already been registered in the memory **55**, the ID registration is implemented by overwriting. Moreover, also in the step P**1050**, if an ID has already been registered in the sensors **10**, **20**, **30** and **40**, the ID registration is implemented by overwriting. Therefore, in the case of tire replacement or tire rotation, an ID newly set in a repair shop or a dealer can be re-registered in each of the sensors **10**, **20**, **30** and **40** and the monitoring apparatus **50**.

When the above-described control processing is executed in the tire pressure monitoring apparatus **50** and each of the air pressure sensors **10**, **20**, **30** and **40**, the air pressure sensor IDs can be registered in a state associated with the tire positions: front left, rear left, rear right and front right positions. Moreover, at this time, mistaken registration due to radio interference or the registration-impossible state due to other electric waves does not occur, unlike the conventional technique. In addition, at the tire replacement or at the tire rotation, through the above-described control processing, the sensor IDs can be registered in a state associated with the tire positions after the replacement. Still additionally, also in the case of the rotation, the ID re-registration reflecting a change of position is feasible. Yet additionally, also in this re-registration operation, the problem of the mistaken registration due to the radio interference is solvable.

Fifth Embodiment

Furthermore, a description will be given hereinbelow of a fifth embodiment of the present invention. In the fifth embodiment, the ID registration procedure is similar to that of the above-described fourth embodiment. The contents of a program installed in an ID registration tool **60** according to the fifth embodiment will be described hereinbelow with reference to the flow charts of FIGS. **40** to **42**. The following program starts by pushing a predetermined button on a control panel **68** of the ID registration tool **60**. In this program, as shown in FIG. **40**, first of all, trigger signals are transmitted so that the tire air pressure sensors **10**, **20**, **30**, **40** and the tire pressure monitoring apparatus **50** are set in an ID registration mode (P**1110**, P**1120**).

Following this, an instruction message to the effect of inputting a vehicle body number is displayed on the display **69** (P**1130**), and a decision is made on the input of the vehicle body number (P**1140**). If the decision shows the input of the vehicle body number (P**1140**: YES), four code data are automatically produced in a manner such that "00", "01", "10" and "11" are added as low-order bits of the vehicle body number inputted (P**1150**), and in the memory **66**, the data including the added low-order bits "00" is stored as an ID for the front left tire, the data including the added low-order bits "01" as an ID for the rear left tire, the data including the added low-order bits "10" as an ID for the rear

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right tire, and the data including the added low-order bits "11" as an ID for the front right tire (P1160, P1170, P1180, P1190).

In addition, as shown in FIG. 41, an ID corresponding to the air pressure sensor of the front left tire is first read out from the memory 66 and is transmitted to the tire pressure monitoring apparatus 50 (P1210), and an instruction command for the ID registration is then transmitted to the tire pressure monitoring apparatus 50 (P1220). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus 50 (P1230). If the reply does not come within a predetermined period of time (P1230: NO), the operational flow returns to the step P1210. On the other hand, if the registration completion reply comes therefrom (P1230: YES), an ID corresponding to the air pressure sensor of the rear left tire is read out from the memory 66 and is transmitted to the tire pressure monitoring apparatus 50 (P1240), and an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus 50 (P1250). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus 50 (P1260). If the reply does not come within a predetermined period of time (P1260: NO), the operational flow returns to the step P1240. On the other hand, if the registration completion reply comes therefrom (P1260: YES), an ID corresponding to the air pressure sensor of the rear right tire is read out from the memory 66 and is transmitted to the tire pressure monitoring apparatus 50 (P1270), and an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus 50 (P1280). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus 50 (P1290). If the reply does not come within a predetermined period of time (P1290: NO), the operational flow returns to the step P1270. On the other hand, if the registration completion reply comes therefrom (P1290: YES), an ID corresponding to the air pressure sensor of the front right tire is read out from the memory 66 and is transmitted to the tire pressure monitoring apparatus 50 (P1300), and an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus 50 (P1310). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus 50(P1320). If the reply does not come within a predetermined period of time (P1320: NO), the operational flow returns to the step P1300. On the other hand, if the registration completion reply comes therefrom (P1320: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted to the tire pressure monitoring apparatus 50 (P1330).

Still additionally, as shown in FIG. 42, an ID corresponding to the air pressure sensor of the front left tire is read out from the memory 66 and is transmitted to the air pressure sensor 10 of the front left tire (P1410), and an instruction command for the ID registration is then transmitted to the air pressure sensor 10 (P1420). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor 10(P1430). If the reply does not come within a predetermined period of time (P1430:NO), the operational flow returns to the step P1410. On the other hand, if the registration completion reply comes therefrom (P1430: YES), an ID corresponding to the air pressure sensor of the rear left tire is read out from the memory 66 and is transmitted to the air pressure sensor 20 of the rear left tire (P1440), and an instruction command for the ID registration is transmitted to the air pressure sensor 20 (P1450). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor 20 (P1460). If the reply does not come within a predetermined period of time (P1460: NO), the operational flow returns to the step P1440. On the other hand, if the registration completion reply comes therefrom (P1460: YES), an ID corresponding to the air pressure sensor of the rear right tire is read out from the memory 66 and is transmitted to the air pressure sensor 30 of the rear right tire (P1470), and an instruction command for the ID registration is transmitted to the air pressure sensor 30 (P1480). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor 30 (P1490). If the reply does not come within a predetermined period of time (P1490: NO), the operational flow returns to the step P1470. On the other hand, if the registration completion reply comes therefrom (P1490: YES), an ID corresponding to the air pressure sensor of the front right tire is read out from the memory 66 and is transmitted to the air pressure sensor 40 of the front right tire (P1500), and an instruction command for the ID registration is transmitted to the air pressure sensor 40 (P1510). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor 40 (P1520). If the reply does not come within a predetermined period of time (P1520: NO), the operational flow returns to the step P1500. On the other hand, if the registration completion reply comes therefrom (P1520: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted to each of the air pressure sensors 10, 20, 30 and 40 (P1530), and the processing comes to an end.

The programs installed in the monitoring apparatus 50 and in the sensors 10, 20, 30 and 40 are similar to those in the above-described fourth embodiment.

According to the fifth embodiment, the ID of an air pressure sensor of each of tires is automatically produced on the basis of a vehicle body number and, hence, a peculiar ID can be registered in each of the sensors without duplicating, and the ID setting operation becomes easy. Moreover, since a different ID for each tire is automatically produced on the basis of a vehicle body number, as well as the fourth embodiment, an air pressure sensor ID can be registered in the monitoring apparatus 50 in a state associated with a tire position. Still moreover, in the case of tire replacement or tire rotation, the ID re-registration can be done with respect to only a sensor.

Sixth Embodiment

Furthermore, a description will be given hereinbelow of a sixth embodiment of the present invention. The ID registration procedure of the sixth embodiment is similar to that in the fourth embodiment. The contents of a program installed in an ID registration tool 60 according to the sixth embodiment will be described hereinbelow with reference to the flow charts of FIGS. 43 to 45. The following program starts by pushing a predetermined button on a control panel 68 of the ID registration tool 60. In this program, as shown in FIG. 43, first of all, trigger signals are transmitted so that the tire air pressure sensors 10, 20, 30, 40 and the tire pressure monitoring apparatus 50 are set in an ID registration mode (P1610, P1620).

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Following this, an instruction message to the effect of inputting a vehicle body number is displayed on the display **69** (P**1630**), and a decision is made as to the input of the vehicle body number (P**1640**). If the decision indicates the input of the vehicle body number (P**1640**: YES), a random-number generating unit generates first to fourth random numbers (P**1650**). Moreover, in the memory **66**, data in which the first random number is added as a low-order bit of the vehicle body number is stored as an ID for the front left tire, data including the added second random number as an ID for the rear left tire, data including the added third random number as an ID for the rear right tire, and data including the added fourth random number as an ID for the front right tire (P**1660**, P**1670**, P**1680**, P**1690**).

Thereafter, the processing similar to the step P**1210** and subsequent processing in the fifth embodiment is implemented as shown in FIGS. **44** and **45** (P**1710** to P**1830**, P**1910** to P**2030**).

The programs installed in the monitoring apparatus **50** and in the sensors **10**, **20**, **30** and **40** are similar to those in the above-described fourth embodiment.

Also in the sixth embodiment, the IDs of the air pressure sensors of the tires are automatically produced on the basis of a vehicle body number and four random numbers generated in the random-number generating unit of the tool **60** and, hence, a peculiar ID can be registered in each of the sensors without duplicating, and the ID setting operation becomes easy. Moreover, since a different ID for each tire is automatically produced, as well as the fourth embodiment, an air pressure sensor ID can be registered in the monitoring apparatus **50** in a state associated with a tire position.

Seventh Embodiment

Furthermore, a description will be given hereinbelow of a seventh embodiment of the present invention. In the seventh embodiment, the ID registration procedure is similar to that of the above-described fourth embodiment. The contents of a program installed in an ID registration tool **60** according to the seventh embodiment will be described hereinbelow with reference to the flow charts of FIGS. **46** to **48**. The following program starts by pushing a predetermined button on a control panel **68** of the ID registration tool **60**. In this program, as shown in FIG. **46**, first of all, trigger signals are transmitted so that the tire air pressure sensors **10**, **20**, **30**, **40** and the tire pressure monitoring apparatus **50** are set in an ID registration mode (P**2110**, P**2120**).

Following this, four, i.e., first to fourth, random numbers are generated through the use of the random-number generating unit (P**2150**). The first random number is stored as an ID for the front left tire, the second random number as an ID for the rear left tire, the third random number as an ID for the rear right tire, and the fourth random number as an ID for the front right tire (P**2160**, P**2170**, P**2180**, P**2190**).

Thereafter, the processing similar to the step P**1210** and subsequent processing in the fifth embodiment is implemented as shown in FIGS. **47** and **48** (P**2210** to P**2230**, P**2410** to P**2530**).

The programs installed in the monitoring apparatus **50** and in the sensors **10**, **20**, **30** and **40** are similar to those in the above-described fourth embodiment.

Also in the seventh embodiment, the IDs of the air pressure sensors of the tires are automatically produced on the basis of the four random numbers generated in the random-number generating unit of the tool **60** and, hence, a peculiar ID can be registered in each of the sensors without duplicating, and the ID setting operation becomes easy. Moreover, since a different ID for each tire is automatically produced, as well as the fourth embodiment, an air pressure sensor ID can be registered in the monitoring apparatus **50** in a state associated with a tire position.

Eighth Embodiment

A description will be given hereinbelow of an eighth embodiment of the present invention. In the eighth embodiment, as shown in FIG. **49**, in addition to connectors **64**, **64***a*, **64***b*, **64***c* and **64***d* for making connections through signal lines **63**, **63***a*, **63***b*, **63***c* and **63***d* to the tire pressure monitoring apparatus **50** and the respective air pressure sensors **10**, **20**, **30** and **40**, an ID registration tool **60** is equipped with a connector **72** for a signal line **71** for making a connection to a production management computer **90**. This ID registration tool **60** is designed to set an ID on the basis of production management information given from the production management computer **90** through the signal line **71**.

In the registration operation, as shown in FIG. **50**, first of all, production management information from the production management computer **90** is inputted thereto (P**2610**), and an ID is set on the basis of this production management information (P**2620**). Then, the monitoring apparatus **50** is switched into an ID registration mode (P**2630**), and each of the sensors **10**, **20**, **30** and **40** are also switched into an ID registration mode (P**2640**). Moreover, the ID is transmitted to the monitoring apparatus **50** and each of the sensors **10**, **20**, **30** and **40** (P**2650**). Upon receipt of this ID, the monitoring apparatus **50** and each of the sensors **10**, **20**, **30** and **40** implement the ID registration (P**2660**). Still moreover, a decision is made as to whether or not the ID registration in the monitoring apparatus **50** and the sensors **10**, **20**, **30** and **40** reach completion (P**2670**). In the case of the completion of the ID registration (P**2670**: YES), the monitoring apparatus **50** is switched into the normal mode (P**2680**) and each of the sensors **10**, **20**, **30** and **40** is also switched into the normal mode (P**2690**), and the ID registration operation comes to an end.

Furthermore, referring to FIGS. **51** to **53**, a description will be given hereinbelow of the contents of a program installed in the ID registration tool for conducting the above-described registration operation. The following program starts by pushing a predetermined button on the control panel **68** of the ID registration tool **60**. In this program, as shown in FIG. **51**, production management information is inputted from the production management computer **90** (P**2710**). In this case, as the production management information, various types of information for the production management, such as a vehicle production number, a lot number and a vehicle type, are inputted thereto. Subsequently, vehicle specifying information for specifying a vehicle is produced on the basis of this production management information (P**2720**). For example, as the vehicle specifying information, there is produced code data, pertaining to a vehicle, which is a combination of a vehicle production number, a lot number and a vehicle type. Following this, four code data are automatically produced in a manner such that "00", "01", "10" and "11" are added as low-order bits of the vehicle-peculiar code data (P**2730**), and in the memory **66**, the data including the added low-order bits "00" is stored as an ID for the front left tire, the data including the added low-order bits "01" as an ID for the rear left tire, the data including the added low-order bits "10" as an ID for the rear right tire, and the data including the added low-order bits "11" as an ID for the front right tire (P**2740**, P**2750**, P**2760**, P**2770**). After the ID setting reaches comple-

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tion in this way, trigger signals are transmitted so that the tire pressure monitoring apparatus **50** and each of the sensors **10**, **20**, **30** and **40** are set in an ID registration mode (P**2780**, P**2790**).

Thereafter, the processing similar to the step P**1210** and subsequent processing in the fifth embodiment is implemented as shown in FIGS. **52** and **53** (P**2810** to P**2930**, P**3010** to P**3130**).

The programs installed in the monitoring apparatus **50** and in the sensors **10**, **20**, **30** and **40** are similar to those in the above-described fourth embodiment.

According to the eighth embodiment, the ID of an air pressure sensor of each of tires is automatically produced and set on the basis of the production management information given from the production management computer **90** and, hence, a peculiar ID can be registered in each of the sensors without duplicating, and the ID setting operation becomes easy. Moreover, since a different ID for each tire is automatically produced, as well as the fourth embodiment, an air pressure sensor ID can be registered in the monitoring apparatus **50** in a state associated with a tire position. Still moreover, since the ID is produced in the form of including a lot number or a vehicle type, it is expectable to offer the effects of smoothly specifying a vehicle type or lot in which a sensor failure has occurred.

Ninth Embodiment

Furthermore, a description will be given hereinbelow of a ninth embodiment of the present invention. First, referring to flow charts of FIGS. **54** and **55**, a description will be given hereinbelow of the contents of a program installed in an ID registration tool **60** according to the ninth embodiment. The following program starts by pushing a predetermined button on a control panel **68** of the ID registration tool **60**. In this program, a decision as to whether for the initial registration or for re-registration is made as shown in FIG. **54**, (P**3210**). The decision as to whether for the initial registration or for the re-registration can depend on a manner such that an initial-registration button and a re-registration button are provided on the control panel **68** and a judgment is made on which of the initial-registration button and the re-registration button is depressed for activating this program. If the decision shows the initial registration (P**3210**: initial registration), trigger signals are transmitted so that the tire air pressure sensors **10**, **20**, **30**, **40** and the tire pressure monitoring apparatus **50** are set in an ID registration mode (P**3220**).

Following this, an instruction message to the effect of inputting a vehicle body number is displayed on the display **69** (P**3230**), and a decision is made as to the input of the vehicle body number (P**3240**). If the decision indicates the input of the vehicle body number (P**3240**: YES), the vehicle body number is stored in the memory **66** (P**3250**).

Subsequently, the vehicle body number is read out from the memory **66** and is then transmitted to all the air pressure sensors **10**, **20**, **30** and **40** and the tire pressure monitoring apparatus **50** (P**3260**), and an instruction command for the ID registration is transmitted to the air pressure sensors **10**, **20**, **30** and **40** and the tire pressure monitoring apparatus **50** (S**3270**). A decision is made as to whether or not replies indicative of the completion of the registration come from the air pressure sensors **10**, **20**, **30** and **40** and the tire pressure monitoring apparatus **50** (P**3280**). If this reply does not come within a predetermined period of time (P**3280**: NO), the operational flow returns to the step P**3260**. On the other hand, if the registration completion reply comes therefrom (P**3280**: YES), a trigger signal calling for the restoration to the normal mode is outputted to the air pressure sensors **10**, **20**, **30** and **40** and the tire pressure monitoring apparatus **50** (P**3290**), and the processing comes to an end.

On the other hand, the decision at the program activation indicates the re-registration(P**3210**: re-registration), the operational flow proceeds to the processing of FIG. **55** and a trigger signal is transmitted so that an ID registration mode is set with respect to only the signal line **63***a* (P**3310**). Subsequently, an instruction message to the effect of inputting a vehicle body number is displayed on the display **69** (P**3330**), and a decision is made on the input of the vehicle body number (P**3340**). If the decision indicates the input of the vehicle body number (P**3340**: YES), this vehicle body number is stored in the memory **66** (P**3350**).

Following this, the vehicle body number is read out from the memory **66** and is transmitted through the signal line **63***a* (P**3360**), and an instruction command for the ID registration is transmitted through the signal line **63***a* (P**3370**). A decision is made as to whether or not a reply indicative of the completion of the registration comes through the signal line **63***a* (P**3380**). If this reply does not come within a predetermined period of time (P**3380**: NO), the operational flow returns to the step P**3360**. On the other hand, if the registration completion reply comes therefrom (P**3380**: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted through the signal line **63***a* (P**3390**), and the processing comes to an end.

In this connection, according to this embodiment, at the time of the re-registration, the signal line **63***a* is made to be connected to-the air pressure sensor of the tire subjected to the re-registration.

Meanwhile, a program shown in FIG. **56** is installed in the tire pressure monitoring apparatus **50**. That is, a decision is made as to the reception of a trigger signal calling for the switching into the ID registration mode (P**3400**). If the decision indicates the reception of the trigger signal calling for the switching into the ID registration mode (P**3400**: YES), the switching into the ID registration mode is made (P**3410**), and a decision is made on the reception of an ID (P**3420**). In the case of the ID reception (P**3420**: YES), this ID is temporarily stored in a work area of the RAM (P**3430**), and a decision is made on the reception of an instruction on the ID registration (P**3440**). In the case of the reception of the ID registration instruction (P**3440**: YES), the ID temporarily stored in P**3430** is registered as an ID of the air pressure sensor in the memory **55** (P**3450**), and a reply indicative of the ID registration completion is made (P**3460**). Following this, a decision is made on the reception of a trigger signal to the effect that the mode is switched into the normal mode (P**3470**). In the case of the reception of the trigger signal calling for the switching into the normal mode (P**3470**: YES), the switching into the normal mode is made (P**3480**), and the processing comes to an end.

Incidentally, the program installed in each of the air pressure sensors **10**, **20**, **30** and **40** is similar that in the fourth embodiment.

According to the ninth embodiment, a vehicle body number is registered as an ID in each of the air pressure sensors **10**, **20**, **30** and **40** and the monitoring apparatus **50**. Accordingly, the discrimination from air pressure sensors of different vehicles becomes securely feasible. Although the identification of the position of a tire being a monitoring object is unfeasible unlike the above-described fourth to eighth embodiment, a judgment can be made that an abnormality exists in any one of the tires, thus sufficiently achieving a function as a tire pressure monitoring system.

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Moreover, as in the case of the fourth to eighth embodiments, the mistaken registration due to the radio interference in the ID registration is surely avoidable. Still moreover, since the ID registration is made on the basis of a vehicle body number, as mentioned above, in the case of the tire replacement in a repair shop or the like, the ID registration can be done with respect to only the replacing tire, which improves the working efficiency of the ID registration operation at the tire replacement.

Tenth Embodiment

Furthermore, a tenth embodiment of the present invention will be described hereinbelow with reference to flow charts of FIGS. **57** and **58**. According to the tenth embodiment, as shown in FIG. **57**, a decision is made as to whether it is the initial registration or re-registration (P**3500**). In the case of the initial registration (P**3500**: initial registration), the monitoring apparatus **50** is switched into an ID registration mode (P**3510**), and each of the sensors **10**, **20**, **30** and **40** is also switched into an ID registration mode (P**3520**). Moreover, an ID for each sensor is set in registration tool (P**3530**). At this time, the ID is set as information on a combination of a vehicle body number, production number or the like, peculiar to the vehicle, and the tire position. The ID is transmitted to the monitoring apparatus **50** and the sensors **10**, **20**, **30** and **40** (P**3540**). In this case, all the IDs of the four sensors are transmitted to the monitoring apparatus **50**, while the corresponding ID is transmitted to each of the sensors **10**, **20**, **30** and **40**. Upon receipt of the ID, the ID registration is carried out in the monitoring apparatus **50** and each of the sensors **10**, **20**, **30** and **40** (P**3550**). A description is made as to whether or not the ID registration reaches completion in the monitoring apparatus and each of the sensors **10**, **20**, **30** and **40** (P**3560**). In the case of no completion of the ID registration (P**3560**: NO), the step P**3240** and the subsequent processing are repeatedly carried out. In the case of the completion of the ID registration (P**3560**: YES), the monitoring apparatus **50** is switched into the normal mode (P**3570**), and the respective sensors **10**, **20**, **30** and **40** are also switched into the normal mode (P**3580**), and the processing comes to an end.

On the other hand, in the case of the re-registration (P**3500**: re-registration), as shown in FIG. **58**, a decision is made as to whether tire replacement or tire rotation (P**3610**). In the case of the rotation (P**3610**: rotation), the sensors **10**, **20**, **30** and **40** are switched into the ID registration mode (P**3620**), and an ID for each sensor is set in the registration tool **60** (P**3630**). The ID to be set at this time is made to be the same as the ID set in the step P**3530**. The corresponding ID is transmitted to each of the sensors **10**, **20**, **30** and **40** (P**3640**). Upon receipt of the ID, each of the sensors **10**, **20**, **30** and **40** implements the ID re-registration (P**3650**). That is, each of the sensors **10**, **20**, **30** and **40** performs the ID re-registration on a newly received ID by the overwriting on the already registered ID. Subsequently, a decision is made as to whether the ID registration or not the ID registration reaches completion in the sensors **10**, **20**, **30** and **40** (P**3660**). In the case of no completion of the ID registration (P**3660**: NO), the step P**3540** and subsequent processing are repeatedly carried out. In the case of the completion of the ID registration (P**3660**: YES), the sensors **10**, **20**, **30** and **40** are switched into the normal mode (P**3670**, and the ID registration operation comes to an end.

In a case in which the re-registration is due to the tire replacement (P**3610**: tire replacement), a sensor of a tire to be newly mounted is switched into the ID registration mode (P**3720**), and an ID of this sensor is set in the registration tool **60** (P**3730**). The ID to be set at this time is made to the same as the ID set in the step P**3530**. Moreover, this sensor ID is transmitted to the sensor set in the ID registration mode in the step P**3720** (P**3740**), and the sensor receiving this ID carries out the ID registration (P**3750**). Then, a decision is made as to whether or not the ID registration in the sensor comes to completion (P**3760**). In the case of no completion of the ID registration (P**3760**: NO), the step P**3740** and subsequent processing are conducted repeatedly. In the case of the completion of the ID registration (P**3760**: YES), the sensor set in the ID registration mode is switched into the normal mode (P**3780**), and the ID registration operation comes to an end.

Referring to flow charts of FIGS. **59** to **65**, a description will be given hereinbelow of the contents of a program installed in the ID registration tool **60** for carrying out the above-described registration operation. The following program starts by pushing a predetermined button on the control panel **68** of the ID registration tool **60**. In this program, first of all, a decision whether for the initial registration or for re-registration is made as shown in FIG. **59** (P**3800**). The decision as to whether for the initial registration or for the re-registration can depend on a manner such that an initial-registration button and a re-registration button are provided on the control panel **68** and a judgment is made on which of the initial-registration button and the re-registration button is depressed for activating this program. If the decision shows the initial registration (P**3800**: initial registration), an instruction message to the effect that the signal lines **63** and **63***a* to **63***d* are respectively connected to the tire air pressure sensors **10**, **20**, **30** and **40** and the tie pressure monitoring apparatus **50** is put on the display **69** (P**3802**), and the control waits for the panel manipulation for the connections (P**3804**). In response to the completion of the connections (P**3804**: YES), trigger signals are transmitted so that the tire air pressure sensors **10**, **20**, **30**, **40** and the tire pressure monitoring apparatus **50** are set in an ID registration mode (P**3810**, P**3820**).

Following this, an instruction message to the effect of inputting a vehicle body number is put on the display **69** (P**3830**), and a decision is made as to the input of the vehicle body number (P**3840**). If the decision indicates the completion of the input thereof (P**3840**: YES), four code data are automatically produced in a manner such that "00", "01", "10" and "11" are added as low-order bits of the inputted vehicle body number (P**3850**), and in the memory **66**, the data including the added low-order bits "00" is stored as an ID for the front left tire, the data including the added low-order bits "01" as an ID for the rear left tire, the data including the added low-order bits "10" as an ID for the rear right tire, and the data including the added low-order bits "11" as an ID for the front right tire (P**3860**, P**3870**, P**3880**, P**3890**).

