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JP	2000-238515	9/2000
JP	3212311	7/2001

* cited by examiner

Orange Exhibit No. 2004
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FIG. 1

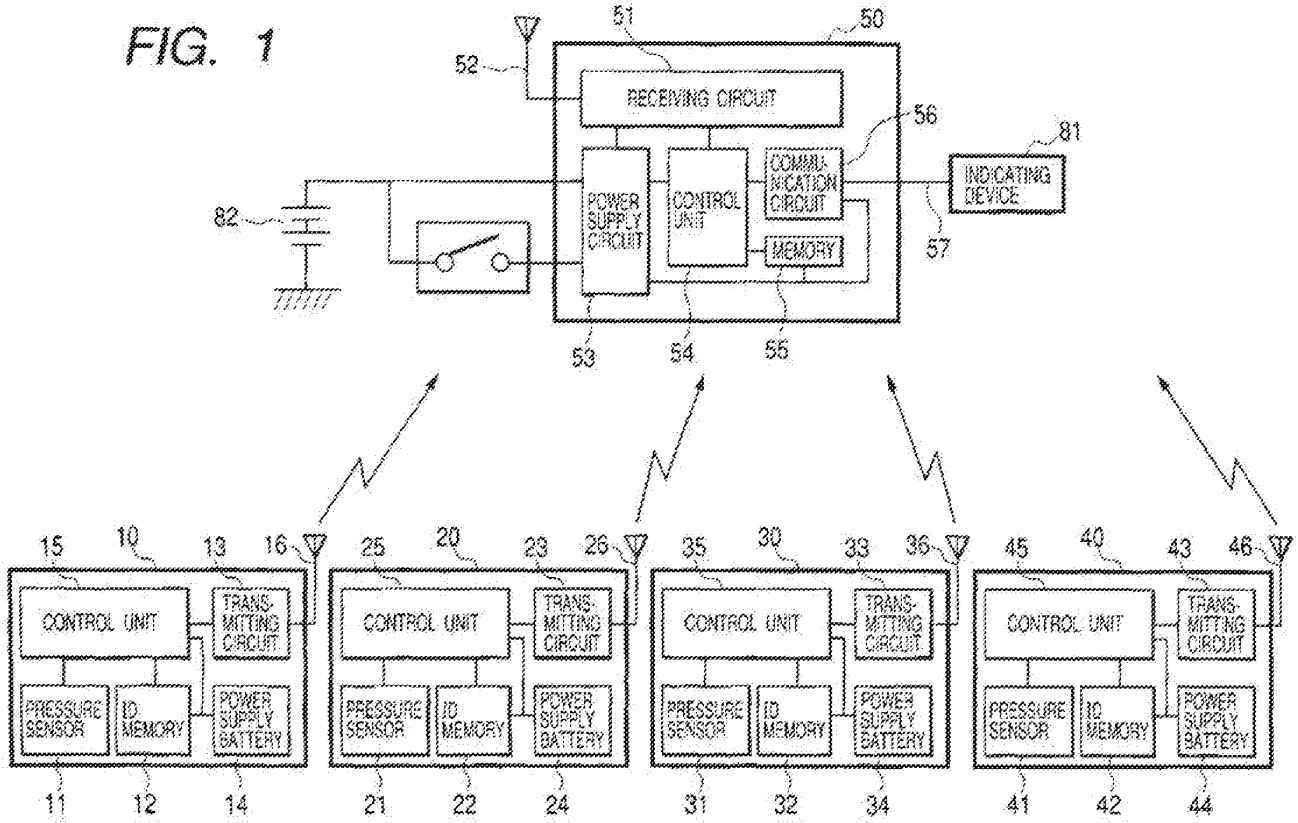

51
50
52
RECEIVING CIRCUIT
56
81
POWER SUPPLY CIRCUIT
CONTROL UNIT
COMMUNICATION CIRCUIT
INDICATING DEVICE
82
MEMORY
57
53
54
55
15
10
13
16
25
20
23
26
35
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33
36
45
40
43
46
CONTROL UNIT
TRANSMITTING CIRCUIT
PRESSURE SENSOR
ID MEMORY
POWER SUPPLY BATTERY
11
12
14
21
22
24
31
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41
42
44

FIG. 2

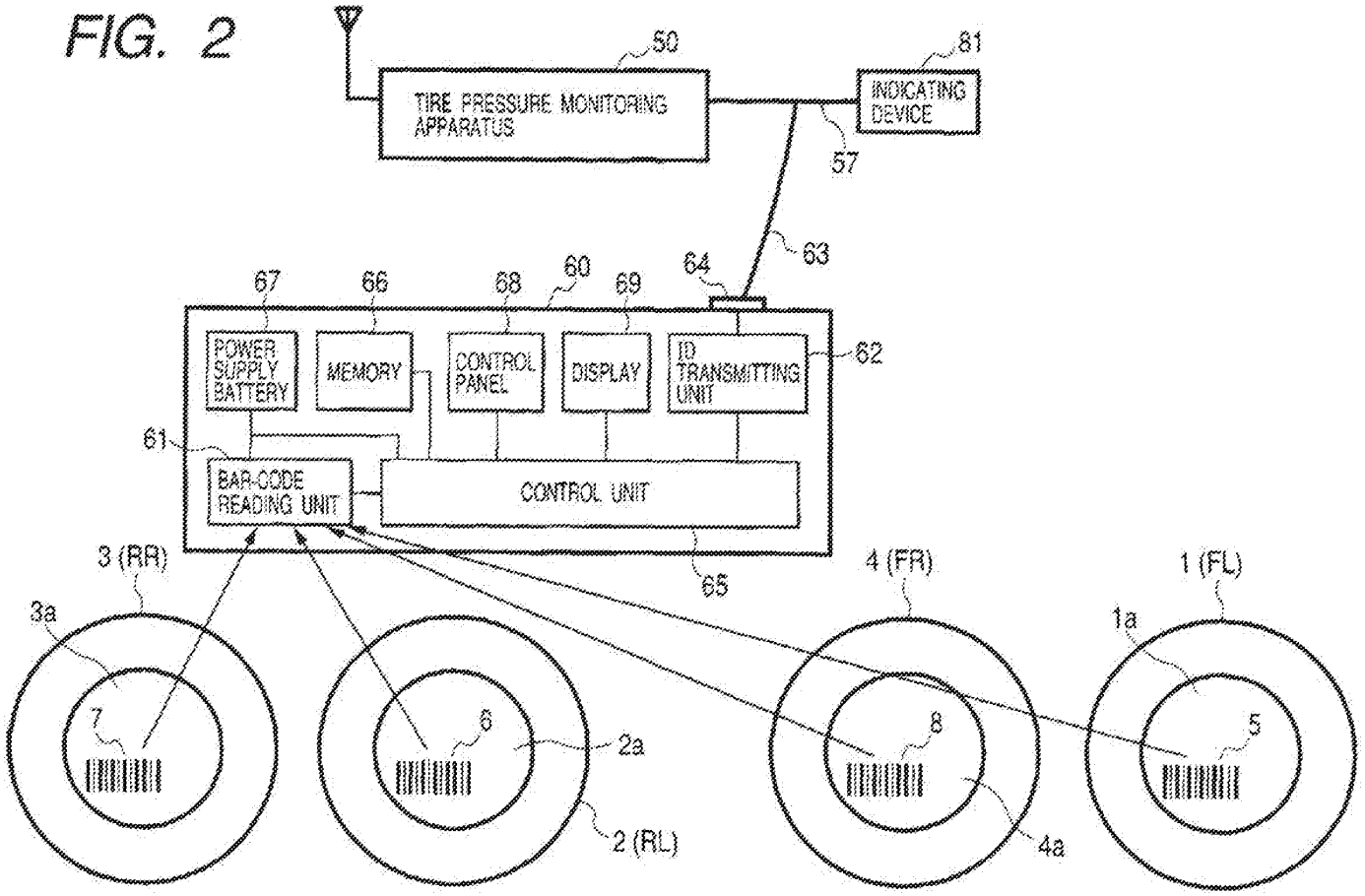
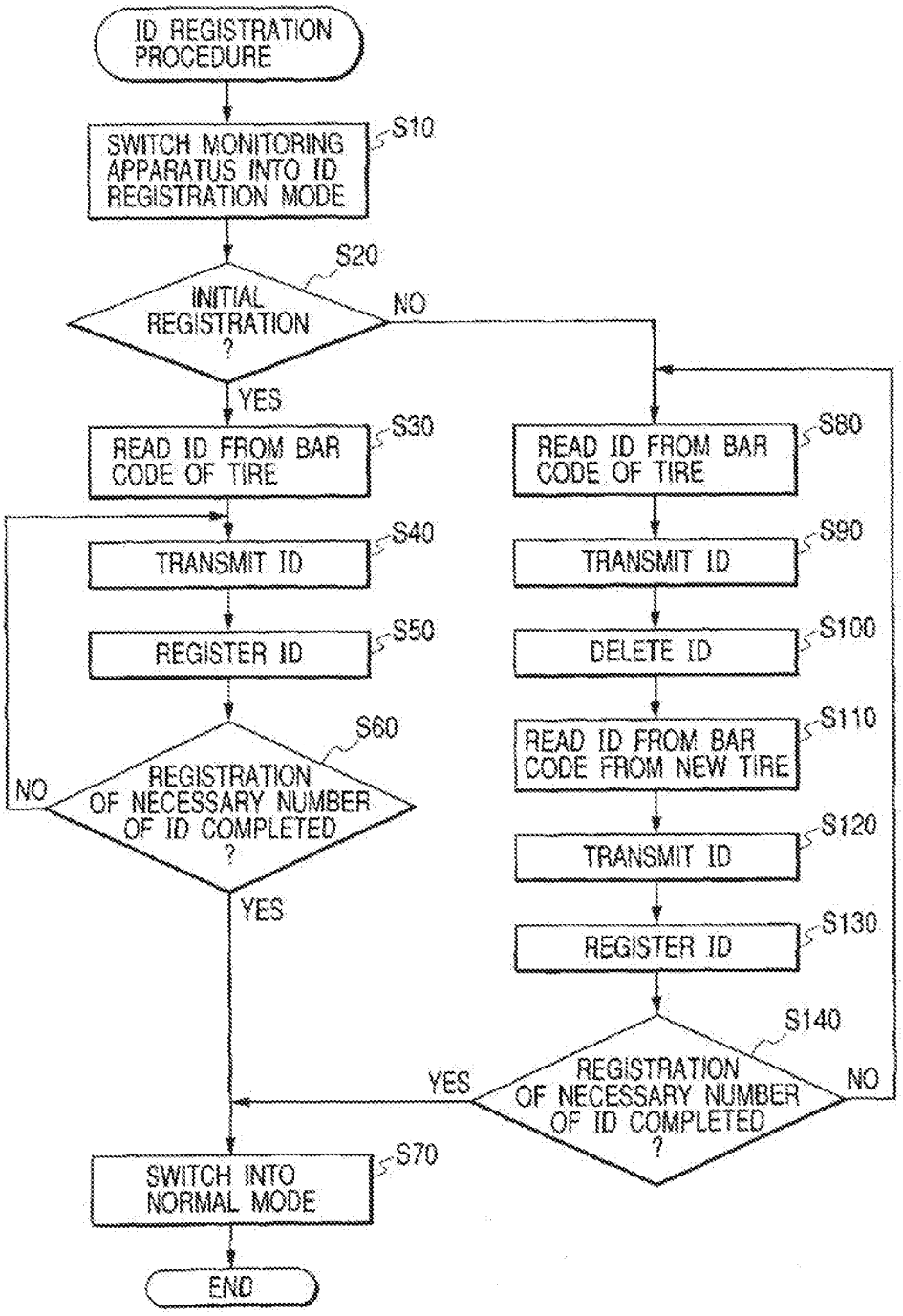
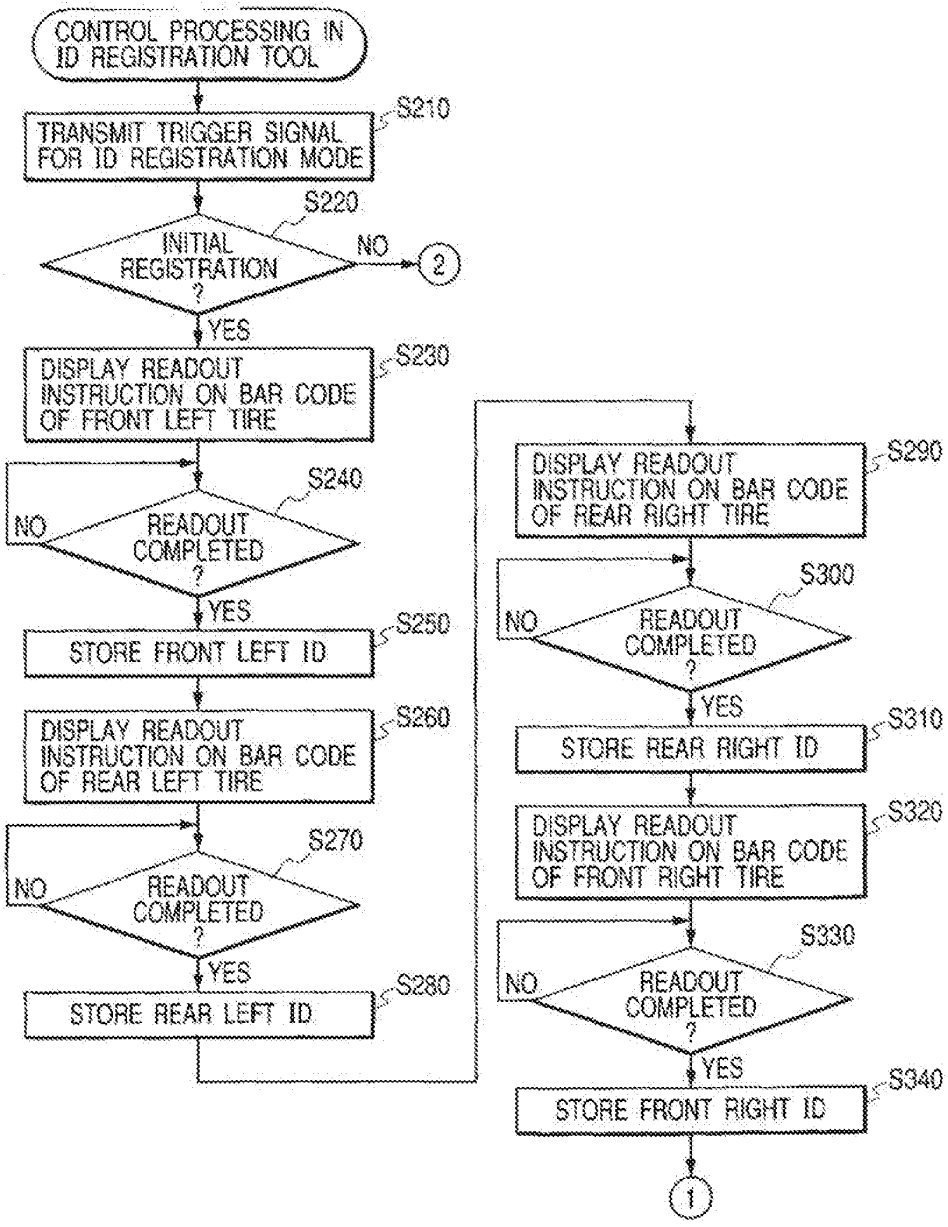

50
TIRE PRESSURE MONITORING APPARATUS
81
INDICATING DEVICE
57
63
64
67
66
68
60
69
62
POWER SUPPLY BATTERY
MEMORY
CONTROL PANEL
DISPLAY
ID TRANSMITTING UNIT
61
BAR-CODE READING UNIT
CONTROL UNIT
65
3 (RR)
4 (FR)
1 (FL)
3a
1a
7
6
2a
8
5
2 (RL)
4a

FIG. 3



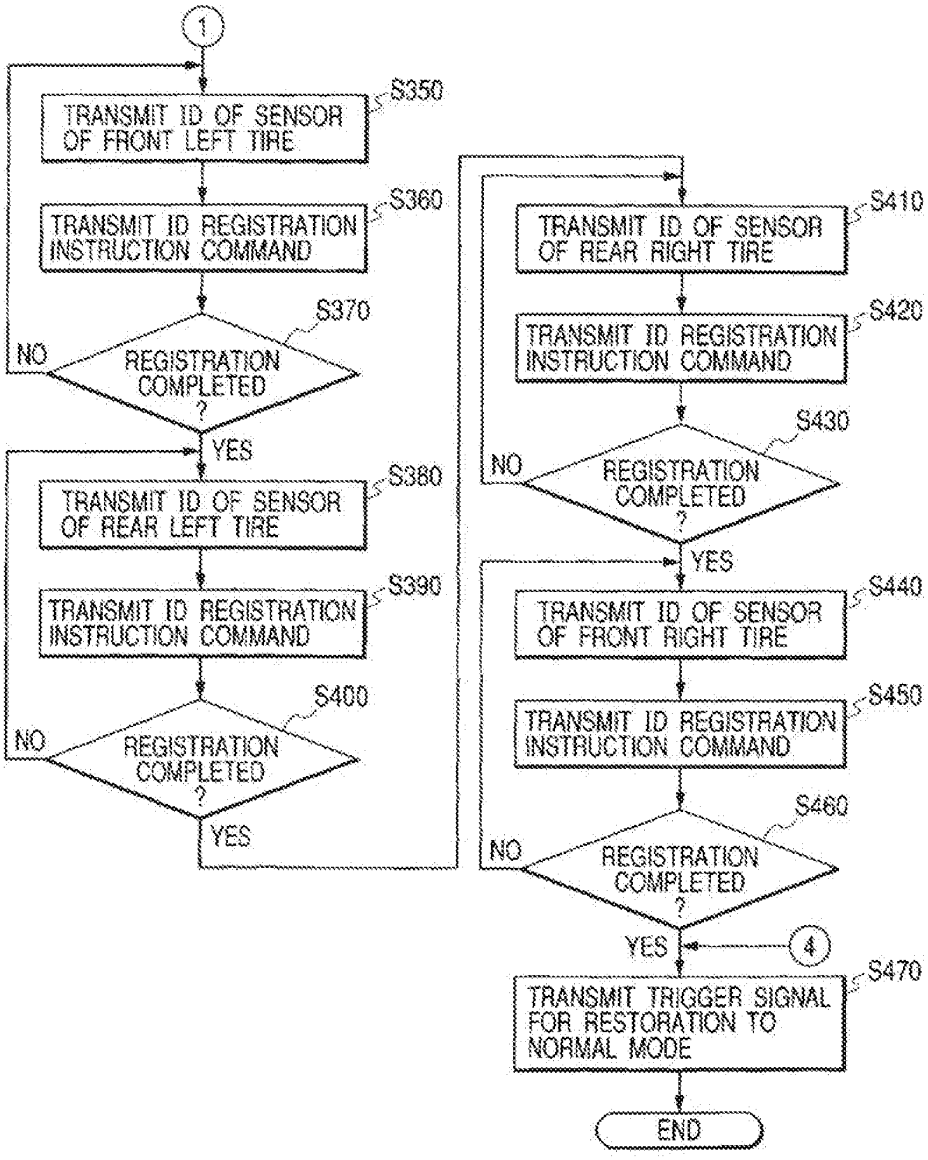
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FIG. 4



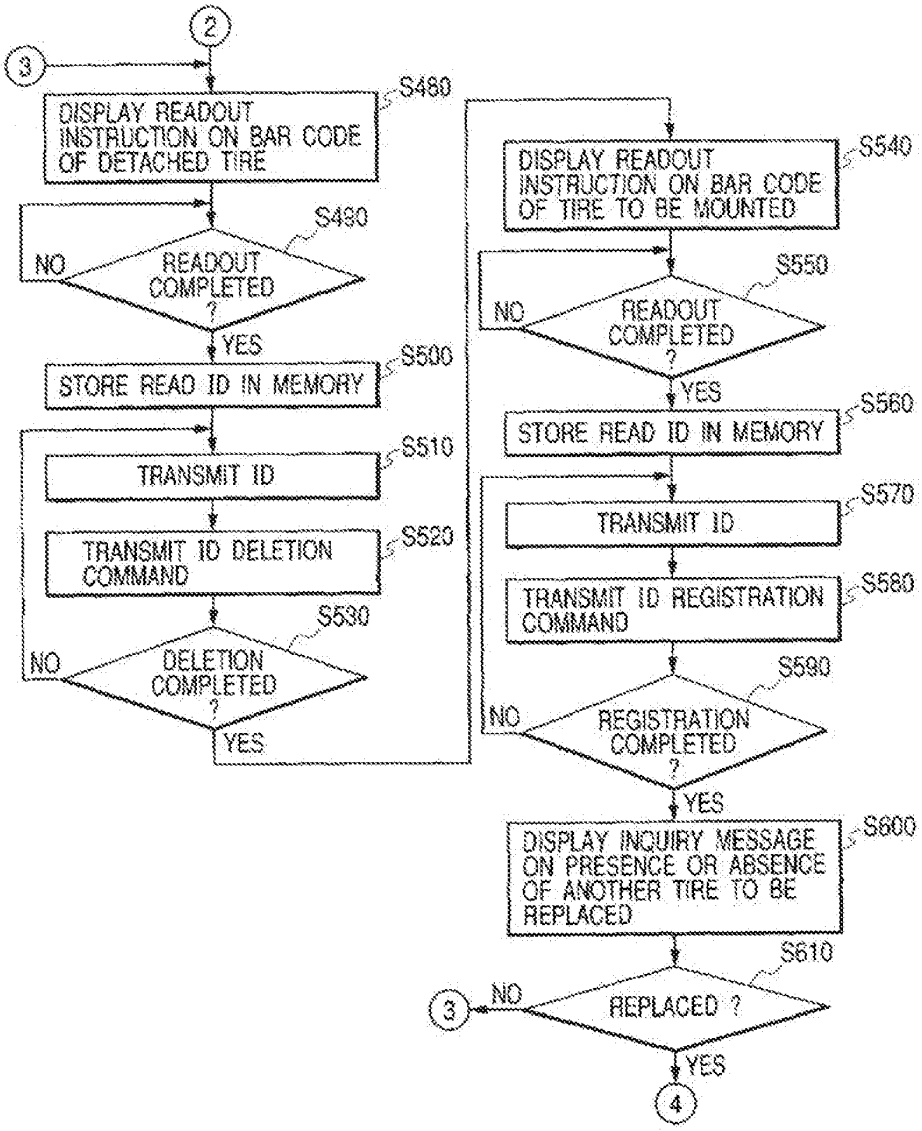
Orange Exhibit No. 2004
IPR2024-00744

FIG. 5



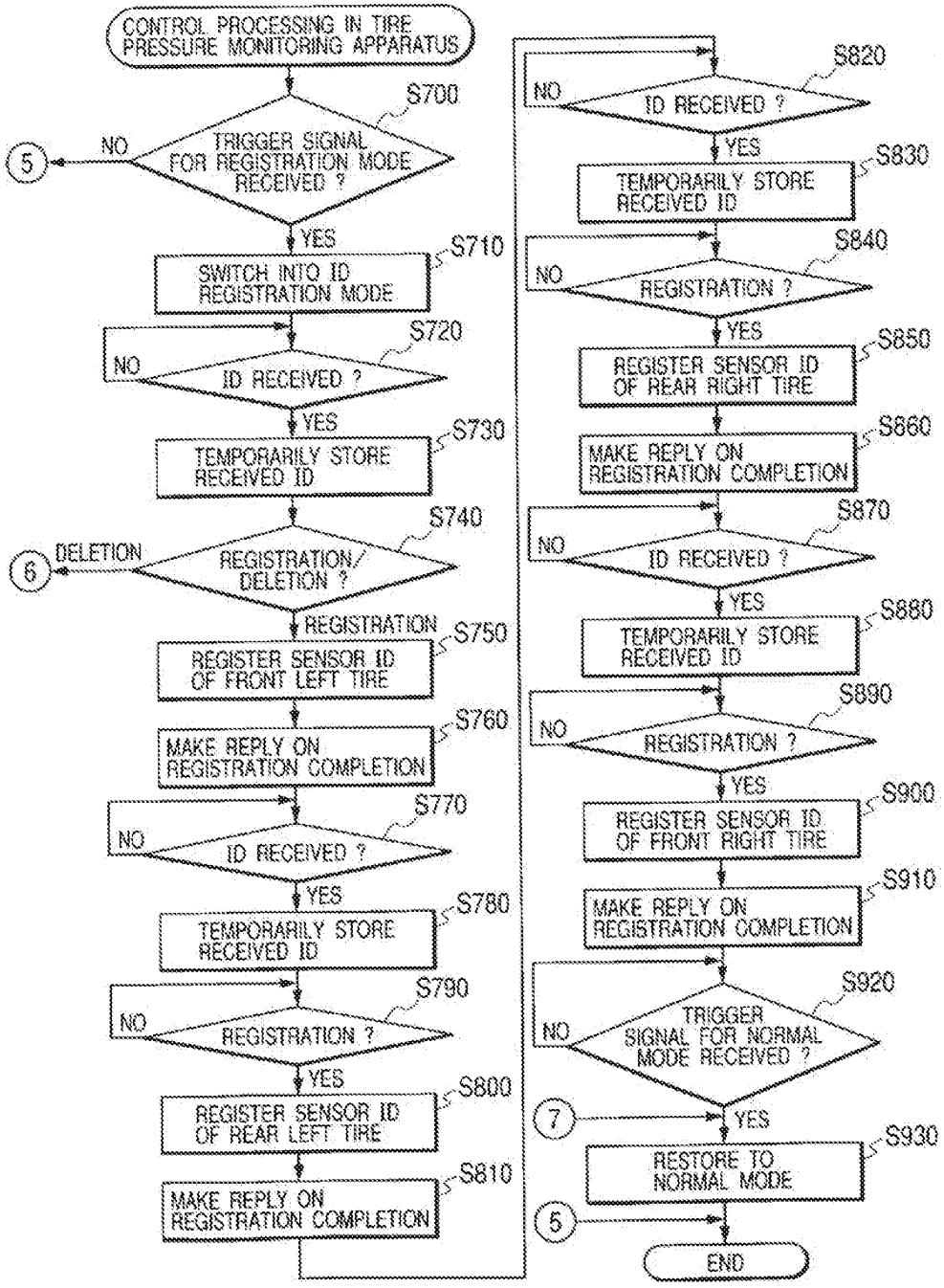
Orange Exhibit No. 2004
IPR2024-00744

FIG. 6



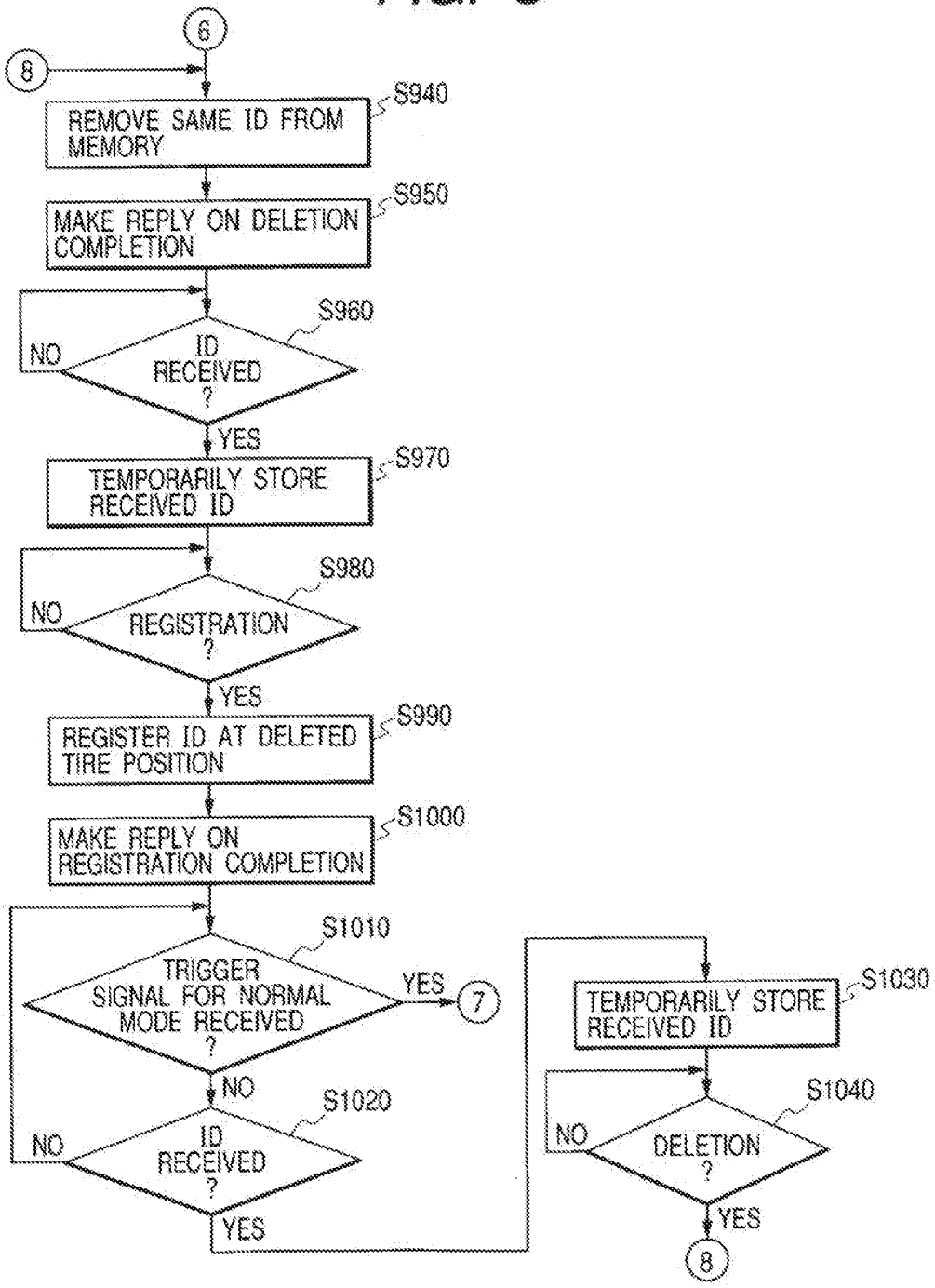
Orange Exhibit No. 2004
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FIG. 7



Orange Exhibit No. 2004
IPR2024-00744

FIG. 8



Orange Exhibit No. 2004
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FIG. 9