In addition, as shown in FIG. **60**, an ID corresponding to the air pressure sensor **10** of the front left tire is first read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P**3910**), and an instruction command for the ID registration is then transmitted to the tire pressure monitoring apparatus **50** (P**3920**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P**3930**). If the reply does not come within a predetermined period of time (P**3930**: NO), the operational flow returns to the step P**3910**. On the other hand, if the registration completion reply comes therefrom (P**3930**: YES), an ID corresponding to the air pressure

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sensor **20** of the rear left tire is read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P**3940**), and an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus **50** (P**3950**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P**3960**). If the reply does not come within a predetermined period of time (P**3960**: NO), the operational flow returns to the step P**3940**. On the other hand, if the registration completion reply comes therefrom (P**3960**: YES), an ID corresponding to the air pressure sensor **30** of the rear right tire is read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P**3970**), and an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus **50** (P**3980**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P**3990**). If the reply does not come within a predetermined period of time (P**3990**: NO), the operational flow returns to the step P**3970**. On the other hand, if the registration completion reply comes therefrom (P**3990**: YES), an ID corresponding to the air pressure sensor **40** of the front right tire is read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P**4000**), and an instruction command for the ID registration is transmitted to the tire pressure monitoring apparatus **50** (P**4010**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P**4020**). If the reply does not come within a predetermined period of time (P**4020**: NO), the operational flow returns to the step P**4000**. On the other hand, if the registration completion reply comes therefrom (P**4020**: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted to the tire pressure monitoring apparatus **50** (P**4030**).

Still additionally, as shown in FIG. **61**, an ID corresponding to the air pressure sensor **10** of the front left tire is read out from the memory **66** and is transmitted to the air pressure sensor **10** (P**4110**), and an instruction command for the ID registration is then transmitted to the air pressure sensor **10** (P**4120**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **10** (P**4130**). If the reply does not come within a predetermined period of time (P**4130**: NO), the operational flow returns to the step P**4110**. On the other hand, if the registration completion reply comes therefrom (P**4130**: YES), an ID corresponding to the air pressure sensor **20** of the rear left tire is read out from the memory **66** and is transmitted to the air pressure sensor **20** (P**4140**), and an instruction command for the ID registration is transmitted to the air pressure sensor **20** (P**4150**). Then, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **20** (P**4160**). If the reply does not come within a predetermined period of time (P**4160**: NO), the operational flow returns to the step P**4140**. On the other hand, if the registration completion reply comes therefrom (P**4160**: YES), an ID corresponding to the air pressure sensor **30** of the rear right tire is read out from the memory **66** and is transmitted to the air pressure sensor **30** (P**4170**), and an instruction command for the ID registration is transmitted to the air pressure sensor **30** (P**4180**). Following this, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **30** (P**4190**). If the reply does not come within a predetermined period of time (P**4190**: NO), the operational flow returns to the step P**4170**. On the other hand, if the registration completion reply comes therefrom (P**4190**: YES), an ID corresponding to the air pressure sensor **40** of the front right tire is read out from the memory **66** and is transmitted to the air pressure sensor **40** (P**4200**), and an instruction command for the ID registration is transmitted to the air pressure sensor **40** (P**4210**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **40** (P**4220**). If the reply does not come within a predetermined period of time (P**4220**: NO), the operational flow returns to the step P**4200**. On the other hand, if the registration completion reply comes therefrom (P**4220**: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted (P**4230**), and the processing comes to an end.

On the other hand, if a decision to the re-registration is made on the basis of the depression of the re-registration button (P**3800**: re-registration), as shown in FIG. **62**, an input instruction message on the kind of re-registration, i.e., rotation or tire replacement, is put on the display **69** (P**4300**), and the control waits for the panel manipulation (P**4310**). In the case of the panel manipulation for the rotation (P**4310**: rotation), an instruction message to the effect that the signal lines **63***a* to **63***d* are respectively connected to the sensors **10**, **20**, **30** and **40** is put on the display **69** (P**4312**), and the control waits for the panel manipulation for the indication of the connection completion (P**4314**). If there is the panel manipulation for the indication of the connection completion (P**4314**: YES), a trigger signal is transmitted so that the tire air pressure sensors **10**, **20**, **30** and **40** are set in an ID registration mode (P**4320**).

Thereafter, an instruction message to the effect of inputting a vehicle body number is put on the display **69** (P**4330**), and a decision is made as to the input from the control panel **68** (S**4340**). In the case of the completion of the input (P**4340**: YES), four code data are automatically produced in a manner such that "00", "01", "10" and "11" are added as the low-order bits of the inputted vehicle body number (P**4350**), and in the memory **66**, the data including the added low-order bits "00" is stored as an ID for the front left tire, the data including the added low-order bits "01" as an ID for the rear left tire, the data including the added low-order bits "10" as an ID for the rear right tire, and the data including the added low-order bits "11" as an ID for the front right tire (P**4360**, P**4370**, P**4380**, P**4390**).

In addition, as shown in FIG. **63**, an ID corresponding to the air pressure sensor **10** of the front left tire is first read out from the memory **66** and is transmitted to the air pressure sensor **10** (P**4410**), and an instruction command for the ID registration is then transmitted to the air pressure sensor **10** (P**4420**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **10** (P**4430**). If the reply does not come within a predetermined period of time (P**4430**: NO), the operational flow returns to the step P**4410**. On the other hand, if the registration completion reply comes therefrom (P**4430**: YES), an ID corresponding to the air pressure sensor **20** of the rear left tire is read out from the memory **66** and is transmitted to the air pressure sensor **20** (P**4440**), and an instruction command for the ID registration is transmitted to the air pressure sensor **20** (P**4450**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **20** (P**4460**). If the reply does not come within a predetermined period of time (P**4460**: NO),

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the operational flow returns to the step P4440. On the other hand, if the registration completion reply comes therefrom (P4460: YES), an ID corresponding to the air pressure sensor 30 of the rear right tire is read out from the memory 66 and is transmitted to the air pressure sensor 30 (P4470), and an instruction command for the ID registration is transmitted to the air pressure sensor 30 (P4480). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor 30 (P4490). If the reply does not come within a predetermined period of time (P4490: NO), the operational flow returns to the step P4470. On the other hand, if the registration completion reply comes therefrom (P4490: YES), an ID corresponding to the air pressure sensor 40 of the front right tire is read out from the memory 66 and is transmitted to the air pressure sensor 40 (P4500), and an instruction command for the ID registration is transmitted to the air pressure sensor 40 (P4510). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor 40 (P4520). If the reply does not come within a predetermined period of time (P4520: NO), the operational flow returns to the step P4500. On the other hand, if the registration completion reply comes therefrom (P4520: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted to each of the air pressure sensors 10, 20, 30 and 40 (P4530).

Moreover, if the re-registration button is pushed (P3800: re-registration) and the tire replacement is designated (P4310: tire replacement), the operational flow advances to the processing in FIG. 64. An instruction message to the effect that a sensor signal line is connected to a sensor to be newly mounted is put on the display 69 (P4602), and the control waits for the panel manipulation indicating the completion of the connection (P4304). In response to the panel manipulation indicating the connection completion (P4604: YES), for the confirmation of the connection, a request signal is transmitted to each of the sensor signal lines 63*a* to 63*d* (P4606), and the control waits for a reply to the request signal (P4608). If the reply takes place (P4608: YES), only the sensor signal line providing the reply is set in an active state (P4610), and a trigger signal is transmitted to only the signal line made active so that the tire air pressure sensor is set in an ID registration mode (P4620).

Following this, an instruction message to the effect of inputting a vehicle body number is put on the display 69 (P4630), and a decision is made as to the input from the control panel 68 (P4640). If the decision indicates the completion of the input (P4640: YES), four code data are automatically produced in a manner such that "00", "01", "10" and "11" are added as low-order bits of the inputted vehicle body number (P4650), and in the memory 66, the data including the added low-order bits "00" is stored as an ID for the front left tire, the data including the added low-order bits "01" as an ID for the rear left tire, the data including the added low-order bits "10" as an ID for the rear right tire, and the data including the added low-order bits "11" as an ID for the front right tire (P4660, P4670, P4680, P4690).

Thereafter, the operational flow proceeds to the processing in FIG. 65 to specify one of the signal lines made active in the step P4610 (P4700). An ID set value at a tire position corresponding to this signal line is read out from the memory 66 (P4710), and this ID set value is transmitted through this signal line (P3720). Then, an instruction command for the ID registration is transmitted to the ID sending signal line (P4730). A decision is made as to whether or not a reply indicative of the registration completion comes from the air pressure sensor through that signal line (P4740). If the reply does not come within a predetermined period of time (P4740: NO), the operational flow returns to the step P4710. On the other hand, if the reply indicative of the registration completion comes therefrom (P4740: YES), a trigger signal is outputted through this signal line for restoring the air pressure sensor to the normal mode (P4750), and this signal line is setting-changed from the active state to the non-active state (P4760). A decision is made as to whether signal lines set in the active state in the step P4610 remain or not (P4770). If they are left (P4770: YES), one of the signal lines left is specified (P4780), and the operational flow returns to the step P4710. On the other hand, if there is no signal line set in the active state (P4770: NO), the processing comes to an end.

The contents of control processing to be implemented in the tire pressure monitoring apparatus 50 is similar to those in the above-described fourth embodiment. Meanwhile, a control processing program, which will be described below, is installed in the air pressure sensors. In this control processing, as shown in FIG. 66, first of all, a decision is made as to the reception of a request signal for the confirmation of the connection (P4800). Upon receipt of the connection confirmation request signal, a reply signal is returned (P4805), and a decision is made on the reception of a trigger signal calling for the switching into an ID registration mode (P4810). In the case of the reception of the trigger signal calling for the switching into an ID registration mode (P4810: YES), the switching into the ID registration mode is made (P4820), and a decision is made on the reception of an ID (P4830). In the case of the reception of the ID (P4830: YES), this ID is temporarily stored in a work area of the RAM (P4840). Then, a decision is made on the reception of an instruction for the ID registration (P4850). If the decision shows the reception of the ID registration instruction (P4850: YES), the ID temporarily stored in the step P4840 is registered in the ID memory (P4860), and a reply indicative of the completion of the ID registration is made (P4870). Following this, a decision is made as to the reception of a trigger signal to the effect that the mode is switched into the normal mode (P4880). In the case of the reception of the trigger signal calling for the switching into the normal mode (P4880: YES), the switching into the normal mode is made (P4890), and the processing comes to an end. On the other hand, in the case of no reception of the request signal for the connection confirmation (P4800: NO), the operational flow jumps the step P4805 and proceeds to the step P4810.

In the step P4860, if an ID has already registered in the sensor ID memory, the ID registration is conducted by overwriting. Therefore, in the case of the tire replacement or rotation, an ID newly set in a repair shop or a dealer can be re-registered in each of the sensors 10, 20, 30 and 40 in conjunction with the tire position. Incidentally, since the sensor ID has been registered in the tire pressure monitoring apparatus 50 in a state associated with the tire position at the initial registration, there is no need to carry out the re-registration at the time of the rotation or tire replacement.

According to the tenth embodiment, the re-registration due to the tire replacement can be carried out with respect to only the sensor of the tire to be newly mounted and, hence, a minimum ID registration operation is needed.

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Eleventh Embodiment

Furthermore, a description will be given hereinbelow of an eleventh embodiment of the present invention. In the eleventh embodiment, a program shown in flow charts of FIGS. **67** to **74** is installed in a ID registration tool **60**, and starts by pushing a predetermined button on the control panel **68** of the ID registration tool **60**. In this program, first of all, a decision whether for the initial registration or for re-registration is made as shown in FIG. **67** (P**4900**). If the decision shows the initial registration (P**4900**: initial registration), an instruction message to the effect that the signal lines **63** and **63***a* to **63***d* are respectively connected to the tire air pressure sensors **10**, **20**, **30** and **40** and the tie pressure monitoring apparatus **50** is put on the display **69** (P**4902**), and the control waits for the panel manipulation for the connections (P**4904**). In response to the completion of the connections (P**4904**: YES), trigger signals are transmitted so that the tire air pressure sensors **10**, **20**, **30**, **40** and the tire pressure monitoring apparatus **50** are set in an ID registration mode (P**4910**, P**4920**).

Following this, a random-number generating unit is activated to generate a random number (P**4930**), and four code data are automatically produced in a manner such that "00", "01", "10" and "11" are added as low-order bits of the random number (P**4950**), and in the memory **66**, the data including the added low-order bits "00" is stored as an ID for the front left tire, the data including the added low-order bits "01" as an ID for the rear left tire, the data including the added low-order bits "10" as an ID for the rear right tire, and the data including the added low-order bits "11" as an ID for the front right tire (P**4960**, P**4970**, P**4980**, P**4990**).

Thereafter, the operational flow proceeds to the processing in FIG. **68**, and an ID corresponding to the air pressure sensor **10** of the front left tire is first read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P**5010**), and an instruction command for the ID initial-registration is then transmitted to the tire pressure monitoring apparatus **50** (P**5020**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P**5030**). If the reply does not come within a predetermined period of time (P**5030**: NO), the operational flow returns to the step P**5010**. On the other hand, if the registration completion reply comes therefrom (P**5030**: YES), an ID corresponding to the air pressure sensor **20** of the rear left tire is read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P**5040**), and an instruction command for the ID initial-registration is transmitted to the tire pressure monitoring apparatus **50** (P**5050**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P**5060**). If the reply does not come within a predetermined period of time (P**5060**: NO), the operational flow returns to the step P**5040**. On the other hand, if the registration completion reply comes therefrom (P**5060**: YES), an ID corresponding to the air pressure sensor **30** of the rear right tire is read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P**5070**), and an instruction command for the ID initial-registration is transmitted to the tire pressure monitoring apparatus **50** (P**5080**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P**5090**). If the reply does not come within a predetermined period of time (P**5090**: NO), the operational flow returns to the step P**5070**. On the other hand, if the registration completion reply comes therefrom (P**5090**: YES), an ID corresponding to the air pressure sensor **40** of the front right tire is read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P**5100**), and an instruction command for the ID initial-registration is transmitted to the tire pressure monitoring apparatus **50** (P**5110**). Then, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the tire pressure monitoring apparatus **50** (P**5120**). If the reply does not come within a predetermined period of time (P**5120**:NO), the operational flow returns to the step P**5100**. On the other hand, if the registration completion reply comes therefrom (P**5120**: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted to the tire pressure monitoring apparatus **50** (P**5130**).

In addition, the operational flow advances to the processing in FIG. **69**. An ID corresponding to the air pressure sensor **10** of the front left tire is first read out from the memory **66** and is transmitted to the air pressure sensor **10** (P**5210**), and an instruction command for the ID initial-registration is then transmitted to the air pressure sensor **10** (P**5220**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **10** (P**5230**). If the reply does not come within a predetermined period of time (P**5230**: NO), the operational flow returns to the step P**5210**. On the other hand, if the registration completion reply comes therefrom (P**5230**: YES), an ID corresponding to the air pressure sensor **20** of the rear left tire is read out from the memory **66** and is transmitted to the air pressure sensor **20** (P**5240**), and an instruction command for the ID initial-registration is transmitted to the air pressure sensor **20** (P**5250**). Then, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **20** (P**5260**). If the reply does not come within a predetermined period of time (P**5260**: NO), the operational flow returns to the step P**5240**. On the other hand, if the registration completion reply comes therefrom (P**5260**: YES), an ID corresponding to the air pressure sensor **30** of the rear right tire is read out from the memory **66** and is transmitted to the air pressure sensor **30** (P**5270**), and an instruction command for the ID initial-registration is transmitted to the air pressure sensor **30** (P**5280**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **30** (P**5290**). If the reply does not come within a predetermined period of time (P**5290**: NO), the operational flow returns to the step P**5270**. On the other hand, if the registration completion reply comes therefrom (P**5290**: YES), an ID corresponding to the air pressure sensor **40** of the front right tire is read out from the memory **66** and is transmitted to the air pressure sensor **40** (P**5300**), and an instruction command for the ID initial-registration is transmitted to the air pressure sensor **40** (P**5310**). Following this, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **40** (P**5320**). If the reply does not come within a predetermined period of time (P**5320**: NO), the operational flow returns to the step P**5300**. On the other hand, if the registration completion reply comes therefrom (P**5320**: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted to each of the air pressure sensors **10**, **20**, **30** and **40** (P**5330**), and the processing comes to an end.

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On the other hand, if a decision to the re-registration is made on the basis of the depression of the re-registration button (P**4900**: re-registration), the operational flow advances to the processing in FIG. **70**. An input instruction message on the kind of re-registration, i.e., rotation or tire replacement, is put on the display **69** (P**5400**), and the control waits for the panel manipulation (P**4540**). In the case of the panel manipulation for the rotation (P**5410**: rotation), an instruction message to the effect that the signal lines **63** and **63***a* to **63***d* are respectively connected to the tire pressure monitoring apparatus **50** and the sensors **10**, **20**, **30** and **40** is put on the display **69** (P**5412**), and the control waits for the panel manipulation for the indication of the connection completion (P**5414**). If there is the panel manipulation for the indication of the connection completion (P**5414**: YES), a trigger signal is transmitted so that the air pressure monitoring apparatus **50** and the tire air pressure sensors **10**, **20**, **30** and **40** are set in an ID registration mode (P**5414**, P**5420**).

Following this, a random-number generating unit is activated to generate a random number (P**5430**), and four code data are automatically produced in a manner such that "00", "01", "10" and "11" are added as low-order bits of the random number (P**5450**), and in the memory **66**, the data including the added low-order bits "00" is stored as an ID for the front left tire, the data including the added low-order bits "01" as an ID for the rear left tire, the data including the added low-order bits "10" as an ID for the rear right tire, and the data including the added low-order bits "11" as an ID for the front right tire (P**5460**, P**5470**, P**5480**, P**5490**).

Thereafter, the operational flow proceeds to the processing in FIG. **71**. An ID corresponding to the air pressure sensor **10** of the front left tire is first read out from the memory **66** and is transmitted to the air pressure sensor **10** (P**5510**), and an instruction command for the ID re-registration at the time of the rotation is then transmitted to the air pressure sensor **10** (P**5520**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **10** (P**5530**). If the reply does not come within a predetermined period of time (P**5530**: NO), the operational flow returns to the step P**5510**. On the other hand, if the registration completion reply comes therefrom (P**5530**: YES), an ID corresponding to the air pressure sensor **20** of the rear left tire is read out from the memory **66** and is transmitted to the air pressure sensor **20** (P**5540**), and an instruction command for the ID re-registration in the case of the rotation is transmitted to the air pressure sensor **20** (P**5550**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **20** (P**5560**). If the reply does not come within a predetermined period of time (P**5560**: NO), the operational flow returns to the step P**5540**. On the other hand, if the registration completion reply comes therefrom (P**5560**: YES), an ID corresponding to the air pressure sensor **30** of the rear right tire is read out from the memory **66** and is transmitted to the air pressure sensor **30** (P**5570**), and an instruction command for the ID re-registration at the rotation is transmitted to the air pressure sensor **30** (P**5580**). Then, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **30** (P**5590**). If the reply does not come within a predetermined period of time (P**5590**: NO), the operational flow returns to the step P**5570**. On the other hand, if the registration completion reply comes therefrom (P**5590**: YES), an ID corresponding to the air pressure sensor **40** of the front right tire is read out from the memory **66** and is transmitted to the air pressure sensor **40** (P**5600**), and an instruction command for the ID re-registration at the rotation is transmitted to the air pressure sensor **40** (P**5610**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the air pressure sensor **40** (P**5620**). If the reply does not come within a predetermined period of time (P**5620**:NO), the operational flow returns to the step P**5610**. On the other hand, if the registration completion reply comes therefrom (P**5620**: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted to each of the air pressure sensors **10**, **20**, **30** and **40** (P**5630**).

Following this, the operational flow advances to the processing in FIG. **72**. An ID corresponding to the air pressure sensor **10** of the front left tire is first read out from the memory **66** and is transmitted to the tire pressure monitoring apparatus **50** (P**5710**), and an instruction command for the ID re-registration in the case of the rotation is then transmitted to the monitoring apparatus **50** (P**5720**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the monitoring apparatus **50** (P**5730**). If the reply does not come within a predetermined period of time (P**5730**: NO), the operational flow returns to the step P**5710**. On the other hand, if the registration completion reply comes therefrom (P**5730**: YES), an ID corresponding to the air pressure sensor **20** of the rear left tire is read out from the memory **66** and is transmitted to the monitoring apparatus **50** (P**5740**), and an instruction command for the ID re-registration at the rotation is transmitted to the monitoring apparatus **50** (P**5750**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the monitoring apparatus **50** (P**5760**). If the reply does not come within a predetermined period of time (P**5760**: NO), the operational flow returns to the step P**5740**. On the other hand, if the registration completion reply comes therefrom (P**5760**: YES), an ID corresponding to the air pressure sensor **30** of the rear right tire is read out from the memory **66** and is transmitted to the monitoring apparatus **50** (P**5770**), and an instruction command for the ID re-registration at the rotation is transmitted to the monitoring apparatus **50** (P**5780**). Subsequently, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the monitoring apparatus **50** (P**5790**). If the reply does not come within a predetermined period of time (P**5790**: NO), the operational flow returns to the step P**5770**. On the other hand, if the registration completion reply comes therefrom (P**5790**: YES), an ID corresponding to the air pressure sensor **40** of the front right tire is read out from the memory **66** and is transmitted to the monitoring apparatus **50** (P**5800**), and an instruction command for the ID re-registration at the rotation is transmitted to the monitoring apparatus **50** (P**5810**). Then, a decision is made as to whether or not a reply indicative of the completion of the registration comes from the monitoring apparatus **50** (P**5820**). If the reply does not come within a predetermined period of time (P**5820**: NO), the operational flow returns to the step P**5800**. On the other hand, if the registration completion reply comes therefrom (P**5820**: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted to the monitoring apparatus **50** (P**5830**).

Moreover, if the re-registration button is pushed (P**4900**: re-registration) and the tire replacement is designated (P**5410**: tire replacement), as shown in FIG. **73**, an instruction message to the effect that signal lines is connected to a sensor to be newly mounted and the tire pressure monitoring

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apparatus **50** is put on the display **69** (P**5902**), and the control waits for the panel manipulation indicating the completion of the connection (P**5904**). In response to the panel manipulation indicating the connection completion (P**5904**: YES), for the confirmation of the connection, a request signal is transmitted to each of the sensor signal lines **63***a* to **63***d* (P**5906**), and the control waits for a reply to the request signal (P**5908**). If the reply takes place (P**5908**: YES), only the sensor signal line providing the reply is set in an active state (P**5910**), and a trigger signal is transmitted to only the signal line made active so that the tire air pressure sensor is set in an ID registration mode (P**5920**).

Following this, a random-number generating unit is activated to generate a random number (P**5930**), and four code data are automatically produced in a manner such that "00", "01", "10" and "11" are added as low-order bits of the random number (P**5950**), and in the memory **66**, the data including the added low-order bits "00" is stored as an ID for the front left tire, the data including the added low-order bits "01" as an ID for the rear left tire, the data including the added low-order bits "10" as an ID for the rear right tire, and the data including the added low-order bits "11" as an ID for the front right tire (P**5960**, P**5970**, P**5980**, P**5990**).

Thereafter, as shown in FIG. **74**, one of the signal lines made active is specified (P**6000**), and an ID set value at a tire position corresponding to this signal line is read out from the memory **66** (P**6010**), and this ID set value is transmitted through this signal line (P**6020**). Then, an instruction command for the ID re-registration at the tire replacement is transmitted to the ID sending signal line (P**6030**). A decision is made as to whether or not a reply indicative of the registration completion comes from the air pressure sensor through that signal line (P**6040**). If the reply does not come within a predetermined period of time (P**6040**: NO), the operational flow returns to the step P**6010**. On the other hand, if the reply indicative of the registration completion comes therefrom (P**6040**: YES), a trigger signal is outputted through this signal line for restoring the air pressure sensor to the normal mode (P**6050**), and this signal line is setting-changed from the active state to the non-active state (P**6060**). Then, the ID set value read out in the step P**6010**, together with the tire position information, is transmitted to the tire pressure monitoring apparatus **50** (P**6070**). Subsequently, an instruction command for the ID re-registration at the tire replacement is transmitted to the tire pressure monitoring apparatus **50** (P**6080**), and a decision is made as to whether or not a reply indicative of the registration completion comes from the tire pressure monitoring apparatus **50** (P**6090**). If the reply does not come within a predetermined period of time (P**6090**: NO), the operational flow returns to the step P**6070**. On the other hand, if the reply indicative of the registration completion comes therefrom (P**6090**: YES), a decision is made as to whether signal lines set in the active state in the step P**6010** remain or not (P**6100**). If they are still left (P**6100**: YES), one of the signal lines left is specified (P**6110**), and the operational flow returns to the step P**6010**. On the other hand, if there is no signal line set in the active state (P**6110**: NO), a trigger signal is outputted to restore the tire pressure monitoring apparatus **50** to the normal mode (P**6120**), and the processing comes to an end.

Furthermore, referring to FIGS. **75** to **77**, a description will be given hereinbelow of the contents of control processing to be implemented in the tire pressure monitoring apparatus **50**. In this control processing, as shown in FIG. **75**, a decision is first made as to the reception of a trigger signal giving instruction for the switching into the ID registration mode (P**6200**). In the case of the reception of the trigger signal calling for the switching into the ID registration mode (P**76200**: YES), the switching into the ID registration mode is made (P**6210**), and a decision is made on the reception of an ID (P**6220**). In the case of the reception of the ID (S**6220**: YES), this ID, together with tire position information, is temporarily stored in a work area of the RAM (P**6230**). Then, a decision is made on the reception of an instruction for any one of the ID initial-registration, ID re-registration in the case of the rotation and ID re-registration in the case of the tire replacement (P**6240**). In the case of the reception of the ID initial-registration instruction (P**6240**: initial registration), the ID temporarily stored in the step S**6230** is registered as the ID of the air pressure sensor of the front left tire in the memory **55** (P**6250**), and a reply is made which is indicative of the completion of the ID registration (P**6260**). Subsequently, a decision is made on the reception of an ID (P**6270**). In the case of the reception of the ID (S**6270**: YES), this ID is temporarily stored in a work area of the RAM (P**6280**). Then, a decision is made on the reception of an instruction for the ID initial-registration (P**6290**). In the case of the reception of the ID initial-registration instruction (P**6290**: YES), the ID temporarily stored in S**6280** is registered as the ID of the air pressure sensor of the rear left tire in the memory **55** (P**6300**), and a reply is made which is indicative of the completion of the ID registration (P**6310**). Following this, a decision is made on the reception of an ID (P**6320**). In the case of the reception of the ID (S**6320**: YES), this ID is temporarily stored in a work area of the RAM (P**6330**). Then, a decision is made on the reception of an instruction for the ID initial-registration (P**6340**). In the case of the reception of the ID initial-registration instruction (P**6340**: YES), the ID temporarily stored in S**6330** is registered as the ID of the air pressure sensor of the rear right tire in the memory **55** (P**6350**), and a reply is made which is indicative of the completion of the ID registration (P**6360**). Moreover, a decision is made on the reception of an ID (P**6370**). In the case of the reception of the ID (S**6370**: YES), this ID is temporarily stored in a work area of the RAM (P**6380**). Then, a decision is made on the reception of an instruction for the ID initial-registration (P**6390**). In the case of the reception of the ID initial-registration instruction (P**6390**: YES), the ID temporarily stored in S**6380** is registered as the ID of the air pressure sensor of the front right tire in the memory **55** (P**6400**), and a reply is made which is indicative of the completion of the ID registration (P**6410**). Thereafter, a decision is made as to the reception of a trigger signal to the effect that the mode is switched into the normal mode (P**6420**). In the case of the reception of the trigger signal calling for the switching into the normal mode (P**6420**: YES), the mode is switched into the normal mode (P**6430**), and the processing comes to an end.

Still furthermore, in the step P**6240**, in the case of the reception of the ID re-registration instruction for the rotation (P**6240**: rotation), as shown in FIG. **76**, the ID temporarily stored in the step P**6230** is re-registered by overwriting as the ID of the air pressure sensor of the front left tire in the memory **55** (P**6550**), and a reply is carried out which is representative of the ID registration completion (P**6560**). Then, a decision is made on the reception of an ID (P**6570**). In the case of the reception of the ID (P**6570**: YES), this ID is temporarily stored in a work area of the RAM (P**6580**). A decision is made on the reception of an ID initial-registration instruction (P**6590**). In the case of the reception of the ID initial-registration instruction (P**6590**: YES), the ID temporarily stored in the step P**6580** is re-registered by overwriting

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as an ID of the air pressure sensor of the rear left tire in the memory **55** (P**6600**), and a reply is made which is representative of the ID registration completion (P**6610**). Then, a decision is made on the reception of an ID (P**6620**). In the case of the reception of the ID (P**6620**: YES), this ID is temporarily stored in a work area of the RAM (P**6630**). A decision is made on the reception of an ID initial-registration instruction (P**6640**). In the case of the reception of the ID initial-registration instruction (P**6640**: YES), the ID temporarily stored in the step P**6630** is re-registered by overwriting as an ID of the air pressure sensor of the rear right tire in the memory **55** (P**6650**), and a reply is made which is representative of the ID registration completion (P**6660**). subsequently, a decision is made on the reception of an ID (P**6670**). In the case of the reception of the ID (P**6670**: YES), this ID is temporarily stored in a work area of the RAM (P**6680**). A decision is made on the reception of an ID initial-registration instruction (P**6690**). In the case of the reception of the ID initial-registration instruction (P**6690**: YES), the ID temporarily stored in the step P**6680** is re-registered by overwriting as an ID of the air pressure sensor of the rear right tire in the memory **55** (P**6700**), and a reply is made which is representative of the ID registration completion (P**6710**). Thereafter, a decision is made as to the reception of a trigger signal to the effect that the mode is switched into a normal mode (P**6720**). In the case of the reception of the trigger signal calling for the switching into the normal mode (P**6720**: YES), the switching into the normal mode is done (P**6730**), and the processing comes to an end.

Yet furthermore, in the step P**6240**, in the case of the reception of the ID re-registration instruction for the tire replacement (P**6240**: tire replacement), as shown in FIG. **77**, the ID temporarily stored in the step P**6230** is read out therefrom and is registered by overwriting as the ID of the air pressure sensor at the corresponding tire position on the basis of the tire position information received in the step P**6230** (P**6810**), and a reply is carried out which is representative of the ID registration completion (P**6820**). Then, a decision is made on the reception of an ID (P**6830**). In the case of the reception of the ID (P**6830**: YES), this ID, together with the tire position information, is temporarily stored in the RAM (P**6840**), and a decision is made on the reception of an ID re-registration instruction at the tire replacement (P**6850**). In the case of the reception of the ID re-registration instruction at the tire replacement (P**6850**: YES), the operational flow returns to the step P**6810**. On the other hand, in the case of no reception of an ID (P**6830**: NO), a decision is made as to the reception of a trigger signal to the effect that the mode is switched into a normal mode (P**6860**). In the case of the reception of the trigger signal calling for the switching into the normal mode (P**6860**: YES), the switching into the normal mode is done (P**6870**), and the processing comes to an end.

The contents of the control processing to be implemented in the air pressure sensor is similar to those in the tenth embodiment.

Also in the eleventh embodiment, the re-registration stemming from the tire replacement can be done with respect to only the sensor of a tire to be newly mounted, thus reducing the number of steps for the ID registration operation at the time of the tire replacement. Moreover, since a sensor ID is set through the use of a random-number generating function of the tool, for both the initial registration and re-registration, it is possible to lessen the burden imposed in the operator.

It should be understood that the present invention is not limited to the above-described embodiments, and that it is intended to cover all changes and modifications of the embodiments of the invention herein which do not constitute departures from the spirit and scope of the invention.

In the description of the fourth to eleventh embodiments, although an ID transmitted from the tool **60** through wires to the sensors **10**, **20**, **30** and **40** and to the tire pressure monitoring apparatus **50** to be registered therein, it is also acceptable that a set ID is transmitted from the tool **60** through radio using electric wave thereto. In this case, for example, it is also acceptable that a specific band-pass filter can be placed to function so that the receiving circuit in the sensors **10**, **20**, **30** and **40** and the tire pressure monitoring apparatus **50** is capable of receiving only a specific frequency-band signal different from a common pressure detection signal when receiving a trigger signal for setting an ID registration mode, and an ID set value is transmitted as this specific frequency-band from the tool **60**, that the electric wave directivity from the tool **60** is enhanced to prevent the radio interference, or that an information transmission medium (for example, ultrasonic wave) with a high directivity is employed for the ID registration.

In addition, for example, in a case in which an ID is set using a random number, it is also appropriate that an ID is produced on the basis of a combination of the random number and date and time, information on a factory or the like in order to avoid the coincidence. Also in a case in which an ID is manually set in a tool, if the ID is produced on the basis of a combination of an input value and the date and time, an ID registration place, an operator code or the like, it is possible to avoid the coincidence.

In the eleventh embodiment, although an ID is re-registered in the tire pressure monitoring apparatus **50** by means of the overwriting at the time of the re-registration stemming from the rotation or the tire replacement, it is also appropriate that, instead of the overwriting, a new ID is registered while the previous ID is left in a registered condition. This is because the sensor side ID is altered with respect to the initial registration and a pressure detection signal is transmitted only together with the ID after the re-registration and, hence, there arises no problem even if the ID at the time of the initial registration remains in the interior of the monitoring apparatus **50**.

Still additionally, if information in which the fact of re-registration or the number of times of re-registration is attached to an ID is stored in the tire pressure monitoring apparatus **50** at the time of the re-registration stemming from the tire rotation or the tire replacement, it is possible to seize the rotation history or tire replacement history from the ID registration information of the monitoring apparatus **50**.

What is claimed is:

1. A method of registering a tire air pressure sensor ID in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with an ID of an air pressure sensor of each of tires mounted on said vehicle from said air pressure sensor to monitor an air pressure of each of said tires mounted on said vehicle, comprising:

a step of reading said ID offered as readable information, said readable information being optically readable information and being configured to facilitate being read through the use of an optical information reader; and

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a step of writing the read ID in an ID storage unit of each of said air pressure sensors and in an ID storage unit of said tire pressure monitoring apparatus.

2. A method of registering a tire air pressure sensor ID in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with an ID of an air pressure sensor of each of tires mounted on said vehicle from said air pressure sensor to monitor an air pressure of each of said tires mounted on said vehicle, comprising:

a step of indicating a sensor ID as readable information on each of said air pressure sensors, each of said tires, a wheel of each of said tires wheel cover of each of said tires, said readable information being optically readable information and being configured to facilitate being read through the use of an optical information reader;

a step of reading said ID from said readable information; and

a step of writing the read ID in an ID storage unit of said tire pressure monitoring apparatus.

3. The method according to claim **1**, further comprising a step of, when an ID is read out from said readable information is inputted in said tire pressure monitoring apparatus, clearing, of IDs already written in said ID storage unit of said tire pressure monitoring apparatus, a previously stored ID corresponding to said ID inputted this time, such that a new ID can be stored.

4. The method according claim **2**, further comprising a step of, when an ID is read out from said readable information and is inputted in said tire pressure monitoring apparatus, clearing, of IDs already written in a ID storage unit of said tire pressure monitoring apparatus, a previously stored ID corresponding to said ID inputted this time, such that a new ID can be stored.

5. A method of registering a tire air pressure sensor ID in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with an ID of an air pressure sensor of each of tires mounted on said vehicle from said air pressure sensor to monitor an air pressure of each of said tires mounted on said vehicle, comprising:

a step of reading said ID offered as readable information; and

a step of writing the read ID In an ID storage unit each of said air pressure sensors and in an ID storage unit of said tire pressure monitoring apparatus,

wherein, as said readable information, are used optically-readable information including bar code, data code, QR code, maxi code, CP code, PDF417, code 49, code 16K and coder block, and said ID is read out through the use of an optical information reading unit and said ID read by said optical information reading unit is written in said ID storage unit through the use of a predetermined unit.

6. A method of registering a tire air pressure sensor ID in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with an ID of an air pressure sensor of each of tires mounted on said vehicle from said air pressure sensor to monitor an air pressure of each of said tires mounted on said vehicle, comprising:

a step of indicating a sensor ID as readable information on each of said air pressure sensors, each of said tires, a wheel of each of said tires or a wheel cover of each of said tires;

a step of reading said ID from said readable information; and

a step of writing the read ID in an ID storage unit of said tire pressure monitoring apparatus,

wherein, as said readable information, are used optically-readable information including bar code, data code, QR code, maxi code, CP code, PDF417, code 49, code 16K and coder block, and said ID is read out through the use of an optical information reading unit and said ID read by said optical information reading unit is written in said ID storage unit through the use of a predetermined unit.

7. The method according to claim **5**, wherein said optical information reading unit and said tire pressure monitoring apparatus are connected to each other through a signal line so that the read ID is transmitted from said optical information reading unit through said signal line to said tire pressure monitoring apparatus.

8. The method according to claim **6**, wherein said optical information reading unit and said tire pressure monitoring apparatus are connected to each other through a signal line so that the read ID is transmitted from said optical information reading unit through said signal line to said tire pressure monitoring apparatus.

9. A tire air pressure sensor ID registration apparatus for use in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with an ID of an air pressure sensor of each of tires mounted on said vehicle from said air a tire sensor to monitor an air press of each of said tires mounted on said vehicle, comprising:

an ID indicating unit for indicating readable information including an ID, said readable information being optically readable information and being configured to facilitate being read through the use of an optical information reader;

a reading unit for reading out said ID from said readable information indicated by ID indicating unit; and

ID writing unit for writing said ID, read by said reading unit, in an ID storage unit of each of said air pressure sensors and in an ID storage unit of said tire pressure monitoring apparatus.

10. A tire air pressure sensor ID registration apparatus for use in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with an ID of an air pressure sensor of each of tires mounted on said vehicle from said air pressure sensor to monitor an air pressure of each of said tires mounted on said vehicle, comprising:

a readable information indication label including a sensor ID for indicating readable information and adhered onto each of said air pressure sensors, each of said tires, a wheel of each of said tires or a wheel cover of each of said tires, said readable information being optically readable information and being configured to facilitate being read through the use of an optically information reader;

a reading unit for reading out said ID from said readable information indication label; and

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an ID writing unit for writing said ID, read out by the reading unit, in an ID storage unit of said tire pressure monitoring apparatus.

11. The apparatus according claim **9**, further comprising an ID deletion unit for, when said ID read out by said reading unit is imputed in said tire pressure monitoring apparatus, clearing, of IDs already written in said ID storage unit of said tire pressure monitoring apparatus, a previously stored ID corresponding to said ID inputted this time, such that a new ID can be stored.

12. The apparatus according to claim **10**, further comprising an ID deletion unit for, when said ID read out by said reading unit is inputted in said tire pressure monitoring apparatus, clearing, of IDs already written in said ID storage unit of said tire pressure monitoring apparatus, a previously stored ID corresponding to said ID inputted this time, such that a new ID can be stored.

13. The apparatus according to claim **9**, wherein, as said readable information, are used optically-readable information including bar code, data code, QR code, maxi code, CP code, PDF417, code 49, code 16K and coder block, and said ID read out through the use of an optical information reading unit and said ID read by said optical information reading unit is written in said ID storage unit through the use of said ID writing unit.

14. The apparatus according to claim **9**, wherein, as said readable information, are used optically-readable information including bar code, data code, QR code, mini code, CP code, PDF417, code 49, code 16K and coder block, and said ID is read out through the use of an optical information reading unit and said ID read by said optical information reading unit is written in said ID storage unit through the use of said ID writing unit.

15. The apparatus according to claim **13**, wherein said optical information reading unit and said tire pressure monitoring apparatus are connected to each other through a signal line so that the ID to be stored in said tire pressure monitoring apparatus is transmitted through said signal.

16. The apparatus according to claim **14**, wherein said optical information reading wilt and said tire pressure monitoring apparatus an connected to each other through a signal line so that the ID to be stored in said tire pressure monitoring apparatus is transmitted through said signal.

17. An ID registration tool for use in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with an ID of an air pressure sensor of each of tires mounted on said vehicle from said air pressure sensor to monitor an air pressure of each of said tires mounted on said vehicle, comprising:

a reading unit for reading out a sensor ID from a readable information indication label including said sensor ID for indicating readable information and adhered onto each of said air pressure sensors, each of said tires, a wheel of each of said tires or a wheel cover of each of said tires, said readable information being optically readable information and being configured to facilitate being read through the use of an optical information reader;

ID transmitting unit for transmitting said ID, read out by said reading unit, to said tire pressure monitoring apparatus; and

a storage state instruction unit for giving an instruction on registration or deletion of said ID transmitted from said ID transmitting unit.

18. An ID registration tool for use in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with an ID of an air pressure sensor of each of tires mounted on said vehicle from said air pressure sensor to monitor an air pressure of each of said tires mounted on said vehicle, comprising:

a reading unit for reading out a sensor ID from a readable information indication label including said sensor ID and adhered onto each of said air pressure sensors, each of said tires, a wheel of each of said tires or a wheel cover of each of said tires;

ID transmitting unit for transmitting said ID, read out by said reading unit, to said tire pressure monitoring apparatus; and

a storage state instruction unit for giving an instruction on registration or deletion of said ID transmitted from said ID transmitting unit,

wherein said reading unit is an optical information reading unit for optically reading optically-readable information including bar code, data code, QR code, maxi code, CP code, PDF417, code 49, cock 16K and coder block.

19. The tool according to claim **17**, further comprising a signal line for making connection with respect to said tire pressure monitoring apparatus or a connector for connection of said signal line.

20. The tool according to claim **17**, further a trigger signal transmitting unit for transmitting a trigger signal for setting an ID registration mode to said tire pressure monitoring apparatus.

21. A tire with an air pressure sensor in which an optically-readable information label indicating information including an ID of said air pressure sensor is adhered onto said air pressure sensor, said tire itself, a tire wheel or a tire wheel cover, and said optically-readable information label is one of a data code label, a OR code label, a maxi code label, and a CP code label.

22. A method of registering an ID of each of tire air pressure sensors for use in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with said ID from said air pressure sensor of each of tires mounted on said vehicle to monitor an air pressure of each of said tires, comprising:

placing each of said sensors and said tire pressure monitoring apparatus into an ID registration mode,

transmitting said ID to each of said sensors stored therein, and

while said ID is transmitted, transmitting the same ID, which is identical in content to said ID transmitted to each of said sensors, to said tire pressure monitoring apparatus to be stored therein.

23. A method of registering an ID of each of tire air pressure sensors for use in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with said ID from said air pressure sensor of each of tires mounted on said vehicle to monitor an air pressure of each of said tires, comprising:

placing each of said sensors and said tire pressure monitoring apparatus into an ID registration mode,

transmitting said ID to each of said sensors through the use of an ID registration tool to be stored in each of said sensors, and

while said ID is transmitted, transmitting the same ID, which is identical in content to said ID transmitted to each of said sensors, to said tire pressure monitoring

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IPR2024-00744

apparatus through said ID registration tool to be stored in said tire pressure monitoring apparatus.

24. The method according to claim **23**, wherein, when said ID is stored in each of said air pressure sensors and said tire pressure monitoring apparatus, connections between each of said sensors and said ID registration tool and between said tire pressure monitoring apparatus and said ID registration tool are made through signal lines so that said ID is transmitted from said ID registration tool through said signal lines to each of said sensors and said tire pressure monitoring apparatus.

25. The method according to claim **22**, wherein said ID is set on the basis of peculiar vehicle information on production management, including a vehicle production number, and is stored in each of said sensors and said tire pressure monitoring apparatus.

26. The method according to claim **23**, wherein said ID is set on the basis of peculiar vehicle information on production management, including a vehicle production number, and is stored in each of said sensors and said tire pressure monitoring apparatus.

27. The method according to claim **22**, wherein said ID is set on the basis of a random number, and is stored in each of said sensors and said tire pressure monitoring apparatus.

28. The method according to claim **23**, wherein said ID is set on the basis of a random number, and is stored in each of said sensors and said tire pressure monitoring apparatus.

29. The method according to claim **22**, wherein said ID is a peculiar ID for each tire position.

30. The method according to claim **23**, wherein said ID is a peculiar ID for each tire position.

31. A tire air pressure sensor ID registration apparatus for use in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with a registration ID from an air pressure sensor of each of tires mounted on said vehicle to monitor an air pressure of each of said tires, said ID registration apparatus comprising:

a receiver mode switching unit for switching said tire pressure monitoring apparatus into an ID registration mode;

a transmitter mode switching unit for switching said air pressure sensor of each of said tires into an ID registration mode;

an ID setting unit for setting said registration ID to be stored in said air pressure sensor; and

an ID registration tool including an ID transmitting unit for transmitting the set registration ID to said air pressure sensor switched into said ID registration mode by said transmitter mode switching unit and further for transmitting the same set registration ID, which is identical in content to said set registration ID transmitted to said air pressure sensor, to said tire pressure monitoring apparatus switched into said ID registration mode by said receiver mode switching unit.

32. The apparatus according to claim **31**, wherein said ID registration tool is connected through signal lines to said air pressure sensor and said tire pressure monitoring apparatus so that said registration ID is transmitted through said signal lines to said air pressure sensor and said tire pressure monitoring apparatus to be stored in said air pressure sensor and said tire pressure monitoring apparatus.

33. The apparatus according to claim **31**, wherein said ID registration tool is made to be connectable to a production management computer, and said ID setting unit is made to set said registration ID on the basis of production management information peculiar to each vehicle, including a vehicle body number or a vehicle production number, given from said production management computer.

34. An ID registration tool for use in a tire pressure monitoring system in which a tire pressure monitoring apparatus mounted on a body of a vehicle receives an air pressure signal transmitted together with a registration ID from an air pressure sensor of each of tires mounted on said vehicle to monitor an air pressure of each of said tires, and made to register said registration ID in said tire pressure monitoring apparatus, said tool comprising:

an ID setting unit for setting said registration ID to be stored in said air pressure sensor to be mounted on said vehicle; and

an ID transmitting unit for transmitting said registration ID, set in said ID setting unit, to said air pressure sensor and further for transmitting the same set registration ID, which is identical in content to said set registration ID transmitted to said air pressure sensor, to said tire pressure monitoring apparatus.

35. The tool according to claim **34**, further comprising:

signal lines for making connections with respect to said air pressure sensor and said tire pressure monitoring apparatus or connectors for establishing connections with respect to said signal lines.

36. The tool according to claim **34**, further comprising:

a trigger signal transmitting unit for transmitting a trigger signal to said air pressure sensor and said tire pressure monitoring apparatus for placing said air pressure sensor and said tire pressure monitoring apparatus into an ID registration mode.

37. The tool according to claim **34**, wherein said ID setting unit comprises a sensor-peculiar ID producing unit for producing an registration ID peculiar to each of said sensors on the basis of peculiar vehicle information on production management, including a vehicle body number or a vehicle production number.

38. The tool according to claim **34**, wherein said ID setting unit comprises a random-number producing unit for producing a random number and a sensor-peculiar ID producing unit for producing an ID peculiar to each of said sensors on the basis of said random number produced by said random-number producing unit.

39. The tool according to claim **34**, wherein said tool is made to be connectable to production management computer, and said ID setting unit is made to set an ID including a portion of or all of production management information peculiar to each vehicle, including a vehicle body number or a vehicle production number, given by said production management computer.

40. A tire pressure monitoring apparatus which registers an ID of an air pressure sensor of each of tires mounted on a vehicle and receives, through an antenna, an air pressure signal transmitted together with said ID from said sensor to monitor an air pressure of each of said tires on the basis of a result of the reception, said apparatus comprising:

a signal line connecting unit for making a connection through a signal line to a predetermined ID registration tool;

an ID registration mode activating unit for activating an ID registration mode;

a tire position judging unit for making a judgment on a tire position on the basis of registration ID data received

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through said signal line in a state where said ID registration mode is activated;

an ID registration unit for registering said ID of said air pressure sensors in the form of specifying a tire position on the basis of a result of judgment in said tire position judging unit;

a re-registration judging unit for making a judgment on the basis of a command received from said ID registration tool as to whether or not the present registration is re-registration; and

a re-registration unit for, when the judgment in said re-registration judging unit indicates the re-registration, re-registering an air pressure sensor ID in a memory on to basis of a result of the judgment in said tire position judging unit so that an ID already registered with respect to an air pressure sensor existing at a tire position undergoing the tire position judgment is actually replaced with said air pressure sensor ID.