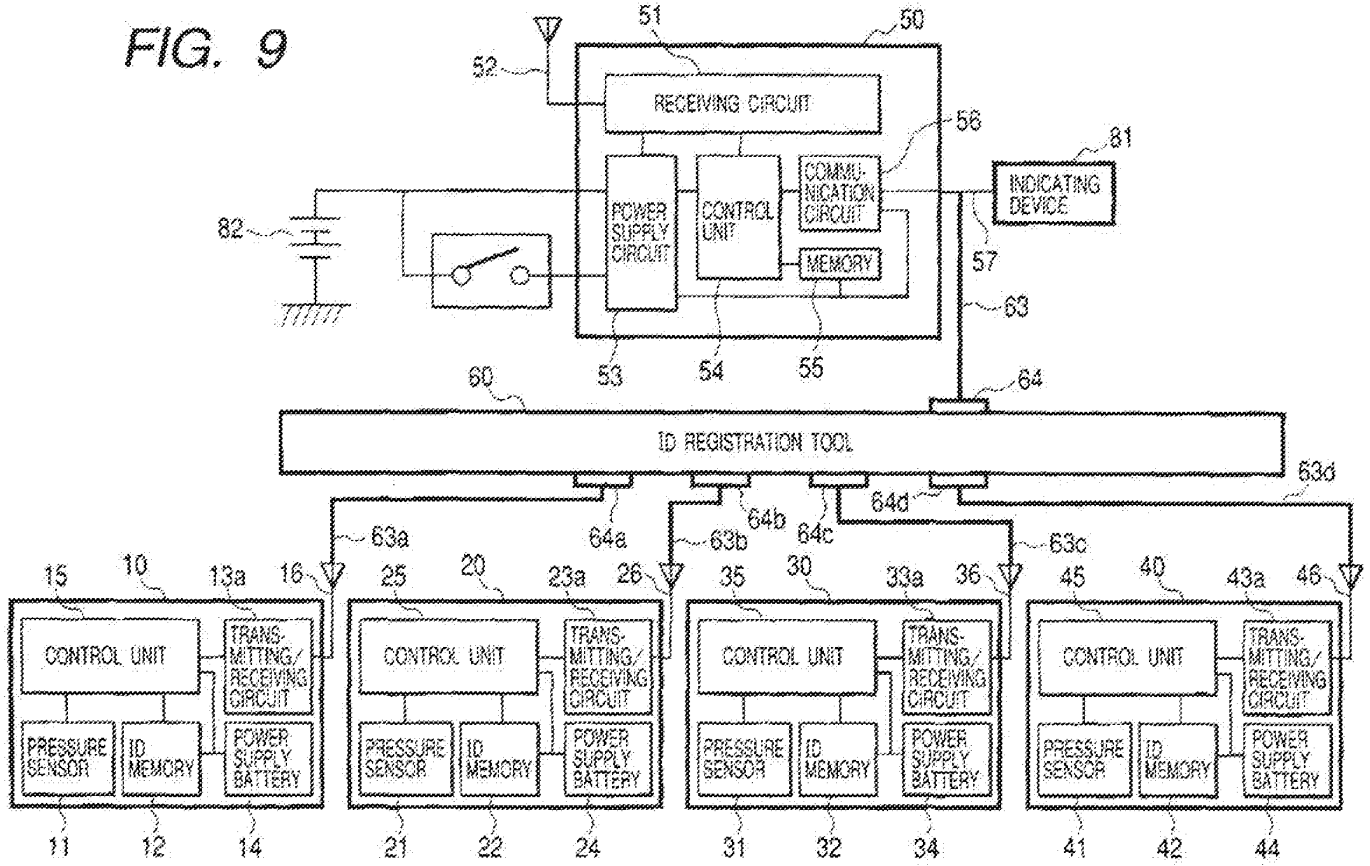
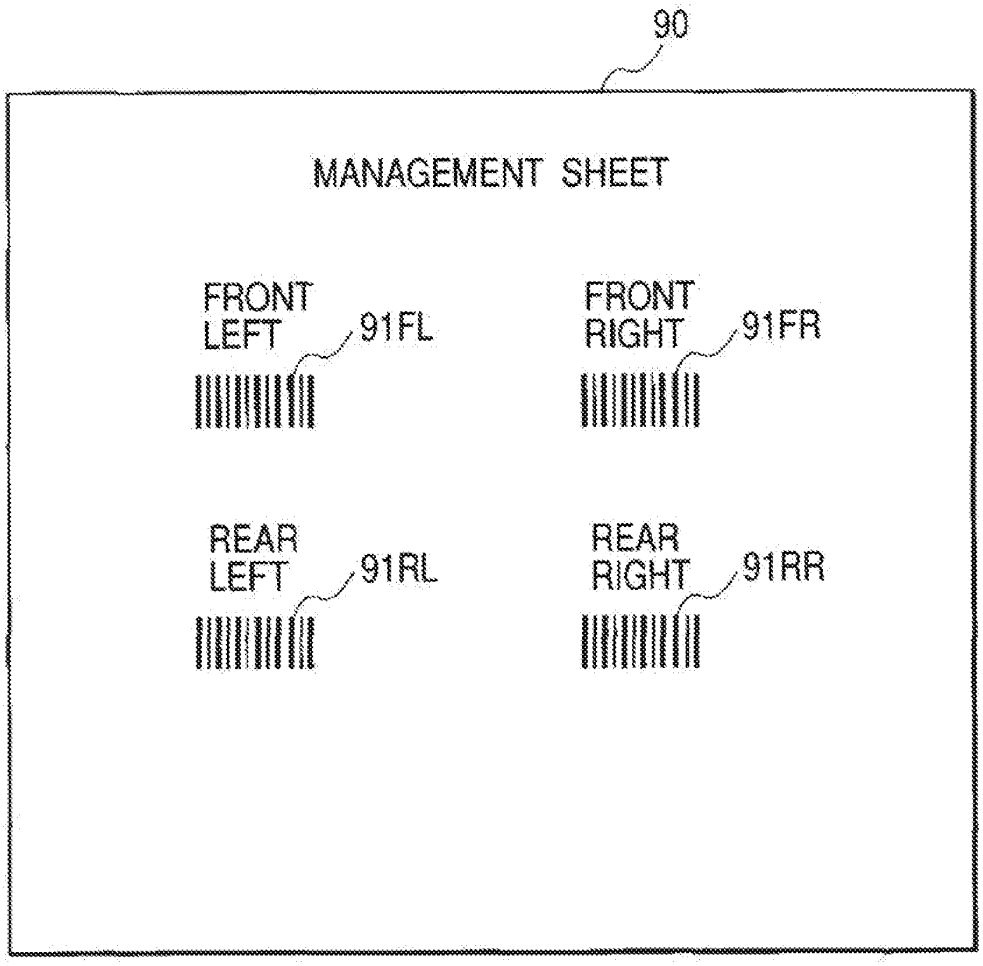
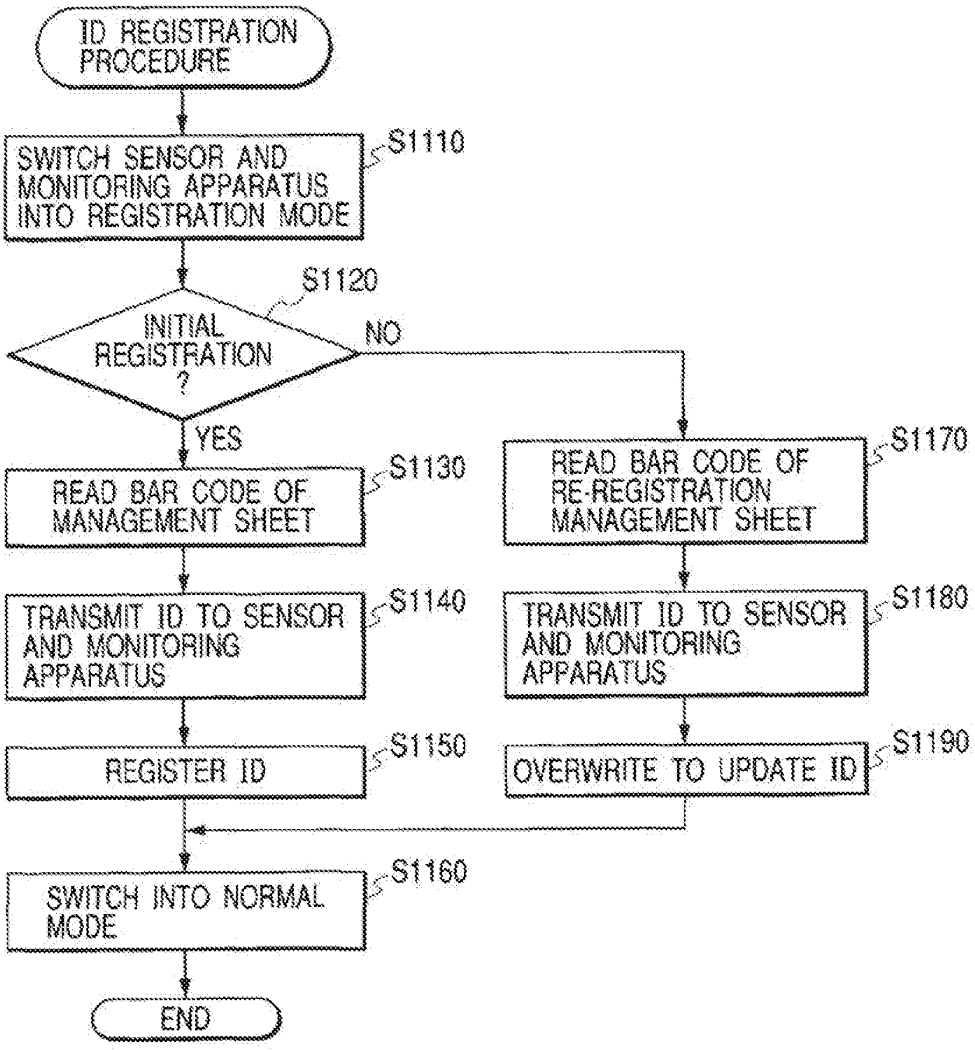

51
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RECEIVING CIRCUIT
56
81
INDICATING DEVICE
82
POWER SUPPLY CIRCUIT
CONTROL UNIT
COMMU-NICATION CIRCUIT
MEMORY
57
63
53
54
55
60
64
ID REGISTRATION TOOL
63d
64d
64a
63b
64b
64c
63c
63a
15
10
13a
16
25
20
23a
26
35
30
33a
36
45
40
43a
46
CONTROL UNIT
TRANS-MITTING/ RECEIVING CIRCUIT
PRESSURE SENSOR
ID MEMORY
POWER SUPPLY BATTERY
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FIG. 10



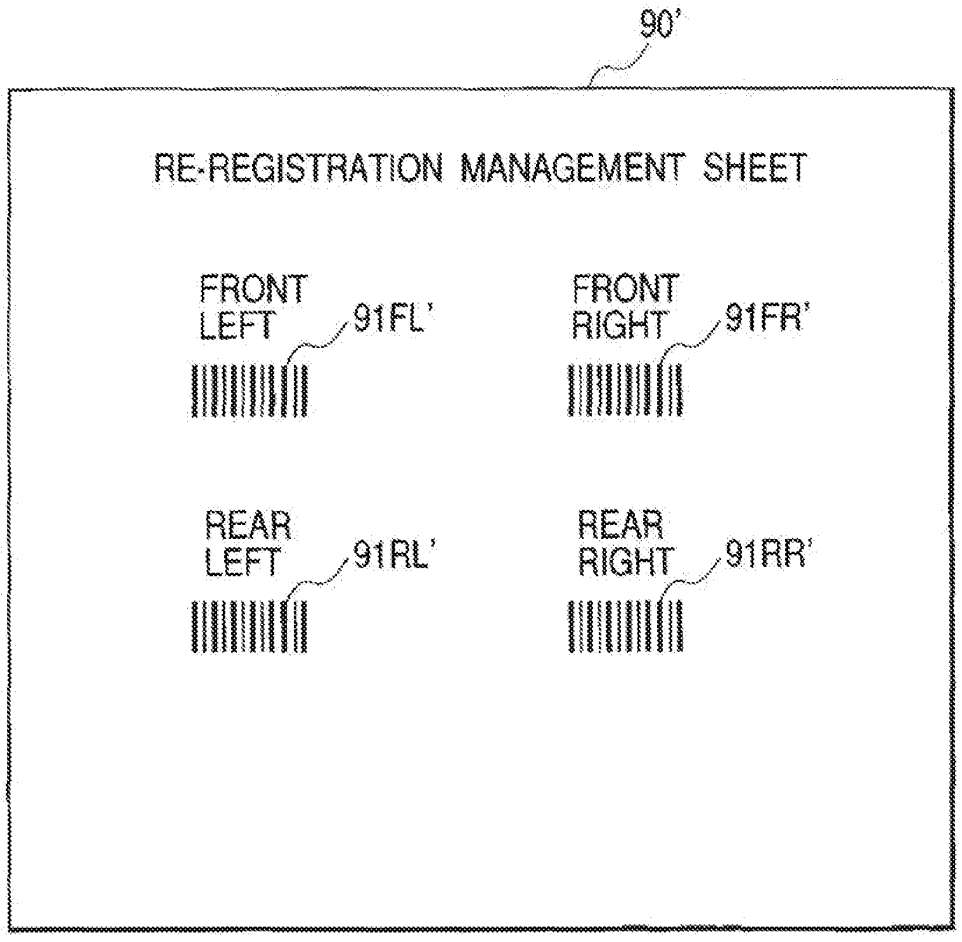
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FIG. 11



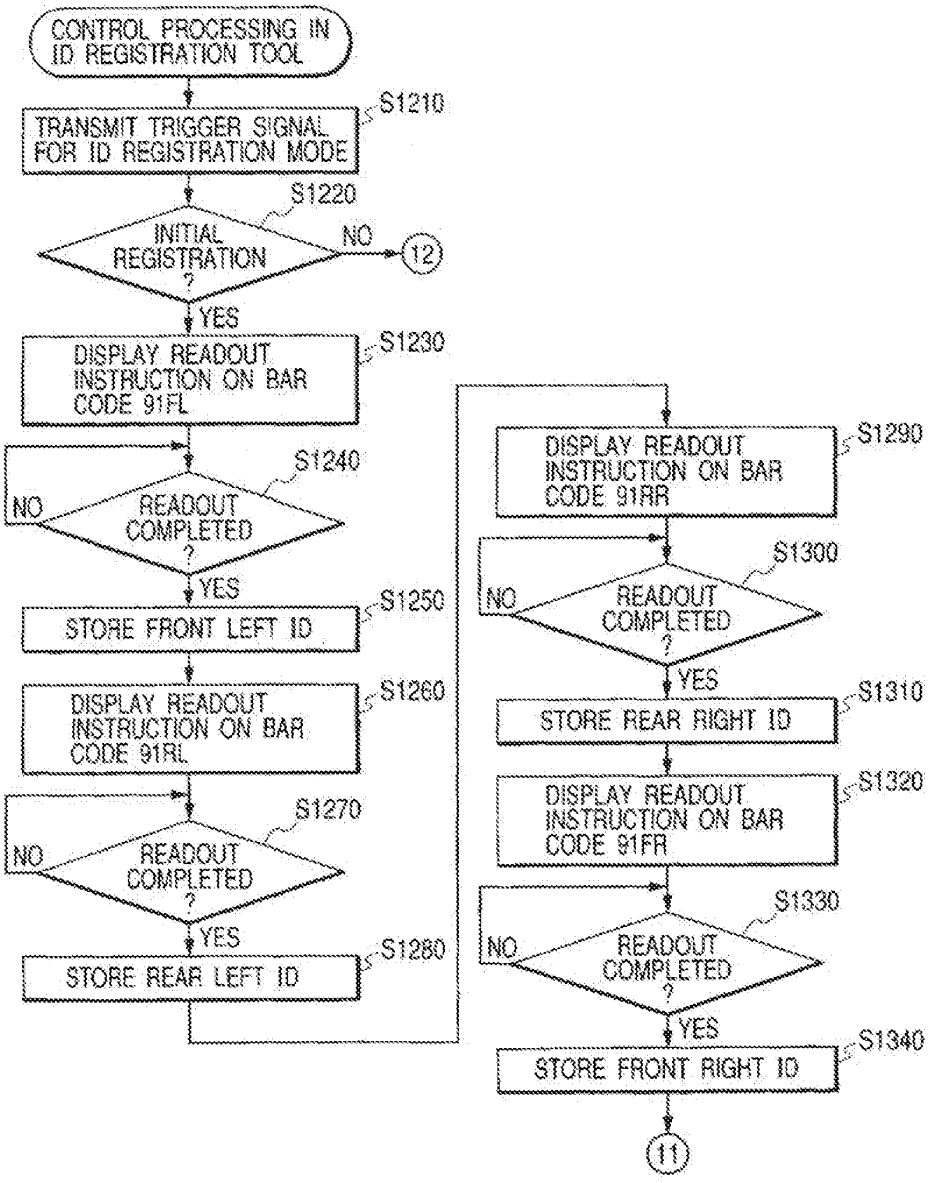
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FIG. 12



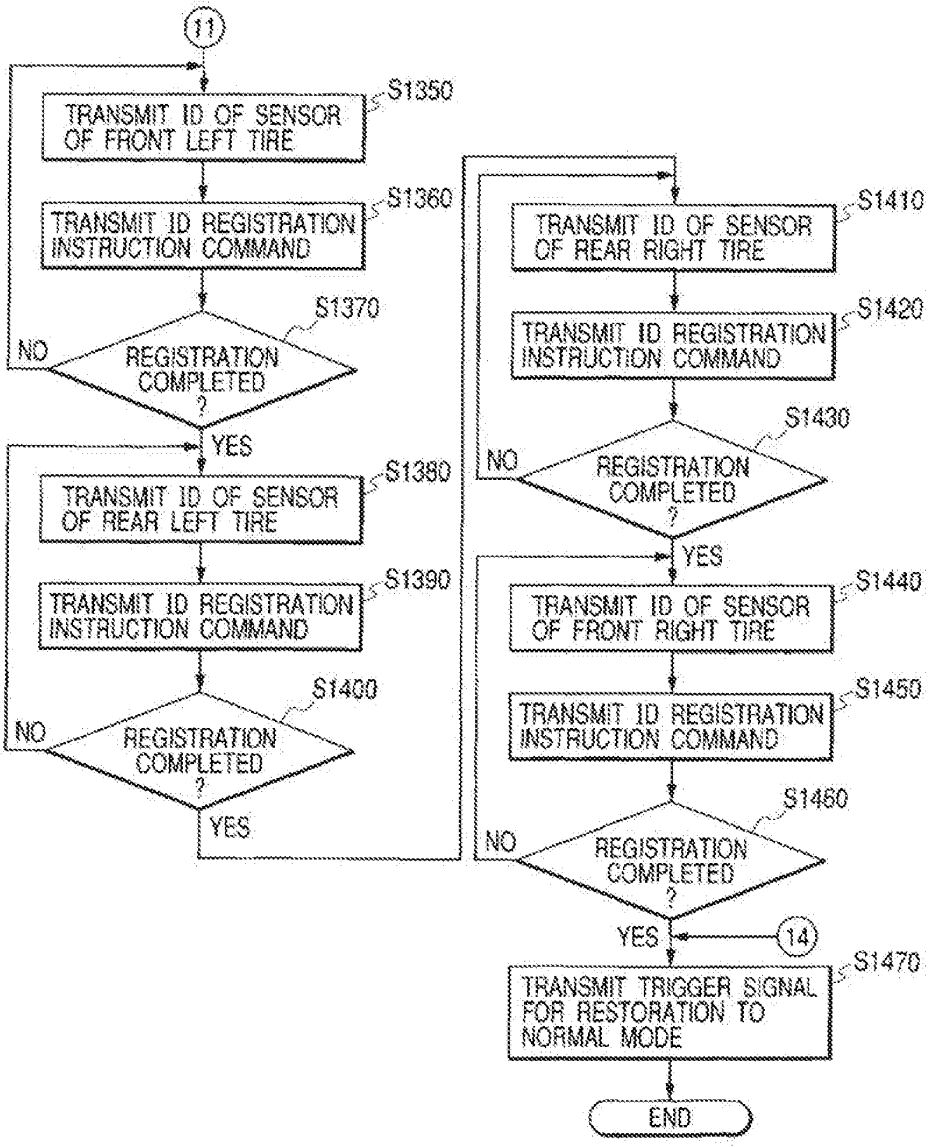
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FIG. 13



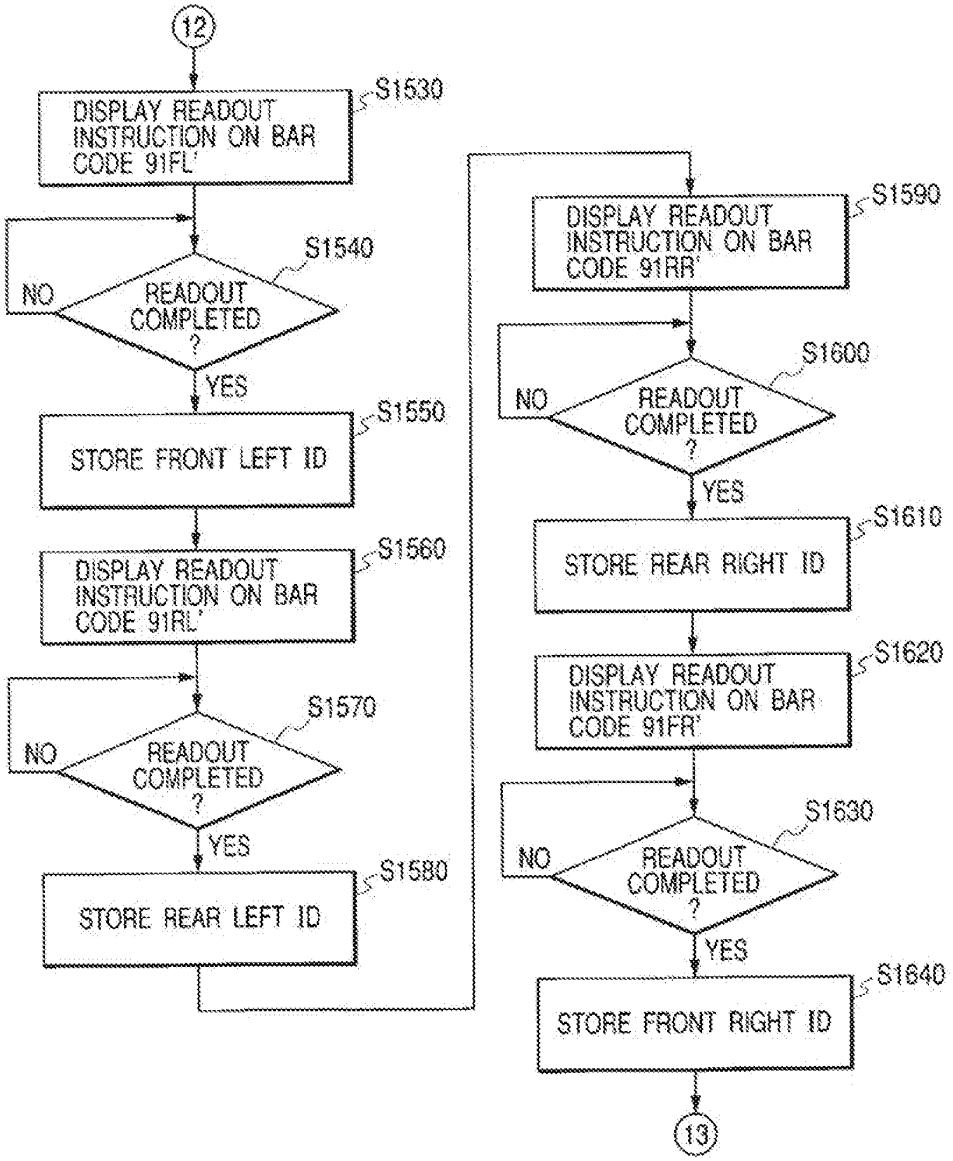
Orange Exhibit No. 2004
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FIG. 14



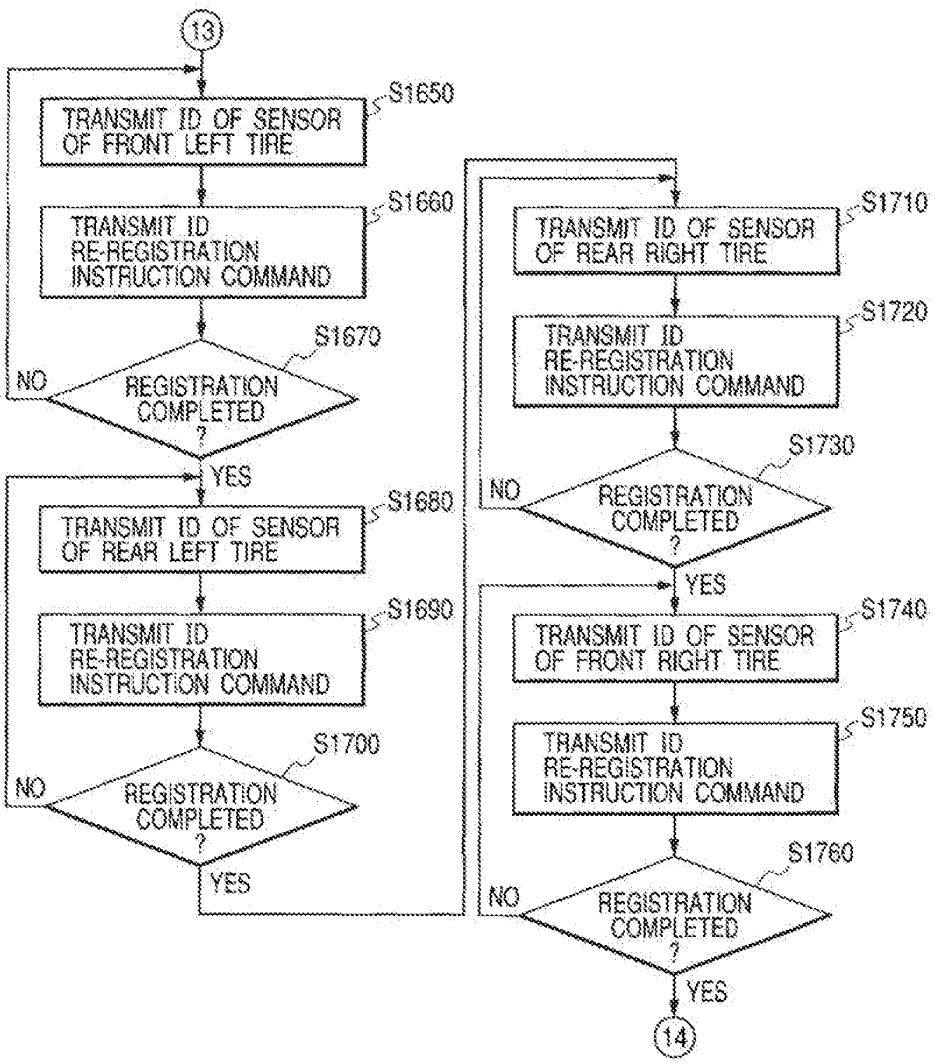
Orange Exhibit No. 2004
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FIG. 15



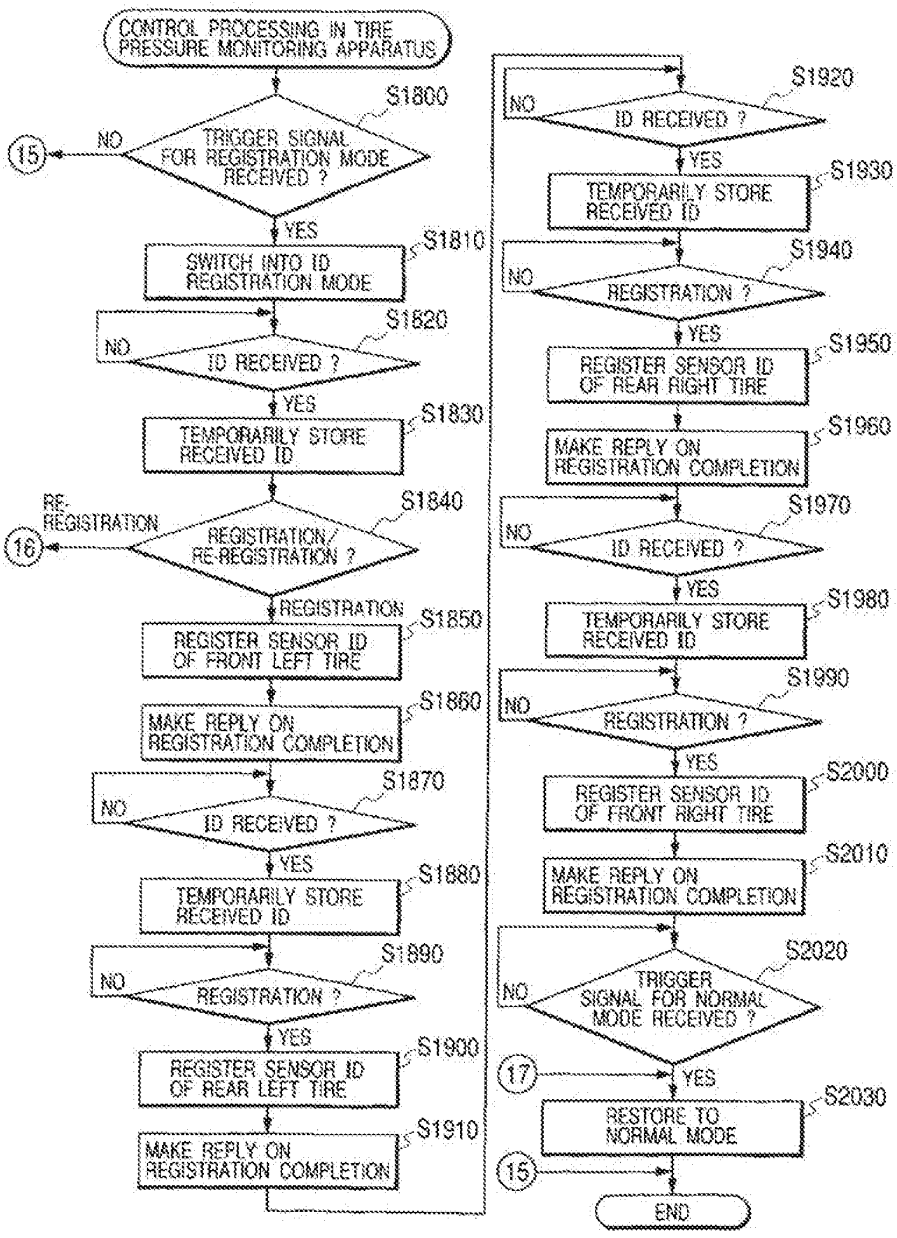
Orange Exhibit No. 2004
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FIG. 16