* * * * *

Orange Exhibit No. 2003
IPR2024-00744

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	Tire Pressure Detecting Apparatus And Tire Pressure Detector Identification Copying Method For The Same
First Named Inventor/Applicant Name:	Hung-Chih Yu
Filer:	Vincent M. Deluca
Attorney Docket Number:	8031604.RE

Filed as Small Entity

ex parte reexam Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
REQUEST FOR EX PARTE REEXAMINATION	2812	1	6000	6000
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Orange Exhibit No. 2003
IPR2024-00744

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**6000**

Orange Exhibit No. 2003
IPR2024-00744

Electronic Acknowledgement Receipt	
EFS ID:	18341185
Application Number:	90013169
International Application Number:	
Confirmation Number:	1047
Title of Invention:	Tire Pressure Detecting Apparatus And Tire Pressure Detector Identification Copying Method For The Same
First Named Inventor/Applicant Name:	Hung-Chih Yu
Customer Number:	20230
Filer:	Vincent M. Deluca
Filer Authorized By:	
Attorney Docket Number:	8031604.RE
Receipt Date:	28-FEB-2014
Filing Date:	
Time Stamp:	17:01:16
Application Type:	Reexam (Third Party)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$6000
RAM confirmation Number	4825
Deposit Account	220585
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

Orange Exhibit No. 2003
IPR2024-00744

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Request_for_Ex_Parte_Reexamination.pdf	868965 216492a7549213f24e7fbfa80c18914f7b3b72fd	yes	61
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Receipt of Orig. Ex Parte Request by Third Party		1	60	
	Reexam Certificate of Service		61	61	
Warnings:					
Information:					
2	Copy of patent for which reexamination is requested	pat8031064.pdf	544857 8b83a8f136276c5ff9c1f3b6a3ccca172f1ce23c	no	10
Warnings:					
Information:					
3	Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party	US6414592.pdf	608003 37bd078256b04df11126c9082d02a44b680a01a6	no	8
Warnings:					
Information:					
4	Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party	US6927679.pdf	1933288 51791043b9041f6cfe5c04186384ab0570537685	no	35
Warnings:					
Information:					
5	Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party	US6941801.pdf	526738 49ee158d03182929d1f2273c0046fd2261ee0d9e	no	6
Warnings:					
Information:					
6	Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party	US7079033.pdf	6040556 61a906c0156f9c0144afef7a4a1e97abe96a5aba	no	115
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	29733 2d7677f0e6c3e17b89d569b73fdae9243a97219b	no	2
Warnings:					
Information:					

Total Files Size (in bytes):	10552140

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Alexandria, Virginia 22313-1450
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Bib Data Sheet

CONFIRMATION NO. 1047

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
90/013,169	02/28/2014 RULE	340	3992	8031604.RE

AIA (First Inventor to File): YES

INVENTORS

8031064, Residence Not Provided;
ORANGE ELECTRONIC CO., LTD.(OWNER), TAICHUNG HSIEN, TAIWAN;
VINCENT DE LUCA(3RD.PTY.REQ.), WASHINGTON, DC;

APPLICANTS

VINCENT DE LUCA, WASHINGTON, DC

**** CONTINUING DATA ***************************

This application is a REX of 12/283,979 09/17/2008 PAT 8031064

**** FOREIGN APPLICATIONS *********************

Foreign Priority claimed ☐ yes ☐ no 35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance Verified and Acknowledged Examiner's Signature Initials	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS 13	INDEPENDENT CLAIMS 1

ADDRESS
24728

TITLE

Tire Pressure Detecting Apparatus And Tire Pressure Detector Identification Copying Method For The Same

FILING FEE RECEIVED		
6000	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT: U.S. Patent No. 8,031,064	REEXAMINATION CONTROL NO.: 90013169
DATE OF ISSUE: October 4, 2011	GROUP ART UNIT: Not Yet Known
DATE OF FILING: September 17, 2008	EXAMINER: Not Yet Known
INVENTORS: Hung-Chih Yu	CONFIRMATION NO.: 1047

TITLE: TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME

CORRECTED CERTIFICATE OF SERVICE FOR *EX PARTE* REEXAMINATION OF U.S. PATENT NO. 8,031,064 BY THIRD PARTY

Mail Stop: EX PARTE REEXAMINATION
Attn: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicants noticed that original documents were erroneously sent to: CAMPBELL STEPHENSON LLP, which is the representative for Application Serial Number 08/031,064, not to the representative for Patent Number 8,031,064, which is MORRIS MANNING MARTIN LLP.

Orange Exhibit No. 2003
IPR2024-00744

Pursuant to 37 C.F.R §1.510, Applicants now serve the request for reexamination in its entirety on the patent owner (through the current attorney of record) at the address shown in the accompanying Certificate of Service.

Date: 10 March 2014

Respectfully submitted,

/Vincent M DeLuca/

Vincent M. DeLuca, Esq.
Registration No. 32,408
Attorney for Third Party Requester

CERTIFICATE OF SERVICE

I hereby certify that a true copy of the foregoing Request for Ex-Parte Reexamination was served on the patent owner by mailing a copy of same to the below address on this 10th day of March, 2014, by United States Mail, postage prepaid.

MORRIS MANNING MARTIN LLP
3343 PEACHTREE ROAD, NE
1600 ATLANTA FINANCIAL CENTER
ATLANTA, GA 30326

/Vincent M. DeLuca/
Vincent M. DeLuca, Esq.
Registration No. 32,408

Orange Exhibit No. 2003
IPR2024-00744

Electronic Acknowledgement Receipt	
EFS ID:	18423160
Application Number:	90013169
International Application Number:	
Confirmation Number:	1047
Title of Invention:	Tire Pressure Detecting Apparatus And Tire Pressure Detector Identification Copying Method For The Same
First Named Inventor/Applicant Name:	Hung-Chih Yu
Correspondence Address:	- - - - - - - - - - -
Filer:	Vincent M. Deluca/Elizabeth Evans
Filer Authorized By:	Vincent M. Deluca
Attorney Docket Number:	8031604.RE
Receipt Date:	10-MAR-2014
Filing Date:	
Time Stamp:	17:17:14
Application Type:	Reexam (Third Party)

Payment information:

Submitted with Payment	no

File Listing:

Orange Exhibit No. 2003
IPR2024-00744

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	Corrected_90013169.pdf	113978 28c8914d2819644ae4a2efb38d861964dd933f2e	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	113978		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
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New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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IPR2024-00744

Patent Assignment Abstract of Title

Total Assignments: 1

Application #: 12283979 **Filing Dt:** 09/17/2008 **Patent #:** 8031064 **Issue Dt:** 10/04/2011
PCT #: NONE **Publication #:** US20100066524 **Pub Dt:** 03/18/2010
Inventor: Hung-Chih Yu
Title: TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME

Assignment: 1

Reel/Frame: 021899 / 0710 **Received:** 10/06/2008 **Recorded:** 09/17/2008 **Mailed:** 11/28/2008 **Pages:** 2
Conveyance: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).
Assignor: YU, HUNG-CHIH **Exec Dt:** 09/15/2008
Assignee: ORANGE ELECTRONIC CO., LTD.
1F, NO. 91, LANE 36
SEC. 2, TANSING RD., TANZIH HSIANG
TAICHUNG HSIEN, TAIWAN R.O.C.
Correspondent: CHARLES E. BAXLEY, ESQUIRE
SUITE 309
90 JOHN STREET
NEW YORK, NEW YORK 10038-3243

Search Results as of: 03/14/2014 10:44 AM

If you have any comments or questions concerning the data displayed, contact PRD / Assignments at 571-272-3350. v.2.2.4
Web interface last modified: Jul 8, 2013 v.2.2.4

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REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
90/013,169	02/28/2014	8031064

CONFIRMATION NO. 1047

REEXAM ASSIGNMENT NOTICE

24728
MORRIS MANNING MARTIN LLP
3343 PEACHTREE ROAD, NE
1600 ATLANTA FINANCIAL CENTER
ATLANTA, GA 30326

OC000000067478275

Date Mailed: 04/01/2014

NOTICE OF ASSIGNMENT OF REEXAMINATION REQUEST

The above-identified request for reexamination has been assigned to Art Unit 3992. All future correspondence to the proceeding should be identified by the control number listed above and directed to the assigned Art Unit.

A copy of this Notice is being sent to the latest attorney or agent of record in the patent file or to all owners of record. (See 37 CFR 1.33(c)). If the addressee is not, or does not represent, the current owner, he or she is required to forward all communications regarding this proceeding to the current owner(s). An attorney or agent receiving this communication who does not represent the current owner(s) may wish to seek to withdraw pursuant to 37 CFR 1.36 in order to avoid receiving future communications. If the address of the current owner(s) is unknown, this communication should be returned within the request to withdraw pursuant to Section 1.36.

NOTICE OF USPTO EX PARTE REEXAMINATION PATENT OWNER STATEMENT WAIVER PROGRAM

The USPTO has implemented a pilot program where, after a reexamination proceeding has been granted a filing date and before the examiner begins his or her review, the patent owner may orally waive the right to file a patent owner's statement. See *"Pilot Program for Waiver of Patent Owner's Statement in Ex Parte Reexamination Proceedings,"* 75 FR 47269 (August 5, 2010). One goal of the pilot program is to reduce the pendency of reexamination proceedings and improve the efficiency of the reexamination process.

Ordinarily when ex parte reexamination is ordered, the USPTO must wait until after the receipt of the patent owner's statement and the third party requester's reply, or after the expiration of the time period for filing the statement and reply (a period that can be as long as 5 to 6 months), before mailing a first determination of patentability. The USPTO's first determination of patentability is usually a first Office action on the merits or a Notice of Intent to Issue Reexamination Certificate (NIRC).

Under the pilot program, the patent owner's oral waiver allows the USPTO to act on the first determination of patentability immediately after determining that reexamination will be ordered, and in a suitable case issue the reexamination order and the first determination of patentability (which could be a NIRC if the claims under reexamination are confirmed) at the same time.

Benefits to the Patent Owner for participating in this pilot program include reduction in pendency.

To participate in this pilot program, Patent Owners may contact the USPTO's Central Reexamination Unit (CRU) at 571-272-7705. The USPTO will make the oral waiver of record in the reexamination file in an interview summary and a copy will be mailed to the patent owner and any third party requester.

cc: Third Party Requester(if any)
VINCENT DE LUCA
VORYS, SATER, SEYMOUR & PEASE LLP
1909 K STREET N.W. ; SUITE 900
WASHINGTON, DC 20006

/sdstevenson/

Legal Instruments Examiner
Central Reexamination Unit 571-272-7705; FAX No. 571-273-9900

Orange Exhibit No. 2003
IPR2024-00744

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Address: COMMISSIONER FOR PATENTS
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REEXAM CONTROL NUMBER	FILING OR 371 (c) DATE	PATENT NUMBER
90/013,169	02/28/2014	8031064

CONFIRMATION NO. 1047
REEXAMINATION REQUEST NOTICE

VINCENT DE LUCA
VORYS, SATER, SEYMOUR & PEASE LLP
1909 K STREET N.W. ; SUITE 900
WASHINGTON, DC 20006

OC000000067478273

Date Mailed: 04/01/2014

NOTICE OF REEXAMINATION REQUEST FILING DATE

(Third Party Requester)

Requester is hereby notified that the filing date of the request for reexamination is 02/28/2014, the date that the filing requirements of 37 CFR § 1.510 were received.

A decision on the request for reexamination will be mailed within three months from the filing date of the request for reexamination. (See 37 CFR 1.515(a)).

A copy of the Notice is being sent to the person identified by the requester as the patent owner. Further patent owner correspondence will be the latest attorney or agent of record in the patent file. (See 37 CFR 1.33). Any paper filed should include a reference to the present request for reexamination (by Reexamination Control Number).

cc: Patent Owner
24728
MORRIS MANNING MARTIN LLP
3343 PEACHTREE ROAD, NE
1600 ATLANTA FINANCIAL CENTER
ATLANTA, GA 30326

/sdstevenson/

Legal Instruments Examiner
Central Reexamination Unit 571-272-7705; FAX No. 571-273-9900

Litigation Search Report CRU 3999

Reexam Control No. 90/013,169

To: Linh Nguyen Location: CRU Art Unit: 3999 Date: 4/3/13 Case Serial Number: 90/013,169	From: Alicia Kelley-Collier Location: CRU 3999 MDE 5A74 Phone: (571) 272-6059 alicia.kelley@uspto.gov

Search Notes

U.S. Patent No. **8,031,064**

1) I performed a KeyCite Search in Westlaw, which retrieves all history on the patent including any litigation.

2) I performed a search on the patent in Lexis CourtLink for any open dockets or closed cases.

3) I performed a search in Lexis in the Federal Courts and Administrative Materials databases for any cases found.

4) I performed a search in Lexis in the IP Journal and Periodicals database for any articles on the patent.

5) I performed a search in Lexis in the news databases for any articles about the patent or any articles about litigation on this patent.

No litigation involving this patent was found.

Orange Exhibit No. 2003
IPR2024-00744

Date of Printing: Apr 03, 2014

KEYCITE

© US PAT 8031064 TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME, Assignee: Orange Electronic Co., Ltd. (Oct 04, 2011)

History

Direct History

=> 1 **TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME,** US PAT 8031064 (U.S. PTO Utility Oct 04, 2011)

Patent Family

2 TIRE PRESSURE DETECTING APPARATUS FOR DETECTING AIR PRESSURE INSIDE TIRE OF CAR, HAS POWER SOURCE ELECTRONICALLY CONNECTED TO CONTROL MODULE AND PROVIDING ELECTRICAL POWER TO SETTING APPARATUS, Derwent World Patents Legal 2010-D01202+

Assignments

3 Action: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS). Number of Pages: 002, (DATE RECORDED: Sep 17, 2008)

Patent Status Files

.. Re-Examination Certificate, (OG DATE: Nov 12, 2013)

.. Request for Re-Examination,

Prior Art (Coverage Begins 1976)

© 6 ID REGISTRATION METHOD, ID COLLATION SYSTEM INCORPORATED IN A VEHICLE CONTROL SYSTEM, EMBODIED AS A PNEUMATIC TIRE PRESSURE MONITORING APPARATUS ASSOCIATED WITH PNEUMATIC PRESSURE SENSORS, AND AN ID REGISTRATION TOOL COMBINED WITH PNEUMATIC TIRE PRESSURE MONITORING APPARATUS, US PAT 6927679Assignee: Denso Corporation, (U.S. PTO Utility 2005)

© 7 TIRE AIR PRESSURE MONITORING SYSTEM, US PAT 7137296Assignee: Nissan Motor Co., Ltd., (U.S. PTO Utility 2006)

© 8 TIRE PRESSURE SENSOR UNIT, TIRE PRESSURE MONITORING SYSTEM, AND METHOD OF REGISTERING IDENTIFICATION CODE OF TIRE PRESSURE SENSOR UNIT, US PAT 6920785Assignee: Bridgestone Corporation, (U.S. PTO Utility 2005)

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Patent Search 8031064 4/ 3/ 2014

No cases found.

Return to Search

(Charges for search still apply)

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1. 8,031,064, EX PARTE REEXAMINATION CERTIFICATE C1 (9926th), Nov. 7, 2013, Tire Pressure Detecting Apparatus and Tire Pressure Detector Identification Copying Method for the Same, Yu, Hung-Chih, Taichung, Taiwan, Orange Electronic Co., Ltd., Tanzih Hsiang, Taichung Hsien, Taiwan

2. 8031064, October 4, 2011, Tire pressure detecting apparatus and tire pressure detector identification copying method for the same, Yu, Hung-Chih, Taichung, Taiwan, Republic of China (R.O.C.)(TW), Taiwan, Republic of China (R.O.C.)(); 283979, September 17, 2008, ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS)., ORANGE ELECTRONIC CO., LTD., SEC. 2, TANSING RD., TANZIH HSIANG, 1F, NO. 91, LANE 36, TAICHUNG HSIEN, TAIWAN( ), R.O.C., reel-frame:021898/0710, Orange Electronic Co., Ltd., Tanzih Hsiang Taichung Hsien, Taiwan, Republic of China (R.O.C.)(TW), Foreign company or corporation

CORE TERMS: tire, detector, identification, module, rewriteable, external, micro-processing, preset, monitoring, wireless, electronically, detecting, interface, memory, input, inside, low frequency, transmitting, sensing, valve stem, acceleration-detecting, controller, serviceman, frequency, memorized, barcode, send, car, acceleration, installed

Source: **Legal > Area of Law - By Topic > Patent Law > Find Patents > Utility, Design and Plant Patents**
Terms: **patno=8031064**
View: Cite
Date/Time: Thursday, April 3, 2014 - 3:51 PM EDT

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1. US Patent Issued to Orange Electronic on Oct. 4 for "Tire Pressure Detecting Apparatus and Tire Pressure Detector Identification Copying Method for the Same" (Taiwanese Inventor), US Fed News, October 8, 2011 Saturday 1:28 PM EST, , 236 words, ALEXANDRIA, Va.

2. Orange Electronic Assigned Patent, Targeted News Service, October 6, 2011 Thursday 11:00 PM EST, , 252 words, Targeted News Service, Alexandria, Va.

3. PTO Litigation Center Report - March 4, 2014, National Law Review, March 4, 2014 Tuesday 11:10 PM EST, , 338 words, Sterne, Kessler, Goldstein Fox P.L.L.C.

Source: **News & Business > Combined Sources > All English Language News**
Terms: **8031064 or 8,031,064**
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Date/Time: Thursday, April 3, 2014 - 3:52 PM EDT

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/013,169	02/28/2014	8031064	8031604.RE	1047

24728 7590 04/09/2014
MORRIS MANNING MARTIN LLP
3343 PEACHTREE ROAD, NE
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ATLANTA, GA 30326

EXAMINER	
NGUYEN, LINH M	
ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
04/09/2014	PAPER

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The time period for reply, if any, is set in the attached communication.

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(THIRD PARTY REQUESTER'S CORRESPONDENCE ADDRESS)

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EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/013,169*.

PATENT NO. *8031064*.

ART UNIT *3992*.

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

Orange Exhibit No. 2003
IPR2024-00744

DECISION ON REQUEST

A substantial new question of patentability ("SNQ") exists, affecting claims 8 and 10-15 of United States Patent Number 8,031,064 (hereinafter "the '064 patent"), is raised by the reexamination request filed 2/28/2014 ("Request"). The '064 patent was previously subject to reexaminations 90/012,430 ("the '12,430 proceeding") and the claims are as presented in the reexamination certificate from that proceeding.

References Cited in the Request

U.S. 7,079,033 to Itou, July 18, 2006

U.S. 6,941,801 to Lemense, et al. (hereinafter "Lemense"), September 13, 2005

U.S. 6,414,592 to Dixit, et al. (hereinafter "Dixit"), July 2, 2002

U.S. 6,927,679 to Taguchi, et al. (hereinafter "Taguchi"), August 9, 2005.

Of the above-mentioned references, Taguchi has been applied in prior art rejection. Insofar as Requester has applied the aforesaid reference with other prior art in a manner that plausibly suggests teachings reflected in the base patent claims, the Request has successfully presented this reference in a new light. See Ex Parte Chicago Rawhide Mfg Co. 223 USPQ 351 (BPAI 1984).

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Applying "Old Art" for a New Request for Reexamination

As stated above, Taguchi is considered "old art" for the determination of whether a new substantial question of patentability exists in the instant request for reexamination.

35 U.S.C. 303(a) provides for *ex parte* reexamination (emphasis added):

> "Within three months following the filing of a request for reexamination under the provisions of section 302 of this title, the Director will determine whether a substantial new question of patentability affecting any claim of the patent concerned is raised by the request, with or without consideration of other patents or printed publications **.... The existence of a substantial new question of patentability is not precluded by the fact that a patent or printed publication was previously cited by or to the Office or considered by the Office."**

The reexamination statute makes it clear that a SNQ can be raised by patents and printed publications "previously cited by or to the Office or considered by the Office." This provision was added for both *ex parte* and *inter partes* reexamination via the Patent and Trademark Office Authorization Act of 2002 (Act of 2002).

Therefore, for any reexamination ordered on or after November 2, 2002, the effective date of the statutory revision, reliance on previously cited/considered art, i.e., "old art," does not necessarily preclude the existence of a substantial new question of patentability (SNQ) that is based exclusively on that old art. Rather, determinations on whether a SNQ exists in such an instance shall be based upon a fact-specific inquiry done on a case-by-case basis.

Prosecution History

The '064 patent is drawn to a tire pressure detecting apparatus, and more particularly to an identification rewriteable tire pressure detecting apparatus. The examiner generally agrees

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with the description of the prosecution history found in the Request at pp. 4-9, and that discussion is incorporated by reference.

A notice of Allowability was mailed on 06/9/2011, in response to Applicant's Amendment filed 3/29/2011, without a statement of reasons for allowance. Thus, it appears that the claims were allowed because of the amendatory subject matter. A reasonable examiner would have considered prior art that teaches the amendatory features to be important in determining the patentability of the claims.

The '12430 proceeding

In the '12430 proceeding, substantial new questions of patentability were raised by the combination of Taguchi and the PUR-TPMS publication. During the reexamination, claims 1-7 and 9 were cancelled. Claims 14-23 were added, with claims 14-17, 19-21, and 23 subsequently being cancelled. Ultimately, claims 8, 10-13, 18, and 22 were allowable.

Claims 18 and 22 were similar to independent claim 1 and included the features of independent claim 1. Additionally, claim 18 recited:

"*a setting apparatus arranged to communicate with the identification rewritable tire pressure detector via wireless, including: reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and wirelessly writing the old identification into a new identification rewritable tire pressure detector by the setting apparatus.*"

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Somewhat similarly, claim 22 recited: "*a setting apparatus arranged to communicate with the identification rewritable tire pressure detector via wireless, including: reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and wirelessly writing the old identification into a new identification rewritable tire pressure detector by the setting apparatus.*"

The patentability of claims 8 and 10-13 was confirmed because the prior art did not teach or suggest "the input module is a code scanner," as recited in claim 8, and the reference cited against claims 10-13, 18 and 22 was not considered prior art.

A Reexamination Certificate was issued on November 7, 2013 in which the patentability of claims 8 and 10-13 was confirmed, application claims 18 and 22 were added to the '064 patent renumbered as claim 14 and 15, and claims 1-7 and 9 were cancelled.

References showing a tire pressure detecting apparatus having such allowed features would therefore have been important to a reasonable examiner in considering the patentability of the claims.

Requester's Proposed Rejections/SNQs

The following rejections are proposed by the third party.

1. Claim 8 is unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Dixit and Itou.
2. Claim 8 is unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi

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in view of Lemense and Itou.

3. Claims 10-13[1] are unpatentable under 35 U.S.C. § 102 (a) and (b) as being anticipated by Lemense.

4. Claims 14 and 15 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense and Dixit.

5. Claim 14 and 15 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense.

Discussion of the References Pertaining to the Alleged SNQs

Proposals 1 and 2 – Claim 8

It is agreed that Taguchi in combination with Itou and Dixit or Lemense raises a SNQ for dependent claim 8 of the '064 patent. Insofar as the explanation and the item-matching at pp. 18-34 of the request at least facially suggest that the combination of Taguchi with Itou and Dixit or Lemense teaches a tire pressure detector with all of the features cited in claim 8. Taguchi discloses a tire pressure detector with the exception of the input module being a code scanner as defined in dependent claim 8. Lemense and Dixit each disclose the manual ID input as recited in claim 8 of the '064 patent. Specifically, Dixit includes a plurality of manual input arrangements 42A-42D (Figure 1), each associated with one of the tire sensor units. Dixit at col. 3, ll. 38-45. Additionally, as illustrated in Figure 2, Dixit includes a transmitter device 44 that a person

[1] There appears to be a typographical error at page 15, line 1 of Request; "Claim 10" should instead be replaced with "Claims 10-13" since Request shows explanation for SNQ of all claims 10-13 at pp. 34-38.

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manually operates to input an identification code via an input key pad 50. Lemense includes a service tool 24 including a microcontroller 30. The microcontroller 30 performs various functions to interrogate a sensor unit using the service tool 24 to receive an ID code from each sensor. Lemense at col. 3, ll. 4-36. The microcontroller 30 is connected to an interface 36 that includes an input device (i.e., keypad 26). Itou includes an ID registration tool 60 that is used to read the IDs from bar codes 5/6/7/8 for wiring the bar codes in the tire pressure monitoring apparatus 50. Itou at col. 17, ll. 32-44. The bar codes are representative of the IDs of the pressure sensors 10/20/30/40. Itou at col. 17, ll. 37-39. The ID registration tool 60 is composed on a bar-code reading unit 61 and an ID transmitting unit 62 for transmitting the IDs. A reasonable examiner would consider the teachings of Taguchi in combination with Itou and Lemense or Dixit important in deciding whether or not claim 8 of the '064 patent are patentable. Accordingly, the teachings of Taguchi in combination with Itou and Lemense or Dixit provide raise a substantial new question of patentability as to claim 8, which question has not been decided in a previous examination of the '064 patent.

Such teachings are not cumulative to any written discussion on the record of the teachings of the prior art, were not previously considered nor addressed during a prior examination and the same question of patentability was not the subject of a final holding of invalidity by Federal Courts.

Proposal 3 – Claims 10-13

It is agreed that Lemense raises a SNQ for claims 10-13 of the '064 patent. Insofar as the explanation and the item-matching at pp. 34-38 of the request at least facially suggest that

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Lemense relates to a method and system for replacing or servicing tires mounted on wheels containing tire pressure sensing units; each sensor unit includes a communication section for transmitting data and an ID code to a control module. Thus, Lemense appears to teach each step and every element of method claim 10 of the '064 patent. Lemense also appears to include the features recited in dependent claims 11-13, the step of verifying the identification newly recorded in the newly identification rewriteable tire pressure detector; and the setting apparatus receiving a wireless signal containing identification from the old tire pressure detector in the step of reading the old identification and through an input module. A reasonable examiner would consider the teachings of Lemense important in deciding whether or not claims 10-13 of the '064 patent are patentable. Accordingly, the teachings of Lemense provide raise a substantial new question of patentability as to claims 10-13, which question has not been decided in a previous examination of the '064 patent.

Such teachings are not cumulative to any written discussion on the record of the teachings of the prior art, were not previously considered nor addressed during a prior examination and the same question of patentability was not the subject of a final holding of invalidity by Federal Courts.

Proposal 4 – Claims 14 and 15

It is agreed that Taguchi in combination with Lemense and Dixit raises a SNQ for claims 14 and 15 of the '064 patent. Insofar as the explanation and the item-matching at pp. 38-49 of

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the request at least facially suggest that the combination of Taguchi with Lemense and Dixit teaches a tire pressure detector with all of the features cited in claims 14 and 15. Taguchi discloses a tire pressure detector including a plurality of sensors and a monitoring apparatus including a setting apparatus. Taguchi, however, fails to teach or suggest an input module to input an identification to be written into the identification rewritable tire pressure. Lemense, however, teaches the claimed input module. Specifically, Lemense includes a service tool including a microcontroller. Thus, Lemense teaches the above feature missing from the disclosure of Taguchi. Moreover, Dixit includes a plurality of manual input arrangements, each associated with one of the tire sensor units, Dixit also includes a transmitter device that person manually operates to input an identification code via an input key pad. Thus, Dixit teaches the above feature missing from the disclosure of Taguchi. A reasonable examiner would consider the teachings of Taguchi in combination with Lemense and Dixit important in deciding whether or not claims 14 and 15 of the '064 patent are patentable. Accordingly, the teachings of Taguchi in combination with Lemense and Dixit provide raise a substantial new question of patentability as to claims 14 and 15, which question has not been decided in a previous examination of the '064 patent.