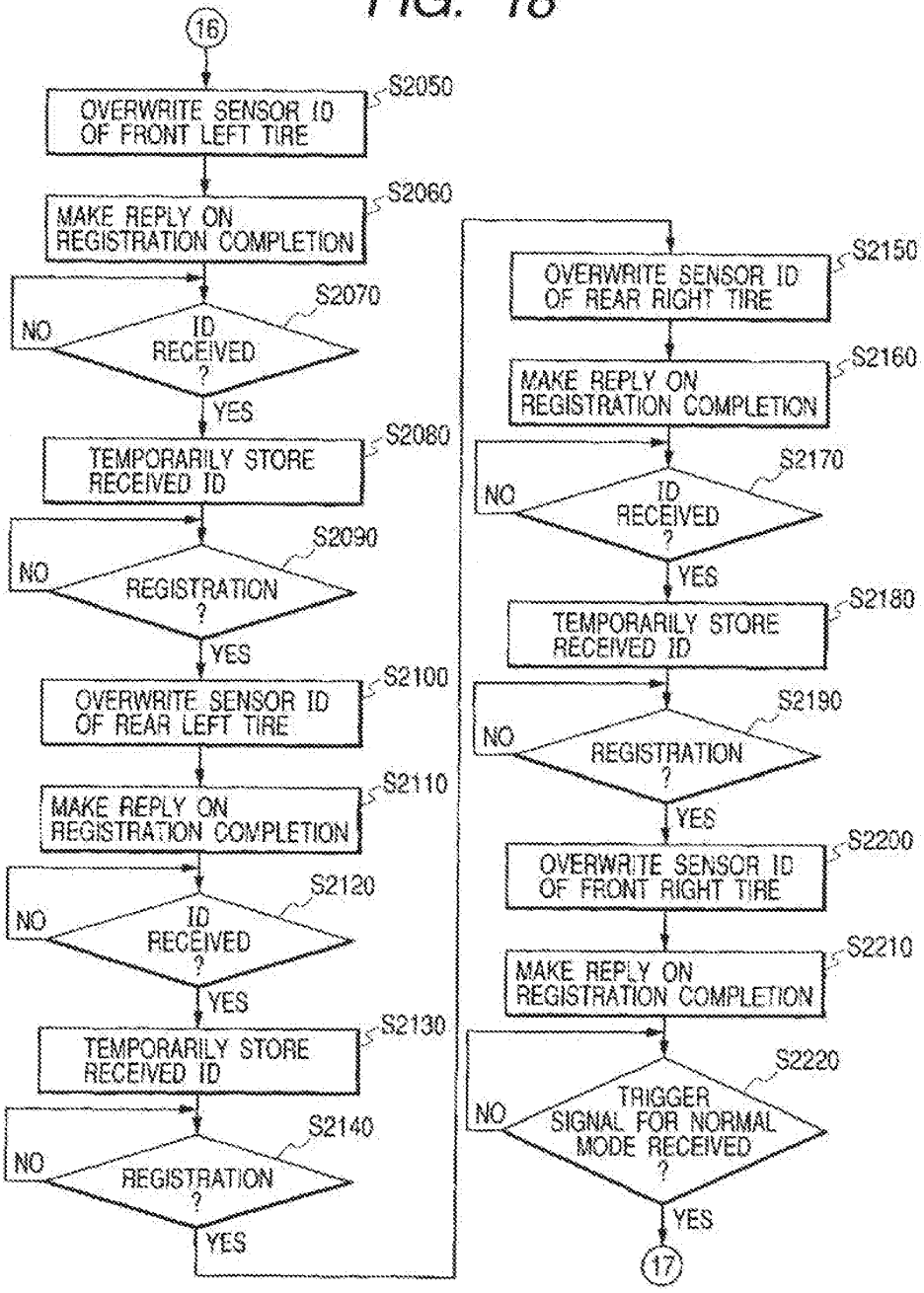
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FIG. 17



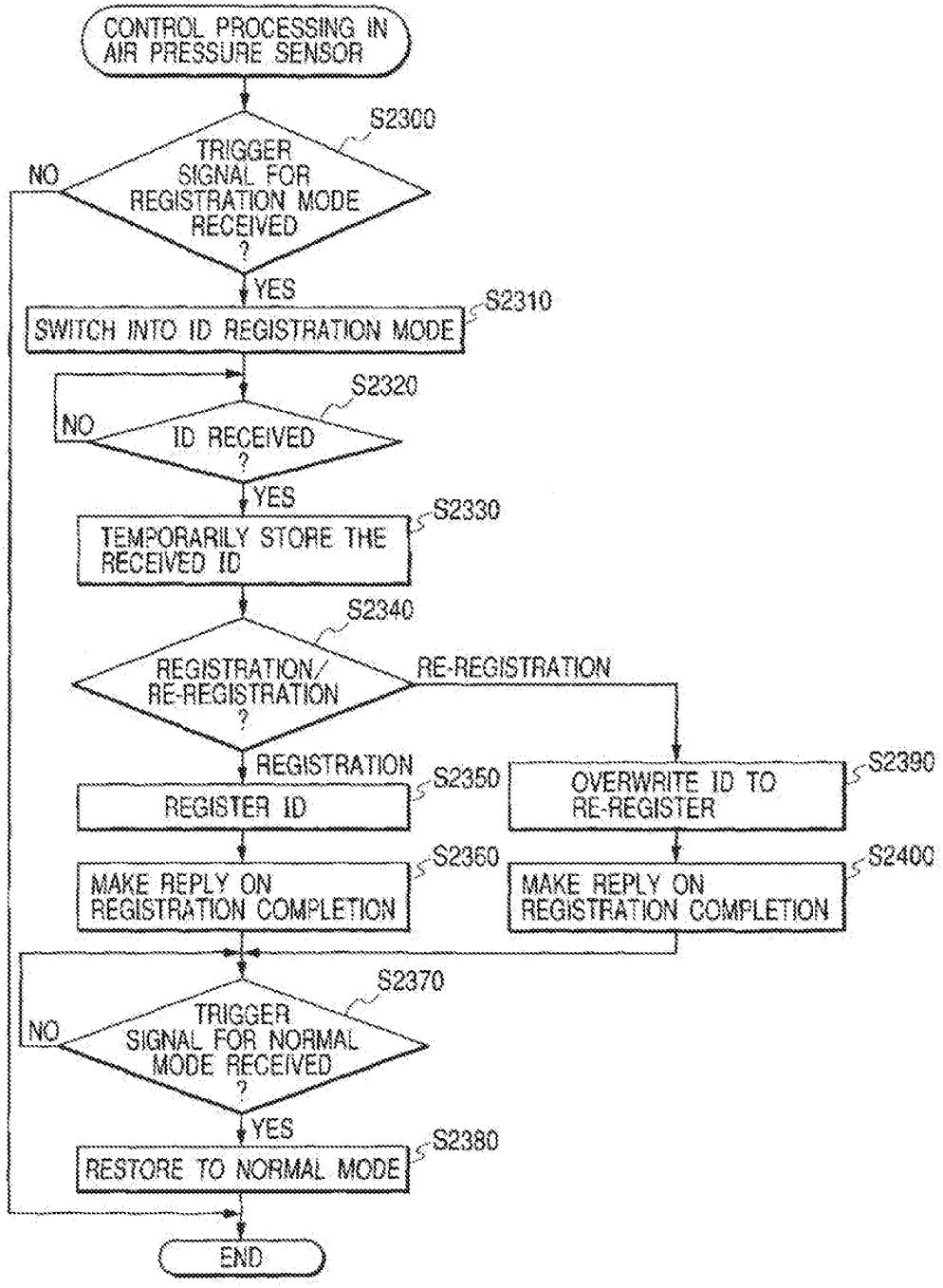
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FIG. 18



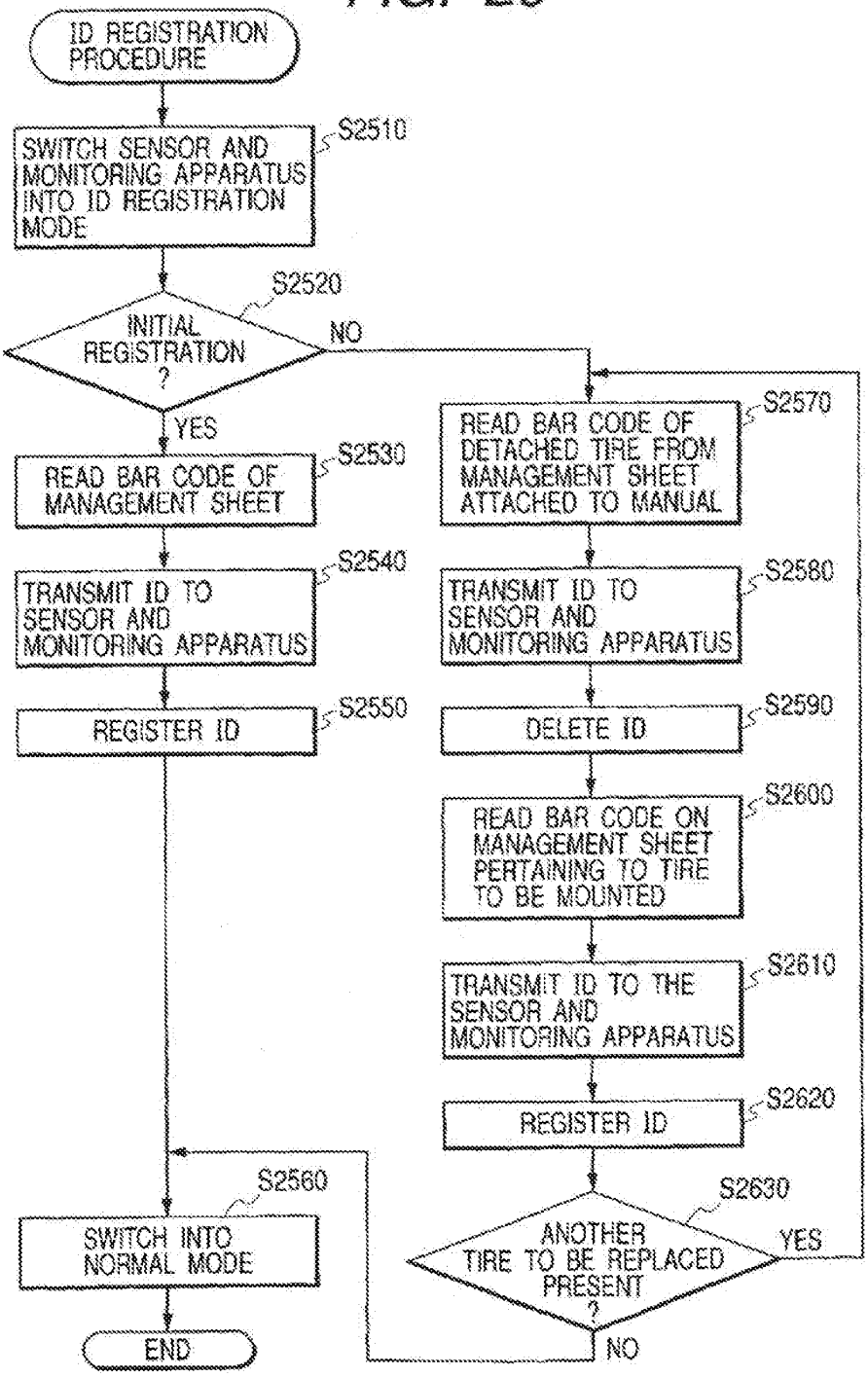
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FIG. 19



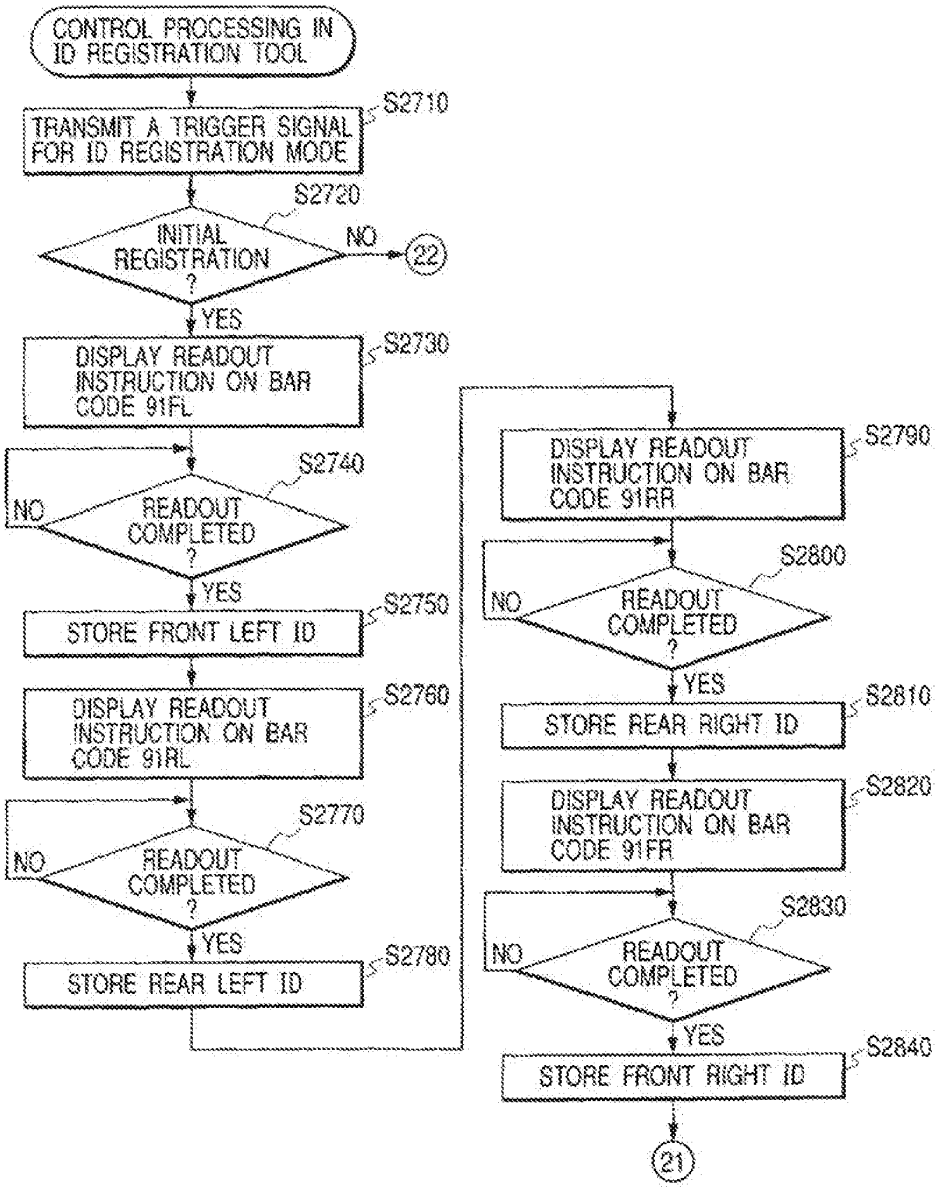
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FIG. 20



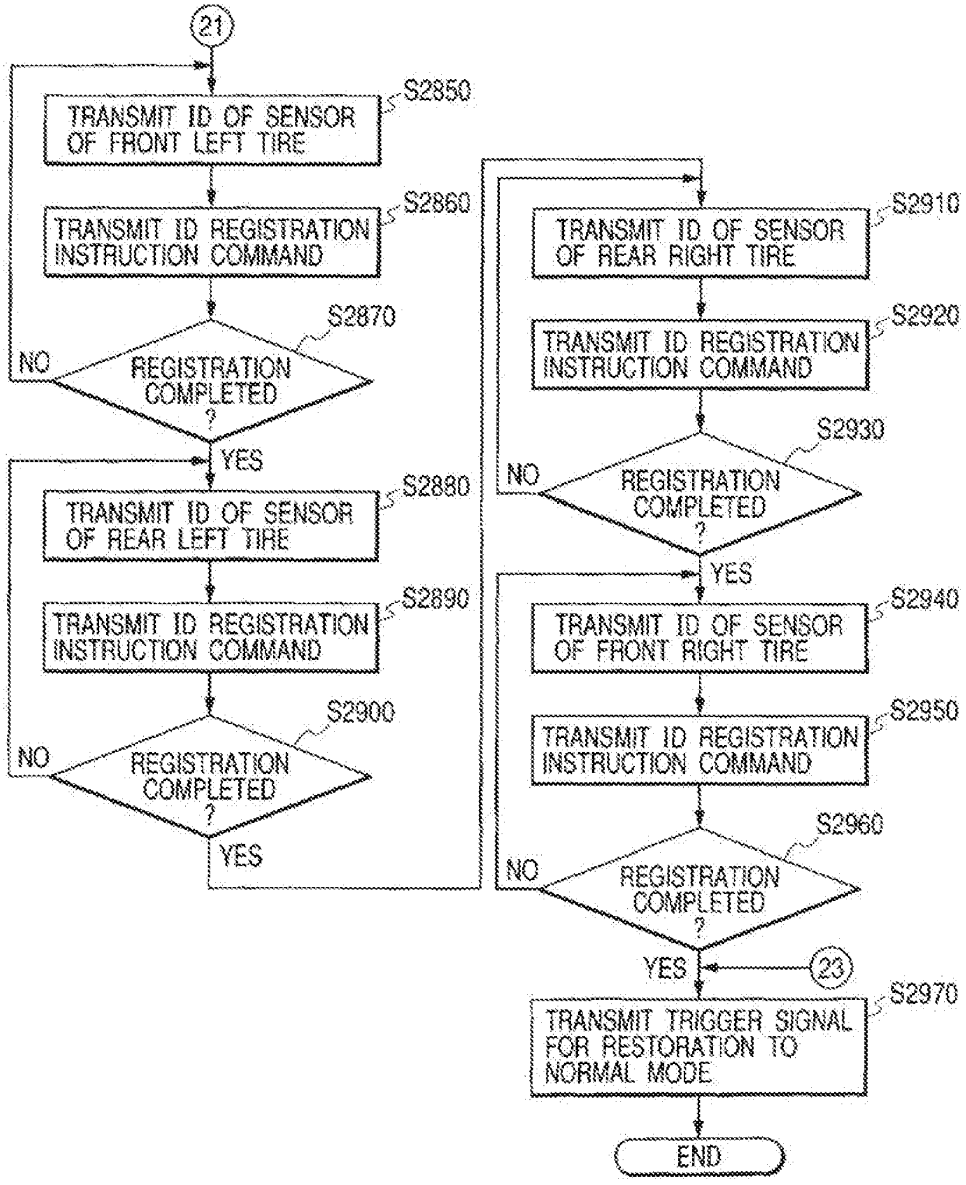
Orange Exhibit No. 2004
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FIG. 21



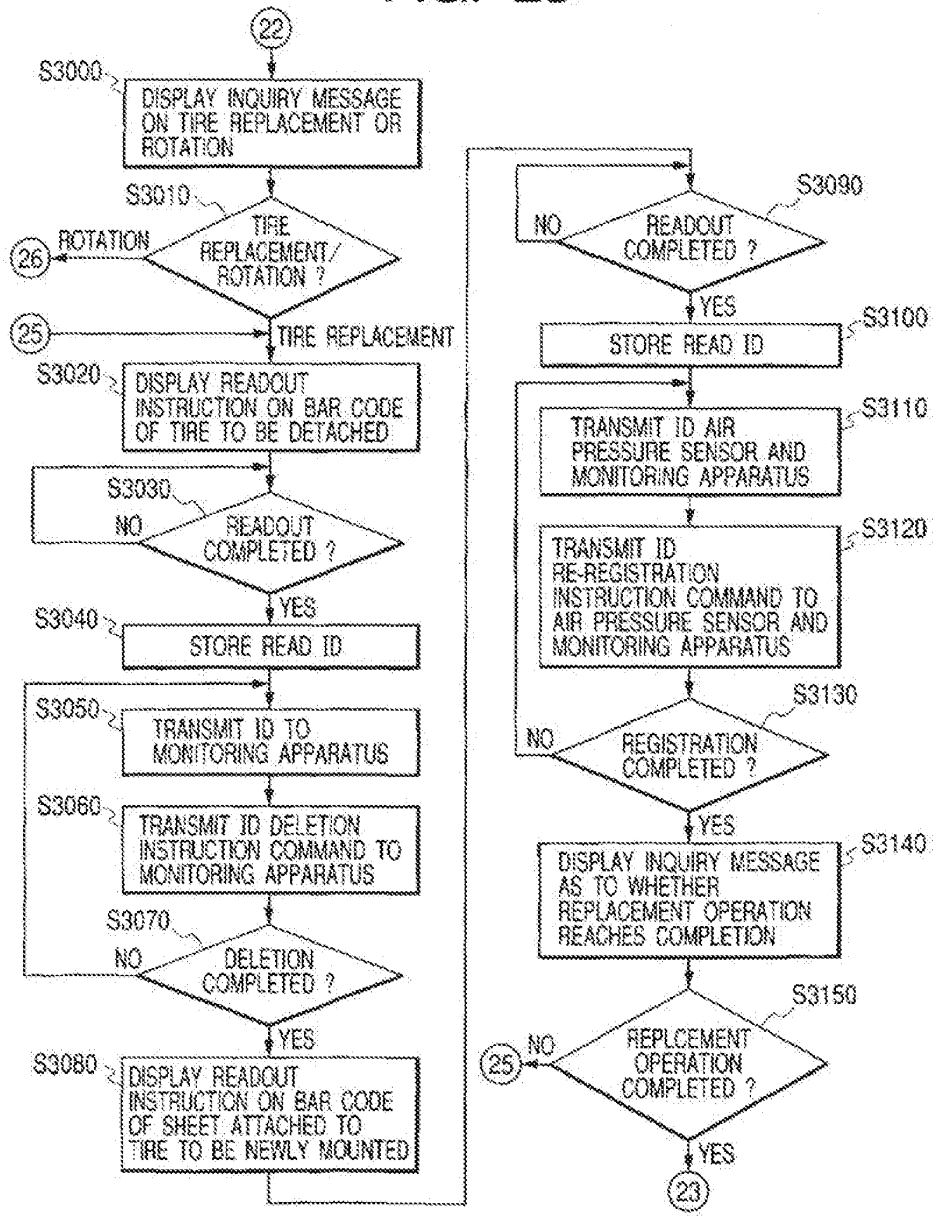
Orange Exhibit No. 2004
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FIG. 22



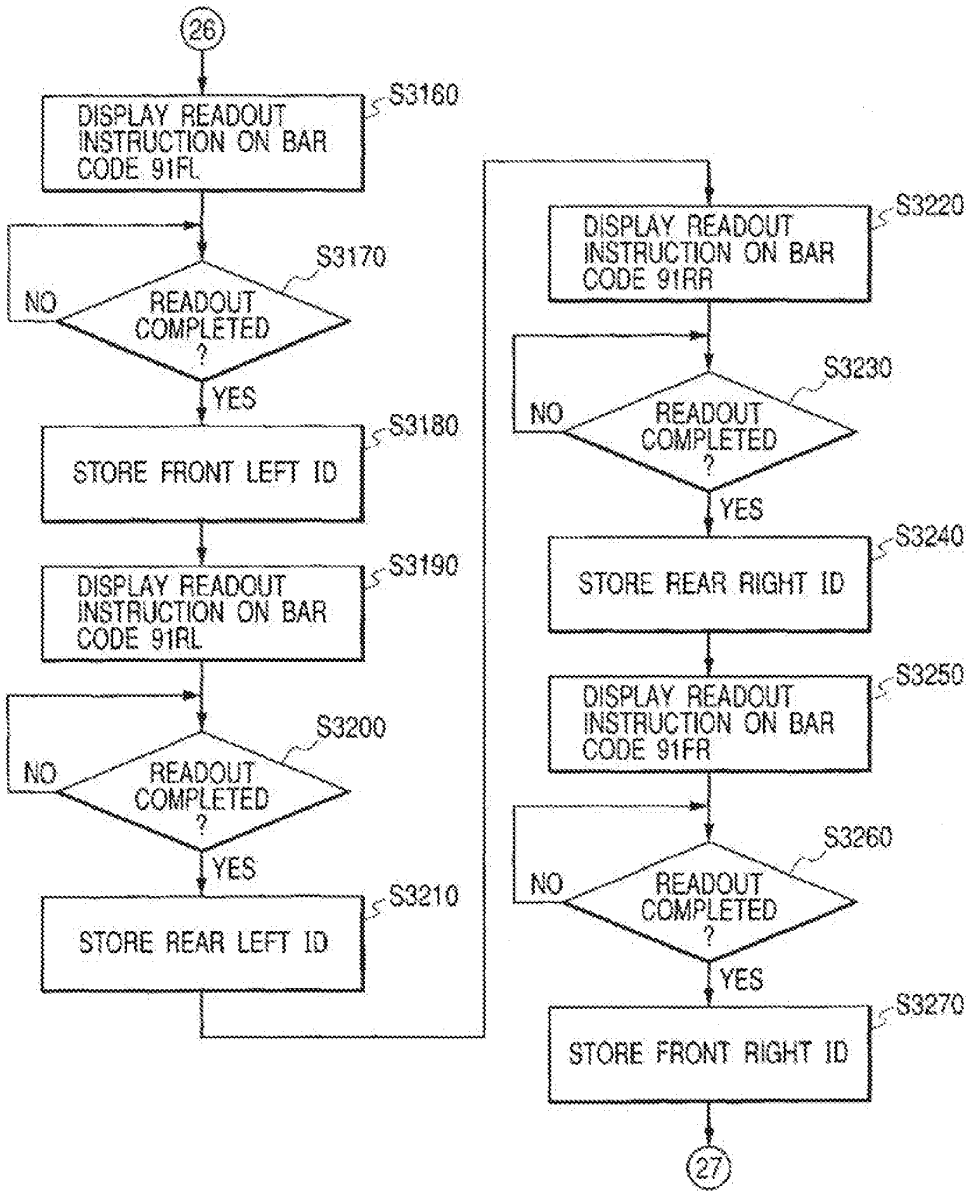
Orange Exhibit No. 2004
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FIG. 23



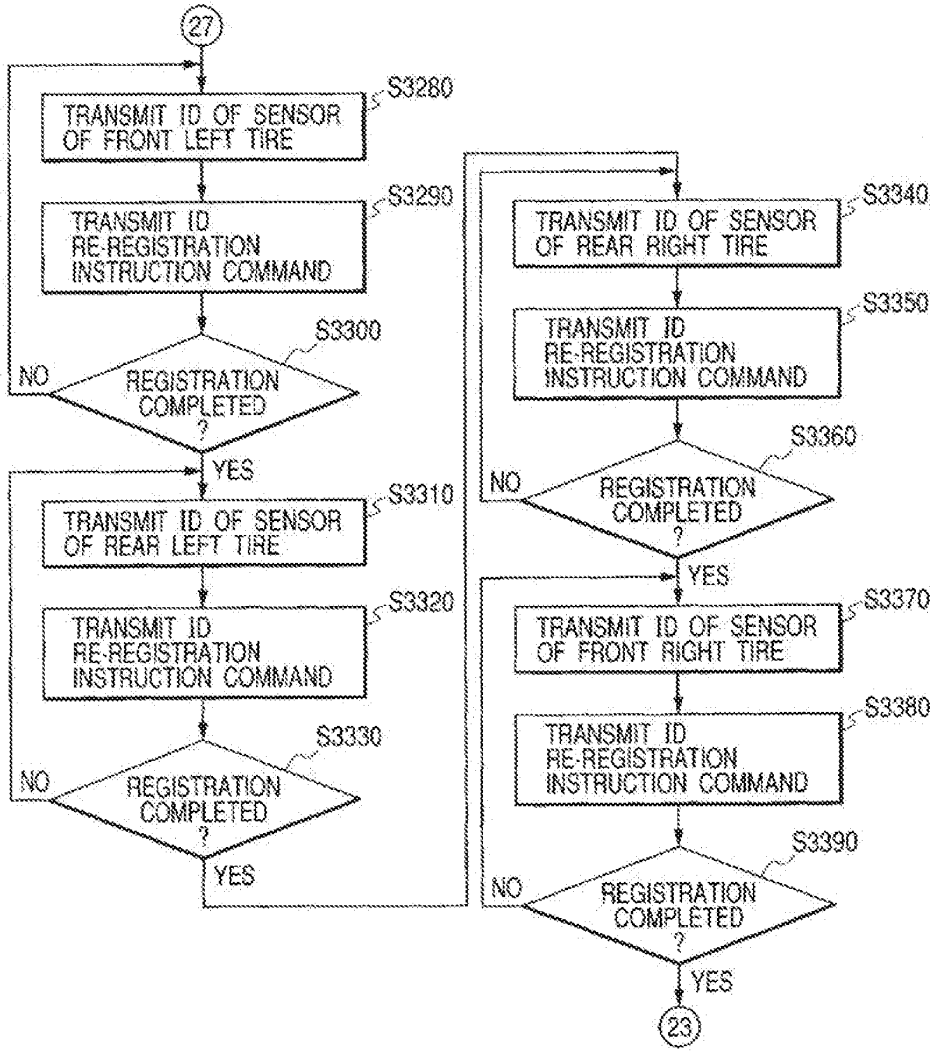
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FIG. 24



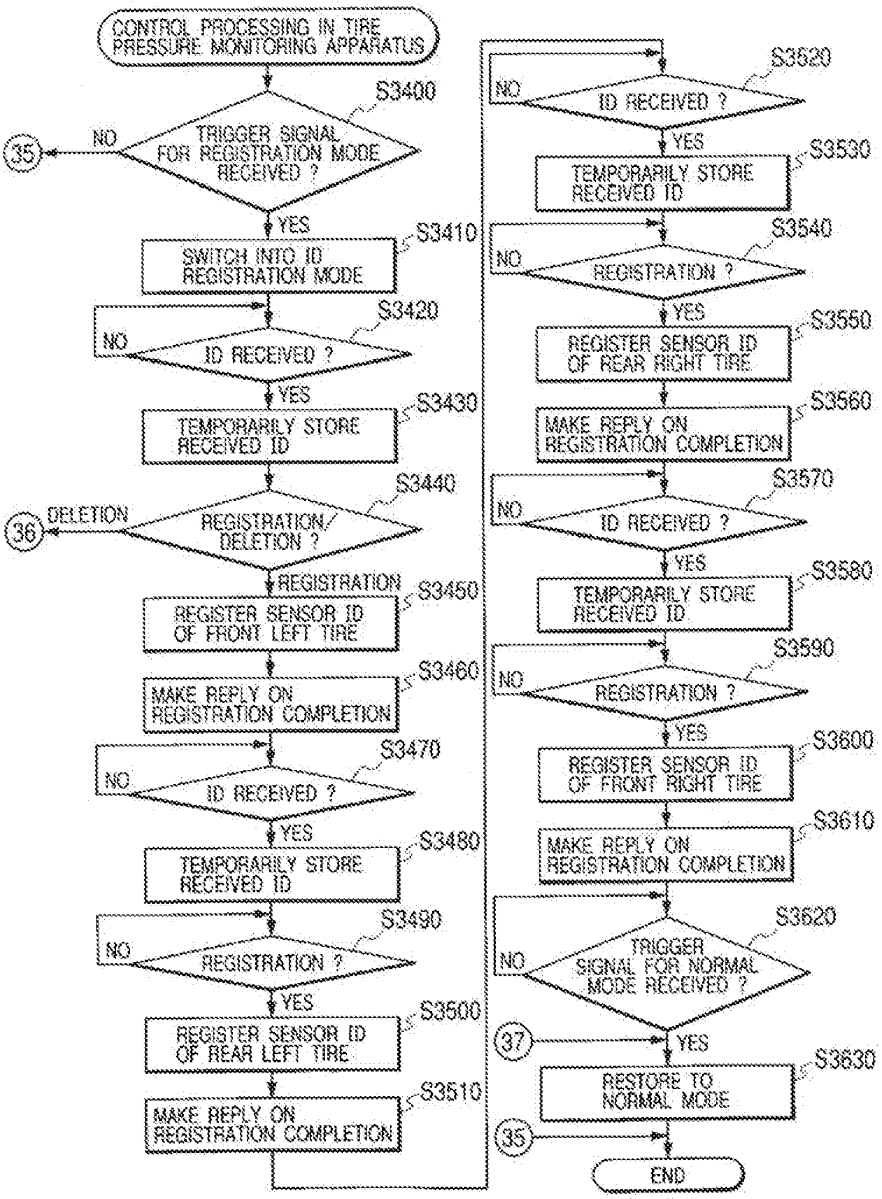
Orange Exhibit No. 2004
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FIG. 25



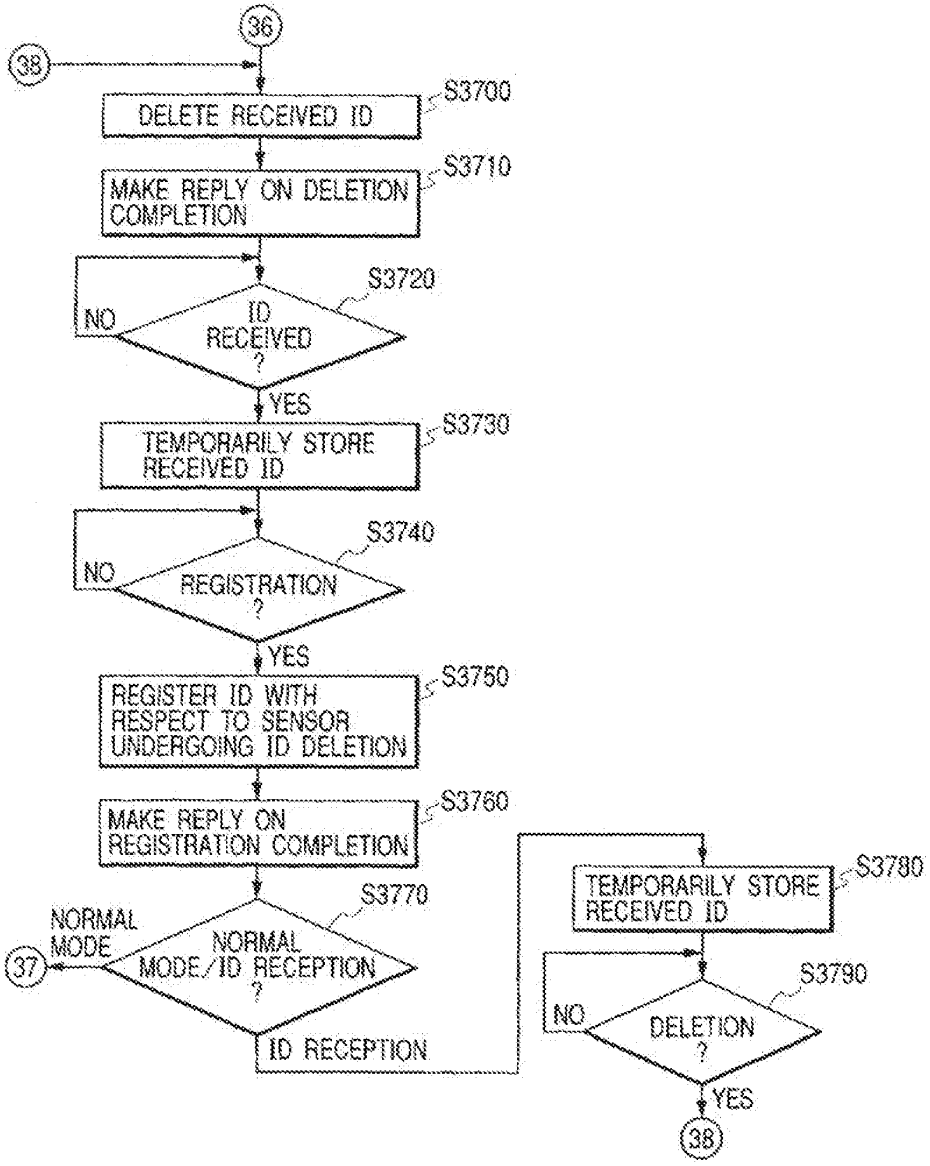
Orange Exhibit No. 2004
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FIG. 26



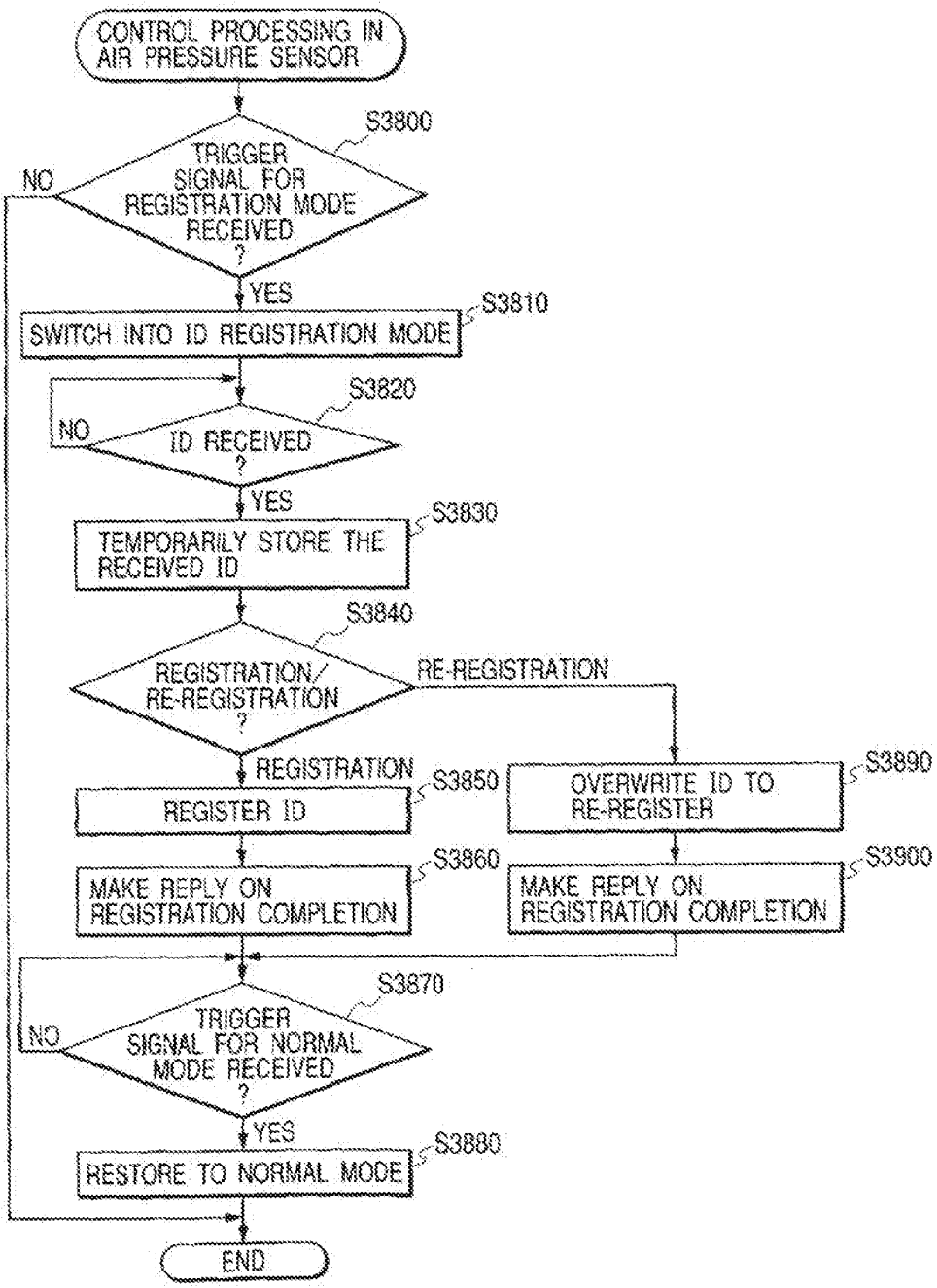
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FIG. 27



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FIG. 28



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FIG. 29A

DATA CODE

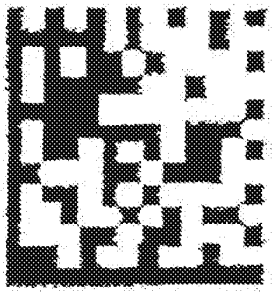


FIG. 29B

QR CODE

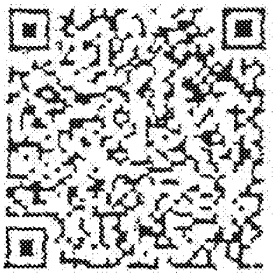


FIG. 29C

MAXI CODE

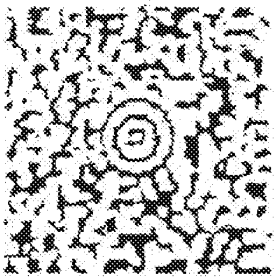
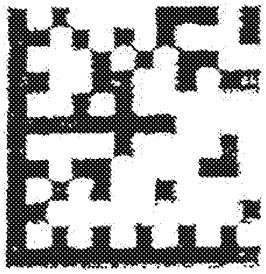


FIG. 29D

CP CODE



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FIG. 30A

EXAMPLE OF TWO-DIMENSIONAL BAR CODE

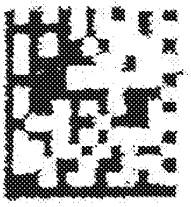
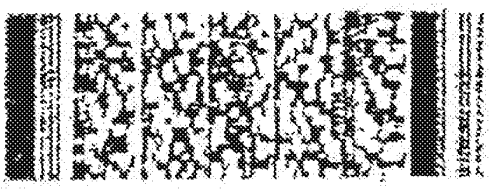


FIG. 30B

EXAMPLE OF TWO-DIMENSIONAL BAR CODE



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FIG. 31A

PDF 417

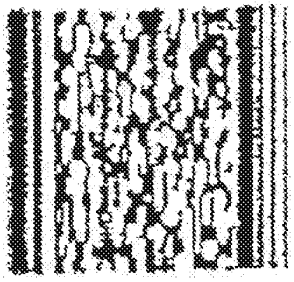


FIG. 31B

CODE 49

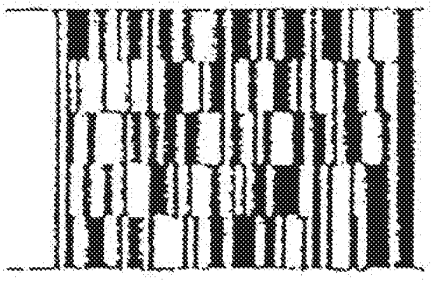


FIG. 31C

CODE 16K

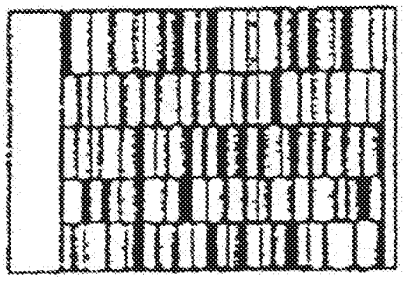
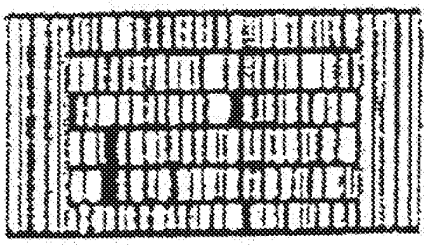


FIG. 31D

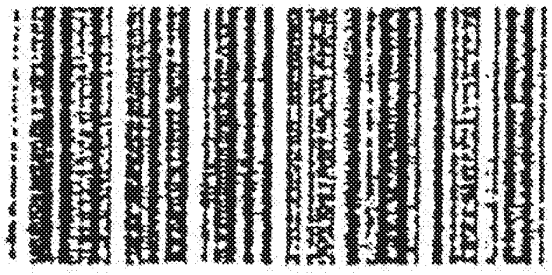
CODER BLOCK



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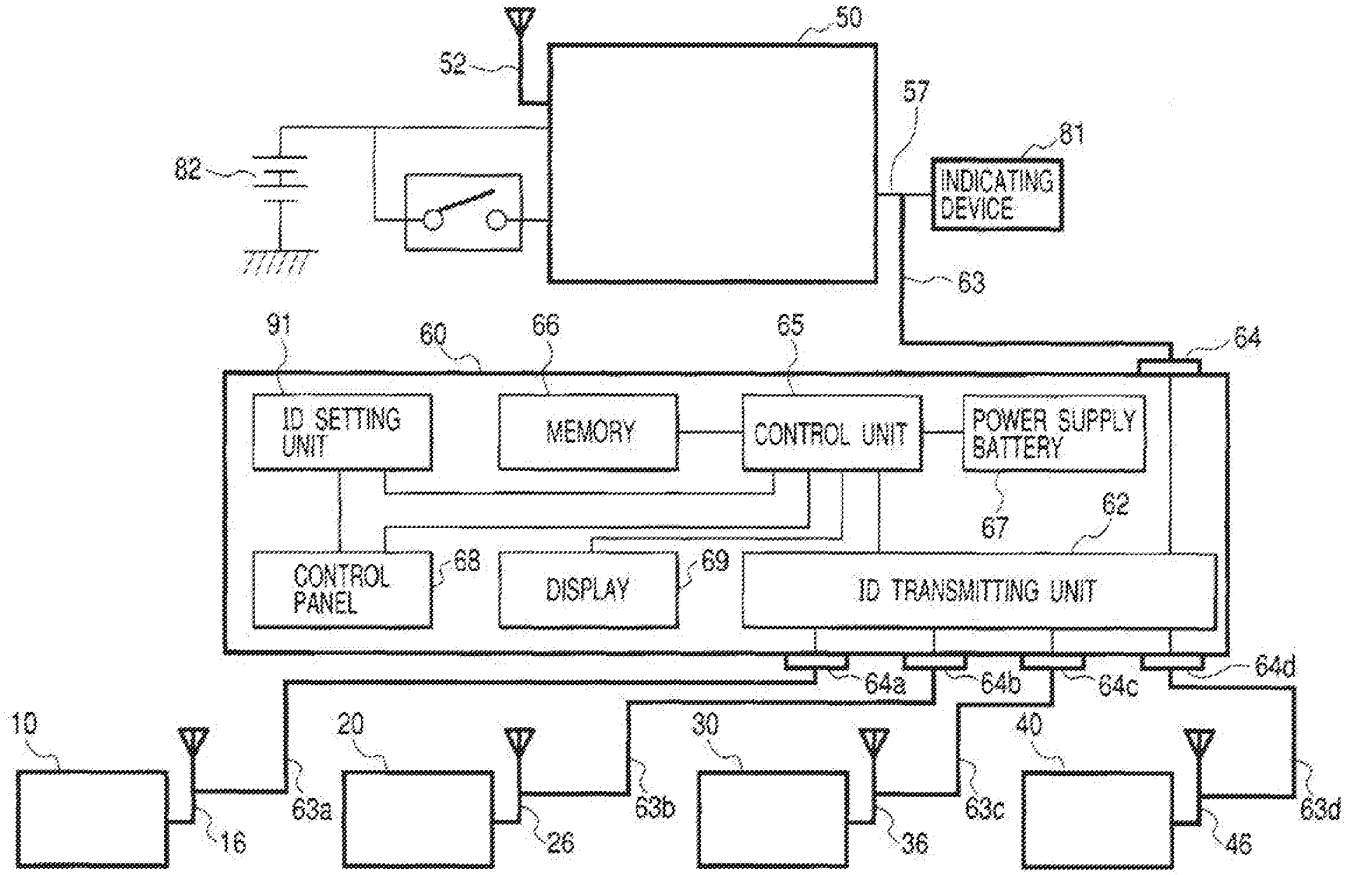
FIG. 32

EXAMPLE OF ONE-DIMENSIONAL BAR CODE



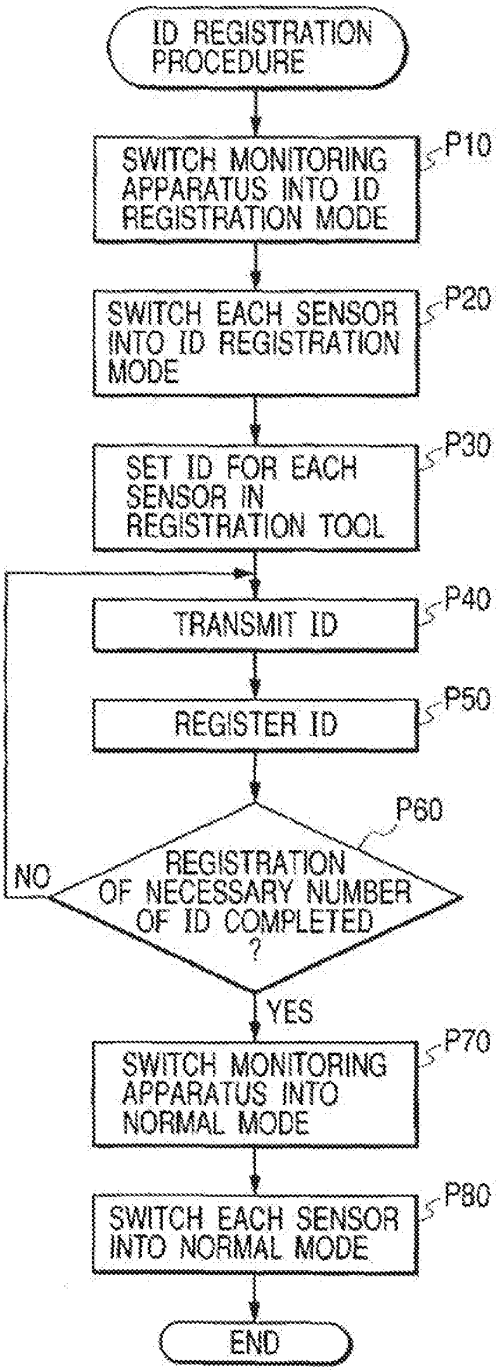
Orange Exhibit No. 2004
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FIG. 33



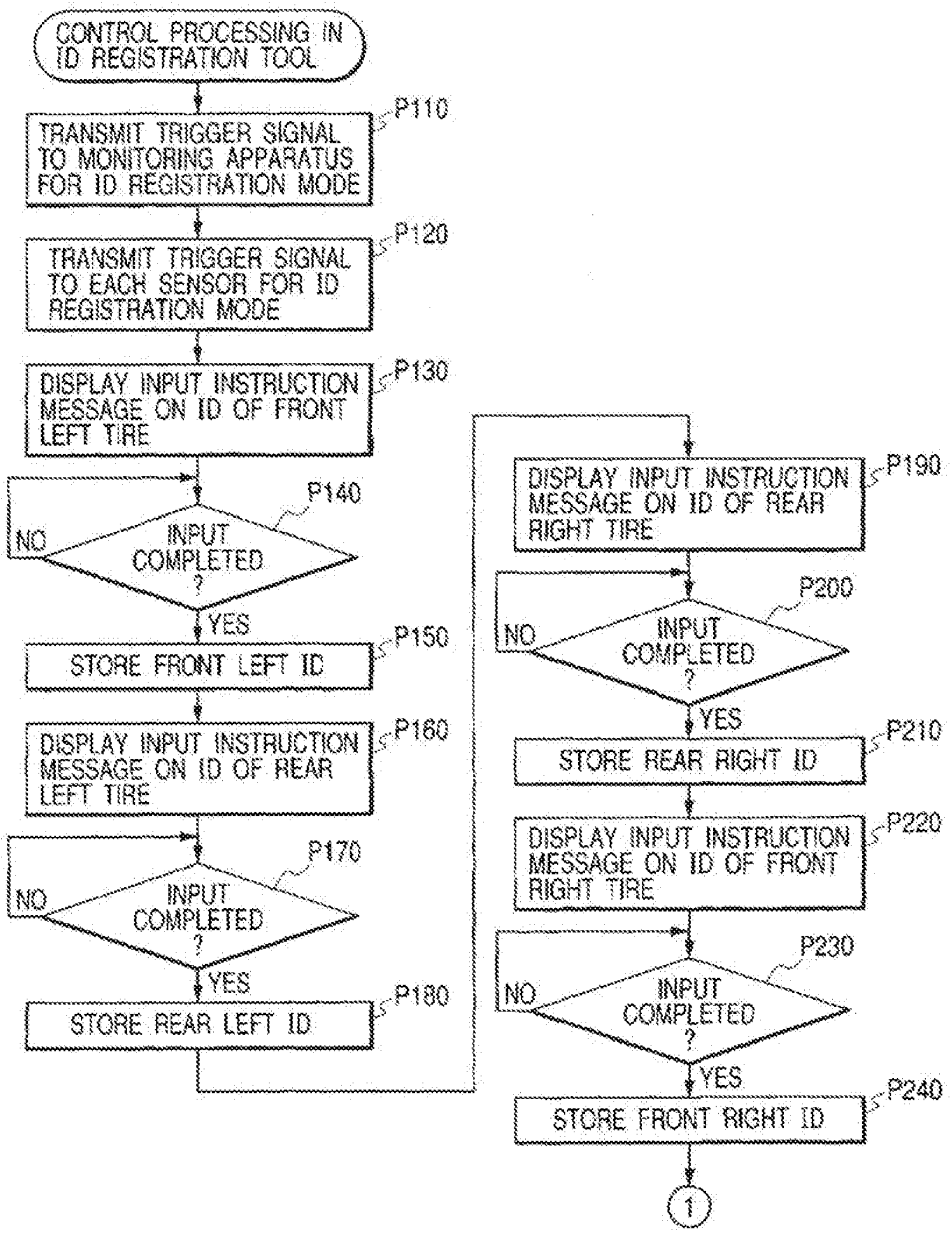
Orange Exhibit No. 2004
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FIG. 34



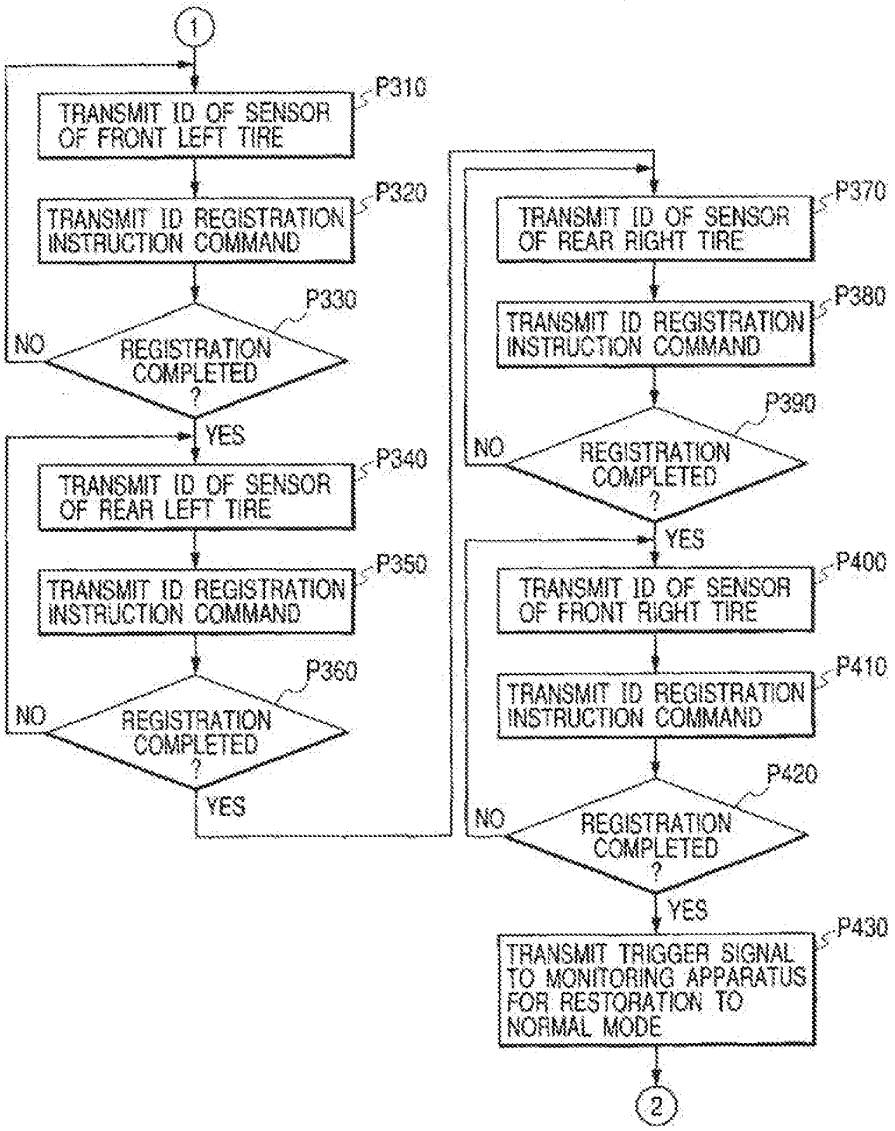
Orange Exhibit No. 2004
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FIG. 35



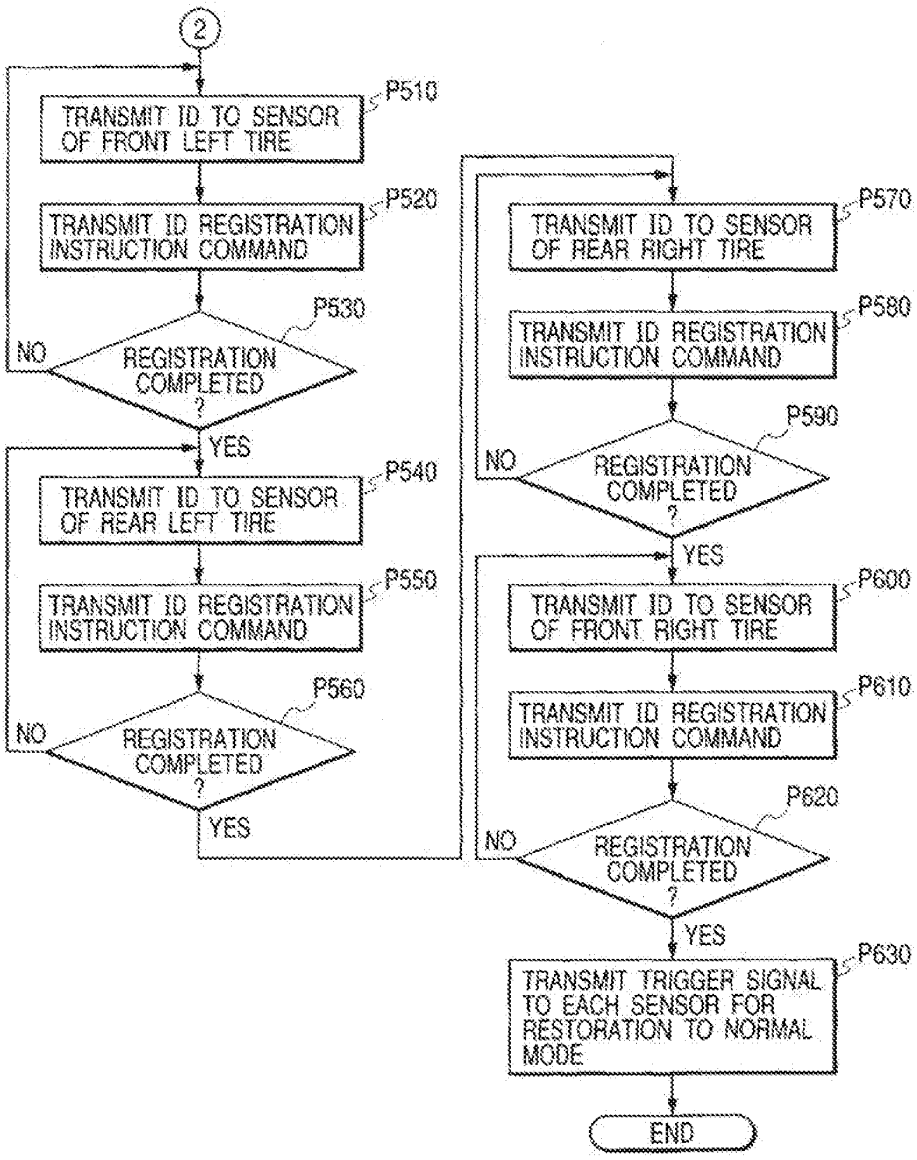
Orange Exhibit No. 2004
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FIG. 36



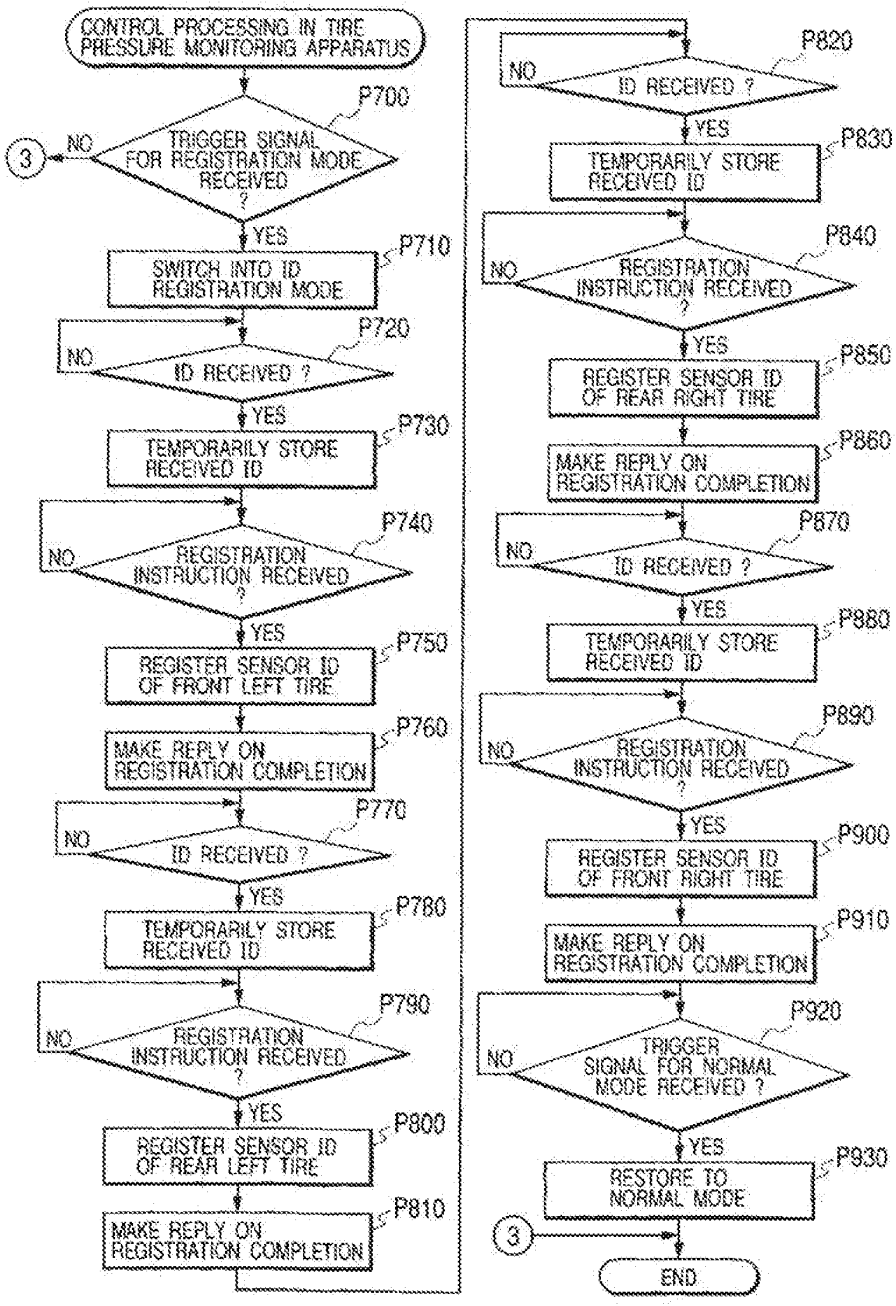
Orange Exhibit No. 2004
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FIG. 37