Such teachings are not cumulative to any written discussion on the record of the teachings of the prior art, were not previously considered nor addressed during a prior examination and the same question of patentability was not the subject of a final holding of invalidity by Federal Courts.

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Proposal 5 – Claims 14 and 15

It is agreed that Taguchi in combination with Lemense raises a SNQ for claims 14 and 15 of the '064 patent. Insofar as the explanation and the item-matching at pp. 49-59 of the request at least facially suggest that the combination of Taguchi with Lemense teaches a tire pressure detector with all of the features cited in claims 14 and 15. Taguchi discloses a tire pressure detector including a plurality of sensors and a monitoring apparatus including a setting apparatus. Taguchi teaches almost each and every element of the tire pressure detecting apparatus in claims 14 and 15 of the '064. Lemense similarly relates to tire pressure monitoring system and appears to teach the features lacking from Taguchi, such as the steps of reading an old identification from an old tire pressure detector by the setting apparatus and storing the old identification in the setting apparatus; and wirelessly writing the old identification into a new identification rewriteable tire pressure detector by the setting apparatus, wherein the setting apparatus comprises an input module connected to the control module to allow an operator to input an identification to be written into the identification rewritable tire pressure. Lemense discloses service tool 24 receives and stores ID code. The service tool is used to replicate or clone the ID code of a broken sensor unit into a replacement sensor unit over a LF communication link between the service tool and the replacement sensor unit. The service tool includes a microcontroller that is connected to an interface that includes an input device, keypad 26. A reasonable examiner would consider the teachings of Taguchi in combination with Lemense important in deciding whether or not claims 14 and 15 of the '064 patent are patentable. Accordingly, the teachings of Taguchi in combination with Lemense provide raise a substantial

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new question of patentability as to claims 14 and 15, which question has not been decided in a previous examination of the '064 patent.

Such teachings are not cumulative to any written discussion on the record of the teachings of the prior art, were not previously considered nor addressed during a prior examination and the same question of patentability was not the subject of a final holding of invalidity by Federal Courts.

Extensions of Time

Extensions of time under 37 CFR 1.136(a) will not be permitted in these proceedings because the provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that reexamination proceedings "will be conducted with special dispatch" (37 CFR 1.550(a)). Extension of time in *ex parte* reexamination proceedings are provided for in 37 CFR 1.550(c).

Notification of Other Proceedings

The patent owner is reminded of the continuing responsibility under 37 CFR 1.985(a), to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving the base patent throughout the course of this reexamination proceeding. The third party requester is also reminded of the ability to similarly apprise the Office of any such activity or proceeding throughout the course of this reexamination proceeding. See MPEP § 2686 and 2686.04.

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IPR2024-00744

Correspondence

All correspondence relating to this *ex parte* reexam proceeding should be directed as follows:

By **U.S. Postal Service Mail** to:

Mail Stop *Ex Parte* Reexam
ATTN: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand to: Customer Service Window
Randolph Building
401 Dulany St.
Alexandria, VA 22314

Registered users of EFS-Web may alternatively submit correspondence via the electronic filing system at https://efs.uspto.gov/efile/myportal/efs-registered

Any inquiry concerning this communication or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:

/Linh M. Nguyen/
Primary Examiner, Art Unit 3992

Conferees:
/James Menefee/
Primary Examiner, Art Unit 3992

/JENNIFER MCNEIL/
Supervisory Patent Examiner, Art Unit 3992

Orange Exhibit No. 2003
IPR2024-00744

Order Granting / Denying Request For Ex Parte Reexamination	**Control No.** 90/013,169	**Patent Under Reexamination** 8031064
	Examiner Linh M. Nguyen	**Art Unit** 3992

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

The request for *ex parte* reexamination filed *28 February 2014* has been considered and a determination has been made. An identification of the claims, the references relied upon, and the rationale supporting the determination are attached.

Attachments: a)☒ PTO-892, b)☐ PTO/SB/08, c)☐ Other: _____

1. ☒ The request for *ex parte* reexamination is GRANTED.

RESPONSE TIMES ARE SET AS FOLLOWS:

For Patent Owner's Statement (Optional): TWO MONTHS from the mailing date of this communication (37 CFR 1.530 (b)). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).**

For Requester's Reply (optional): TWO MONTHS from the **date of service** of any timely filed Patent Owner's Statement (37 CFR 1.535). **NO EXTENSION OF THIS TIME PERIOD IS PERMITTED.** If Patent Owner does not file a timely statement under 37 CFR 1.530(b), then no reply by requester is permitted.

2. ☐ The request for *ex parte* reexamination is DENIED.

This decision is not appealable (35 U.S.C. 303(c)). Requester may seek review by petition to the Commissioner under 37 CFR 1.181 within ONE MONTH from the mailing date of this communication (37 CFR 1.515(c)). **EXTENSION OF TIME TO FILE SUCH A PETITION UNDER 37 CFR 1.181 ARE AVAILABLE ONLY BY PETITION TO SUSPEND OR WAIVE THE REGULATIONS UNDER 37 CFR 1.183.**

In due course, a refund under 37 CFR 1.26 (c) will be made to requester:

a) ☐ by Treasury check or,

b) ☐ by credit to Deposit Account No. _____, or

c) ☐ by credit to a credit card account, unless otherwise notified (35 U.S.C. 303(c)).

cc:Requester (if third party requester)

Notice of References Cited	Application/Control No. 90/013,169	Applicant(s)/Patent Under Reexamination 8031064	
	Examiner Linh M. Nguyen	Art Unit 3992	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,079,033	07-2006	Itou, Shintarou	340/572.3
*	B	US-6,941,801	09-2005	Lemense et al.	73/146
*	C	US-6,414,592	07-2002	Dixit et al.	340/447
*	D	US-6,927,679	08-2005	Taguchi et al.	340/442
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent under Reexamination	
	90/013,169	8031064	
	Examiner	Art Unit	
	Linh M. Nguyen	3992	

SEARCHED			
Class	Subclass	Date	Examiner
None		4/2/2014	LMN

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Review of patented file's prosecution history	4/2/2014	LMN

Reexamination	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90/013,169	8031064
	Certificate Date	Certificate Number

Requester Correspondence Address:	☐ Patent Owner	☒ Third Party

DE LUCA,VINCENT
Vorys, Sater, Seymour & Pease LLP
1909 K St., N.W.
Suite 900
Washington, DC 20006

LITIGATION REVIEW ☒	LMN (examiner initials)	4/2/2014 (date)
Case Name		Director Initials
None		

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	NUMBER
1. N/A	
2.	
3.	
4.	

U.S. Patent and Trademark Office DOC. CODE **RXFILJKT**

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IPR2024-00744

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/013,169	02/28/2014	8031064	8031604.RE	1047

24728 7590 07/11/2014
MORRIS MANNING MARTIN LLP
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ATLANTA, GA 30326

EXAMINER	
NGUYEN, LINH M	
ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
07/11/2014	PAPER

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The time period for reply, if any, is set in the attached communication.

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(THIRD PARTY REQUESTER'S CORRESPONDENCE ADDRESS)

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EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/013,169*.

PATENT NO. *8031064*.

ART UNIT *3992*.

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

Orange Exhibit No. 2003
IPR2024-00744

Office Action in Ex Parte Reexamination	**Control No.** 90/013,169	**Patent Under Reexamination** 8031064	
	Examiner Linh M. Nguyen	**Art Unit** 3992	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

a. ☐ Responsive to the communication(s) filed on _____ .
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

b. ☐ This action is made FINAL.

c. ☒ A statement under 37 CFR 1.530 has not been received from the patent owner.

A shortened statutory period for response to this action is set to expire *2* month(s) from the mailing date of this letter. Failure to respond within the period for response will result in termination of the proceeding and issuance of an *ex parte* reexamination certificate in accordance with this action. 37 CFR 1.550(d). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).** If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☐ Information Disclosure Statement, PTO/SB/08.
3. ☐ Interview Summary, PTO-474.
4. ☐ _____.

Part II SUMMARY OF ACTION

1a. ☒ Claims *8 and 10-15* are subject to reexamination.
1b. ☐ Claims _____ are not subject to reexamination.
2. ☐ Claims _____ have been canceled in the present reexamination proceeding.
3. ☐ Claims _____ are patentable and/or confirmed.
4. ☒ Claims *8 and 10-15* are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ The drawings, filed on _____ are acceptable.
7. ☐ The proposed drawing correction, filed on _____ has been (7a) ☐ approved (7b) ☐ disapproved.
8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the certified copies have
   1 ☐ been received.
   2 ☐ not been received.
   3 ☐ been filed in Application No. _____ .
   4 ☐ been filed in reexamination Control No. _____.
   5 ☐ been received by the International Bureau in PCT application No. _____.
   * See the attached detailed Office action for a list of the certified copies not received.
9. ☐ Since the proceeding appears to be in condition for issuance of an *ex parte* reexamination certificate except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte* Quayle, 1935 C.D. 11, 453 O.G. 213.
10. ☒ Other: *Claims 1-7, 9 were cancelled by a previous reexamination certificate.*

cc: Requester (if third party requester)

The present application is being examined under the pre-AIA first to invent provisions.

NON-FINAL REJECTION

The present application is being examined under the pre-AIA first to invent provisions.

This is an *ex parte* reexamination of claims affecting claims 8 and 10-15 of United States Patent Number 8,031,064 (hereinafter "the '064 patent"), entitled "TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME". The '064 patent was previously subject to reexaminations 90/012,430 ("the '12,430 proceeding") and the claims are as presented in the reexamination certificate from that proceeding.

References Cited in the Request

U.S. 7,079,033 to Itou, July 18, 2006

U.S. 6,941,801 to Lemense, et al. (hereinafter "Lemense"), September 13, 2005

U.S. 6,414,592 to Dixit, et al. (hereinafter "Dixit"), July 2, 2002

U.S. 6,927,679 to Taguchi, et al. (hereinafter "Taguchi"), August 9, 2005.

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1. Claim 8 is unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Dixit and Itou.

2. Claim 8 is unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense and Itou.

3. Claims 10-13[1] are unpatentable under 35 U.S.C. § 102(a) and/or 102(b) as being anticipated by Lemense.

4. Claims 14 and 15 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense and Dixit.

5. Claim 14 and 15 are unpatentable under 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense.

Claim Rejections - 35 USC §§ 102 & 103

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

[1] There appears to be a typographical error at page 15, line 1 of the Request; "Claim 10" should instead be replaced with "Claims 10-13" since the Request provides explanation for SNQ of all claims 10-13 at pp. 34-38.

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> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claim 8 is rejected under pre-AIA 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Dixit and Itou.

This rejection was proposed by the third party requester in the request for reexamination, and it is accepted for the reasons set forth in the request for reexamination as shown in the explanation and the item-matching at pp. 18-27 of the request, which is hereby incorporated by reference as the rejection.

2. Claim 8 is rejected under pre-AIA 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense and Itou.

This rejection was proposed by the third party requester in the request for reexamination, and it is accepted for the reasons set forth in the request for reexamination as shown in the explanation and the item-matching at pp. 18-20 and 27-34 of the request, which is hereby incorporated by reference as the rejection.

3. Claims 10-13[2] are rejected under pre-AIA 35 U.S.C. § 102(b)[3] as being anticipated by Lemense.

---

[2] There appears to be a typographical error at page 15, line 1 of the request; "Claim 10" should instead be replaced with "Claims 10-13" since the Request provides explanation for SNQ of all claims 10-13 at pp. 34-38.

[3] Although requester proposed this rejection under both 35 U.S.C. 102(a) and 102(b) only 102(b) is applied since reference to Lemense was issued over a year before filing.

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This rejection was proposed by the third party requester in the request for reexamination, and it is accepted for the reasons set forth in the request for reexamination as shown in the explanation and the item-matching at pp. 34-38 of the Request, which is hereby incorporated by reference as the rejection.

4. Claims 14 and 15 are rejected under pre-AIA 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense and Dixit.

This rejection was proposed by the third party requester in the request for reexamination, and it is accepted for the reasons set forth in the request for reexamination as shown in the explanation and the item-matching at pp. 38-49 of the Request, which is hereby incorporated by reference as the rejection.

5. Claim 14 and 15 are rejected under pre-AIA 35 U.S.C. § 103(a) as being obvious over Taguchi in view of Lemense.

This rejection was proposed by the third party requester in the request for reexamination, and it is accepted for the reasons set forth in the request for reexamination as shown in the explanation and the item-matching at pp. 49-59 of the Request, which is hereby incorporated by reference as the rejection.

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Conclusion

In order to ensure full consideration of any amendments, affidavits or declarations, or other documents as evidence of patentability, such documents must be submitted in response to this Office action. Submissions after the next Office action, which is intended to be a final action, will be governed by the requirements of 37 CFR 1.116, after final rejection and 37 CFR 41.33 after appeal, which will be strictly enforced.

Patent owner is reminded that any proposed amendment to the specification and/or claims in this proceeding must comply with 37 CFR 1.530(d)-(j).

Extensions of time under 37 CFR 1.136(a) will not be permitted in these proceedings because the provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Additionally, 35 U.S.C. 305 requires that *ex parte* reexamination proceedings "will be conducted with special dispatch" (37 CFR 1.550(a)). Extensions of time in *ex parte* reexamination proceedings are provided for in 37 CFR 1.550(c).

The patent owner is reminded of the continuing responsibility under 37 CFR 1.565(a), to apprise the Office of any litigation activity, or other prior or concurrent proceeding, involving the base patent throughout the course of this reexamination

Orange Exhibit No. 2003
IPR2024-00744

proceeding. See MPEP §§ 2207, 2282 and 2286. The third party requester is similarly apprised of the ability to disclose such proceedings.

Correspondence

All correspondence relating to this *inter partes* reexamination proceeding should be directed:
By Mail to: Mail Stop *Inter Partes* Reexam
Attn: Central Reexamination Unit
Commissioner for Patents
United States Patent & Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand: Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Registered users of EFS-Web may alternatively submit such correspondence via the electronic filing system EFS-Web, at https://efs.uspto.gov/efile/myportal/efs-registered.html. EFS-Web offers the benefit of quick submission to the particular area of the Office that needs to act on the correspondence. Also, EFS-Web submissions are "soft scanned" (i.e., electronically uploaded) directly into the official file for the reexamination proceeding, which offers parties the opportunity to review the content of their submissions after the "soft scanning" process is complete.

Any inquiry concerning this communication or earlier communications from the examiner, or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:

/Linh M. Nguyen/
Primary Examiner, Art Unit 3992

Conferees:

/JAMES MENEFEE/

Primary Examiner, Art Unit 3992

Orange Exhibit No. 2003
IPR2024-00744

/JENNIFER MCNEIL/

Supervisory Patent Examiner, Art Unit 3992

Orange Exhibit No. 2003
IPR2024-00744

Reexamination	Application/Control No. 90/013,169	Applicant(s)/Patent Under Reexamination 8031064
	Certificate Date	Certificate Number

Requester	Correspondence Address:	☐ Patent Owner	☒ Third Party

DE LUCA,VINCENT
Vorys, Sater, Seymour & Pease LLP
1909 K St., N.W.
Suite 900
Washington, DC 20006

LITIGATION REVIEW ☒	LMN (examiner initials)	6/23/2014 (date)
Case Name		Director Initials
None		/JM/ for IY

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	NUMBER
1. N/A	
2.	
3.	
4.	

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/013,169	02/28/2014	8031064	8031604.RE	1047

24728 7590 07/31/2014
MORRIS MANNING MARTIN LLP
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EXAMINER	
NGUYEN, LINH M	
ART UNIT	**PAPER NUMBER**
3992	

MAIL DATE	DELIVERY MODE
07/31/2014	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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(THIRD PARTY REQUESTER'S CORRESPONDENCE ADDRESS)

DE LUCA, VINCENT

Vorys, Sater, Seymour & Pease LLP

1909 K St., N.W.

Suite 900

Washington, DC 20006

EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/013,169*.

PATENT NO. *8031064*.

ART UNIT *3992*.

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

Orange Exhibit No. 2003
IPR2024-00744

Ex Parte Reexamination Interview Summary	Control No.	Patent Under Reexamination
	90/013,169	8031064
	Examiner	Art Unit
	Linh M. Nguyen	3992

All participants (USPTO personnel, patent owner, patent owner's representative):

(1) *Linh M. Nguyen*	(3) *James Menefee*
(2) *Woo Choi*	(4) *Calvin Chen*

Date of Interview: *29 July 2014*

Type: a)☒ Telephonic b)☐ Video Conference
c)☐ Personal (copy given to: 1)☐ patent owner 2)☐ patent owner's representative)

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____

Agreement with respect to the claims f)☐ was reached. g)☒ was not reached. h)☐ N/A.
Any other agreement(s) are set forth below under "Description of the general nature of what was agreed to…"

Claim(s) discussed: *16-25*.

Identification of prior art discussed: *Dixit, Lemense*.

Description of the general nature of what was agreed to if an agreement was reached, or any other comments:
Discussed amendment regarding new claims 16-25. Examiner made reference to potential claim broadening as to at least new independent claim 20..

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims patentable, if available, must be attached. Also, where no copy of the amendments that would render the claims patentable is available, a summary thereof must be attached.)

A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION MUST INCLUDE PATENT OWNER'S STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. (See MPEP § 2281). IF A RESPONSE TO THE LAST OFFICE ACTION HAS ALREADY BEEN FILED, THEN PATENT OWNER IS GIVEN **ONE MONTH** FROM THIS INTERVIEW DATE TO PROVIDE THE MANDATORY STATEMENT OF THE SUBSTANCE OF THE INTERVIEW (37 CFR 1.560(b)). THE REQUIREMENT FOR PATENT OWNER'S STATEMENT CAN NOT BE WAIVED. **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).**

/Linh M. Nguyen/ Primary Examiner, Art Unit 3992	/James Menefee/ Primary Examiner AU 3992	/Woo H. Choi/ Supervisory Patent Reexamination Specialist, AU 3992

cc: Requester (if third party requester)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner:	Orange Electronic Co., LTD.	Confirmation No.:	1047
U.S. Patent No.:	8,031,064	Group Art Unit:	3992
Application No.:	90/013,169	Examiner:	Linh M. Nguyen
Filed:	February 28, 2014		
For:	Tire Pressure Detecting Apparatus and Tire Pressure Detector Identification Copying Method for the Same		

AMENDMENT AND RESPONSE TO OFFICE ACTION
IN *EX PARTE* RE-EXAMINATION

Mail Stop: *Ex Parte* Re-Examination
Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

August 14, 2014

Customer No. 24728

Dear Sir/Madam:

In response to the Office Action mailed July 11, 2014, please amend the above-identified application as follows and consider the following Remarks:

Amendments to the Claims begin on page **2** of this paper.

Claim Status and Support for Amendments (37 CFR 1.530(e)) begin on page **8** of this paper.

Remarks begin on page **9** of this paper.

A **PATENT OWNER STATEMENT OF THE INTERVIEW UNDER 37 C.F.R. 1.560** is attached as a separate paper following the Remarks of the paper.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims

1-15. (Canceled).

16. (New): A tire pressure detecting system, comprising:

an identification rewritable tire pressure detector comprising:

a micro-processing module having a rewritable memory unit to record an identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal, wherein the RF signal comprises the detection result and the identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module to supply power to the identification rewriteable tire pressure detector; and

an interface arranged to receive an external signal and send the external signal to the micro-processing module, wherein the external signal comprises an external identification to be written into the rewriteable memory unit or to be used to overwrite a preset identification in the rewriteable memory unit; and

a portable setting apparatus arranged to communicate with the identification rewriteable tire pressure detector, comprising:

a control module;

an input module connected to the control module to enable an operator to manually input an identification to be written into the identification rewriteable tire pressure detector:

a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector and to send the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the identification rewriteable tire pressure detector, via the interface, wherein the external signal comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source connected to the control module to supply power to the setting apparatus;

wherein the setting apparatus is configured to:

obtain an update identification to be written into a new identification rewriteable tire pressure detector either by (1) receiving the RF signal from an old tire pressure detector by the receiving module, retrieving an old identification of the old tire pressure detector from the RF signal, and using the old identification as the update identification, or by (2) receiving a manual input of the identification from the input module, and using the identification as the update identification;

store the update identification in the setting apparatus; and

generate the external signal comprising the update identification as the external identification, and send the external signal to the new identification rewriteable tire pressure detector such that the new identification rewriteable tire pressure detector records the update identification in the rewritable memory unit or overwrites the preset identification in the rewritable memory unit by the update identification.

17. (New): The tire pressure detecting apparatus as claimed in claim 16, wherein the input module comprises a code scanner.

18. (New): A tire pressure detecting system, comprising:

an identification rewritable tire pressure detector comprising:

a micro-processing module having a rewritable memory unit to record an

identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal, wherein the RF signal comprises the detection result and the identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module to supply power to the identification rewriteable tire pressure detector; and

an interface arranged to receive an external signal and send the external signal to the micro-processing module, wherein the external signal comprises an external identification to be written into the rewriteable memory unit or to be used to overwrite a preset identification in the rewriteable memory unit; and

a portable setting apparatus arranged to communicate with the identification rewriteable tire pressure detector, comprising:

a control module;

an input module connected to the control module to enable an operator to manually input an identification to be written into the identification rewriteable tire pressure detector;

a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector and to send the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the identification rewriteable tire pressure detector, via the interface, wherein the external signal comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source connected to the control module to supply power to the setting apparatus;

wherein the setting apparatus is configured to:

obtain an update identification to be written into a new identification rewriteable tire pressure detector, wherein the update identification is either (1) an old identification of an old tire pressure detector, obtained by receiving the RF signal from the old tire pressure detector by the receiving module and retrieving the old identification from the RF signal, or (2) the identification manually inputted and received from the input module; and

generate the external signal comprising the update identification as the external identification, and send the external signal to the new identification rewriteable tire pressure detector;

wherein the new identification rewriteable tire pressure detector is configured to:

acquire the update identification from the external signal;

when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and

when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit.

19. (New): The tire pressure detecting apparatus as claimed in claim 18, wherein the input module comprises a code scanner.

20. (New): A tire pressure detector identification updating method comprising the steps of:

providing a setting apparatus, comprising an input module and a receiving module;

obtaining, by the setting apparatus, an update identification to be written into a new identification rewriteable tire pressure detector by either (1) reading an old identification from an old tire pressure detector by the receiving module of the setting apparatus by receiving radio frequency (RF) signal from the old tire pressure detector by the receiving module and retrieving the old identification of the old tire pressure detector from the RF signal, and storing the old identification in the setting apparatus for using the old identification as the update identification,

or (2) receiving an input of a manually input identification from an input module of the setting apparatus, and using the manually input identification as the update identification;

when the update identification is the old identification from the old tire pressure detector, wirelessly writing the old identification into a new identification rewritable tire pressure detector by the setting apparatus by generating an external signal comprising the old identification, and sending the external signal to the new identification rewritable tire pressure detector, such that the new identification rewriteable tire pressure detector records the update identification in a rewritable memory unit or overwrites a preset identification in the rewritable memory unit by the update identification; and

when the update identification is the manually input identification from the input module, writing the manually input identification into the new identification rewritable tire pressure detector by the setting apparatus by generating the external signal comprising the manually input identification, and sending the external signal to a new identification rewriteable tire pressure detector, such that the new identification rewriteable tire pressure detector records the update identification in the rewritable memory unit or overwrites the preset identification in the rewritable memory unit by the update identification.

21. (New): The method as claimed in claim 20, wherein the new identification rewriteable tire pressure detector is configured to record the update identification in the rewritable memory unit or overwrite the preset identification in the rewritable memory unit by the update identification by:

acquiring the update identification from the external signal;

when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and

when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit.

22. (New): The method as claimed in claim 20, further comprising:

verifying the update identification newly recorded in the rewritable memory unit of the

new identification rewriteable tire pressure detector.

23. (New): The method as claimed in claim 22, wherein the verifying step comprises:

receiving, by the setting apparatus, a wireless signal from the new identification rewriteable tire pressure detector, wherein the wireless signal comprises the update identification newly recorded in the rewritable memory unit;

judging, by the setting apparatus, consistency of the update identification newly recorded in the rewritable memory unit and the old identification of the old tire pressure detector; and

if the update identification newly recorded in the rewritable memory unit is not consistent with the old identification of the old tire pressure detector, performing the generating step again.

24. (New): The method as claimed in claim 20, wherein the setting apparatus is configured to receive the RF signal wirelessly.

25. (New): The method as claimed in claim 20, wherein the input module comprises a code scanner.

CLAIM STATUS AND SUPPORT FOR AMENDMENTS (37 CFR 1.530(e))

Claims 1-15 were under reexamination. Of them, claims 1-13 remained unchanged relative to the original patent, and claims 14-15 were new relative to the original patent, before this amendment as set forth above.

By this amendment, new claims 16-25 are added, and claims 1-15 are canceled.

Support for the amendment can be found throughout the original patent. None of the newly added claims 16-25 broadens the claim scope of the originally issued claims 1-13.

Upon entry of this amendment, claims 16-25 are pending in in this reexamination proceeding. The claim status is listed as follows:

Claims 1-15.	Canceled.
Claims 16-25.	Pending - new.