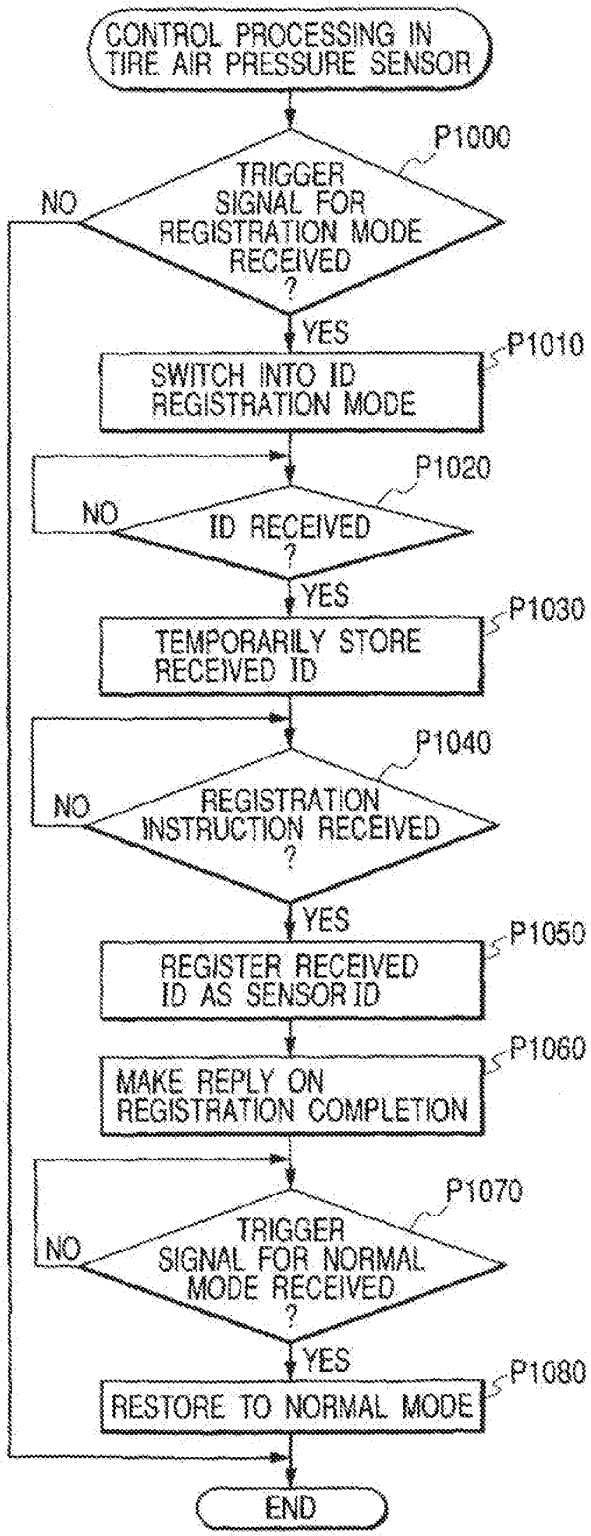
Orange Exhibit No. 2004
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FIG. 38



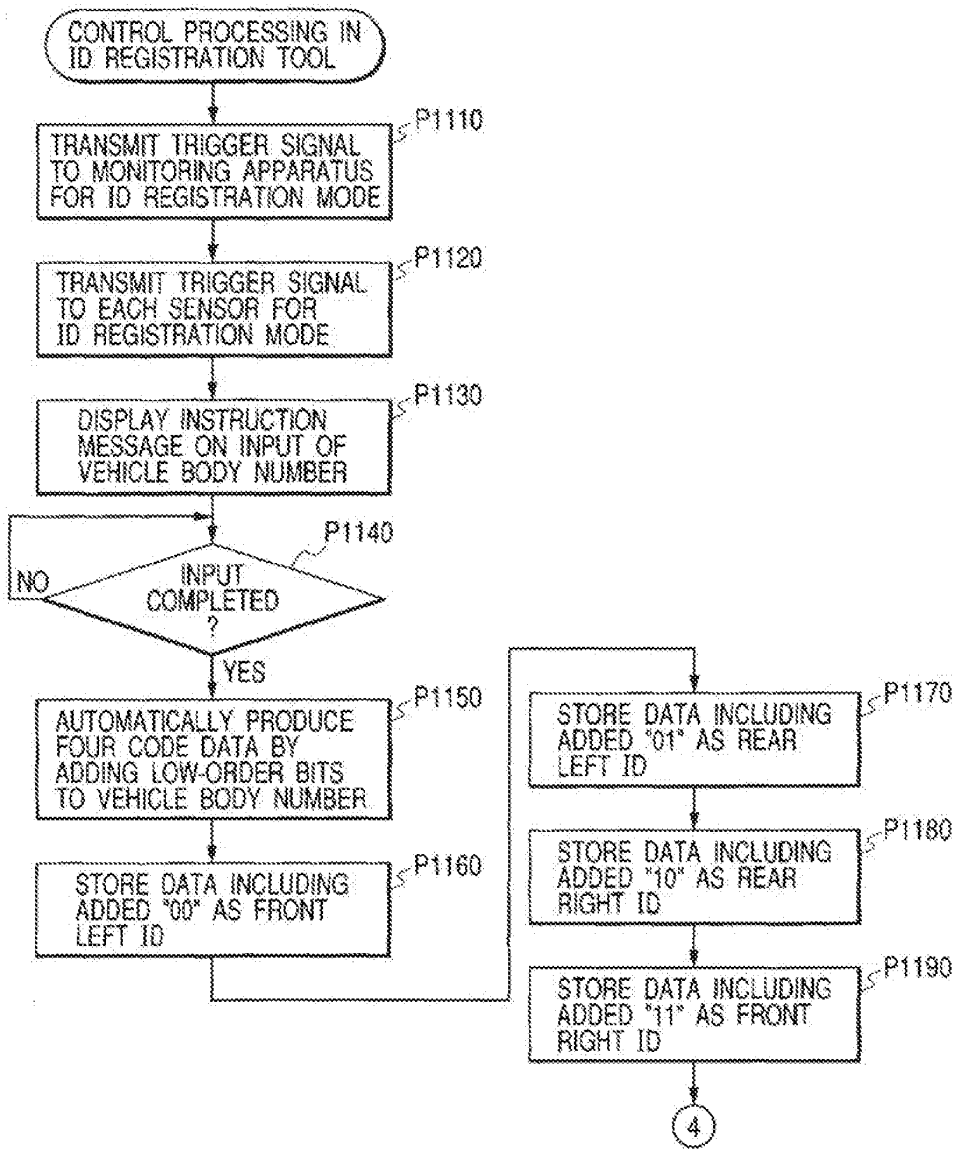
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FIG. 39



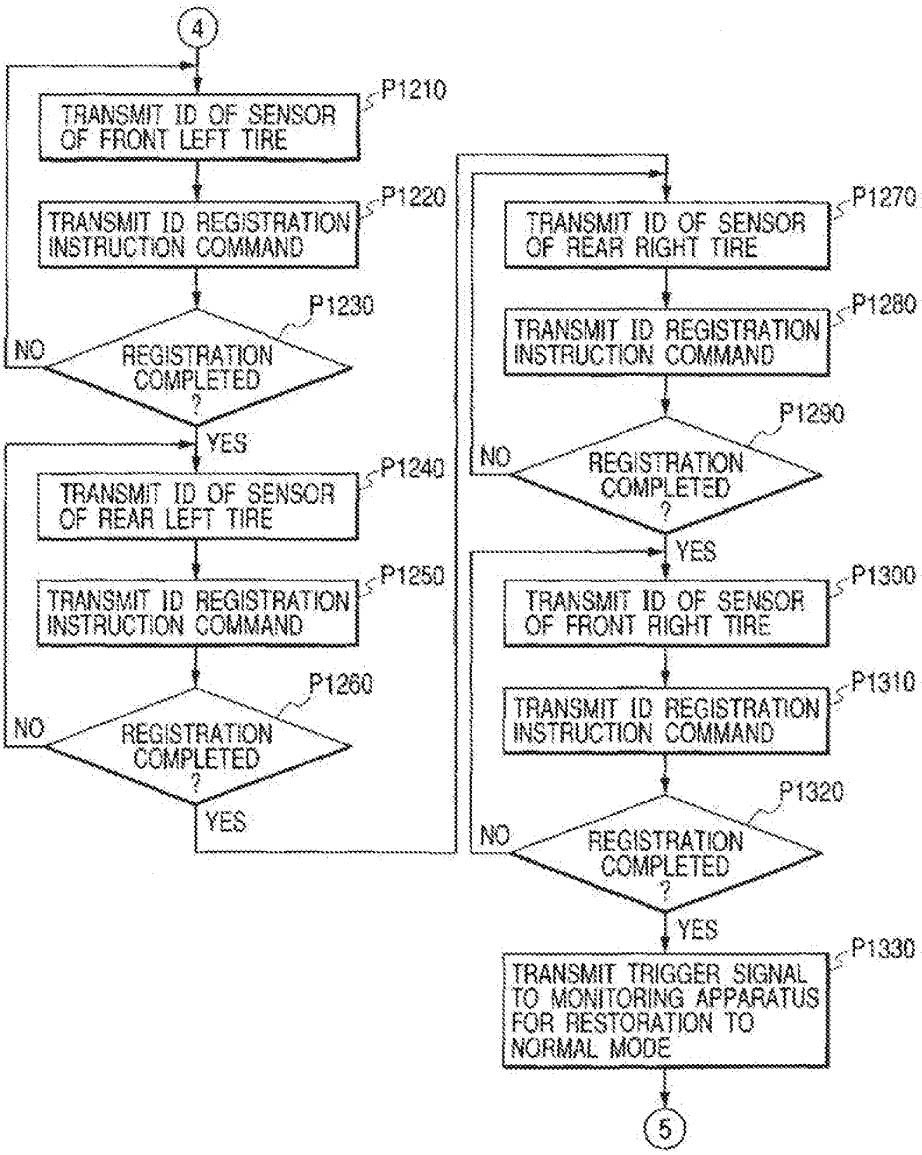
Orange Exhibit No. 2004
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FIG. 40



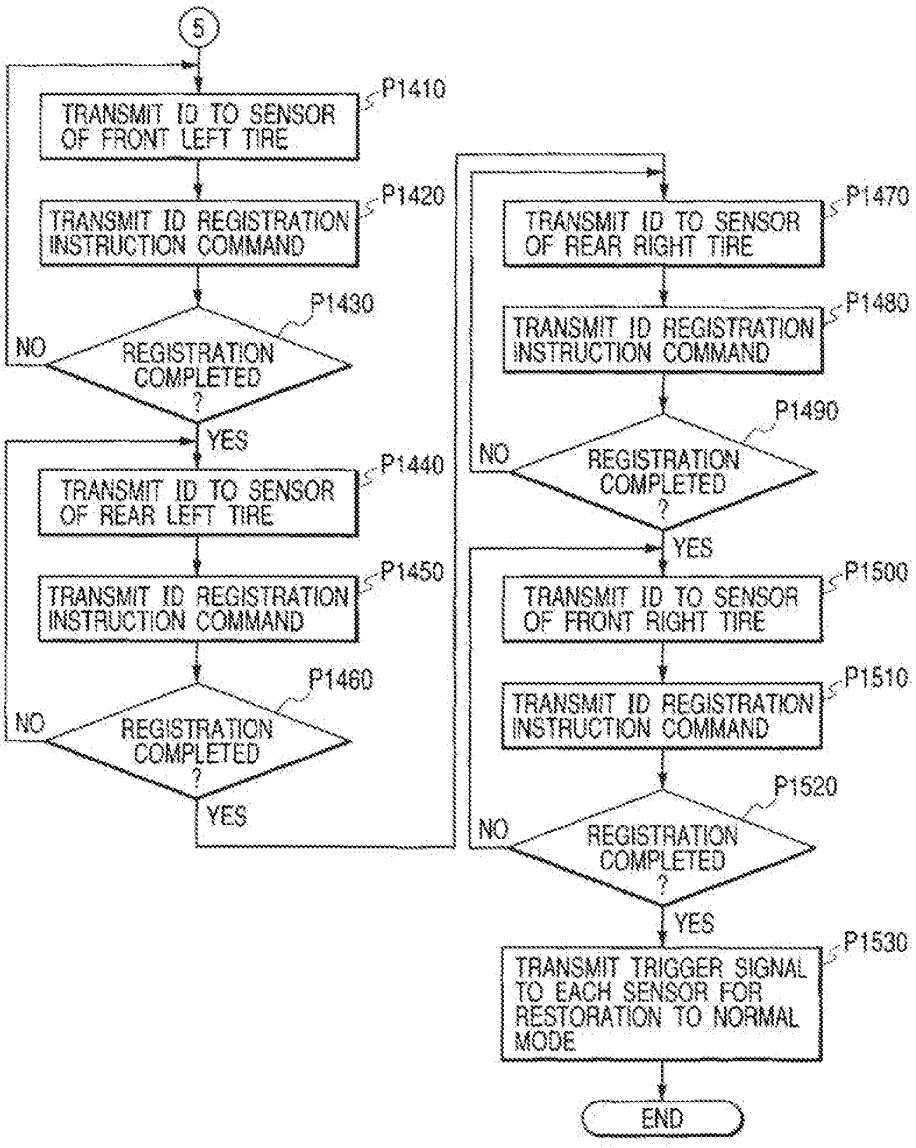
Orange Exhibit No. 2004
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FIG. 41



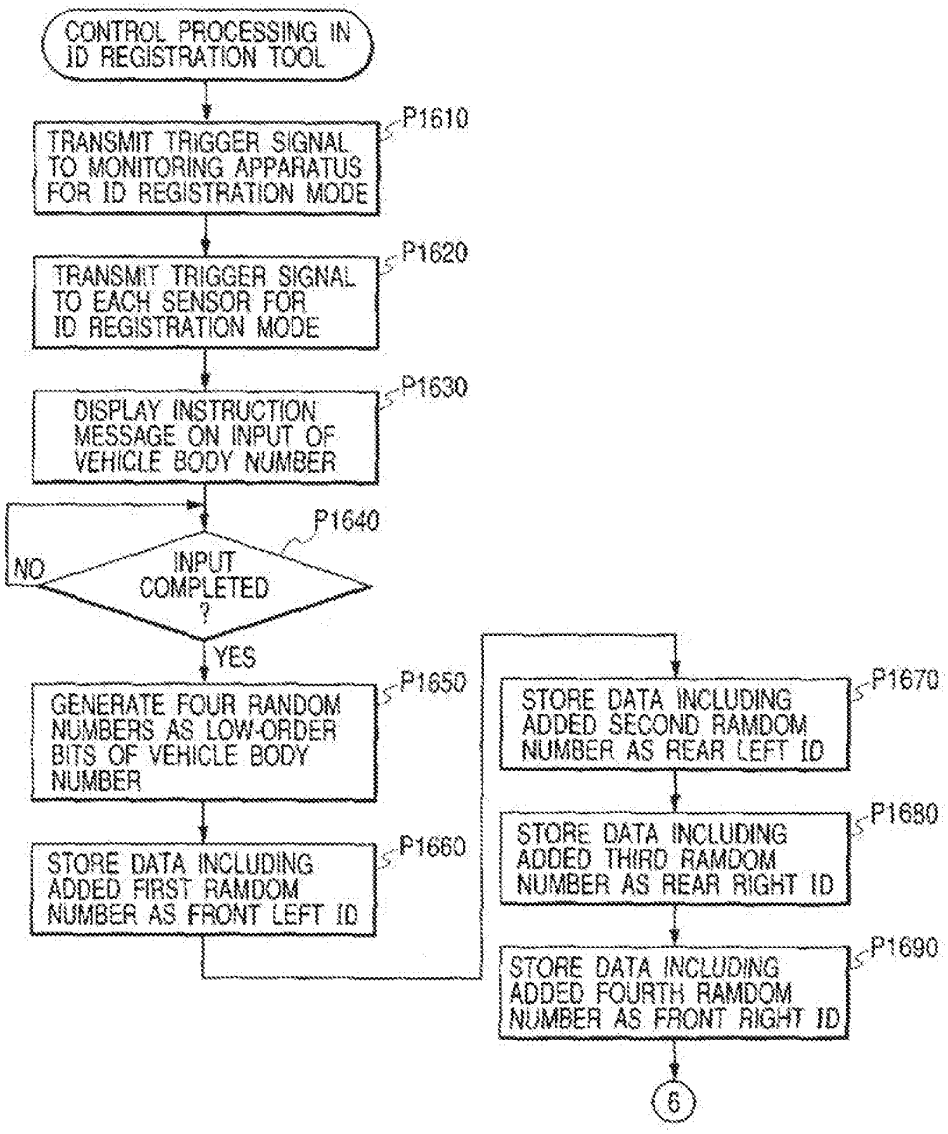
Orange Exhibit No. 2004
IPR2024-00744

FIG. 42



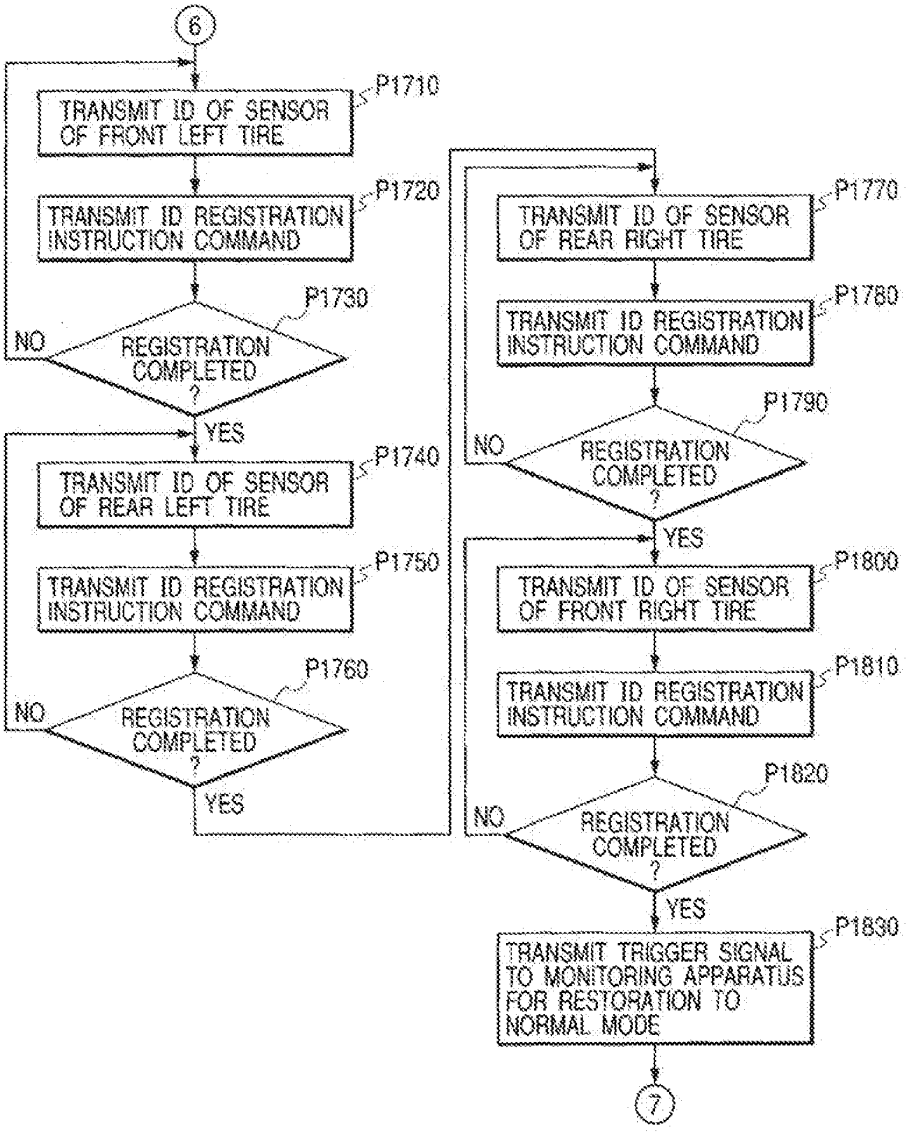
Orange Exhibit No. 2004
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FIG. 43



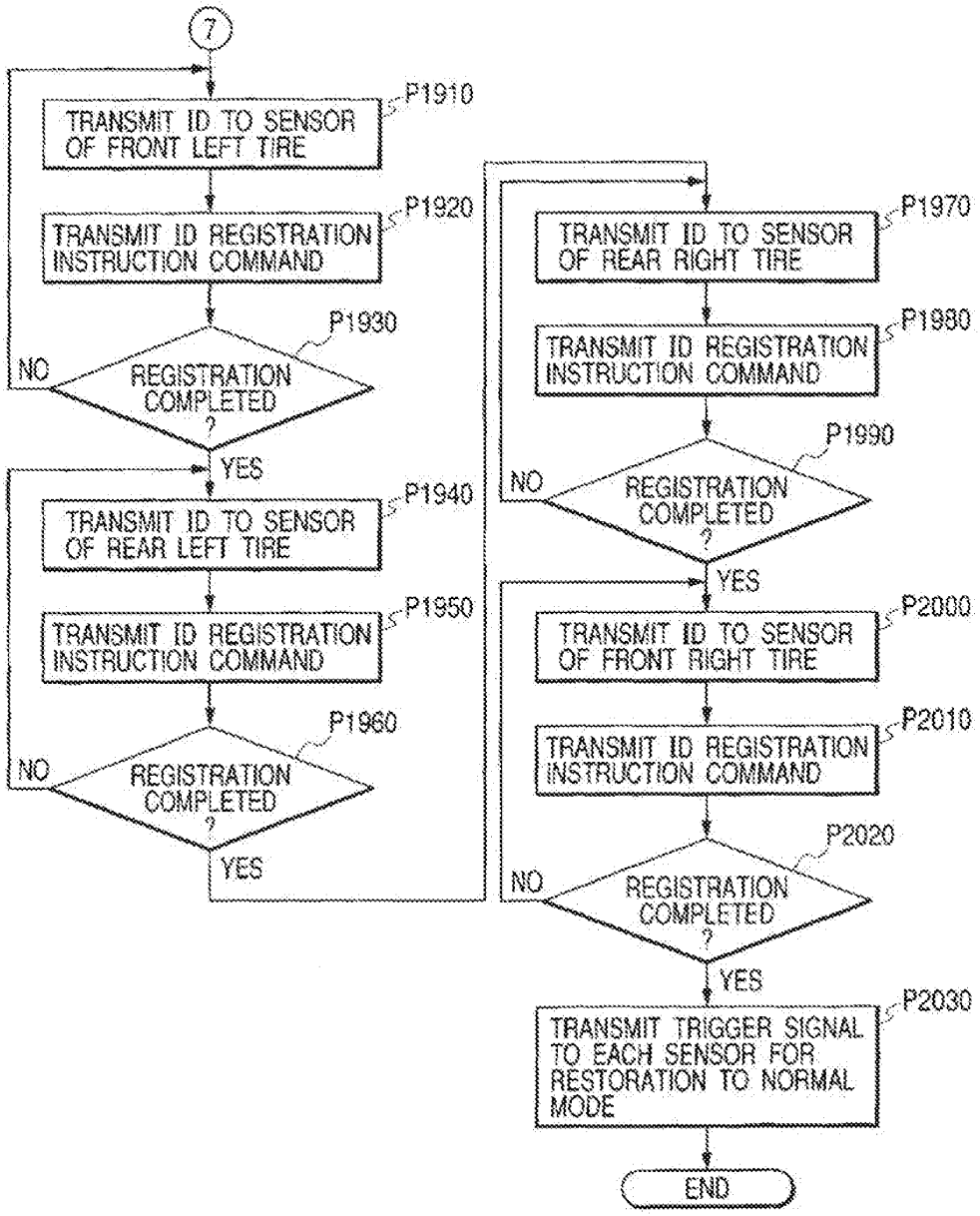
Orange Exhibit No. 2004
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FIG. 44



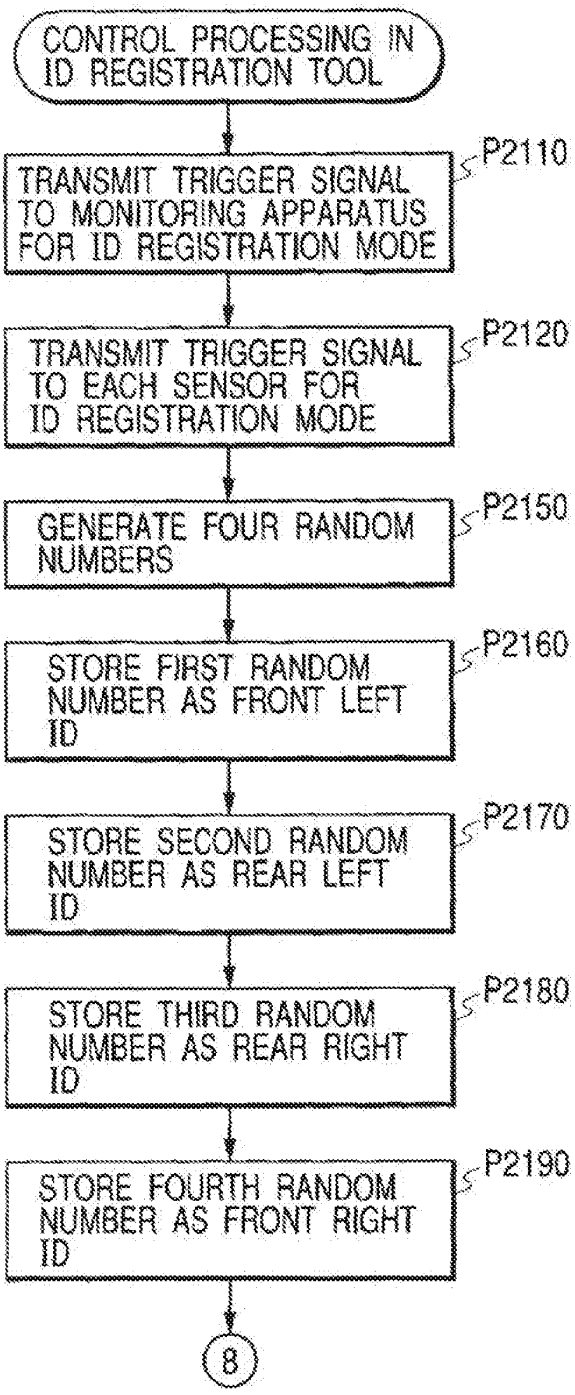
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FIG. 45



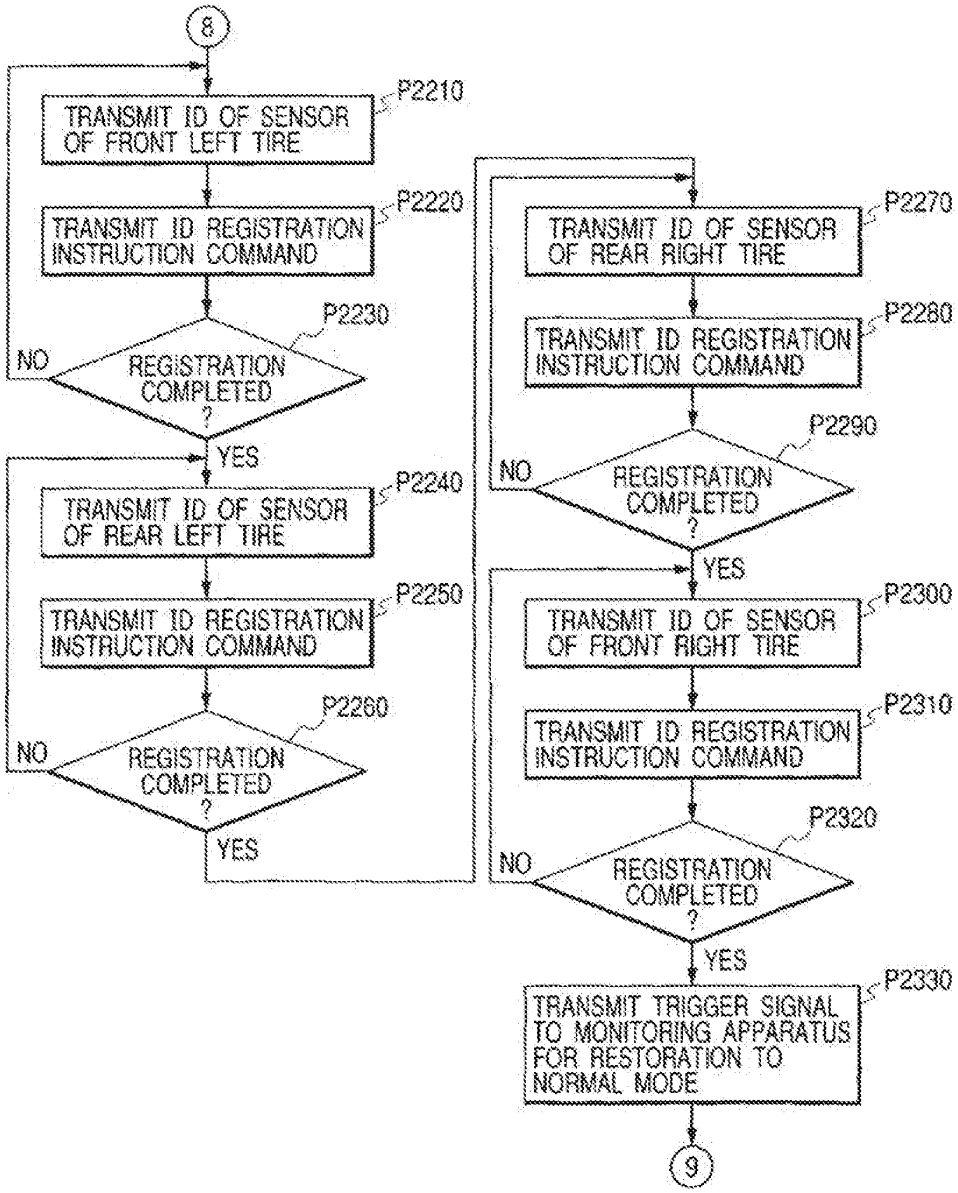
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FIG. 46



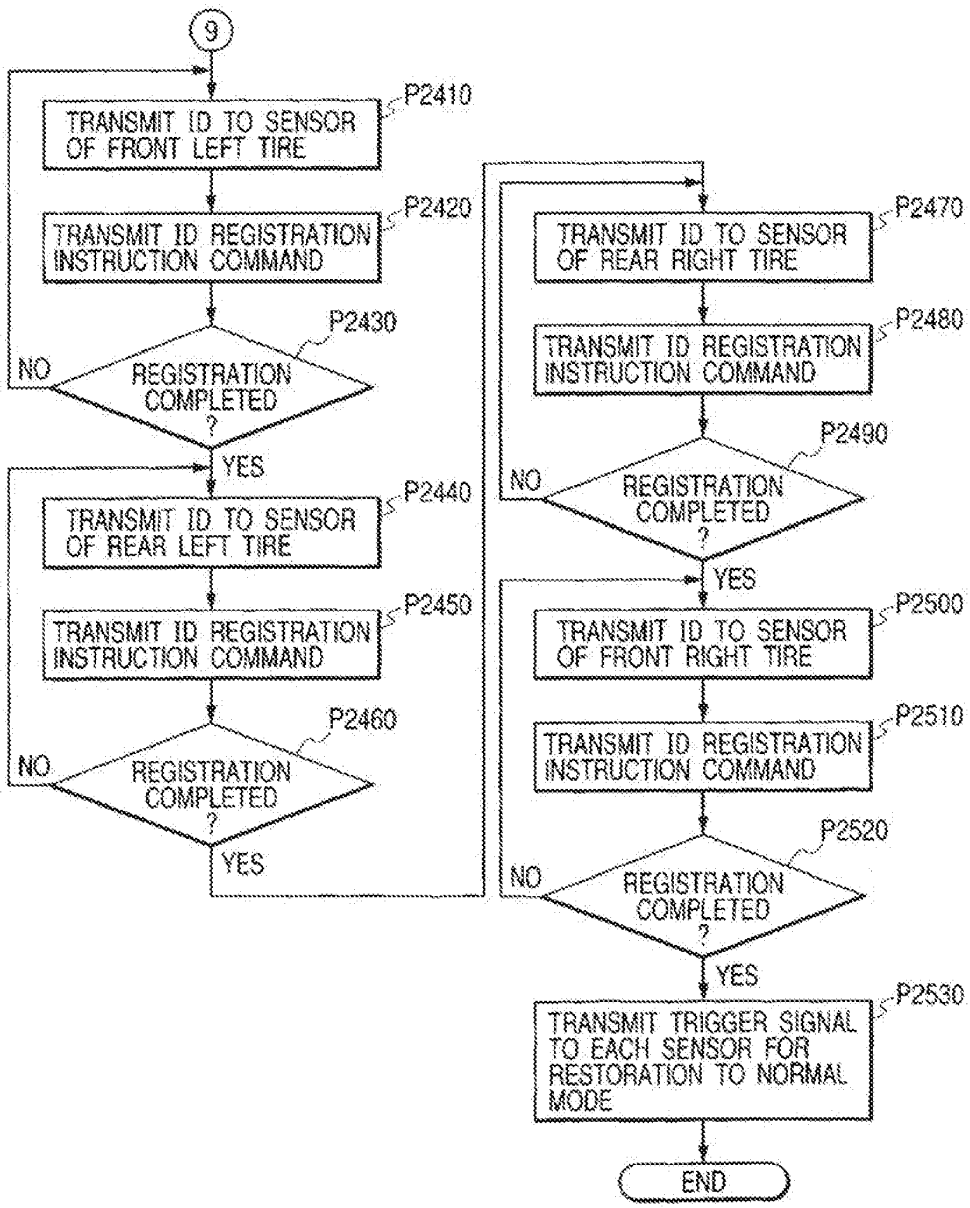
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FIG. 47



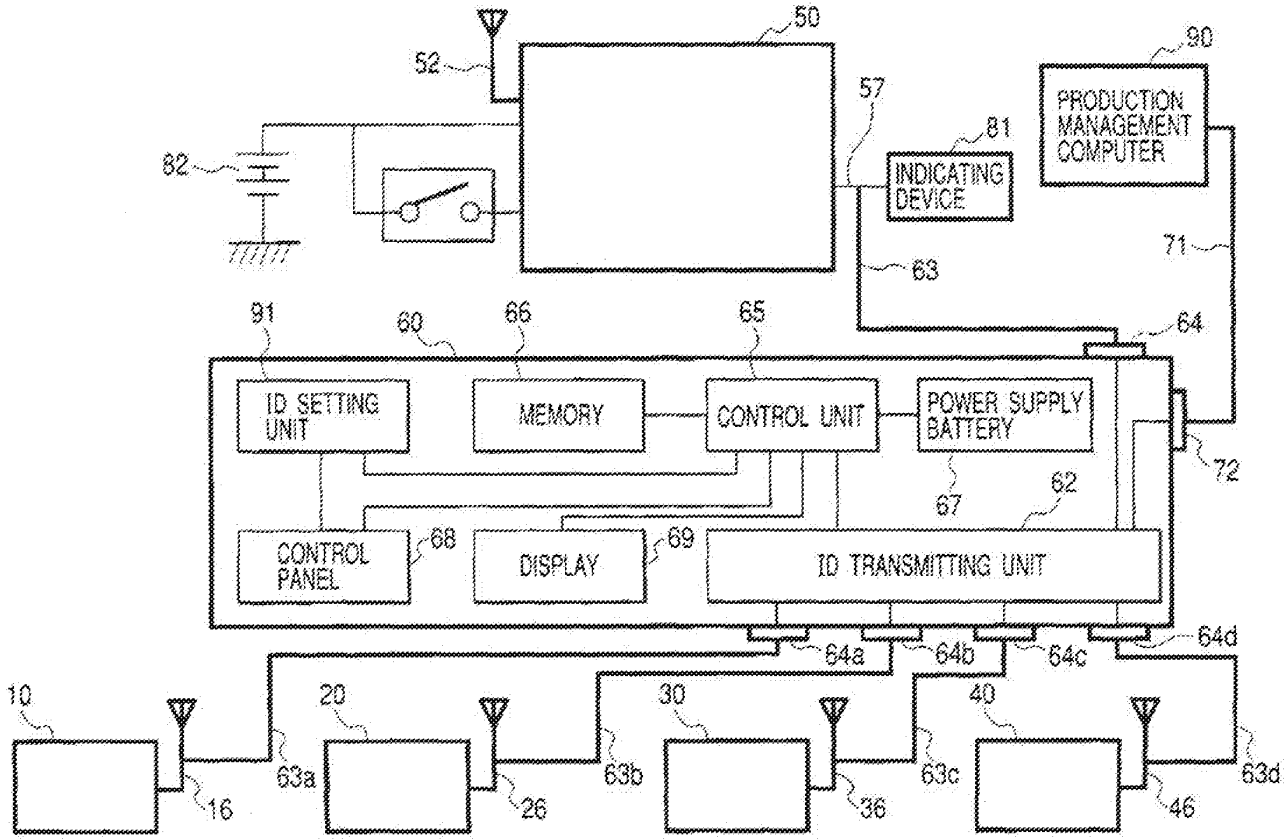
Orange Exhibit No. 2004
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FIG. 48



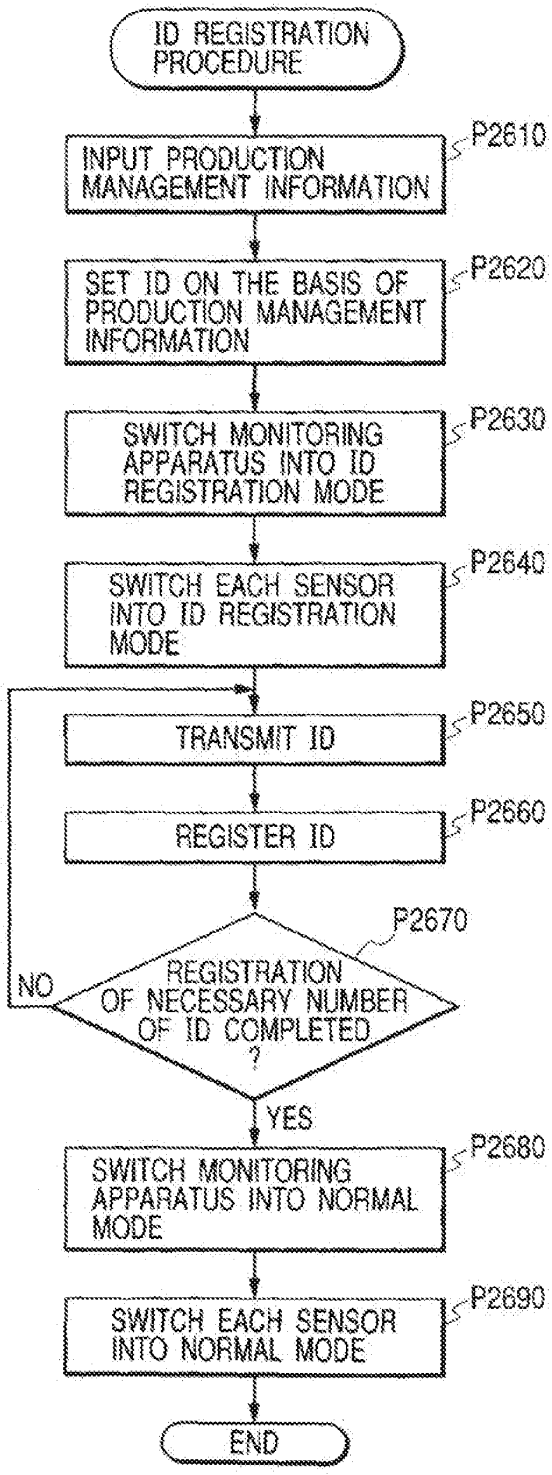
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IPR2024-00744

FIG. 49



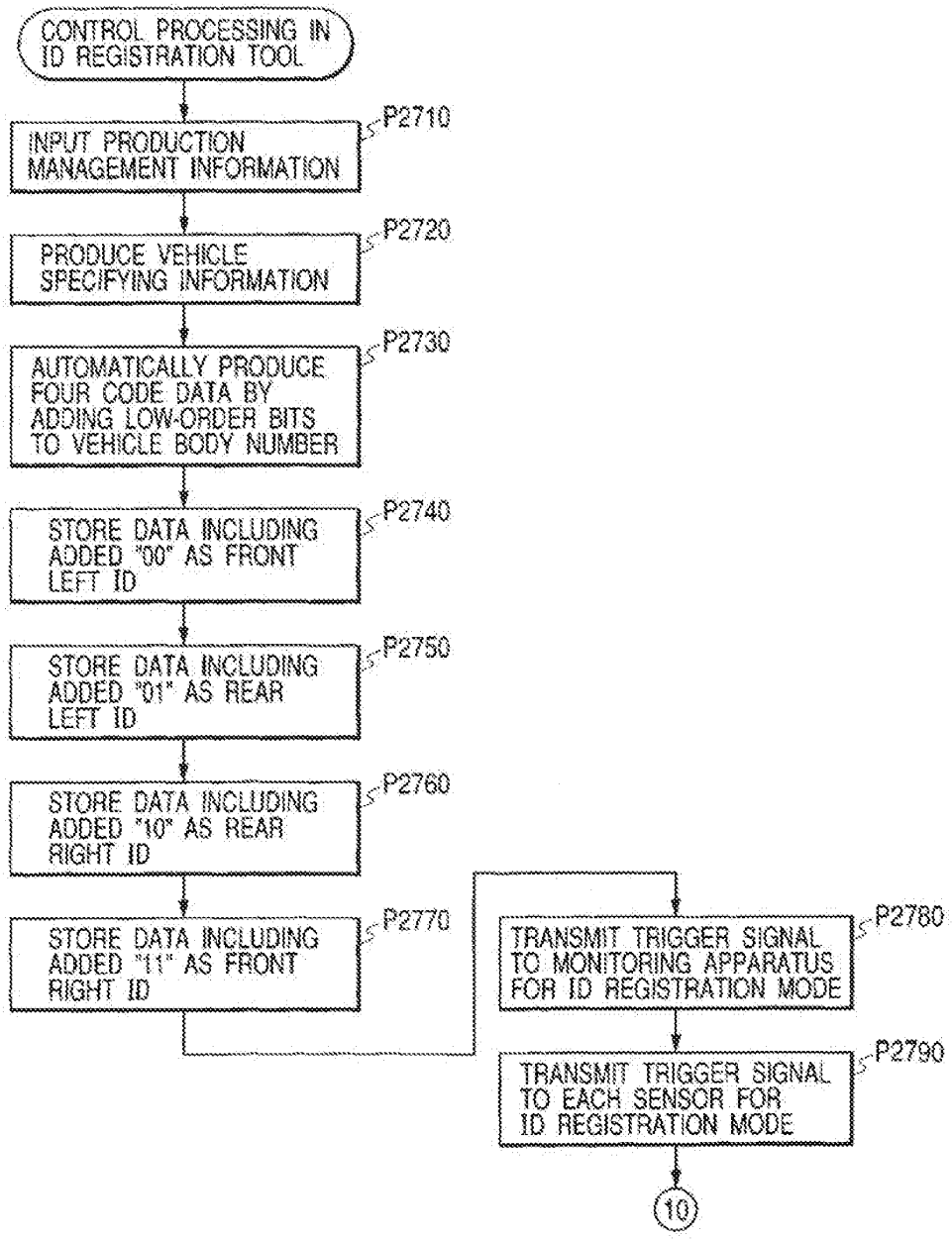
Orange Exhibit No. 2004
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FIG. 50



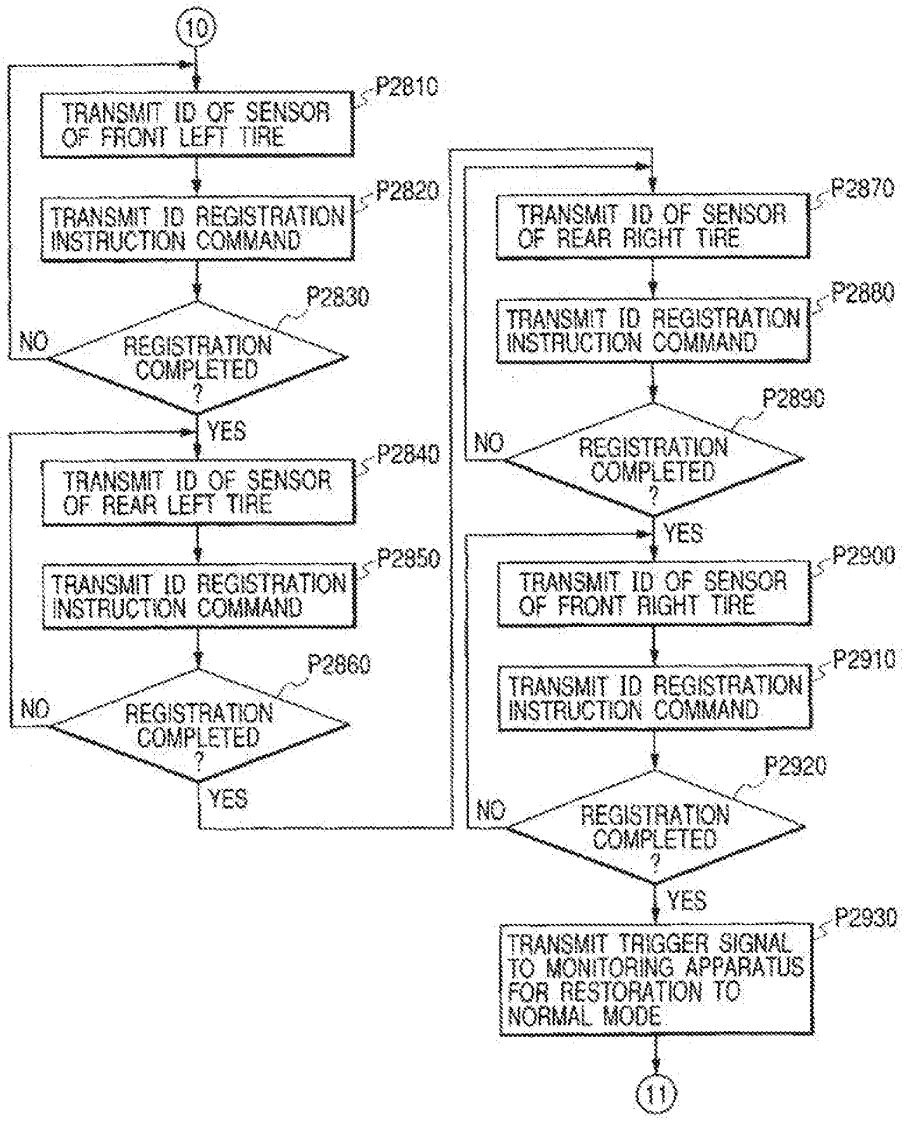
Orange Exhibit No. 2004
IPR2024-00744

FIG. 51



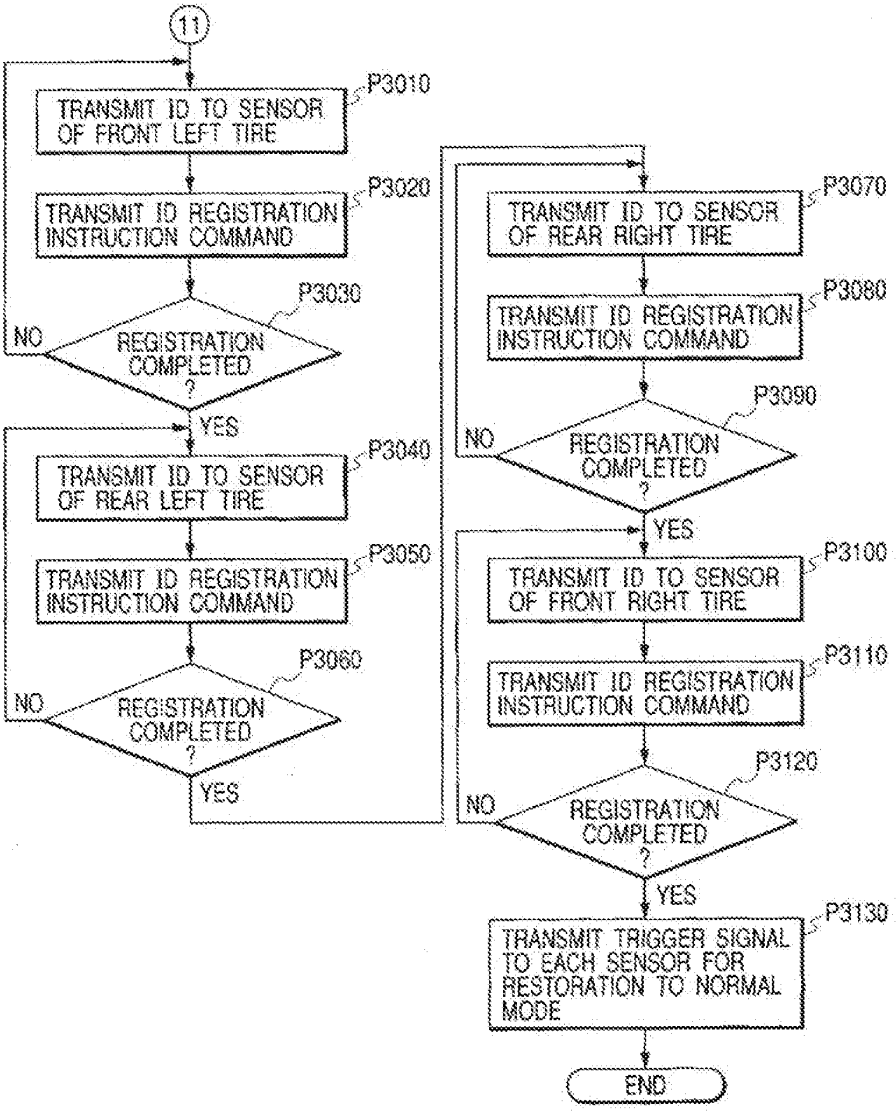
Orange Exhibit No. 2004
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FIG. 52



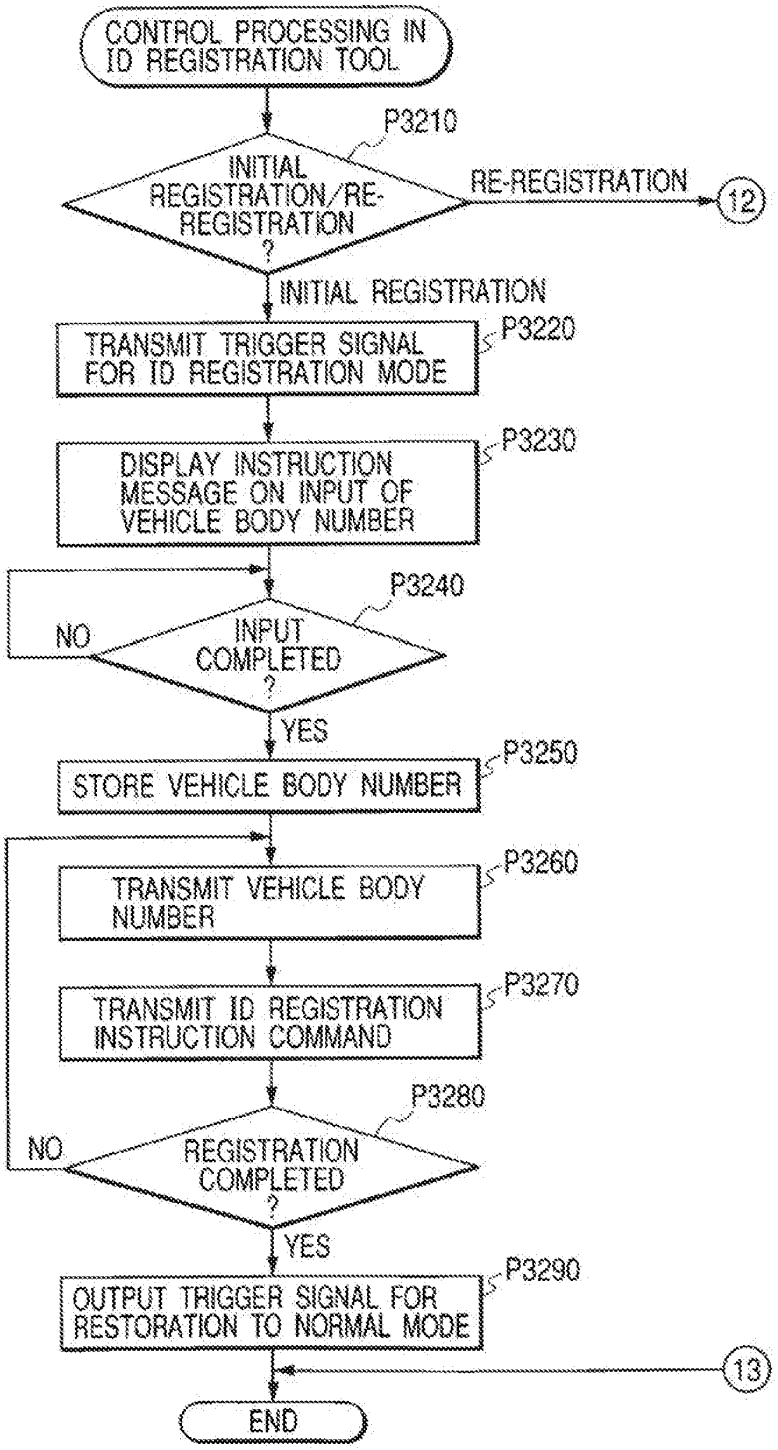
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FIG. 53



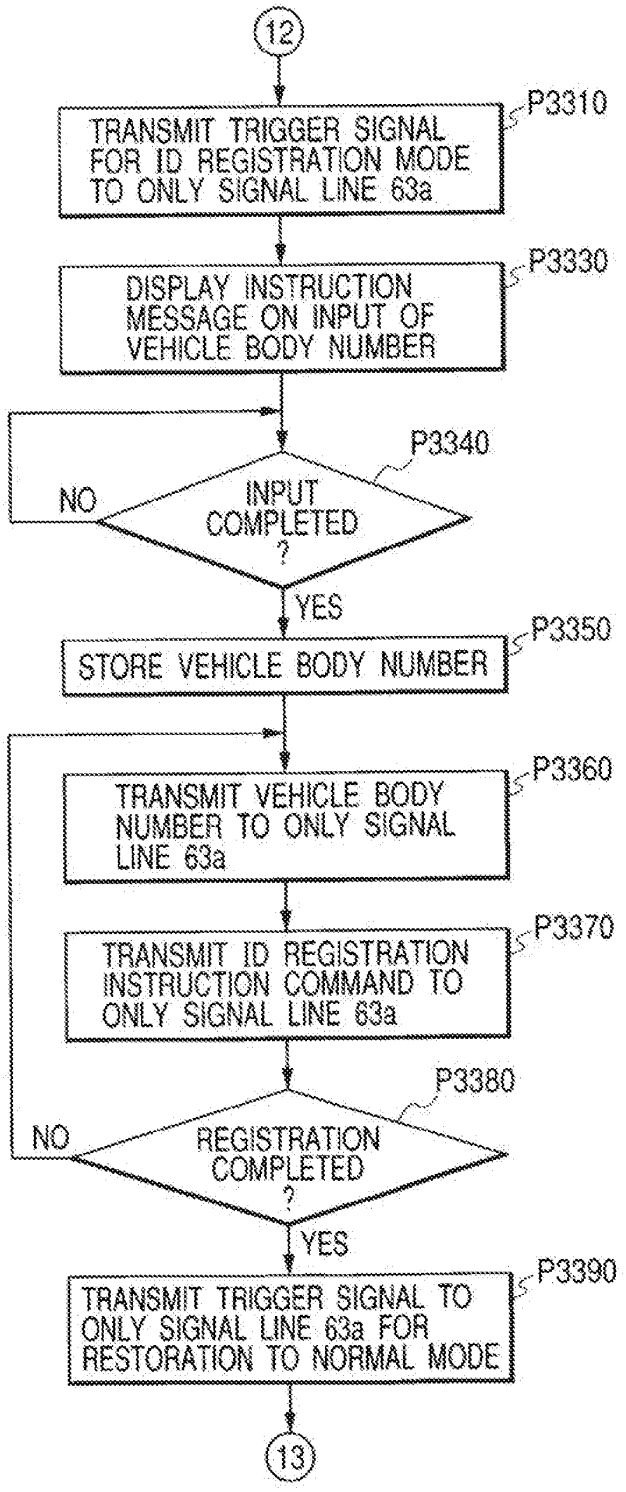
Orange Exhibit No. 2004
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FIG. 54