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REMARKS

Claims 1-15 were under reexamination. By the amendment, new claims 16-25 are added, and claims 1-15 are canceled.

In the Office Action, claim 8 was rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Taguchi et al. (US Pat. No. 6,927,679, hereinafter "Taguchi") in view of Dixit et al. (U.S. Pat. No. 6,414,592, hereinafter "Dixit") and Itou (U.S. Pat. No. 7,079,033, hereinafter "Itou"). Claim 8 was rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Taguchi in view of Lemense et al. (U.S. Pat. No. 6,941,801, hereinafter "Lemense") and Itou. Claims 10-13 were rejected under 35 U.S.C. 103(a) as being allegedly anticipated by Lemense. Claims 14 and 15 were rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Taguchi in view of Lemense and Dixit. Claims 14 and 15 were rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Taguchi in view of Lemense.

A telephone interview which, at the request of the Patent Owner and for the purpose of facilitating the reexamination process, was conducted between the Examiners of the Reexamination Panel and the Patent Owner's representative of record: Calvin Chen on July 29, 2014. During the interview, the Patent Owner's representative presented proposed amendments and arguments, and described the difference between the subject matter of proposed new independent claims 16, 18 and 20 and the cited references of Taguchi, Itou, Lemense and Dixit. The Patent Owner's representative also specified that the cited references do not teach such feature. While no agreement was reached during the interview regarding the patentability of the proposed claims 16, 18 and 20, the Examiners of the Reexamination Panel reminded that the Patent Owner should make sure that any amended or new claims, if filed in a formal Response to the Office Action, should not enlarges the scope of the original claims, pursuant to 35 U.S.C. 305. The Examiners also requested that the Patent Owner provide a written statement of the interview.

The Patent Owner appreciates very much the careful review of the patent by the Reexamination Panel, and gratefully acknowledges the courtesies extended by the Reexamination Panel in granting and conducting the interview. The Patent Owner also appreciates the professionalism shown by the Examiners during the telephone interview.

In response, as set forth above, without acquiescing to the Examiners' assertion, which the Patent Owner does not agree, and in order to advance the prosecution of the confirmed claims and allowable claims, the Patent Owner has canceled claims 1-15 without prejudice, waiver or disclaimer. With the cancelation of claims 1-15, the Patent Owner respectfully submits that there are no outstanding rejections in this reexamination proceeding.

Furthermore, new claims 16-25 have been added. Of them, new claims 16, 18 and 20 are independent claims. Support for the amendment can be found throughout the original patent. None of the newly added claims 16-25 broadens the claim scope of the originally issued claims 1-13.

Any amendments to the claims not specifically referred to herein as being included for the purpose of distinguishing the claims from cited references are included for the purpose of clarification, consistence and/or grammatical correction only.

In view of the foregoing, the Patent Owner respectfully requests allowance of the presently pending claims in this reexamination proceeding.

The following remarks herein are considered to be responsive thereto.

New Claims 16-17

New claim 16 includes the limitation of canceled claim 1, and the new limitations as follows:

> wherein the setting apparatus is configured to:
>
> ***obtain an update identification to be written into a new identification rewriteable tire pressure detector either by (1) receiving the RF signal from an old tire pressure detector by the receiving module, retrieving the old identification of the old tire pressure detector from the RF signal, and using the old identification as the update identification, or by (2) receiving a manual input of the identification from the input module, and using the identification as the update identification;***
>
> store the update identification in the setting apparatus; and
>
> generate the external signal comprising the update identification as the external identification, and send the external signal to the new identification rewriteable tire pressure detector ***such that the new identification rewriteable tire pressure detector records the update identification in the rewritable memory unit or overwrites the preset identification in the rewritable memory unit by the update identification***. (Emphasis added.)

Specifically, according to new claim 16, the setting apparatus includes an input module to enable an operator to input an identification to be written into the identification rewriteable tire pressure detector, and a receiving module to receive the RF signal from the identification rewriteable tire pressure detector and to send the RF signal to the control module. The setting apparatus may obtain an ***update identification*** to be recorded into a rewritable memory unit of a new identification rewriteable tire pressure detector, or to be used to ***overwrite a preset identification in the rewritable memory unit by the update identification***. The update identification can be obtained by either one of the following two ways:

(1) ***receiving, by the receiving module, the RF signal from an old tire pressure detector, retrieving the old identification of the old tire pressure detector from the RF signal, and using the old identification as the update identification***, or

(2) ***receiving, from the input module, a manual input of the identification, and using the identification as the update identification***.

In other words, the setting apparatus may receive the update identification either from the receiving module (old ID from an old tire pressure detector), or from the input module (manually input ID).

In the Office Action, the Examiner relied upon Taguchi, Dixit, Lemense and Itou as the basis of rejecting canceled claims 8 and 10-15. Specifically, the Examiner acknowledged that Taguchi discloses a tire pressure detector with the exception of the input module. To remedy this deficiency, the Examiner relied upon Dixit and Lemense, stating that Lemense and Dixit each discloses the manual ID input. Specifically, the Examiner allegedly stated that Dixit includes a plurality of manual input arrangements 42A-42D (Figure 1), each associated with one of the tire sensor units (Dixit, column 3, lines 38-45), and a transmitter device 44 (Figure 2) that a person manually operates to input an identification code via an input key pad 50. Further, the Examiner allegedly stated that Lemense includes a service tool 24 including a microcontroller 30, which performs various functions to interrogate a sensor unit using the service tool 24 to receive an ID code from each sensor (Lemense, column 3, lines 4-36), and that the microcontroller 30 is connected to an interface 36 that includes an input device (i.e. keypad 26). Further, the Examiner allegedly stated that Itou includes an ID registration tool 60 that is used to

read the IDs from bar codes 5/6/7/8 for wiring the bar codes in the tire pressure monitoring apparatus 50.

However, none of the references teaches the action of the input module as recited in new claim 16. Specifically, there is no description in any of the cited references that ***the setting apparatus receives from an input module a manually input identification as the update identification***. In Dixit, the manual input arrangements 42A-42D are ***directly connected*** to the respective tire condition sensor units 18A-18D (Dixit, FIG. 1 and column 3, lines 43-45), and the transmitter device 44 is a part of the manual input arrangement 42 (Dixit, column 4, lines 16-17). Nowhere in Dixit discloses or teaches an input device connected to a ***setting apparatus***, which is used to obtain ***an update identification*** for the sensor. In Lemense, the service tool 24 is used "to replicate or clone the ID code of a broken sensor unit into a replacement sensor unit over a LF communication link between the service tool and the replacement sensor unit." (Lemense, column 3, lines 56-60.) In other words, Lemense at best teaches ***the receiving module***, but not the input module, as recited in new claim 16. Although Lemense teaches a keypad 26 (column 3, line 13), nowhere in Lemense describes the data that can be input by the keypad 26 or how the microcontroller 30 processes the data input by the keypad 26. In Itou, the ID registration tool 60 is used to read the IDs from bar codes 5/6/7/8 for wiring the bar codes in the tire pressure monitoring apparatus 50. In other words, Itou at best teaches ***the receiving module***, but not the input module, as recited in new claim 16.

Accordingly, the cited references, taken alone or in combination, fail to disclose, teach or suggest the limitation of "wherein the setting apparatus is configured to: ***obtain an update identification to be written into a new identification rewriteable tire pressure detector either by (1) receiving the RF signal from an old tire pressure detector by the receiving module, retrieving the old identification of the old tire pressure detector from the RF signal, and using the old identification as the update identification, or by (2) receiving a manual input of the identification from the input module, and using the identification as the update identification***", as recited in new claim 16.

Thus, new claim 16 and its dependent claim 17 should be patentable over the cited references under 35 U.S.C. 103(a).

New Claims 18-19

New claim 18 includes the limitation of canceled claim 1, and the new limitations as follows:

> wherein the setting apparatus is configured to:
> ***obtain an update identification to be written into a new identification rewriteable tire pressure detector, wherein the update identification is either (1) an old identification of an old tire pressure detector, obtained by receiving the RF signal from the old tire pressure detector by the receiving module and retrieving the old identification from the RF signal, or (2) the identification received from the input module;*** and
> generate the external signal comprising the update identification as the external identification, and send the external signal to the new identification rewriteable tire pressure detector;
> wherein the new identification rewriteable tire pressure detector is configured to:
> acquire the update identification from the external signal;
> ***when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and***
> ***when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit.*** (Emphasis added.)

Specifically, according to new claim 18, the setting apparatus includes an input module to enable an operator to input an identification to be written into the identification rewriteable tire pressure detector, and a receiving module to receive the RF signal from the identification rewriteable tire pressure detector and to send the RF signal to the control module. The setting apparatus may obtain an ***update identification*** to be recorded into a rewritable memory unit of a new identification rewriteable tire pressure detector, or to be used to ***overwrite a preset identification in the rewritable memory unit by the update identification***. The update identification can be one of the following two types of identifications:

(1) ***an old identification of an old tire pressure detector***, obtained by ***receiving the RF signal from the old tire pressure detector by the receiving module and retrieving the old identification from the RF signal***, or

(2) ***an identification manually inputted and*** received from ***the input module***.

In other words, the setting apparatus may receive the update identification either from the

Orange Exhibit No. 2003
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receiving module (old ID from an old tire pressure detector), or from the input module (manually input ID).

Furthermore, according to new claim 18, after the new identification rewriteable tire pressure detector acquires the update identification from the external signal, the new identification rewriteable tire pressure detector will process the update identification determine with two possible conditional options, based on whether the rewritable memory unit has the preset identification stored therein or not:

(a) when the rewritable memory unit ***has the preset identification*** stored therein, the new identification rewriteable tire pressure detector ***overwrites the preset identification in the rewritable memory unit by the update identification***, or

(b) when the rewritable memory unit ***does not have the preset identification*** stored therein, the new identification rewriteable tire pressure detector ***records the update identification in the rewritable memory unit***.

In the Office Action, the Examiner relied upon Taguchi, Dixit, Lemense and Itou as the basis of rejecting canceled claims 8 and 10-15.

However, as discussed above, none of the references teaches the action of the input module as recited in new claim 18. Specifically, there is no description in any of the cited references that ***the setting apparatus receives from an input module a manually input identification as the update identification***.

Accordingly, the cited references, taken alone or in combination, fail to disclose, teach or suggest the limitation of "wherein the setting apparatus is configured to: ***obtain an update identification to be written into a new identification rewriteable tire pressure detector, wherein the update identification is either (1) an old identification of an old tire pressure detector, obtained by wirelessly receiving the RF signal from the old tire pressure detector by the receiving module and retrieving the old identification from the RF signal, or (2) the identification manually inputted and received from the input module***", as recited in new claim 18.

Furthermore, none of the references teaches the two possible conditional options of the new identification rewriteable tire pressure detector as recited in new claim 18. Specifically,

Lemense at best teaches that the service tool 24 is used "to replicate or clone the ID code of a broken sensor unit into a replacement sensor unit over a LF communication link between the service tool and the replacement sensor unit." (Lemense, column 3, lines 56-60.) Nowhere in Lemense discloses or teaches how the replicated or cloned ID code is stored into the replacement sensor unit, or that two possible conditional options should be used in the replication or clone step.

Accordingly, the cited references, taken alone or in combination, fail to disclose, teach or suggest the limitation of "wherein the new identification rewriteable tire pressure detector is configured to: … ***when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit***", as recited in new claim 18.

Thus, new claim 18 and its dependent claim 19 should be patentable over the cited references under 35 U.S.C. 103(a).

New Claims 20-25

New claim 20 is a method claim corresponding to the apparatus claim 16. Specifically, new claim 20 includes the limitation of canceled claim 10, and the new limitation as follows:

> ***obtaining, by the setting apparatus, an update identification to be written into a new identification rewriteable tire pressure detector by either (1) reading an old identification from an old tire pressure detector by the receiving module of the setting apparatus by receiving radio frequency (RF) signal from an the old tire pressure detector by the receiving module and retrieving the old identification of the old tire pressure detector from the RF signal, and storing the old identification in the setting apparatus for using the old identification as the update identification, or (2) receiving an input of a manually input identification from an input module of the setting apparatus, and using the manually input identification as the update identification*** [.] (Emphasis added.)

As discussed above, none of the cited references teaches the action of the input module as recited in new claim 20. Specifically, there is no description in any of the cited references about ***receiving an input of a manually input identification from the input module of the setting***

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apparatus, and using the manually input identification as the update identification.

Accordingly, the cited references, taken alone or in combination, fail to disclose, teach or suggest the limitation of "***obtaining, by the setting apparatus, an update identification to be written into a new identification rewriteable tire pressure detector by either (1) reading an old identification from an old tire pressure detector by the receiving module of the setting apparatus by receiving radio frequency (RF) signal from an the old tire pressure detector by the receiving module and retrieving the old identification of the old tire pressure detector from the RF signal, and storing the old identification in the setting apparatus for using the old identification as the update identification, or (2) receiving an input of a manually input identification from an input module of the setting apparatus, and using the manually input identification as the update identification***", as recited in new claim 20.

Thus, new claim 20 and its dependent claim 21-25 should be patentable over the cited references under 35 U.S.C. 103(a).

New Claim 21

New claim 21 is a dependent method claim corresponding to the new limitation as recited in the apparatus claim 18. Specifically, new claim 21 includes the limitation of:

> wherein new identification rewriteable tire pressure detector is configured to record the update identification in the rewritable memory unit or overwrite the preset identification in the rewritable memory unit by the update identification by:
>
> acquiring the update identification from the external signal;
>
> ***when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and***
>
> ***when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit.*** (Emphasis added.)

As discussed above, none of the references teaches the two conditional options of the new identification rewriteable tire pressure detector as recited in new claim 21. Accordingly, the cited references, taken alone or in combination, fail to disclose, teach or suggest the limitation of "***when the rewritable memory unit has the preset identification stored therein, overwrite the***

preset identification in the rewritable memory unit by the update identification; and when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit", as recited in new claim 21.

Thus, new claim 21 should be patentable over the cited references under 35 U.S.C. 103(a).

CONCLUSION

The Patent Owner respectfully requests allowance of the presently pending claims in this reexamination proceeding. If the Examiner believes that there are any issues that can be resolved by a telephone conference, or that there are any informalities that can be corrected by an Examiner's amendment, please call the undersigned at 404-495-3678.

It is believed that no fee is due. However, the Commissioner is hereby authorized to charge any deficiency of fees that may be required, and credit of any overpayments to Deposit Account No. 50-3537.

Respectfully submitted,
MORRIS, MANNING & MARTIN, LLP

August 14, 2014



Tim Tingkang Xia
Reg. No. 45,242
Attorney for Patent Owner on the Record

1600 Atlanta Financial Center
3343 Peachtree Road, N.E.
Atlanta, Georgia 30326-1044
Phone: 404-233-7000
Customer No. 24728

EX PARTE **RE-EXAMINATION** **Attorney Docket No.: 26223-98211**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner:	Orange Electronic Co., LTD.	Confirmation No.:	1047
U.S. Patent No.:	8,031,064	Group Art Unit:	3992
Application No.:	90/013,169	Examiner:	Linh M. Nguyen
Filed:	February 28, 2014		
For:	Tire Pressure Detecting Apparatus and Tire Pressure Detector Identification Copying Method for the Same		

PATENT OWNER STATEMENT OF THE INTERVIEW UNDER 37 C.F.R. 1.560

Mail Stop: *Ex Parte* Re-Examination
Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

August 14, 2014

Customer No. 24728

Dear Sir/Madam:

This paper is a Patent Owner's statement of a telephone interview which, at the request of the Patent Owner and for the purpose of facilitating the reexamination process, was conducted between the Examiners of the Reexamination Panel and the Patent Owner's representative of record: Calvin Chen on July 29, 2014. The Patent Owner appreciates very much the careful review of the patent by the Reexamination Panel, and gratefully acknowledges the courtesies extended by the Reexamination Panel in granting and conducting the interview. The Patent Owner also appreciates the professionalism shown by the Examiners during the telephone interview.

During the interview, the Patent Owner's representative presented proposed amendments and arguments, and described the difference between the subject matter of proposed new independent claims 16, 18 and 20 and the cited references of Taguchi, Itou, Lemense and Dixit. In particular, the Patent Owner's representative described the new feature, as recited in the proposed claims 16, 18 and 20, about the setting apparatus being configured to obtain an update

identification, wherein the update identification is either (1) an old identification of an old tire pressure detector, obtained by receiving the RF signal from the old tire pressure detector by the receiving module and retrieving the old identification from the RF signal, or (2) the identification received from the input module. The Patent Owner's representative also specified that the cited references do not teach such feature. While no agreement was reached during the interview regarding the patentability of the proposed claims 16, 18 and 20, the Examiners of the Reexamination Panel reminded that the Patent Owner should make sure that any amended or new claims, if filed in a formal Response to the Office Action, should not enlarges the scope of the original claims, pursuant to 35 U.S.C. 305. The Examiners also requested that the Patent Owner provide a written statement of the interview.

The Patent Owner again wishes to thank the Reexamination Panel for the courtesies in granting and conducting the interview.

Respectfully submitted,
MORRIS, MANNING & MARTIN, LLP

August 14, 2014

Tim Tingkang Xia
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner:	Orange Electronic Co., LTD.	Confirmation No.:	1047
U.S. Patent No.:	8,031,064	Group Art Unit:	3992
Application No.:	90/013,169	Examiner:	Linh M. Nguyen
Filed:	February 28, 2014		
For:	Tire Pressure Detecting Apparatus and Tire Pressure Detector Identification Copying Method for the Same		

CERTIFICATE OF SERVICE

Mail Stop Ex Parte Re-Examination
Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

August 14, 2014

Customer No. 24728

Dear Sir/Madam:

Pursuant to 37 CFR § 1.248, the undersigned, on behalf of the Patent Owner, hereby certifies that a copy of the following documents:

AMENDMENT AND RESPONSE TO OFFICE ACTION IN *EX PARTE* RE-EXAMINATION, and

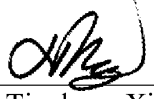
PATENT OWNER STATEMENT OF THE INTERVIEW UNDER 37 C.F.R. 1.560,

both submitted in the above-identified application on **August 14, 2014**, was served on the Third Party Requester at the following address:

Mr. Vincent De Luca
Vorys, Sater, Seymour & Pease LLP
1909 K St., N.W.
Suite 900
Washington, DC 20006

provided for in 37 CFR § 1.33(c) via first class mail on **August 14, 2014**.

Respectfully submitted,
MORRIS, MANNING & MARTIN, LLP



Tim Tingkang Xia
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1600 Atlanta Financial Center
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Customer No. 24728

Electronic Acknowledgement Receipt

EFS ID:	19867035
Application Number:	90013169
International Application Number:	
Confirmation Number:	1047
Title of Invention:	Tire Pressure Detecting Apparatus And Tire Pressure Detector Identification Copying Method For The Same
First Named Inventor/Applicant Name:	8031064
Customer Number:	24728
Filer:	Tim Tingkang Xia/Debby Yew
Filer Authorized By:	Tim Tingkang Xia
Attorney Docket Number:	8031604.RE
Receipt Date:	14-AUG-2014
Filing Date:	28-FEB-2014
Time Stamp:	14:29:35
Application Type:	Reexam (Patent Owner)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Response after non-final action-owner timely	2622398211ResponseReExamOA.pdf	186151 5cf73507254e9a124ce916271775f162a792615b	no	18

Warnings:

Information:

Orange Exhibit No. 2003
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2	Reexam Miscellaneous Incoming Letter	2622398211StmtOfInterview.pdf	124304 d5cf19bb5c19153891f7b0d7ab8a2064b29b0703	no	2
Warnings:					
Information:					
3	Reexam Certificate of Service	2622398211CertificateOfService.pdf	108677 eda7f756a65a2d50a73bc1479a94fc632e4698ab	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	419132		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/013,169	02/28/2014	8031064	26223-98211	1047

24728 7590 09/19/2014
MORRIS MANNING MARTIN LLP
3343 PEACHTREE ROAD, NE
1600 ATLANTA FINANCIAL CENTER
ATLANTA, GA 30326

EXAMINER	
NGUYEN, LINH M	
ART UNIT	**PAPER NUMBER**
3992	

MAIL DATE	DELIVERY MODE
09/19/2014	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
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Alexandria, VA 22313-1450
www.uspto.gov

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(THIRD PARTY REQUESTER'S CORRESPONDENCE ADDRESS)

DE LUCA,VINCENT

Vorys, Sater, Seymour & Pease LLP

1909 K St., N.W.

Suite 900

Washington, DC 20006

EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/013,169*.

PATENT NO. *8031064*.

ART UNIT *3992*.

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

Orange Exhibit No. 2003
IPR2024-00744

FINAL REJECTION

The present application is being examined under the pre-AIA first to invent provisions.

This is an *ex parte* reexamination of claims affecting claims 8 and 10-15 of United States Patent Number 8,031,064 (hereinafter "the '064 patent"), entitled "TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME". The '064 patent was previously subject to reexaminations 90/012,430 ("the '12,430 proceeding") and the claims are as presented in the reexamination certificate from that proceeding.

Status of Claims:

Claims 1-7 and 9 were canceled by the previous reexamination certificate.

According to Patent Owner's amendment filed 8/14/2014:

- Claims 8 and 10-15 are canceled;
- Claims 16-25 are newly added.

References Cited in the Request

U.S. 7,079,033 to Itou, July 18, 2006

U.S. 6,941,801 to Lemense, et al. (hereinafter "Lemense"), September 13, 2005

U.S. 6,414,592 to Dixit, et al. (hereinafter "Dixit"), July 2, 2002

U.S. 6,927,679 to Taguchi, et al. (hereinafter "Taguchi"), August 9, 2005.

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Previous Rejections

All of the rejections previously applied to claims 8 and 10-15 have been removed since these claims are now canceled accordingly to Patent Owner's amendment filed 8/14/2014.

Claim Rejections- 35 USC § 305

New claims 16-19 are rejected under 35 U.S.C. 305 as enlarging the scope of the claim(s) of the patent being reexamined. In 35 U.S.C. 305, it is stated that "[n]o proposed amended or new claim enlarging the scope of a claim of the patent will be permitted in a reexamination proceeding .... "A claim presented in a reexamination "enlarges the scope" & the patent claim(s) where the claim is broader than any claim of the patent. A claim is broader in scope than the original claims if it contains within its scope any conceivable product or process which would not have infringed the original patent. A claim is broadened if it is broader in any one respect, even though it may be narrower in other respects.

New independent claims 16 and 18 are being compared to the based original claim 1, which shows the limitations that both claims 16 and 18 are lacking:

- For "a receiving module...." lacking "*or a tire pressure detector*";

- For "a setting output module…" lacking "*send the external signal to the receiving interface, where the external signal is generated by the control module*".

Orange Exhibit No. 2003
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Claims 17 and 19 depend from independent claims 16 and 18, respectively; as such, they are also rejected under 35 U.S.C. 305 as enlarging the scope of the claim(s) of the patent being reexamined.

STATEMENT OF REASONS

FOR PATENTABILITY AND/OR CONFIRMATION

Claims 20-25 are patentable.

The following is an examiner's statement of reasons for patentability and/or confirmation of the claims found patentable in this reexamination proceeding:

The closest prior art fails to disclose or fairly suggest:

A tire pressure detector identification updating method having the step of *obtaining, by the setting apparatus, an update identification to be written into a new identification rewriteable tire pressure detector by either (1) reading an old identification from an old tire pressure detector by the receiving module of the setting apparatus by receiving radio frequency (RF) signal from an the old tire pressure detector by the receiving module and retrieving the old identification of the old tire pressure detector from the RF signal and storing the old identification in the setting apparatus for using the old identification as the update identification, or (2) receiving an input of a manually input identification from an input module of the setting apparatus, and using the manually input identification as the update identification from an input module of the setting apparatus, and using the manually input identification as the update*

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IPR2024-00744

identification", as recited in new claim 20 (newly added claims 21-25 depend from independent claim 20).

Conclusion

THIS ACTION IS MADE FINAL.

A shortened statutory period for response to this action is set to expire 2 months from the mailing date of this action.

Extensions of time under 37 CFR 1.136(a) do not apply in reexamination proceedings. The provisions of 37 CFR 1.136 apply only to "an applicant" and not to parties in a reexamination proceeding. Further, in 35 U.S.C. 305 and in 37 CFR 1.550(a), it is required that reexamination proceedings "will be conducted with special dispatch within the Office."

Extensions of time in reexamination proceedings are provided for in 37 CFR 1.550(c). A request for extension of time must specify the requested period of extension and it must be accompanied by the petition fee set forth in 37 CFR 1.17(g). Any request for an extension in a third party requested *ex parte* reexamination must be filed on or before the day on which action by the patent owner is due, and the mere filing of a request will not affect any extension of time. A request for an extension of time in a third party requested *ex parte* reexamination will be granted only for sufficient cause, and for a reasonable time specified. Any request for extension in a patent owner requested *ex parte* reexamination for up to two months from the time period set in the Office action must be filed no later than two months from the expiration of the time period set in the Office action. A request for an extension in a patent

owner requested *ex parte* reexamination for more than two months from the time period set in the Office action must be filed on or before the day on which action by the patent owner is due, and the mere filing of a request for an extension for more than two months will not affect the extension. The time for taking action in a patent owner requested *ex parte* reexamination will not be extended for more than two months from the time period set in the Office action in the absence of sufficient cause or for more than a reasonable time.