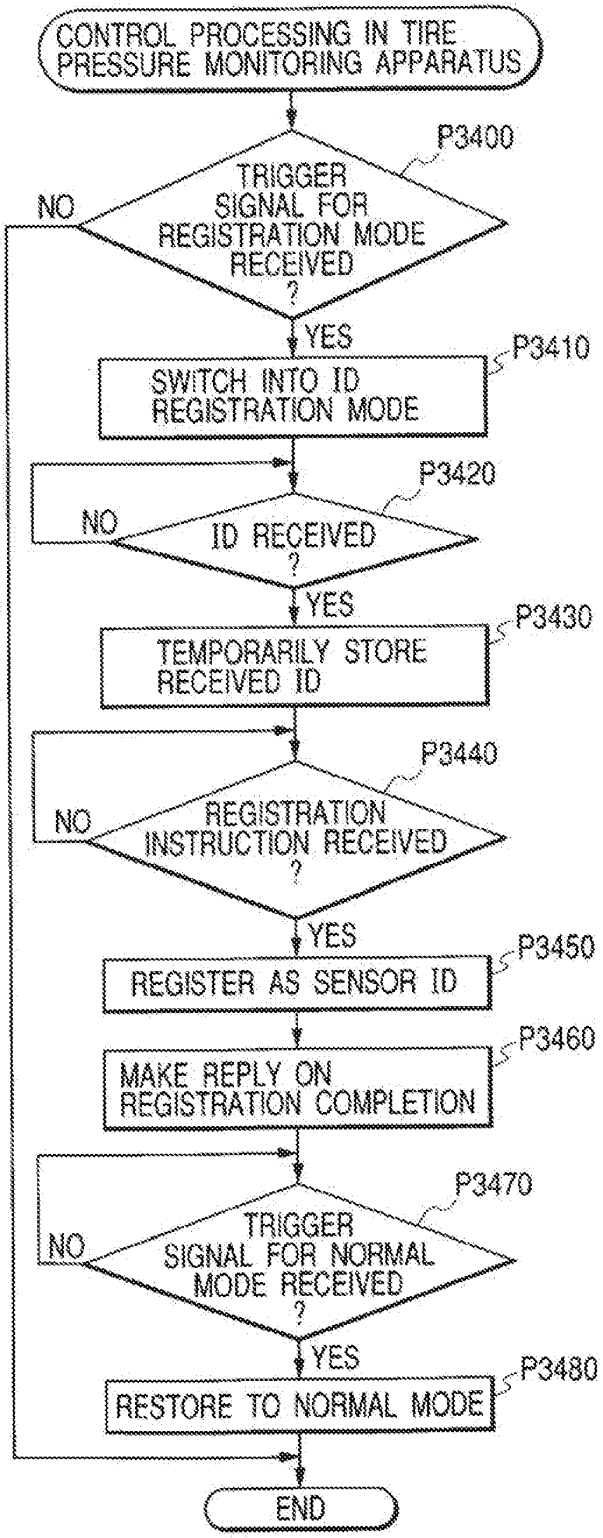
Orange Exhibit No. 2004
IPR2024-00744

FIG. 55



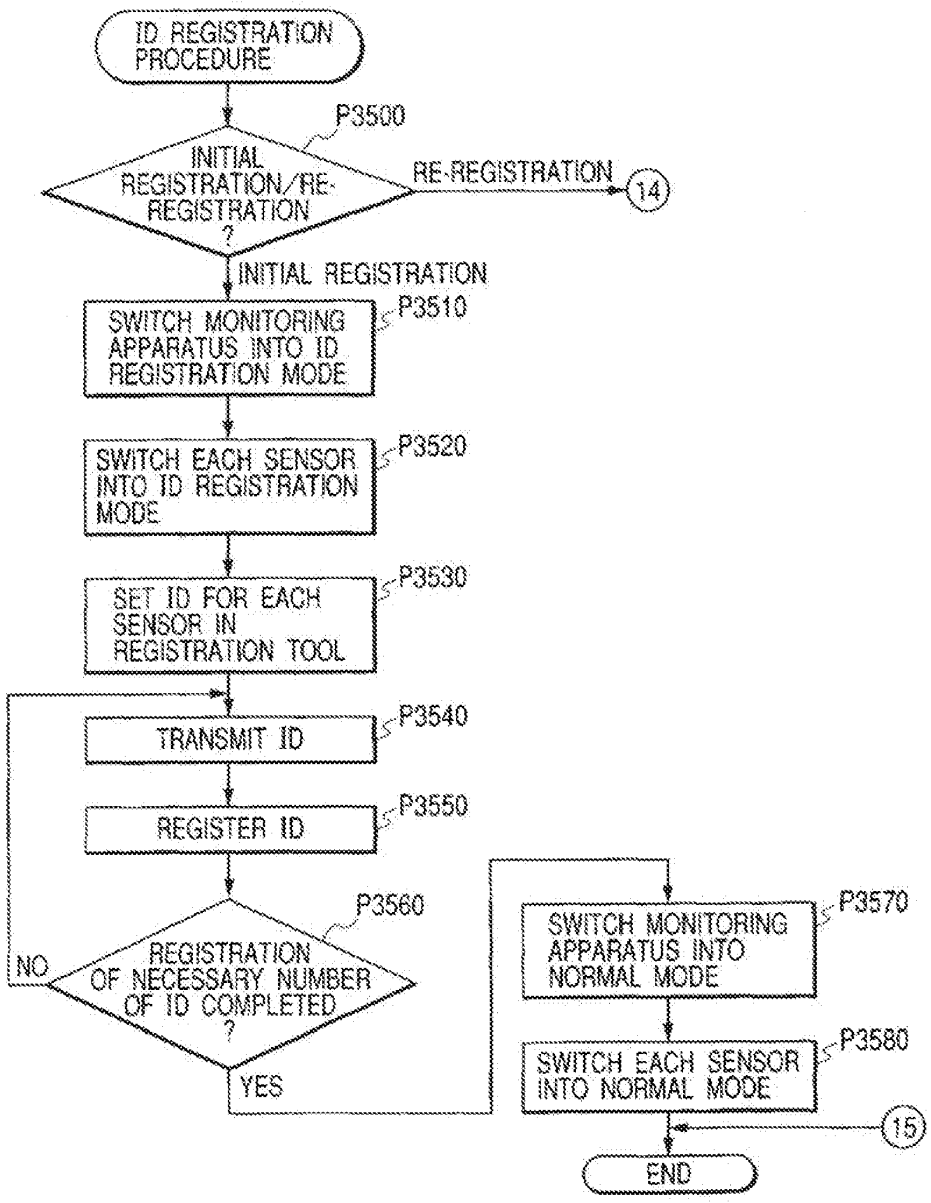
Orange Exhibit No. 2004
IPR2024-00744

FIG. 56



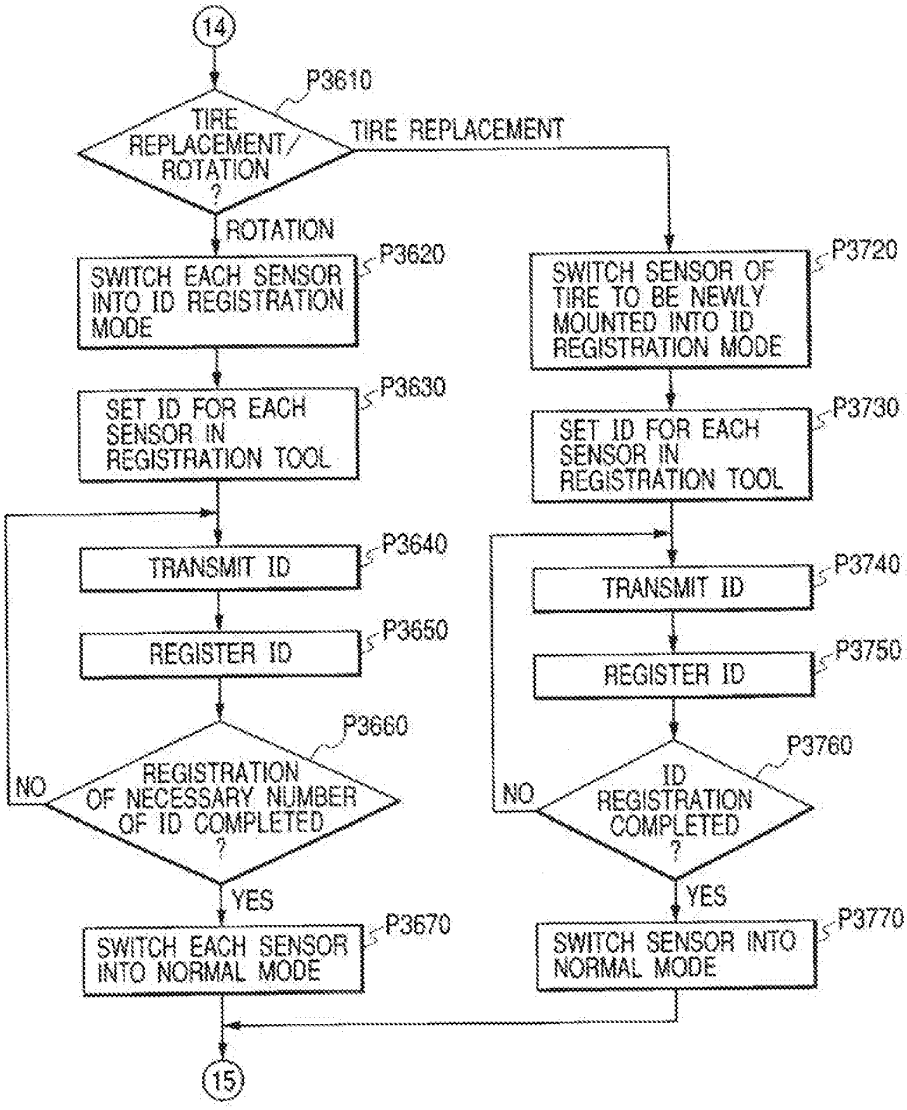
Orange Exhibit No. 2004
IPR2024-00744

FIG. 57



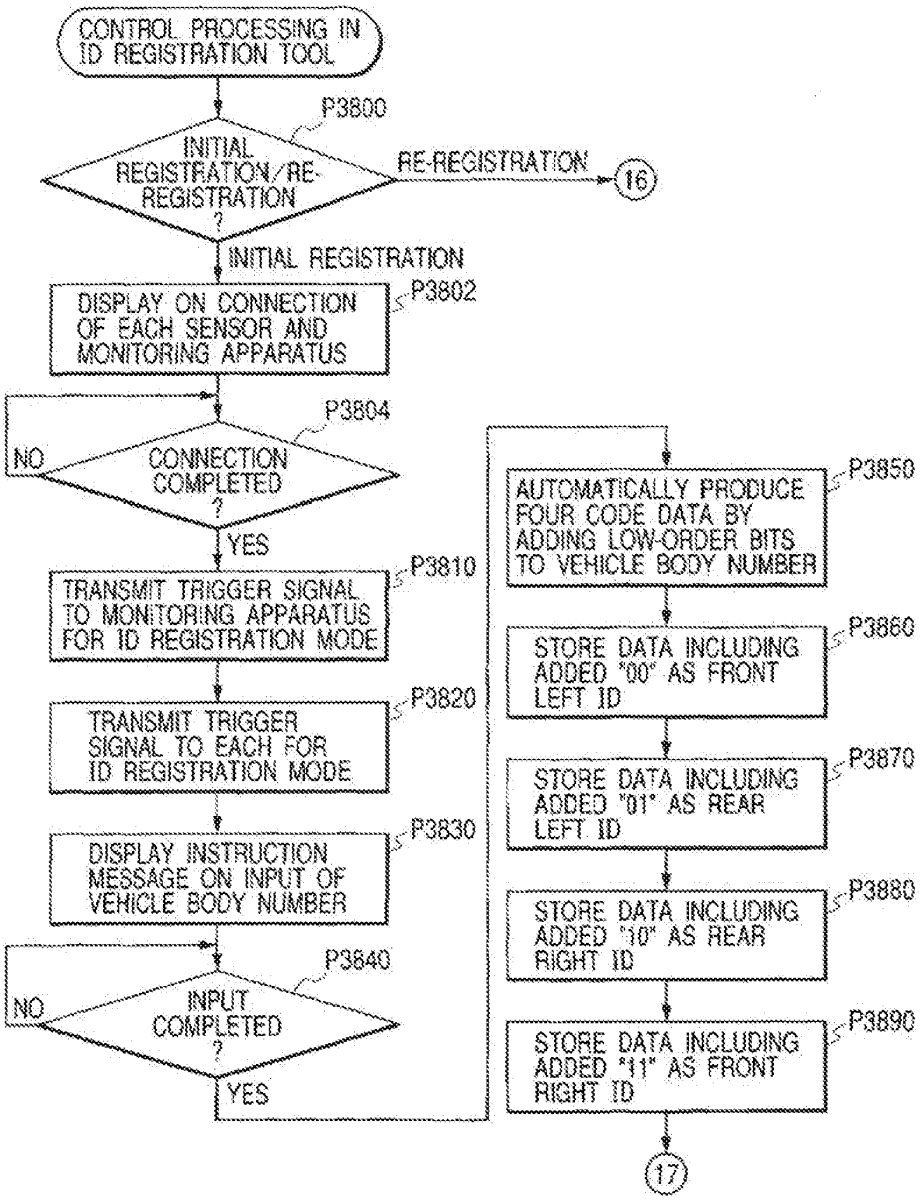
Orange Exhibit No. 2004
IPR2024-00744

FIG. 58



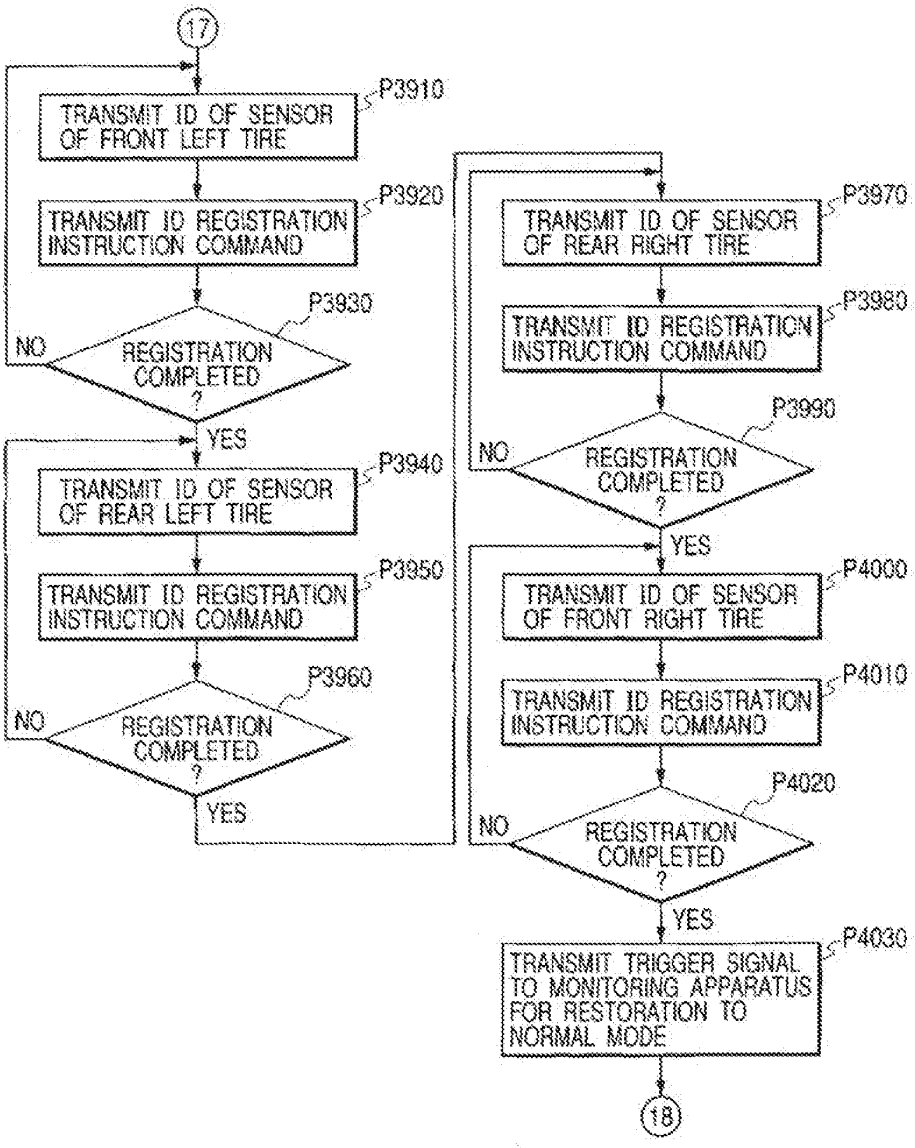
Orange Exhibit No. 2004
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FIG. 59



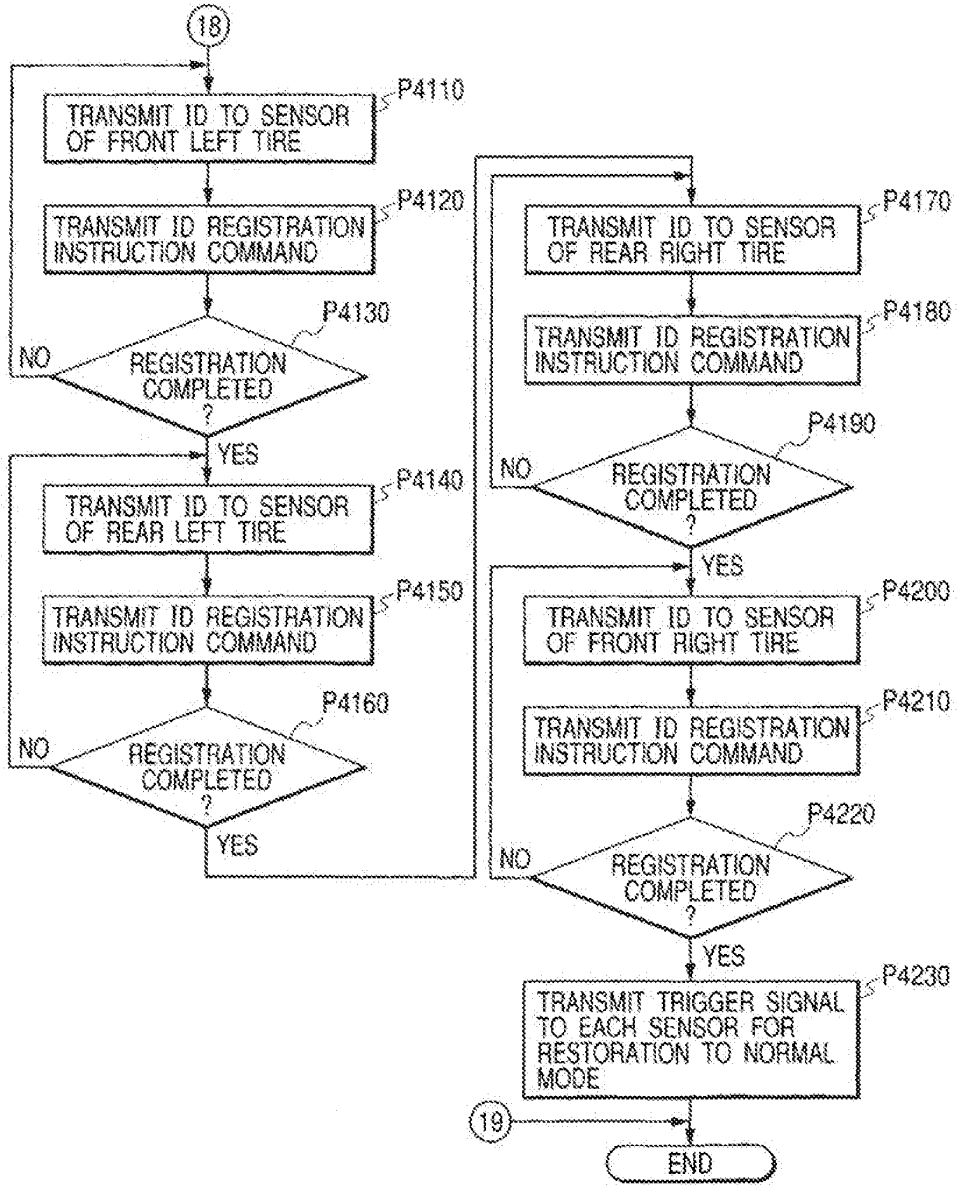
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FIG. 60



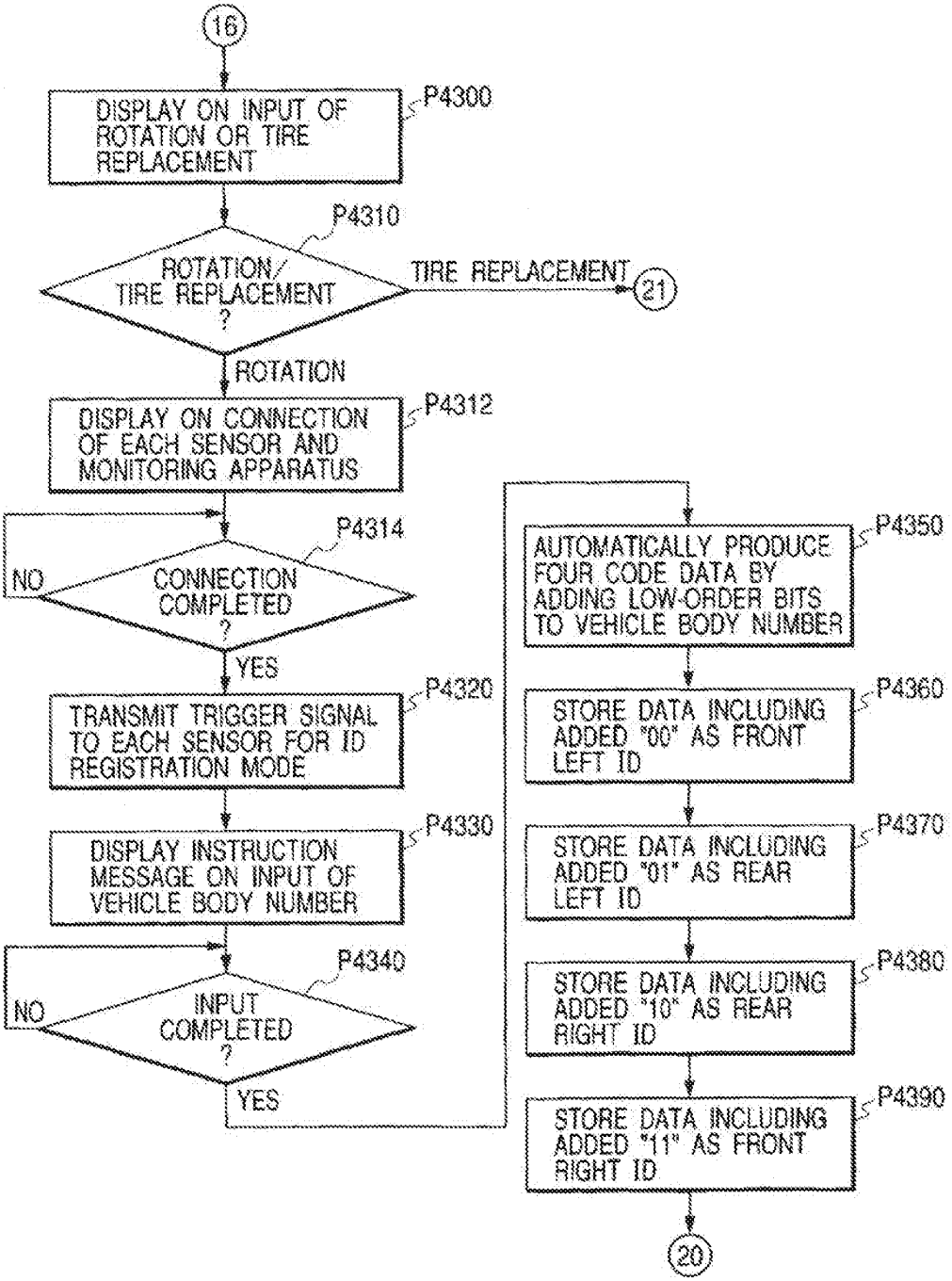
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FIG. 61



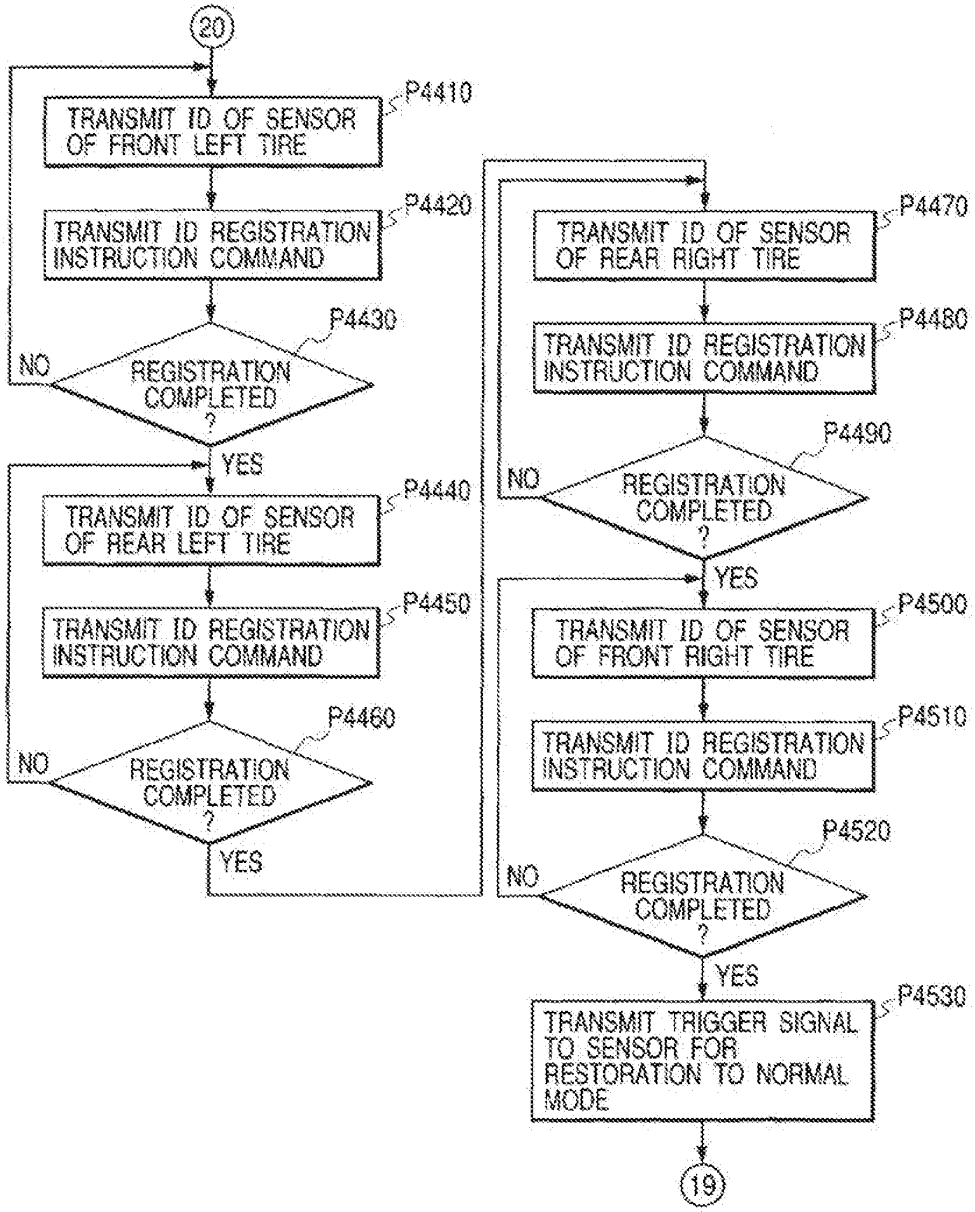
Orange Exhibit No. 2004
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FIG. 62



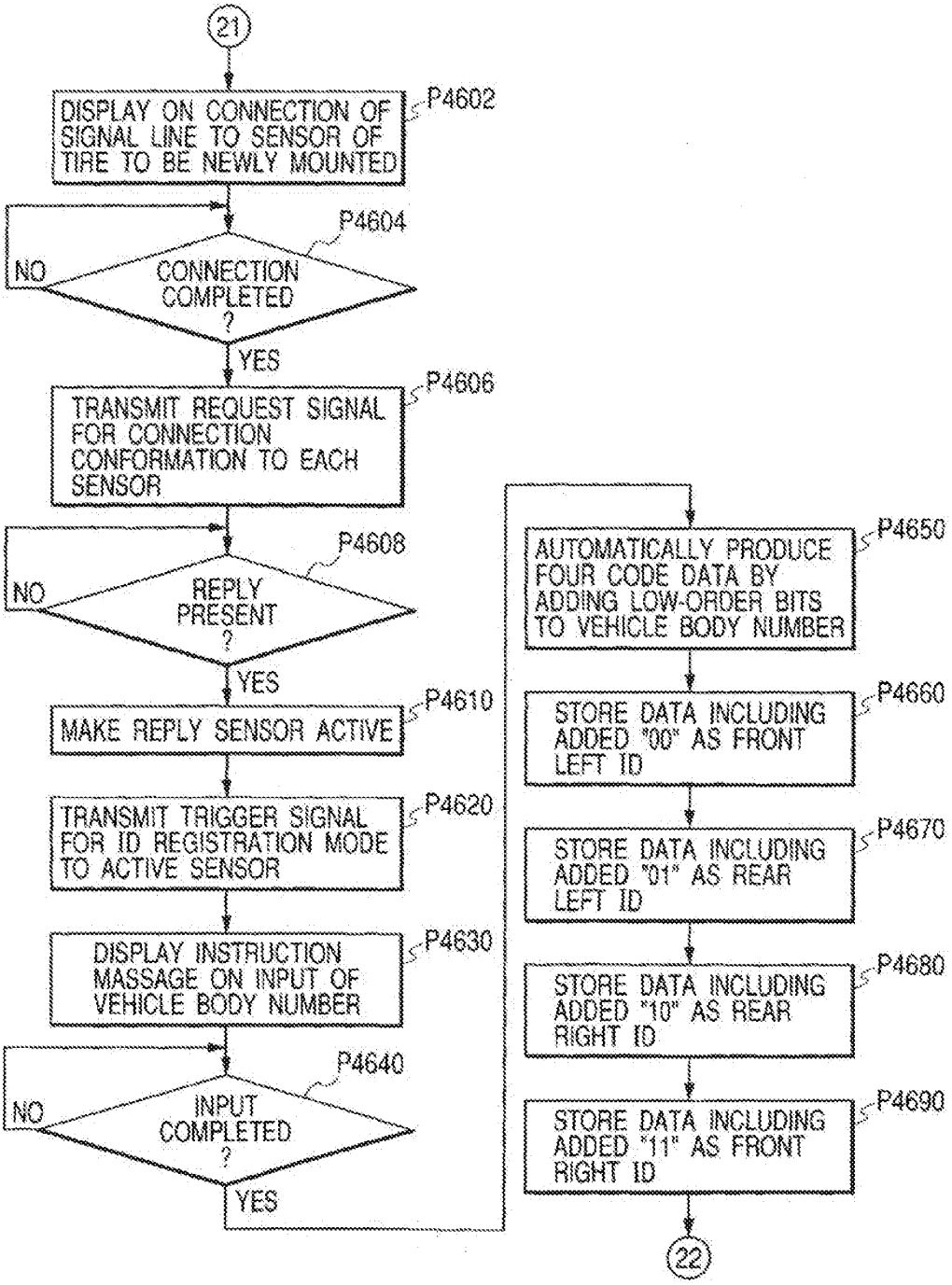
Orange Exhibit No. 2004
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FIG. 63



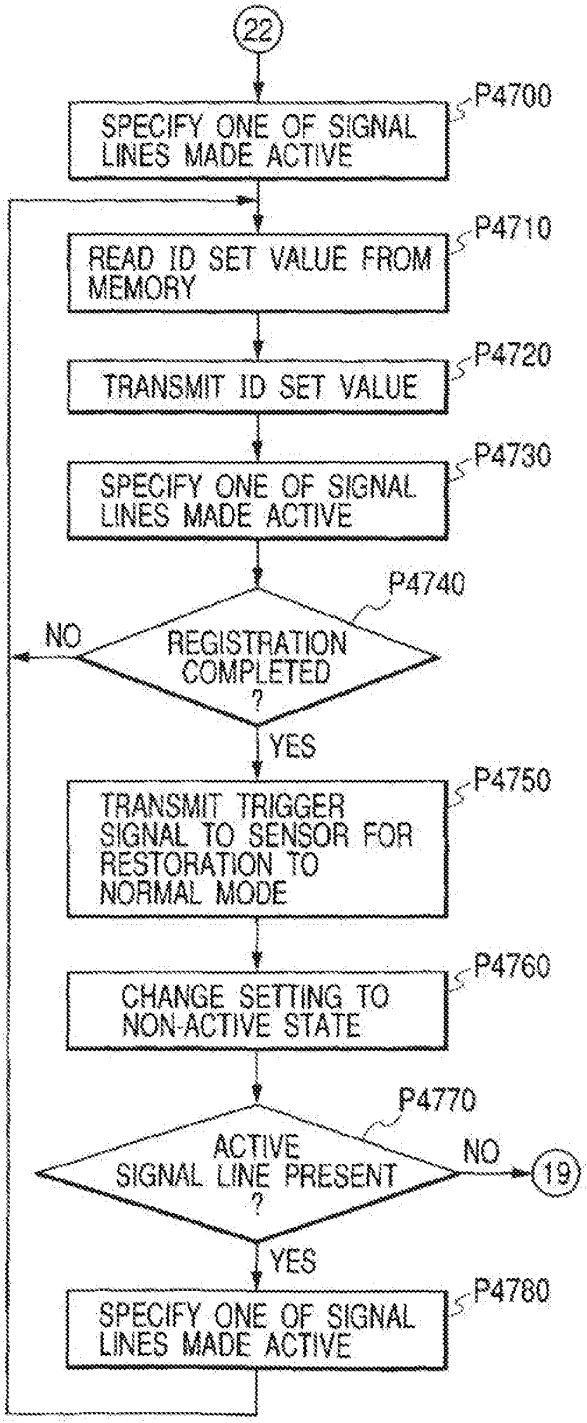
Orange Exhibit No. 2004
IPR2024-00744

FIG. 64



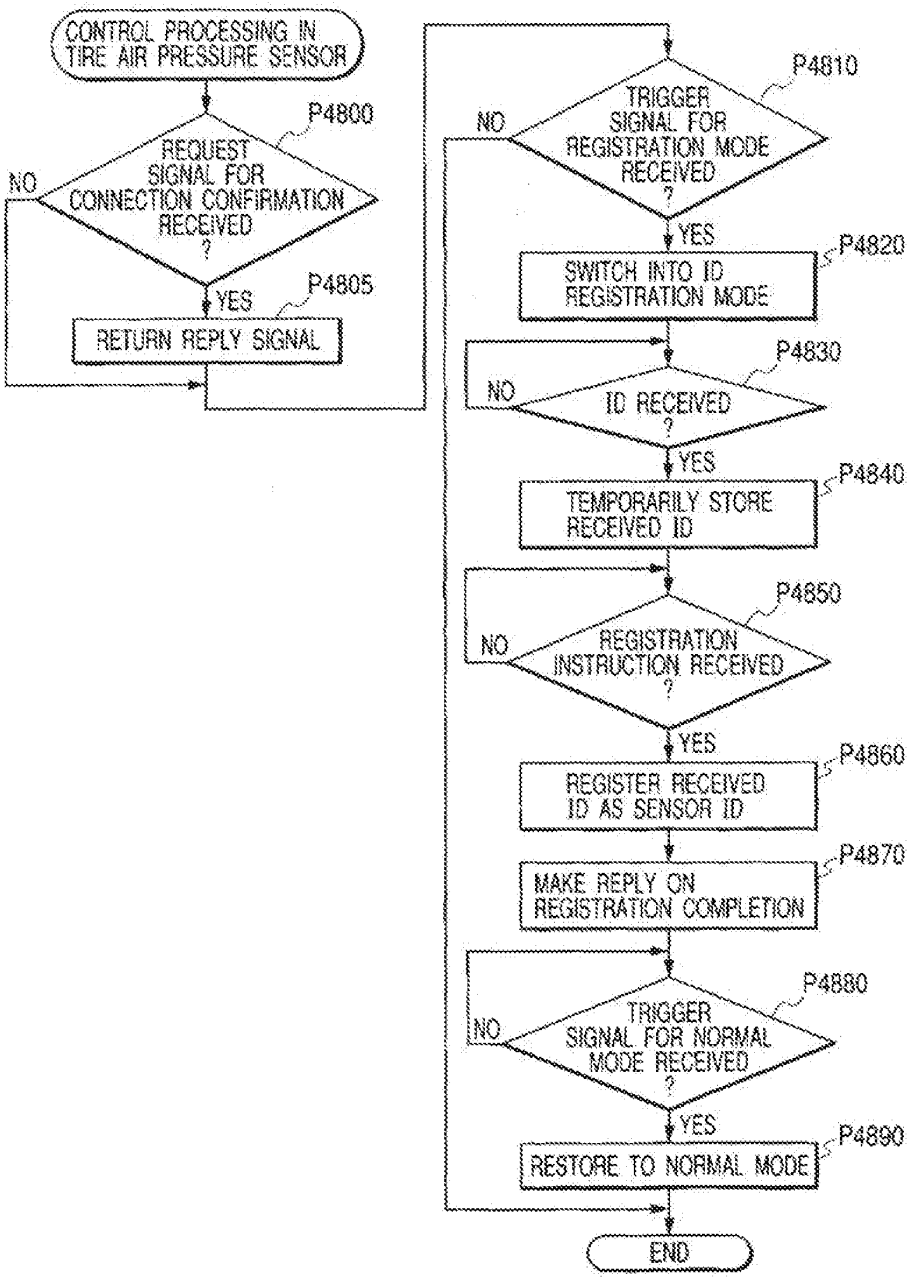
Orange Exhibit No. 2004
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FIG. 65