The filing of a timely first response to this final rejection will be construed as including a request to extend the shortened statutory period for an additional month, which will be granted even if previous extensions have been granted. In no event, however, will the statutory period for response expire later than SIX MONTHS from the mailing date of the final action. See MPEP § 2265.

Correspondence

All correspondence relating to this *ex parte* reexam proceeding should be directed as follows:

By **U.S. Postal Service Mail** to:

Mail Stop *Ex Parte* Reexam
ATTN: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand to: Customer Service Window
Randolph Building
401 Dulany St.

Alexandria, VA 22314

Registered users of EFS-Web may alternatively submit correspondence via the electronic filing system at https://efs.uspto.gov/efile/myportal/efs-registered

Any inquiry concerning this communication or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:

/Linh M. Nguyen/
Primary Examiner, Art Unit 3992

Conferees:

/JAMES MENEFEE/
Primary Examiner, Art Unit 3992

/Andrew J. Fischer/
Supervisory Patent Examiner, Art Unit 3992

Orange Exhibit No. 2003
IPR2024-00744

Office Action in Ex Parte Reexamination	**Control No.** 90/013,169	**Patent Under Reexamination** 8031064	
	Examiner Linh M. Nguyen	**Art Unit** 3992	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

a. ☒ Responsive to the communication(s) filed on *8/14/2014* .
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

b. ☒ This action is made FINAL.

c. ☐ A statement under 37 CFR 1.530 has not been received from the patent owner.

A shortened statutory period for response to this action is set to expire *2* month(s) from the mailing date of this letter. Failure to respond within the period for response will result in termination of the proceeding and issuance of an *ex parte* reexamination certificate in accordance with this action. 37 CFR 1.550(d). **EXTENSIONS OF TIME ARE GOVERNED BY 37 CFR 1.550(c).** If the period for response specified above is less than thirty (30) days, a response within the statutory minimum of thirty (30) days will be considered timely.

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☐ Information Disclosure Statement, PTO/SB/08.
3. ☐ Interview Summary, PTO-474.
4. ☐ _____.

Part II SUMMARY OF ACTION

1a. ☒ Claims *8 and 10-25* are subject to reexamination.
1b. ☐ Claims _____ are not subject to reexamination.
2. ☒ Claims *8 and 10-15* have been canceled in the present reexamination proceeding.
3. ☒ Claims *20-25* are patentable and/or confirmed.
4. ☒ Claims *16-19* are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ The drawings, filed on _____ are acceptable.
7. ☐ The proposed drawing correction, filed on _____ has been (7a) ☐ approved (7b) ☐ disapproved.
8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the certified copies have
   1 ☐ been received.
   2 ☐ not been received.
   3 ☐ been filed in Application No. _____ .
   4 ☐ been filed in reexamination Control No. _____.
   5 ☐ been received by the International Bureau in PCT application No. _____.
   * See the attached detailed Office action for a list of the certified copies not received.
9. ☐ Since the proceeding appears to be in condition for issuance of an *ex parte* reexamination certificate except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte* Quayle, 1935 C.D. 11, 453 O.G. 213.
10. ☐ Other: _____

cc: Requester (if third party requester)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner:	Orange Electronic Co., LTD.	Confirmation No.:	1047
U.S. Patent No.:	8,031,064	Group Art Unit:	3992
Application No.:	90/013,169	Examiner:	Linh M. Nguyen
Filed:	February 28, 2014		
For:	Tire Pressure Detecting Apparatus and Tire Pressure Detector Identification Copying Method for the Same		

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION IN *EX PARTE* RE-EXAMINATION

Mail Stop: *Ex Parte* Re-Examination
Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

October 27, 2014

Customer No. 24728

Dear Sir/Madam:

In response to the Final Office Action mailed September 19, 2014, please amend the above-identified application as follows and consider the following Remarks:

Amendments to the Claims begin on page **2** of this paper.

Claim Status and Support for Amendments (37 CFR 1.530(e)) begin on page **8** of this paper.

Remarks begin on page **9** of this paper.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims

1-15. (Canceled).

16. (Currently amended): A tire pressure detecting system, comprising:

an identification rewritable tire pressure detector comprising:

a micro-processing module having a rewritable memory unit to record an identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal, wherein the RF signal comprises the detection result and the identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module to supply power to the identification rewriteable tire pressure detector; and

an interface arranged to receive an external signal and send the external signal to the micro-processing module, wherein the external signal comprises an external identification to be written into the rewriteable memory unit or to be used to overwrite a preset identification in the rewriteable memory unit; and

a portable setting apparatus arranged to communicate with the identification rewriteable tire pressure detector, comprising:

a control module;

an input module connected to the control module to enable an operator to

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manually input an identification to be written into the identification rewriteable tire pressure detector:

a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector or a tire pressure detector and to send the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the interface of the identification rewriteable tire pressure detector, ~~via the interface,~~ wherein the external signal is generated by the control module and comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source connected to the control module to supply power to the setting apparatus;

wherein the setting apparatus is configured to:

obtain an update identification to be written into a new identification rewriteable tire pressure detector either by (1) receiving the RF signal from an old tire pressure detector by the receiving module, retrieving an old identification of the old tire pressure detector from the RF signal, and using the old identification as the update identification, or by (2) receiving a manual input of the identification from the input module, and using the identification as the update identification;

store the update identification in the setting apparatus; and

generate the external signal comprising the update identification as the external identification, and send the external signal to the new identification rewriteable tire pressure detector such that the new identification rewriteable tire pressure detector records the update identification in the rewritable memory unit or overwrites the preset identification in the rewritable memory unit by the update identification.

17. (Previously presented): The tire pressure detecting apparatus as claimed in claim 16, wherein the input module comprises a code scanner.

18. (Currently amended): A tire pressure detecting system, comprising:

an identification rewritable tire pressure detector comprising:

a micro-processing module having a rewritable memory unit to record an identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal, wherein the RF signal comprises the detection result and the identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module to supply power to the identification rewriteable tire pressure detector; and

an interface arranged to receive an external signal and send the external signal to the micro-processing module, wherein the external signal comprises an external identification to be written into the rewriteable memory unit or to be used to overwrite a preset identification in the rewriteable memory unit; and

a portable setting apparatus arranged to communicate with the identification rewriteable tire pressure detector, comprising:

a control module;

an input module connected to the control module to enable an operator to manually input an identification to be written into the identification rewriteable tire pressure detector:

a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector or a tire pressure detector and to send the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the interface of the identification rewriteable tire pressure detector, ~~via the interface,~~ wherein the external signal is generated by the control module and comprises

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the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source connected to the control module to supply power to the setting apparatus;

wherein the setting apparatus is configured to:

obtain an update identification to be written into a new identification rewriteable tire pressure detector, wherein the update identification is either (1) an old identification of an old tire pressure detector, obtained by receiving the RF signal from the old tire pressure detector by the receiving module and retrieving the old identification from the RF signal, or (2) the identification manually inputted and received from the input module; and

generate the external signal comprising the update identification as the external identification, and send the external signal to the new identification rewriteable tire pressure detector;

wherein the new identification rewriteable tire pressure detector is configured to:

acquire the update identification from the external signal;

when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and

when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit.

19. (Previously presented): The tire pressure detecting apparatus as claimed in claim 18, wherein the input module comprises a code scanner.

20. (Previously presented): A tire pressure detector identification updating method comprising the steps of:

providing a setting apparatus, comprising an input module and a receiving module;

obtaining, by the setting apparatus, an update identification to be written into a new identification rewriteable tire pressure detector by either (1) reading an old identification from an old tire pressure detector by the receiving module of the setting apparatus by receiving radio frequency (RF) signal from the old tire pressure detector by the receiving module and retrieving the old identification of the old tire pressure detector from the RF signal, and storing the old identification in the setting apparatus for using the old identification as the update identification, or (2) receiving an input of a manually input identification from an input module of the setting apparatus, and using the manually input identification as the update identification;

when the update identification is the old identification from the old tire pressure detector, wirelessly writing the old identification into a new identification rewritable tire pressure detector by the setting apparatus by generating an external signal comprising the old identification, and sending the external signal to the new identification rewritable tire pressure detector, such that the new identification rewriteable tire pressure detector records the update identification in a rewritable memory unit or overwrites a preset identification in the rewritable memory unit by the update identification; and

when the update identification is the manually input identification from the input module, writing the manually input identification into the new identification rewritable tire pressure detector by the setting apparatus by generating the external signal comprising the manually input identification, and sending the external signal to a new identification rewriteable tire pressure detector, such that the new identification rewriteable tire pressure detector records the update identification in the rewritable memory unit or overwrites the preset identification in the rewritable memory unit by the update identification.

21. (Previously presented): The method as claimed in claim 20, wherein the new identification rewriteable tire pressure detector is configured to record the update identification in the rewritable memory unit or overwrite the preset identification in the rewritable memory unit by the update identification by:

acquiring the update identification from the external signal;

when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and

when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit.

22. (Previously presented): The method as claimed in claim 20, further comprising:

verifying the update identification newly recorded in the rewritable memory unit of the new identification rewriteable tire pressure detector.

23. (Previously presented): The method as claimed in claim 22, wherein the verifying step comprises:

receiving, by the setting apparatus, a wireless signal from the new identification rewriteable tire pressure detector, wherein the wireless signal comprises the update identification newly recorded in the rewritable memory unit;

judging, by the setting apparatus, consistency of the update identification newly recorded in the rewritable memory unit and the old identification of the old tire pressure detector; and

if the update identification newly recorded in the rewritable memory unit is not consistent with the old identification of the old tire pressure detector, performing the generating step again.

24. (Previously presented): The method as claimed in claim 20, wherein the setting apparatus is configured to receive the RF signal wirelessly.

25. (Previously presented): The method as claimed in claim 20, wherein the input module comprises a code scanner.

CLAIM STATUS AND SUPPORT FOR AMENDMENTS (37 CFR 1.530(e))

Claims 16-25 were under reexamination, before this amendment as set forth above.

By this amendment, claims 17 and 19-25 remain unchanged, and claims 16 and 18 are amended.

Support for the amendment can be found throughout the original patent. None of the amended claims 16 and 18 broadens the claim scope of the originally issued claims 1-13.

Upon entry of this amendment, claims 16-25 are pending in in this reexamination proceeding. The claim status is listed as follows:

Claims 1-15.	Canceled.
Claim 16.	Pending - currently amended.
Claim 17.	Pending - previously presented.
Claim 18.	Pending - currently amended.
Claims 19-25.	Pending - previously presented.

REMARKS

Claims 16-25 were under reexamination. By the amendment, claims 16 and 18 are amended.

In the Office Action, claims 16-19 were rejected under 35 U.S.C. 305 as enlarging the scope of the claim(s) of the patent being reexamined. In particular, the Examiners stated that new independent claims 16 and 18 are being compared to the based original claim 1, which shows the limitations that both claims 16 and 18 are lacking: for "a receiving module …" lacking "*or a tire pressure detector*"; and for "a setting output module …" lacking "*send the external signal to the receiving interface, where the external signal is generated by the control module*".

The Patent Owner appreciates very much the careful review of the patent by the Reexamination Panel.

In response, as set forth above, without acquiescing to the Examiners' assertion, which the Patent Owner does not agree, and in order to advance the prosecution of the confirmed claims and allowable claims, the Patent Owner has amended independent claims 16 and 18 to include the limitations from the based original claim 1, . With the amendments of claims 16 and 18, the Patent Owner respectfully submits that there is no outstanding rejection in this reexamination proceeding.

Any amendments to the claims not specifically referred to herein as being included for the purpose of distinguishing the claims from cited references are included for the purpose of clarification, consistence and/or grammatical correction only.

In view of the foregoing, the Patent Owner respectfully requests allowance of the presently pending claims in this reexamination proceeding.

The following remarks herein are considered to be responsive thereto.

As set forth above, the Patent Owner has amended independent claim 16 to recite the limitations as follows:

> a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector ***or a tire pressure detector*** and to send the RF signal to the control module;
>
> a setting output module controlled by the control module to send the

> external signal to ***the interface of*** the identification rewriteable tire pressure detector, wherein the external signal ***is generated by the control module and*** comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module (emphasis added).

Specifically, the Patent Owner has amended claim 16 to add the limitations which the pre-amended claim 16 are lacking, as stated by the Examiners. The Patent Owner respectfully contends that amended claim 16 now includes all limitations as recited in the based original claim 1, which does not enlarge the scope of the claim(s) of the patent being reexamined, thus overcoming the rejection under 35 U.S.C. 305.

Regarding independent claim 18, the Patent Owner has also amended independent claim 18 to recite the similar limitations. The Patent Owner respectfully contends that amended claim 16 now includes all limitations as recited in the based original claim 1, which does not enlarge the scope of the claim(s) of the patent being reexamined, thus overcoming the rejection under 35 U.S.C. 305.

Thus, the amended claims 16 and 18 and their dependent claims 17 and 19 should be patentable under 35 U.S.C. 305.

CONCLUSION

The Patent Owner respectfully requests allowance of the presently pending claims in this reexamination proceeding. If the Examiner believes that there are any issues that can be resolved by a telephone conference, or that there are any informalities that can be corrected by an Examiner's amendment, please call the undersigned at 404-495-3678.

It is believed that no fee is due. However, the Commissioner is hereby authorized to charge any deficiency of fees that may be required, and credit of any overpayments to Deposit Account No. 50-3537.

Respectfully submitted,
MORRIS, MANNING & MARTIN, LLP

October 27, 2014

Tim Tingkang Xia
Reg. No. 45,242
Attorney for Patent Owner on the Record

1600 Atlanta Financial Center
3343 Peachtree Road, N.E.
Atlanta, Georgia 30326-1044
Phone: 404-233-7000
Customer No. 24728

Electronic Acknowledgement Receipt

EFS ID:	20523966
Application Number:	90013169
International Application Number:	
Confirmation Number:	1047
Title of Invention:	Tire Pressure Detecting Apparatus And Tire Pressure Detector Identification Copying Method For The Same
First Named Inventor/Applicant Name:	8031064
Customer Number:	24728
Filer:	Tim Tingkang Xia/Debby Yew
Filer Authorized By:	Tim Tingkang Xia
Attorney Docket Number:	26223-98211
Receipt Date:	27-OCT-2014
Filing Date:	28-FEB-2014
Time Stamp:	15:20:45
Application Type:	Reexam (Patent Owner)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Reexam Response to Final Rejection	2622398211ResponseReExamFOA.pdf	157759 40cfe734303fa2275f1479cce3b4e4fb6d2ec9e4	no	11
Warnings:					
Information:					

Orange Exhibit No. 2003
IPR2024-00744

Total Files Size (in bytes):	157759

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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IPR2024-00744

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner:	Orange Electronic Co., LTD.	Confirmation No.:	1047
U.S. Patent No.:	8,031,064	Group Art Unit:	3992
Application No.:	90/013,169	Examiner:	Linh M. Nguyen
Filed:	February 28, 2014		
For:	Tire Pressure Detecting Apparatus and Tire Pressure Detector Identification Copying Method for the Same		

CERTIFICATE OF SERVICE

Mail Stop Ex Parte Re-Examination
Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

October 27, 2014

Customer No. 24728

Dear Sir/Madam:

Pursuant to 37 CFR § 1.248, the undersigned, on behalf of the Patent Owner, hereby certifies that a copy of the following document:

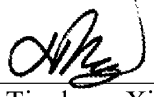
AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION IN *EX PARTE* RE-EXAMINATION,

submitted in the above-identified application on **October 27, 2014**, was served on the Third Party Requester at the following address:

Mr. Vincent De Luca
Vorys, Sater, Seymour & Pease LLP
1909 K St., N.W.
Suite 900
Washington, DC 20006

provided for in 37 CFR § 1.33(c) via first class mail on **October 27, 2014**.

Respectfully submitted,
MORRIS, MANNING & MARTIN, LLP



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1600 Atlanta Financial Center
3343 Peachtree Road, N.E.
Atlanta, Georgia 30326-1044
Phone: 404-233-7000
Customer No. 24728

Electronic Acknowledgement Receipt

EFS ID:	20525828
Application Number:	90013169
International Application Number:	
Confirmation Number:	1047
Title of Invention:	Tire Pressure Detecting Apparatus And Tire Pressure Detector Identification Copying Method For The Same
First Named Inventor/Applicant Name:	8031064
Customer Number:	24728
Filer:	Tim Tingkang Xia/Debby Yew
Filer Authorized By:	Tim Tingkang Xia
Attorney Docket Number:	26223-98211
Receipt Date:	27-OCT-2014
Filing Date:	28-FEB-2014
Time Stamp:	16:24:10
Application Type:	Reexam (Patent Owner)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Reexam Certificate of Service	2622398211CertificateOfService.pdf	108630 c0d9b76f57ff675b6d01a037b281adbaa044b2bf	no	2

Warnings:

Information:

Orange Exhibit No. 2003
IPR2024-00744

Total Files Size (in bytes):	108630

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Orange Exhibit No. 2003
IPR2024-00744

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner:	Orange Electronic Co., LTD.	Confirmation No.:	1047
U.S. Patent No.:	8,031,064	Group Art Unit:	3992
Application No.:	90/013,169	Examiner:	Linh M. Nguyen
Filed:	February 28, 2014		
For:	Tire Pressure Detecting Apparatus and Tire Pressure Detector Identification Copying Method for the Same		

SUPPLEMENTAL AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION IN *EX PARTE* RE-EXAMINATION

Mail Stop: *Ex Parte* Re-Examination
Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

October 29, 2014

Customer No. 24728

Dear Sir/Madam:

In response to the Final Office Action mailed September 19, 2014, please amend the above-identified application as follows and consider the following Remarks:

Amendments to the Claims begin on page **2** of this paper.

Claim Status and Support for Amendments (37 CFR 1.530(e)) begin on page **8** of this paper.

Remarks begin on page **9** of this paper.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

Listing of Claims

1-15. (Canceled).

16. (New): A tire pressure detecting system, comprising:

an identification rewritable tire pressure detector comprising:

a micro-processing module having a rewritable memory unit to record an identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal, wherein the RF signal comprises the detection result and the identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module to supply power to the identification rewriteable tire pressure detector; and

an interface arranged to receive an external signal and send the external signal to the micro-processing module, wherein the external signal comprises an external identification to be written into the rewriteable memory unit or to be used to overwrite a preset identification in the rewriteable memory unit; and

a portable setting apparatus arranged to communicate with the identification rewriteable tire pressure detector, comprising:

a control module;

an input module connected to the control module to enable an operator to

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manually input an identification to be written into the identification rewriteable tire pressure detector;

a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector or a tire pressure detector and to send the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the interface of the identification rewriteable tire pressure detector, wherein the external signal is generated by the control module and comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source connected to the control module to supply power to the setting apparatus;

wherein the setting apparatus is configured to:

obtain an update identification to be written into a new identification rewriteable tire pressure detector either by (1) receiving the RF signal from an old tire pressure detector by the receiving module, retrieving an old identification of the old tire pressure detector from the RF signal, and using the old identification as the update identification, or by (2) receiving a manual input of the identification from the input module, and using the identification as the update identification;

store the update identification in the setting apparatus; and

generate the external signal comprising the update identification as the external identification, and send the external signal to the new identification rewriteable tire pressure detector such that the new identification rewriteable tire pressure detector records the update identification in the rewritable memory unit or overwrites the preset identification in the rewritable memory unit by the update identification.

17. (New): The tire pressure detecting apparatus as claimed in claim 16, wherein the input module comprises a code scanner.

18. (New): A tire pressure detecting system, comprising:

an identification rewritable tire pressure detector comprising:

a micro-processing module having a rewritable memory unit to record an identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal, wherein the RF signal comprises the detection result and the identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module to supply power to the identification rewriteable tire pressure detector; and

an interface arranged to receive an external signal and send the external signal to the micro-processing module, wherein the external signal comprises an external identification to be written into the rewriteable memory unit or to be used to overwrite a preset identification in the rewriteable memory unit; and

a portable setting apparatus arranged to communicate with the identification rewriteable tire pressure detector, comprising:

a control module;

an input module connected to the control module to enable an operator to manually input an identification to be written into the identification rewriteable tire pressure detector;

a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector or a tire pressure detector and to send the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the interface of the identification rewriteable tire pressure detector, wherein the

external signal is generated by the control module and comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source connected to the control module to supply power to the setting apparatus;

wherein the setting apparatus is configured to:

obtain an update identification to be written into a new identification rewriteable tire pressure detector, wherein the update identification is either (1) an old identification of an old tire pressure detector, obtained by receiving the RF signal from the old tire pressure detector by the receiving module and retrieving the old identification from the RF signal, or (2) the identification manually inputted and received from the input module; and

generate the external signal comprising the update identification as the external identification, and send the external signal to the new identification rewriteable tire pressure detector;

wherein the new identification rewriteable tire pressure detector is configured to:

acquire the update identification from the external signal;

when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and

when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit.

19. (New): The tire pressure detecting apparatus as claimed in claim 18, wherein the input module comprises a code scanner.

20. (New): A tire pressure detector identification updating method comprising the steps of:

providing a setting apparatus, comprising an input module and a receiving module;

obtaining, by the setting apparatus, an update identification to be written into a new identification rewriteable tire pressure detector by either (1) reading an old identification from an old tire pressure detector by the receiving module of the setting apparatus by receiving radio frequency (RF) signal from the old tire pressure detector by the receiving module and retrieving the old identification of the old tire pressure detector from the RF signal, and storing the old identification in the setting apparatus for using the old identification as the update identification, or (2) receiving an input of a manually input identification from an input module of the setting apparatus, and using the manually input identification as the update identification;

when the update identification is the old identification from the old tire pressure detector, wirelessly writing the old identification into a new identification rewritable tire pressure detector by the setting apparatus by generating an external signal comprising the old identification, and sending the external signal to the new identification rewritable tire pressure detector, such that the new identification rewriteable tire pressure detector records the update identification in a rewritable memory unit or overwrites a preset identification in the rewritable memory unit by the update identification; and

when the update identification is the manually input identification from the input module, writing the manually input identification into the new identification rewritable tire pressure detector by the setting apparatus by generating the external signal comprising the manually input identification, and sending the external signal to a new identification rewriteable tire pressure detector, such that the new identification rewriteable tire pressure detector records the update identification in the rewritable memory unit or overwrites the preset identification in the rewritable memory unit by the update identification.

21. (New): The method as claimed in claim 20, wherein the new identification rewriteable tire pressure detector is configured to record the update identification in the rewritable memory unit or overwrite the preset identification in the rewritable memory unit by the update identification by:

acquiring the update identification from the external signal;

when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and

when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit.

22. (New): The method as claimed in claim 20, further comprising:

verifying the update identification newly recorded in the rewritable memory unit of the new identification rewriteable tire pressure detector.

23. (New): The method as claimed in claim 22, wherein the verifying step comprises:

receiving, by the setting apparatus, a wireless signal from the new identification rewriteable tire pressure detector, wherein the wireless signal comprises the update identification newly recorded in the rewritable memory unit;

judging, by the setting apparatus, consistency of the update identification newly recorded in the rewritable memory unit and the old identification of the old tire pressure detector; and

if the update identification newly recorded in the rewritable memory unit is not consistent with the old identification of the old tire pressure detector, performing the generating step again.

24. (New): The method as claimed in claim 20, wherein the setting apparatus is configured to receive the RF signal wirelessly.

25. (New): The method as claimed in claim 20, wherein the input module comprises a code scanner.

CLAIM STATUS AND SUPPORT FOR AMENDMENTS (37 CFR 1.530(e))

Claims 1-15 were under reexamination. Of them, claims 1-13 remained unchanged relative to the original patent, and claims 14-15 were new relative to the original patent, before this amendment as set forth above.

By this amendment, new claims 16-25 are added, and claims 1-15 are canceled.

Support for the amendment can be found throughout the original patent. None of the newly added claims 16-25 broadens the claim scope of the originally issued claims 1-13.

Upon entry of this amendment, claims 16-25 are pending in in this reexamination proceeding. The claim status is listed as follows:

Claims 1-15.	Canceled.
Claims 16-25.	Pending - new.

Orange Exhibit No. 2003
IPR2024-00744

REMARKS

Claims 1-15 were under reexamination. By the amendment, new claims 16-25 are added, and claims 1-15 are canceled.

In the Office Action, claims 16-19 were rejected under 35 U.S.C. 305 as enlarging the scope of the claim(s) of the patent being reexamined. In particular, the Examiners stated that new independent claims 16 and 18 are being compared to the based original claim 1, which shows the limitations that both claims 16 and 18 are lacking: for "a receiving module …" lacking "*or a tire pressure detector*"; and for "a setting output module …" lacking "*send the external signal to the receiving interface, where the external signal is generated by the control module*".

The Patent Owner appreciates very much the careful review of the patent by the Reexamination Panel.

In response, as set forth above, without acquiescing to the Examiners' assertion, which the Patent Owner does not agree, and in order to advance the prosecution of the confirmed claims and allowable claims, the Patent Owner has provided new independent claims 16 and 18 to include the limitations from the based original claim 1. The new claims 16 and 18 should overcome the rejections under 35 U.S.C. 305. Accordingly, the Patent Owner respectfully submits that there is no outstanding rejection in this reexamination proceeding.

Any amendments to the claims not specifically referred to herein as being included for the purpose of distinguishing the claims from cited references are included for the purpose of clarification, consistence and/or grammatical correction only.

In view of the foregoing, the Patent Owner respectfully requests allowance of the presently pending claims in this reexamination proceeding.

The following remarks herein are considered to be responsive thereto.

As set forth above, new independent claim 16 recites the limitations as follows:

> a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector ***or a tire pressure detector*** and to send the RF signal to the control module;
>
> a setting output module controlled by the control module to send the external signal to ***the interface of*** the identification rewriteable tire pressure detector, wherein the external signal ***is generated by the control module and***

> comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module (emphasis added).

Specifically, the new claim 16 includes the limitations which the pre-amended claim 16 are lacking, as stated by the Examiners. The Patent Owner respectfully contends that new claim 16 now includes all limitations as recited in the based original claim 1, which does not enlarge the scope of the claim(s) of the patent being reexamined, thus overcoming the rejection under 35 U.S.C. 305.

Regarding independent claim 18, the new independent claim 18 recites the similar limitations as appeared in new claim 16. The Patent Owner respectfully contends that the new claim 18 now includes all limitations as recited in the based original claim 1, which does not enlarge the scope of the claim(s) of the patent being reexamined, thus overcoming the rejection under 35 U.S.C. 305.

Thus, the new claims 16 and 18 and their dependent claims 17 and 19 should be patentable under 35 U.S.C. 305.

CONCLUSION

The Patent Owner respectfully requests allowance of the presently pending claims in this reexamination proceeding. If the Examiner believes that there are any issues that can be resolved by a telephone conference, or that there are any informalities that can be corrected by an Examiner's amendment, please call the undersigned at 404-495-3678.

It is believed that no fee is due. However, the Commissioner is hereby authorized to charge any deficiency of fees that may be required, and credit of any overpayments to Deposit Account No. 50-3537.

Respectfully submitted,
MORRIS, MANNING & MARTIN, LLP

October 29, 2014



Tim Tingkang Xia
Reg. No. 45,242
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Customer No. 24728

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Owner:	Orange Electronic Co., LTD.	Confirmation No.:	1047
U.S. Patent No.:	8,031,064	Group Art Unit:	3992
Application No.:	90/013,169	Examiner:	Linh M. Nguyen
Filed:	February 28, 2014		
For:	Tire Pressure Detecting Apparatus and Tire Pressure Detector Identification Copying Method for the Same		

CERTIFICATE OF SERVICE

Mail Stop Ex Parte Re-Examination
Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

October 29, 2014

Customer No. 24728

Dear Sir/Madam:

Pursuant to 37 CFR § 1.248, the undersigned, on behalf of the Patent Owner, hereby certifies that a copy of the following document:

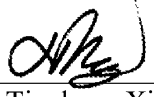
SUPPLEMENTAL AMENDMENT AND RESPONSE TO OFFICE ACTION IN *EX PARTE* RE-EXAMINATION,

submitted in the above-identified application on **October 29, 2014**, was served on the Third Party Requester at the following address:

Mr. Vincent De Luca
Vorys, Sater, Seymour & Pease LLP
1909 K St., N.W.
Suite 900
Washington, DC 20006

provided for in 37 CFR § 1.33(c) via first class mail on **October 29, 2014**.

Respectfully submitted,
MORRIS, MANNING & MARTIN, LLP



Tim Tingkang Xia
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Customer No. 24728

Electronic Acknowledgement Receipt

EFS ID:	20550496
Application Number:	90013169
International Application Number:	
Confirmation Number:	1047
Title of Invention:	Tire Pressure Detecting Apparatus And Tire Pressure Detector Identification Copying Method For The Same
First Named Inventor/Applicant Name:	8031064
Customer Number:	24728
Filer:	Tim Tingkang Xia/Debby Yew
Filer Authorized By:	Tim Tingkang Xia
Attorney Docket Number:	26223-98211
Receipt Date:	29-OCT-2014
Filing Date:	28-FEB-2014
Time Stamp:	15:37:55
Application Type:	Reexam (Patent Owner)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Reexam Response to Final Rejection	2622398211SupplementalResponseReExamFOA.pdf	159005 86fbadd1c6a41aba7704a7f78fcbc75952b0ec6e	no	11

Warnings:	
Information:	

Orange Exhibit No. 2003
IPR2024-00744

2	Reexam Certificate of Service	2622398211CertificateOfService.pdf	108629 146f6d595ba2b965c6b4cd9bf0b593b24e5b87e4	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	267634	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/013,169	02/28/2014	8031064	26223-98211	1047

24728 7590 11/19/2014

MORRIS MANNING MARTIN LLP
IP Department
3343 PEACHTREE ROAD, NE
1600 ATLANTA FINANCIAL CENTER
ATLANTA, GA 30326

EXAMINER	
NGUYEN, LINH M	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
11/19/2014	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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DE LUCA, VINCENT

Vorys, Sater, Seymour & Pease LLP

1909 K St., N.W.

Suite 900

Washington, DC 20006

EX PARTE REEXAMINATION COMMUNICATION TRANSMITTAL FORM

REEXAMINATION CONTROL NO. *90/013,169*.

PATENT NO. *8031064*.

ART UNIT *3992*.

Enclosed is a copy of the latest communication from the United States Patent and Trademark Office in the above identified *ex parte* reexamination proceeding (37 CFR 1.550(f)).

Where this copy is supplied after the reply by requester, 37 CFR 1.535, or the time for filing a reply has passed, no submission on behalf of the *ex parte* reexamination requester will be acknowledged or considered (37 CFR 1.550(g)).

PTOL-465 (Rev.07-04)

Orange Exhibit No. 2003
IPR2024-00744

Notice of Intent to Issue Ex Parte Reexamination Certificate	Control No.	Patent Under Reexamination	
	90/013,169	8031064	
	Examiner	Art Unit	AIA (First Inventor to File) Status
	Linh M. Nguyen	3992	No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

1. ☒ Prosecution on the merits is (or remains) closed in this *ex parte* reexamination proceeding. This proceeding is subject to reopening at the initiative of the Office or upon petition. *Cf.* 37 CFR 1.313(a). A Certificate will be issued in view of
   (a) ☒ Patent owner's communication(s) filed: *29 October 2014*.
   (b) ☐ Patent owner's failure to file an appropriate timely response to the Office action mailed: _____.
   (c) ☐ Patent owner's failure to timely file an Appeal Brief (37 CFR 41.31).
   (d) ☐ The decision on appeal by the ☐ Board of Patent Appeals and Interferences ☐ Court dated _____
   (e) ☐ Other: _____.
2. The Reexamination Certificate will indicate the following:
   (a) Change in the Specification: ☐ Yes ☒ No
   (b) Change in the Drawing(s): ☐ Yes ☒ No
   (c) Status of the Claim(s):
      (1) Patent claim(s) confirmed: _____.
      (2) Patent claim(s) amended (including dependent on amended claim(s)): _____
      (3) Patent claim(s) canceled: *8 and 10-15*.
      (4) Newly presented claim(s) patentable: 16-25.
      (5) Newly presented canceled claims: _____.
      (6) Patent claim(s) ☐ previously ☐ currently disclaimed: _____
      (7) Patent claim(s) not subject to reexamination: _____.
3. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
4. ☒ Note the attached statement of reasons for patentability and/or confirmation. Any comments considered necessary by patent owner regarding reasons for patentability and/or confirmation must be submitted promptly to avoid processing delays. Such submission(s) should be labeled: "Comments On Statement of Reasons for Patentability and/or Confirmation."
5. ☐ Note attached NOTICE OF REFERENCES CITED (PTO-892).
6. ☐ Note attached LIST OF REFERENCES CITED (PTO/SB/08 or PTO/SB/08 substitute).
7. ☐ The drawing correction request filed on _____ is: ☐ approved ☐ disapproved.
8. ☐ Acknowledgment is made of the priority claim under 35 U.S.C. § 119(a)-(d) or (f).
   a)☐ All b)☐ Some* c)☐ None of the certified copies have
   ☐ been received.
   ☐ not been received.
   ☐ been filed in Application No. _____.
   ☐ been filed in reexamination Control No. _____.
   ☐ been received by the International Bureau in PCT Application No. _____.
   * Certified copies not received: _____.
9. ☐ Note attached Examiner's Amendment.
10. ☐ Note attached Interview Summary (PTO-474).
11. ☒ Other: *Claims 1-7 and 9 were cancelled in a previous proceeding.*

All correspondence relating to this reexamination proceeding should be directed to the **Central Reexamination Unit** at the mail, FAX, or hand-carry addresses given at the end of this Office action.

cc: Requester (if third party requester)

Notice of Intent to Issue Ex Parte Reexamination Certificate

The present application is being examined under the pre-AIA first to invent provisions.

This is an *ex parte* reexamination of United States Patent Number 8,031,064 (hereinafter "the '064 patent"), entitled "TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME". The '064 patent was previously subject to reexaminations 90/012,430 ("the '12,430 proceeding") and the claims are as presented in the reexamination certificate from that proceeding.

Status of Claims:

Claims 1-7 and 9 were canceled by the previous reexamination certificate.

According to Patent Owner's supplemental amendment filed 10/29/2014:

- Claims 8 and 10-15 are canceled;
- Claims 16-25 are newly added.

Statement of Reasons for Patentability and/or Confirmation

Claims 16-25 are patentable.

The following is an examiner's statement of reasons for patentability and/or confirmation of the claims found patentable in this reexamination proceeding:

The closest prior art fails to disclose or fairly suggest:

Orange Exhibit No. 2003
IPR2024-00744

A tire pressure detector, in which the setting apparatus is configured to perform the following steps similarly as indicated in the method claims of *obtaining, by the setting apparatus, an update identification to be written into a new identification rewriteable tire pressure detector by either (1) reading an old identification from an old tire pressure detector by the receiving module of the setting apparatus by receiving radio frequency (RF) signal from an the old tire pressure detector by the receiving module and retrieving the old identification of the old tire pressure detector from the RF signal and storing the old identification in the setting apparatus for using the old identification as the update identification, or (2) receiving an input of a manually input identification from an input module of the setting apparatus, and using the manually input identification as the update identification from an input module of the setting apparatus, and using the manually input identification as the update identification",* as recited in newly added independent claims 16, 18 and 20 ((newly added dependent claim(s) 17, 19, and 21-25 are also patentable due to their dependencies from independent claim 16, 18 and 20, respectively).

Any comments considered necessary by PATENT OWNER regarding the above statement must be submitted promptly to avoid processing delays. Such submission by the patent owner should be labeled: "Comments on Statement of Reasons for Patentability and/or Confirmation" and will be placed in the reexamination file.

Conclusion

All correspondence relating to this *ex parte* reexam proceeding should be directed as follows:

By **U.S. Postal Service Mail** to:

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IPR2024-00744

Mail Stop *Ex Parte* Reexam
ATTN: Central Reexamination Unit
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

By FAX to: (571) 273-9900
Central Reexamination Unit

By hand to: Customer Service Window
Randolph Building
401 Dulany St.
Alexandria, VA 22314

Registered users of EFS-Web may alternatively submit correspondence via the electronic filing system at https://efs.uspto.gov/efile/myportal/efs-registered

Any inquiry concerning this communication or as to the status of this proceeding, should be directed to the Central Reexamination Unit at telephone number (571) 272-7705.

Signed:

/Linh M. Nguyen/
Primary Examiner, Art Unit 3992

Conferees:
/JAMES MENEFEE/

Primary Examiner, Art Unit 3992

/JENNIFER MCNEIL/

Supervisory Patent Examiner, Art Unit 3992

Orange Exhibit No. 2003
IPR2024-00744

Reexamination	Application/Control No. 90013169	Applicant(s)/Patent Under Reexamination 8031064
	Certificate Date	Certificate Number C2

Requester Correspondence Address:	☐ Patent Owner	☒ Third Party

DE LUCA,VINCENT
Vorys, Sater, Seymour & Pease LLP 1909 K St., N.W.
Suite 900
Washington, DC 20006

LITIGATION REVIEW ☒	LMN (examiner initials)	11/05/2014 (date)
Case Name		Director Initials
None		/JM/ for IY

COPENDING OFFICE PROCEEDINGS	
TYPE OF PROCEEDING	NUMBER
1. N/A	

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90013169	8031064
	Examiner	**Art Unit**
	LINH M NGUYEN	3992

CPC		
Symbol	**Type**	**Version**

CPC Combination Sets				
Symbol	**Type**	**Set**	**Ranking**	**Version**

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 10	
/LINH M NGUYEN/ Primary Examiner.Art Unit 3992 11/05/2014 (Primary Examiner) (Date)	O.G. Print Claim(s) 16	O.G. Print Figure 1

U.S. Patent and Trademark Office Part of Paper No. 20141105

Orange Exhibit No. 2003
IPR2024-00744

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90013169	8031064
	Examiner	Art Unit
	LINH M NGUYEN	3992

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
340	447	B	6	0	C	23 / 00 (2006.01.01)						
CROSS REFERENCE(S)												
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)											
340	442	445										
73	146	146.5										

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	10	
/LINH M NGUYEN/ Primary Examiner.Art Unit 3992	11/05/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	16	1

U.S. Patent and Trademark Office

Part of Paper No. 20141105

Orange Exhibit No. 2003
IPR2024-00744

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	90013169	8031064
	Examiner	Art Unit
	LINH M NGUYEN	3992

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original

NONE (Assistant Examiner)	(Date)	Total Claims Allowed: 10	
/LINH M NGUYEN/ Primary Examiner.Art Unit 3992 (Primary Examiner)	11/05/2014 (Date)	O.G. Print Claim(s) 16	O.G. Print Figure 1

U.S. Patent and Trademark Office

Part of Paper No. 20141105

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BIB DATA SHEET

CONFIRMATION NO. 1047

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
90/013,169	02/28/2014 RULE	340	3992	26223-98211

APPLICANTS

INVENTORS

8031064, Residence Not Provided;
ORANGE ELECTRONIC CO., LTD.(OWNER), TAICHUNG HSIEN, TAIWAN;
VINCENT DE LUCA(3RD.PTY.REQ.), WASHINGTON, DC;
VINCENT DE LUCA, WASHINGTON, DC

**** CONTINUING DATA ***************************

This application is a REX of 12/283,979 09/17/2008 PAT 8031064

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /LINH M NGUYEN/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
				13	1

ADDRESS

MORRIS MANNING MARTIN LLP
3343 PEACHTREE ROAD, NE
1600 ATLANTA FINANCIAL CENTER
ATLANTA, GA 30326
UNITED STATES

TITLE

Tire Pressure Detecting Apparatus And Tire Pressure Detector Identification Copying Method For The Same

FILING FEE RECEIVED		
6000	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

BIB (Rev. 05/07).

US008031064C2

(12) EX PARTE REEXAMINATION CERTIFICATE (10436th)

United States Patent
Yu

(10) Number: US 8,031,064 C2
(45) Certificate Issued: Dec. 12, 2014

(54) **TIRE PRESSURE DETECTING APPARATUS AND TIRE PRESSURE DETECTOR IDENTIFICATION COPYING METHOD FOR THE SAME**

(75) Inventor: **Hung-Chih Yu**, Taichung (TW)

(73) Assignee: **Orange Electronic Co., Ltd.**, Tanzih Hsiang, Taichung Hsien (TW)

Reexamination Request:
No. 90/013,169, Feb. 28, 2014

Reexamination Certificate for:
Patent No.: **8,031,064**
Issued: **Oct. 4, 2011**
Appl. No.: **12/283,979**
Filed: **Sep. 17, 2008**

Reexamination Certificate C1 8,031,064 issued Nov. 7, 2013

(51) **Int. Cl.**
B60C 23/00 (2006.01)

(52) **U.S. Cl.**
USPC **340/447**; 340/442; 340/445; 73/146; 73/146.5

(58) **Field of Classification Search**
None
See application file for complete search history.

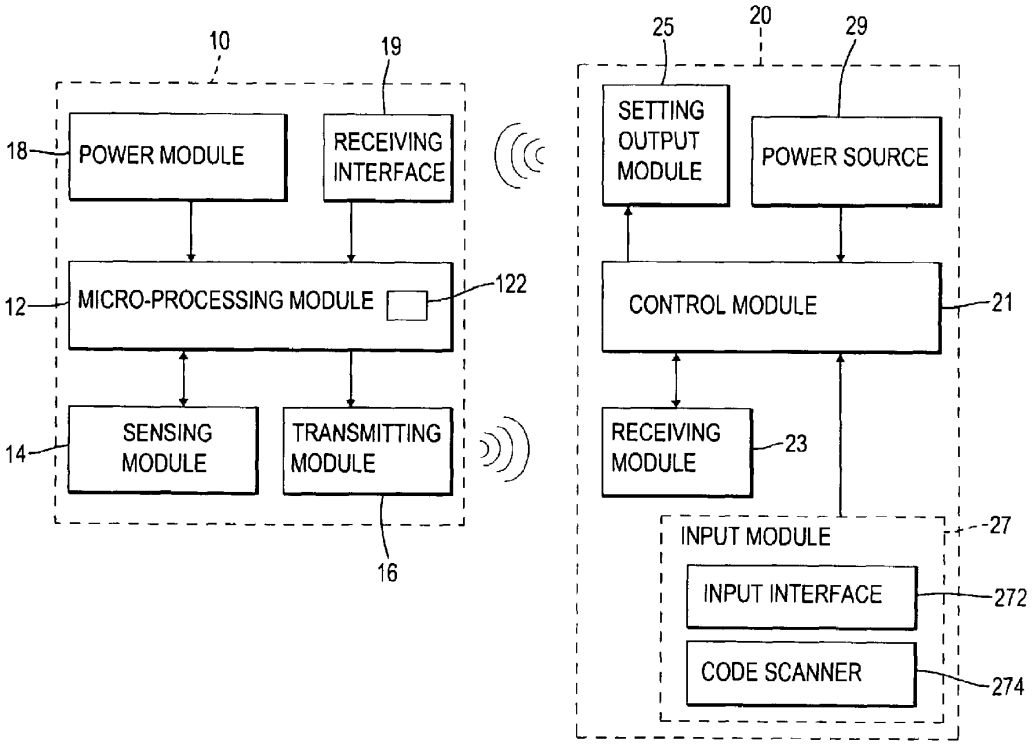
(56) **References Cited**

To view the complete listing of prior art documents cited during the proceeding for Reexamination Control Number 90/013,169, please refer to the USPTO's public Patent Application Information Retrieval (PAIR) system under the Display References tab.

Primary Examiner — Linh M Nguyen

(57) **ABSTRACT**

A tire pressure detecting apparatus has an identification rewriteable tire pressure detector and a setting apparatus. The tire pressure detector is securely mounted on a valve stem inside a tire of a vehicle and has a micro-processing module, a sensing module, a transmitting module and a receiving interface, where the micro-processing module has a memory unit. The setting apparatus is capable of reading or inputting an identification from a failure tire pressure detector, transmits the identification to the identification rewriteable tire pressure detector and writes the identification into the memory unit.



Orange Exhibit No. 2003
IPR2024-00744

EX PARTE REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

Claims **1-7** and **9** were previously cancelled.

Claims **8** and **10-15** are cancelled.

New claims **16-25** are added and determined to be patentable.

16. A tire pressure detecting system, comprising:

an identification rewritable tire pressure detector comprising:

a micro-processing module having a rewritable memory unit to record an identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RF) signal, wherein the RF signal comprises the detection result and the identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module to supply power to the identification rewriteable tire pressure detector; and

an interface arranged to receive an external signal and send the external signal to the micro-processing module, wherein the external signal comprises an external identification to be written into the rewriteable memory unit or to be used to overwrite a preset identification in the rewriteable memory unit; and

a portable setting apparatus arranged to communicate with the identification rewriteable tire pressure detector, comprising:

a control module;

an input module connected to the control module to enable an operator to manually input an identification to be written into the identification rewriteable tire pressure detector:

a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector or a tire pressure detector and to send the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the interface of the identification rewriteable tire pressure detector, wherein the external signal is generated by the control module and comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source connected to the control module to supply power to the setting apparatus;

wherein the setting apparatus is configured to:

obtain an update identification to be written into a new identification rewriteable tire pressure detector either by (1) receiving the RF signal from an old tire pressure detector by the receiving module, retrieving an old identification of the old tire pressure detector from the RF signal, and using the old identification as the update identification, or by (2) receiving a manual input of the identification from the input module, and using the identification as the update identification;

store the update identification in the setting apparatus; and

generate the external signal comprising the update identification as the external identification, and send the external signal to the new identification rewriteable tire pressure detector such that the new identification rewriteable tire pressure detector records the update identification in the rewritable memory unit or overwrites the preset identification in the rewritable memory unit by the update identification.

17. The tire pressure detecting apparatus as claimed in claim 16, wherein the input module comprises a code scanner.

18. A tire pressure detecting system, comprising:

an identification rewritable tire pressure detector comprising:

a micro-processing module having a rewritable memory unit to record an identification;

a sensing module electrically connected to the micro-processing module and having a pressure-detecting unit to detect a tire pressure and send a detection result to the micro-processing module;

a transmitting module controlled by the micro-processing module to transmit a radio frequency (RR) signal, wherein the RR signal comprises the detection result and the identification of the identification rewritable tire pressure detector;

a power module electronically connected to the micro-processing module to supply power to the identification rewriteable tire pressure detector; and

an interface arranged to receive an external signal and send the external signal to the micro-processing module, wherein the external signal comprises an external identification to be written into the rewriteable memory unit or to be used to overwrite a preset identification in the rewriteable memory unit; and

a portable setting apparatus arranged to communicate with the identification rewriteable tire pressure detector, comprising:

a control module;

an input module connected to the control module to enable an operator to manually input an identification to be written into the identification rewriteable tire pressure detector:

a receiving module connected to the control module to receive the RF signal from the identification rewriteable tire pressure detector or a tire pressure detector and to send the RF signal to the control module;

a setting output module controlled by the control module to send the external signal to the interface of the identification rewriteable tire pressure detector, wherein the external signal is generated by the control module and comprises the identification that is provided by the input module or provided by the RF signal received from the receiving module; and

a power source connected to the control module to supply power to the setting apparatus;

Orange Exhibit No. 2003
IPR2024-00744

wherein the setting apparatus is configured to:

obtain an update identification to be written into a new identification rewriteable tire pressure detector, wherein the update identification is either (1) an old identification of an old tire pressure detector, obtained by receiving the RF signal from the old tire pressure detector by the receiving module and retrieving the old identification from the RF signal, or (2) the identification manually inputted and received from the input module; and

generate the external signal comprising the update identification as the external identification, and send the external signal to the new identification rewriteable tire pressure detector;

wherein the new identification rewriteable tire pressure detector is configured to:

acquire the update identification from the external signal;

when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and

when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit.

19. The tire pressure detecting apparatus as claimed in claim 18, wherein the input module comprises a code scanner.

20. A tire pressure detector identification updating method comprising the steps of:

providing a setting apparatus, comprising an input module and a receiving module;

obtaining, by the setting apparatus, an update identification to be written into a new identification rewriteable tire pressure detector by either (1) reading an old identification from an old tire pressure detector by the receiving module of the setting apparatus by receiving radio frequency (RF) signal from the old tire pressure detector by the receiving module and retrieving the old identification of the old tire pressure detector from the RF signal, and storing the old identification in the setting apparatus for using the old identification as the update identification, or (2) receiving an input of a manually input identification from an input module of the setting apparatus, and using the manually input identification as the update identification;

when the update identification is the old identification from the old tire pressure detector, wirelessly writing the old identification into a new identification rewritable tire pressure detector by the setting apparatus by generating an external signal comprising the old identification, and sending the external signal to the new identification rewritable tire pressure detector, such that the new identification rewriteable tire pressure detector records the update identification in a rewritable memory unit or overwrites a preset identification in the rewritable memory unit by the update identification; and

when the update identification is the manually input identification from the input module, writing the manually input identification into the new identification rewritable tire pressure detector by the setting apparatus by generating the external signal comprising the manually input identification, and sending the external signal to a new identification rewriteable tire pressure detector, such that the new identification rewriteable tire pressure detector records the update identification in the rewritable memory unit or overwrites the preset identification in the rewritable memory unit by the update identification.

21. The method as claimed in claim 20, wherein the new identification rewriteable tire pressure detector is configured to record the update identification in the rewritable memory unit or overwrite the preset identification in the rewritable memory unit by the update identification by:

acquiring the update identification from the external signal;

when the rewritable memory unit has the preset identification stored therein, overwrite the preset identification in the rewritable memory unit by the update identification; and

when the rewritable memory unit does not have the preset identification stored therein, record the update identification in the rewritable memory unit.

22. The method as claimed in claim 20, further comprising:

verifying the update identification newly recorded in the rewritable memory unit of the new identification rewriteable tire pressure detector.

23. The method as claimed in claim 22, wherein the verifying step comprises:

receiving, by the setting apparatus, a wireless signal from the new identification rewriteable tire pressure detector, wherein the wireless signal comprises the update identification newly recorded in the rewritable memory unit;

judging, by the setting apparatus, consistency of the update identification newly recorded in the rewritable memory unit and the old identification of the old tire pressure detector; and

if the update identification newly recorded in the rewritable memory unit is not consistent with the old identification of the old tire pressure detector, performing the generating step again.

24. The method as claimed in claim 20, wherein the setting apparatus is configured to receive the RF signal wirelessly.

25. The method as claimed in claim 20, wherein the input module comprises a code scanner.

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