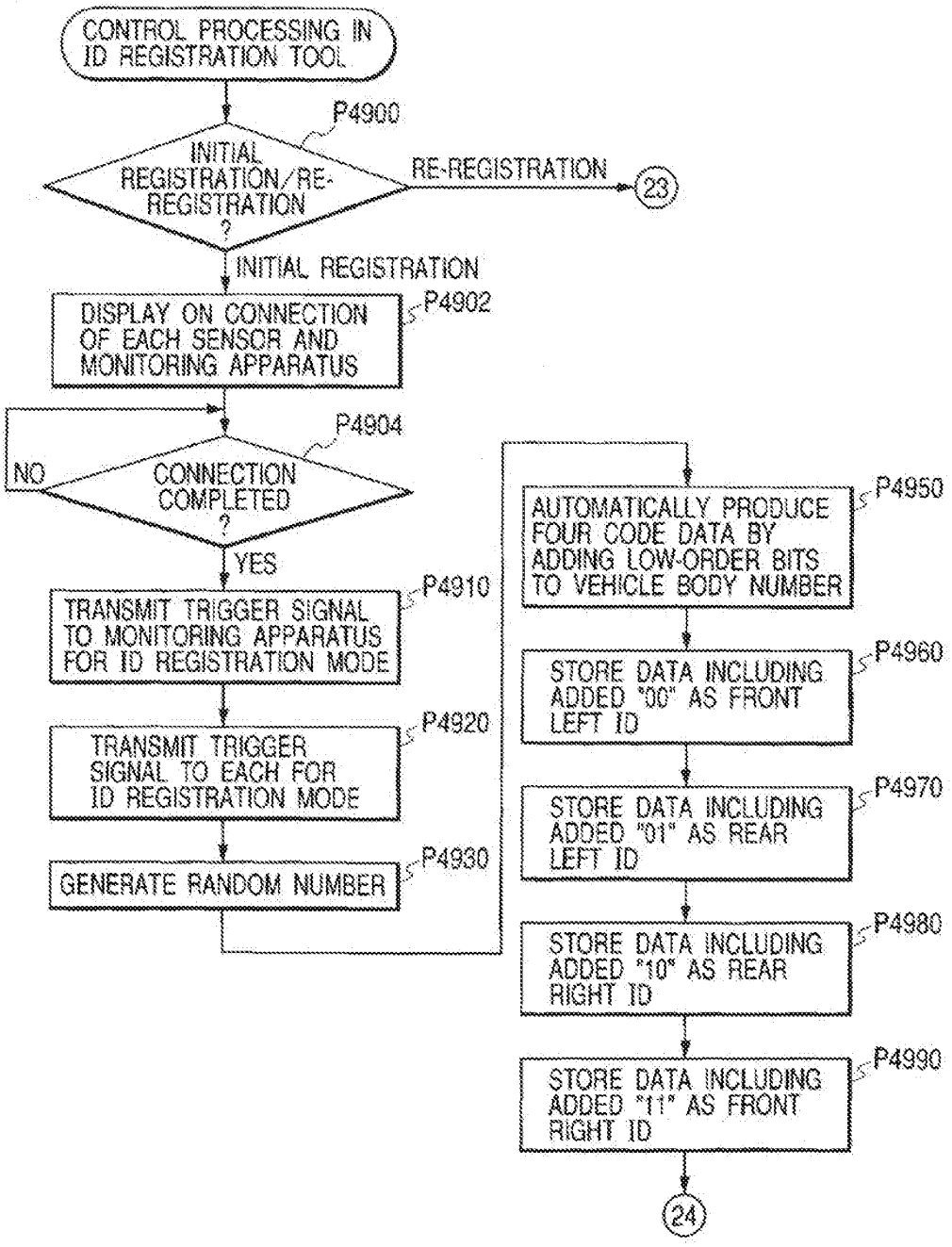
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FIG. 66



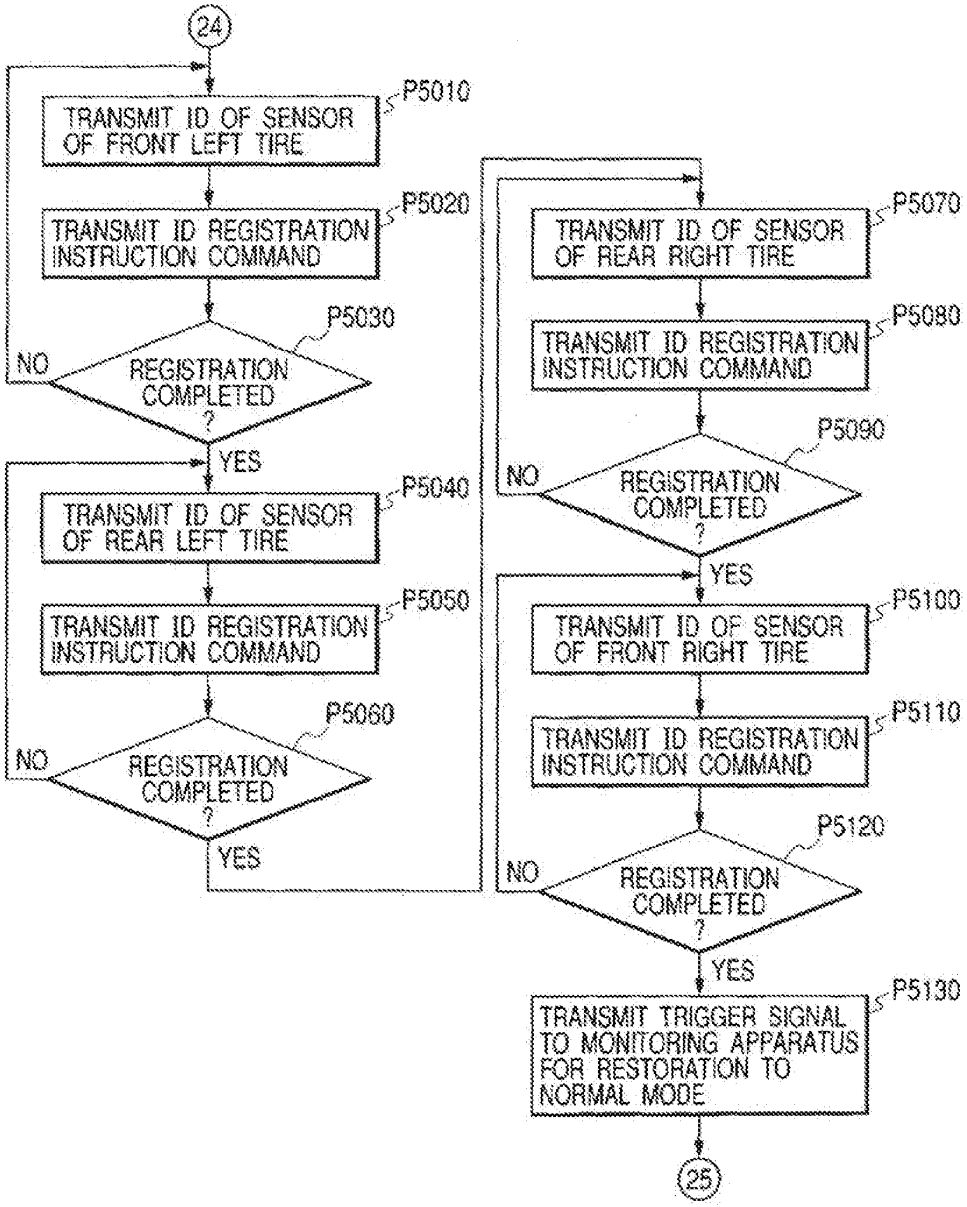
Orange Exhibit No. 2004
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FIG. 67



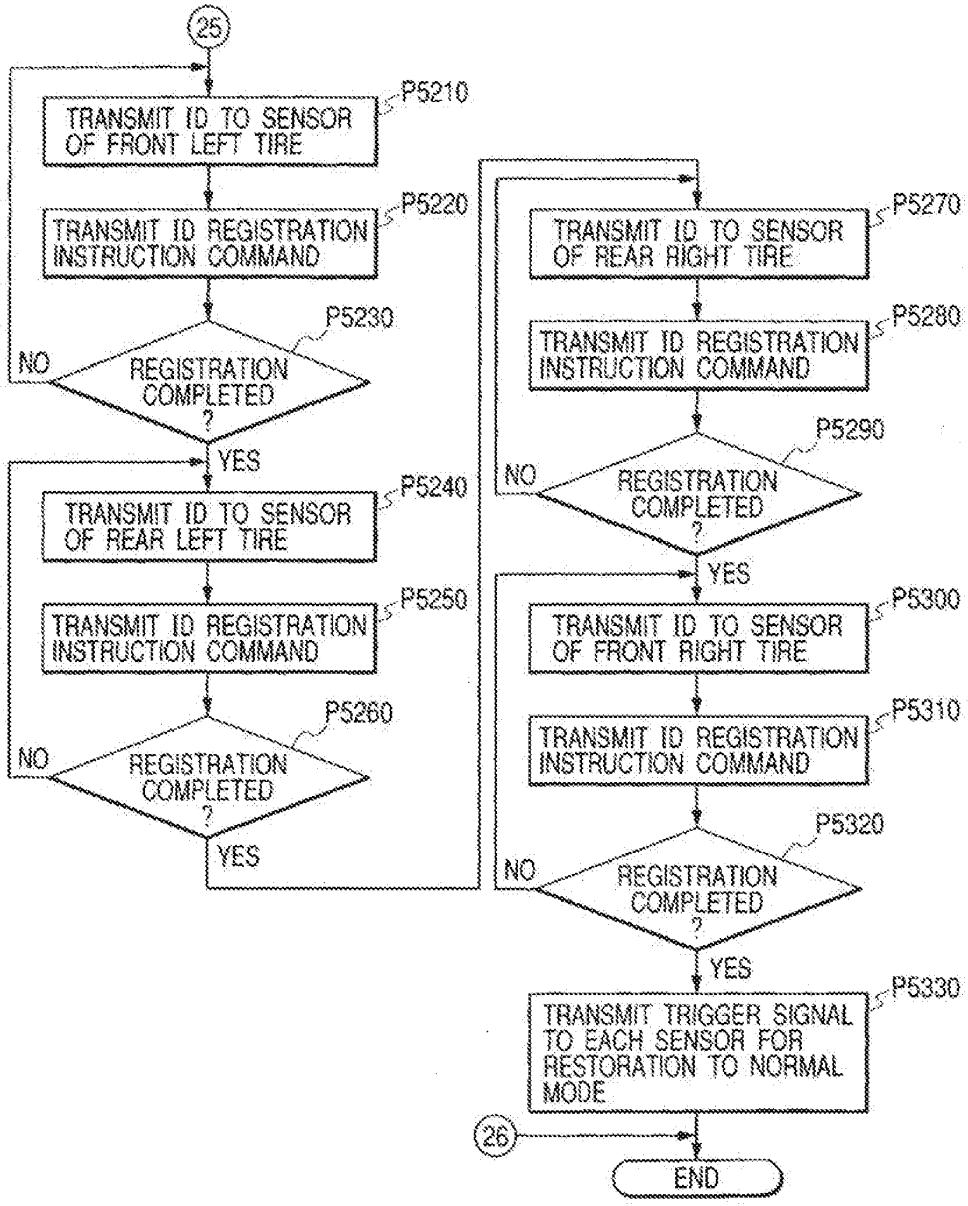
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FIG. 68



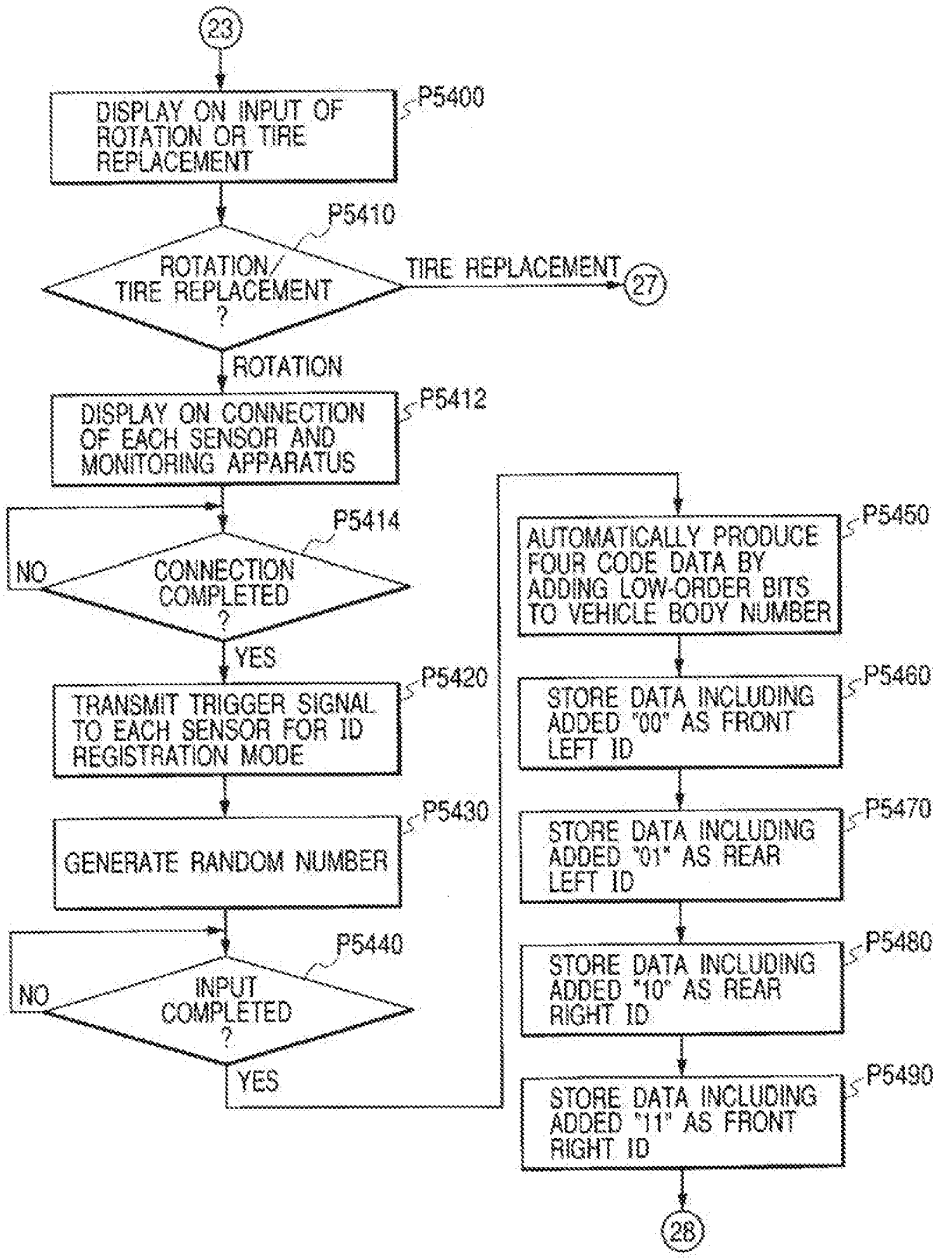
Orange Exhibit No. 2004
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FIG. 69



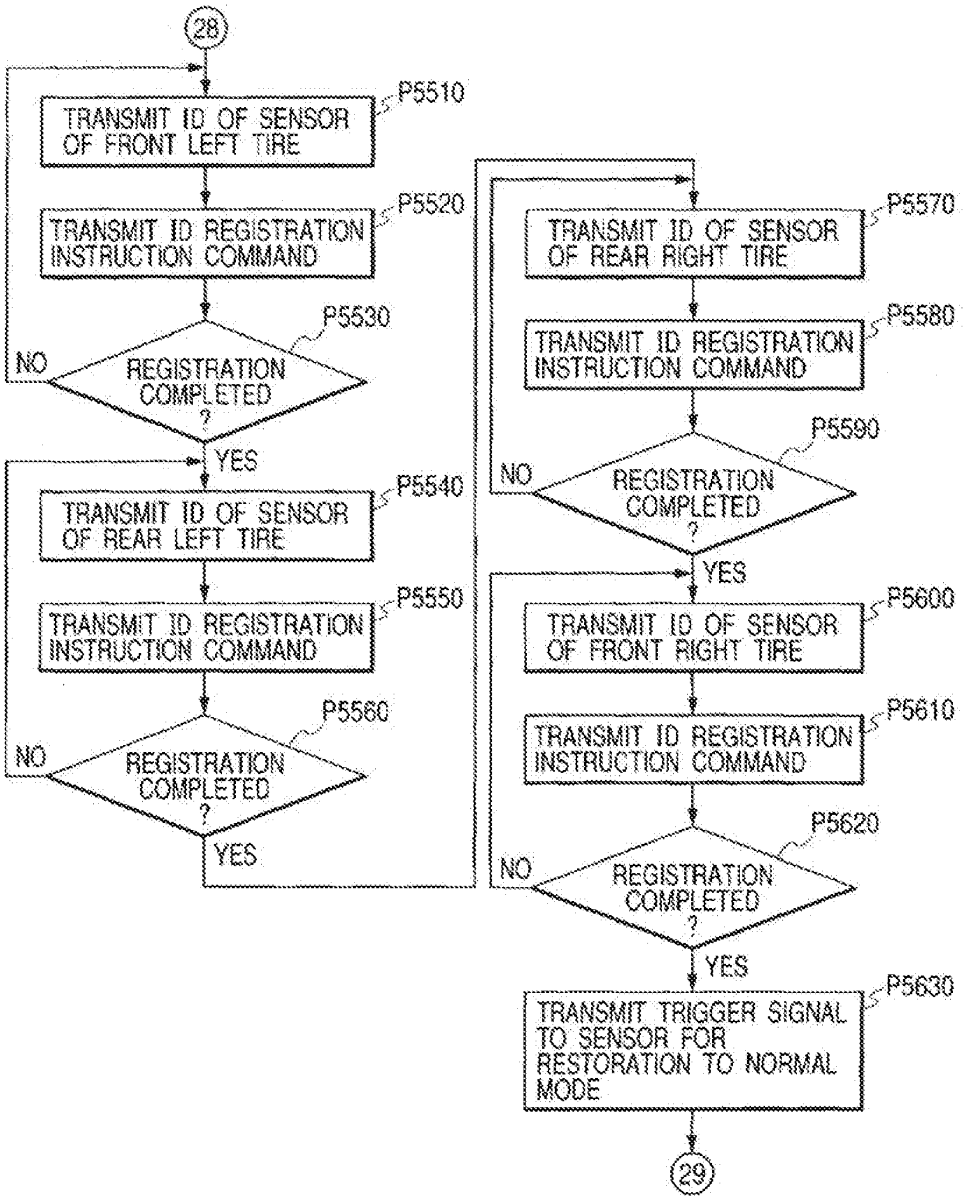
Orange Exhibit No. 2004
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FIG. 70



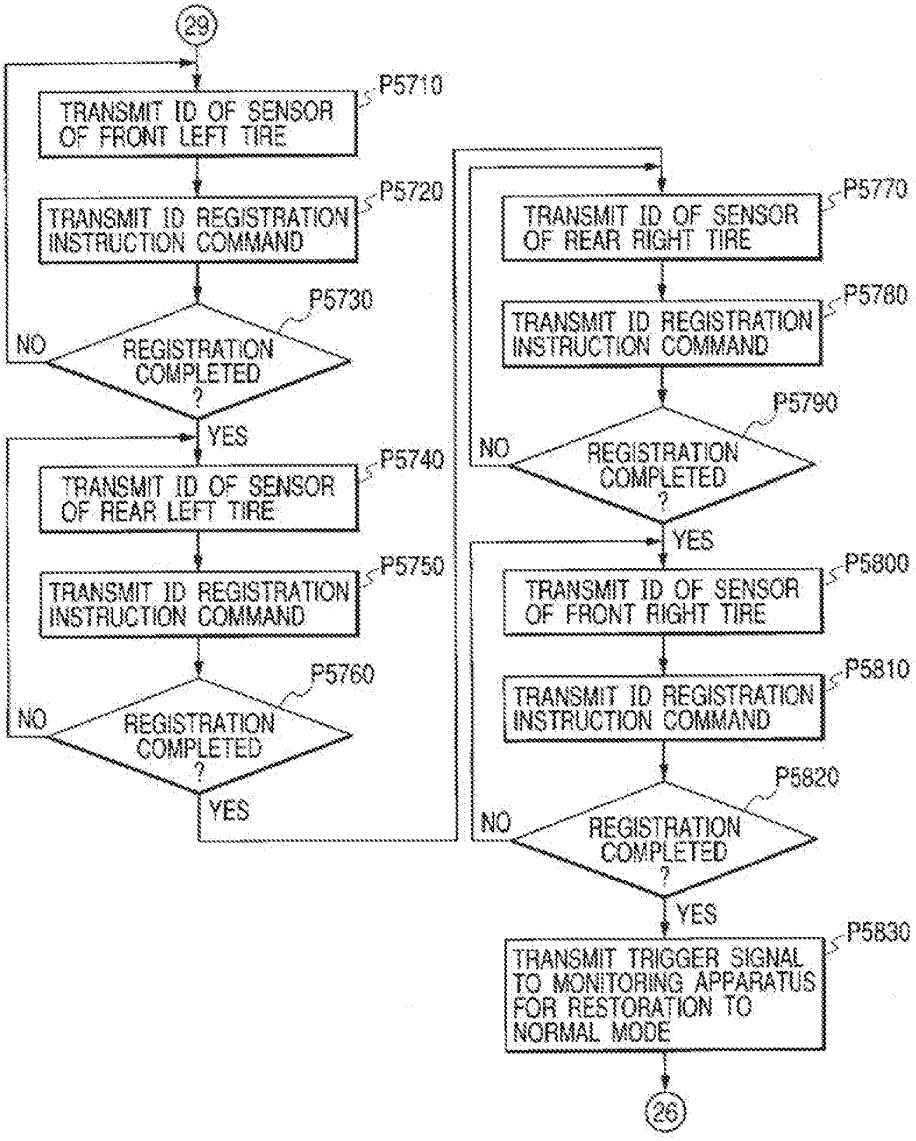
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FIG. 71



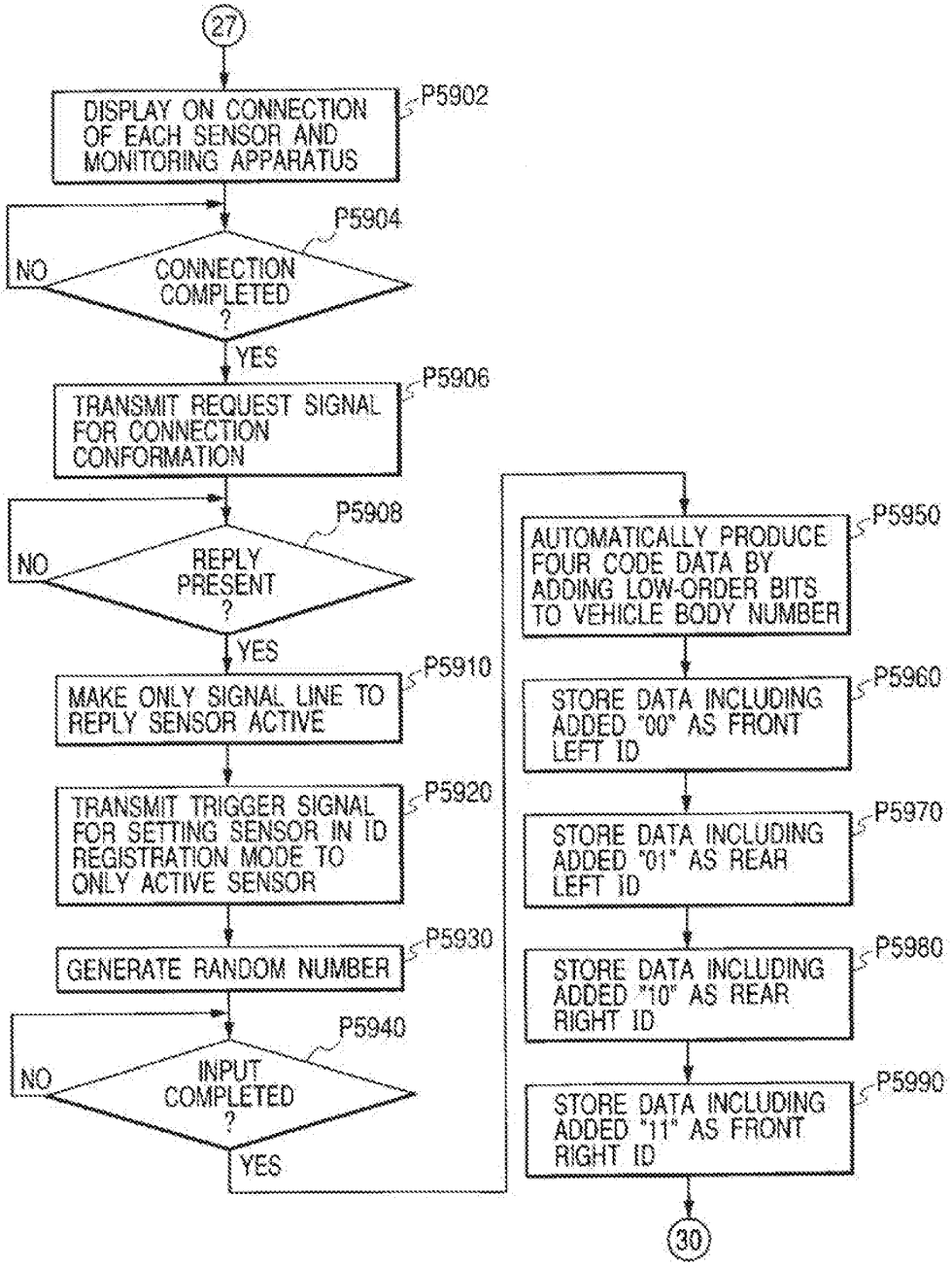
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FIG. 72



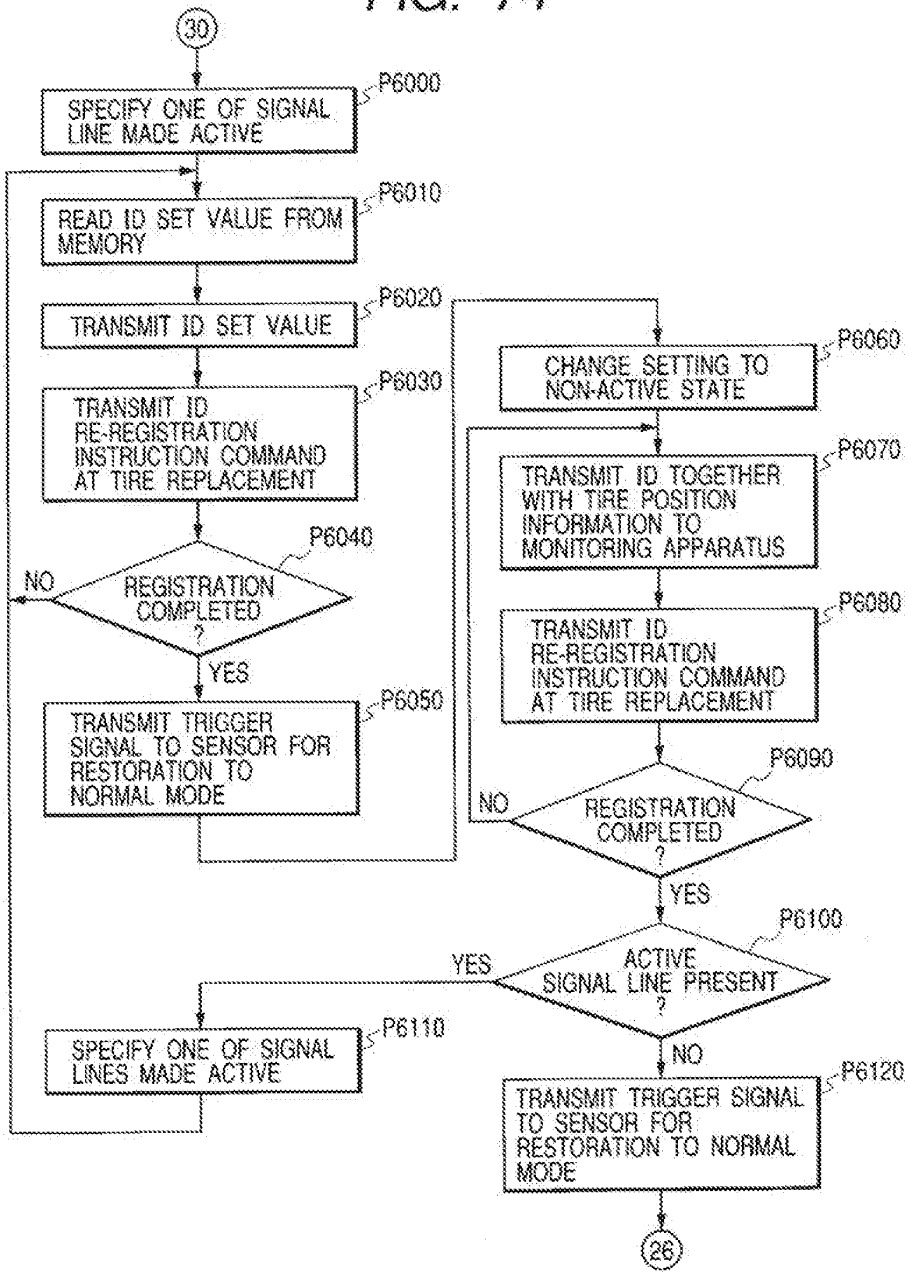
Orange Exhibit No. 2004
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FIG. 73



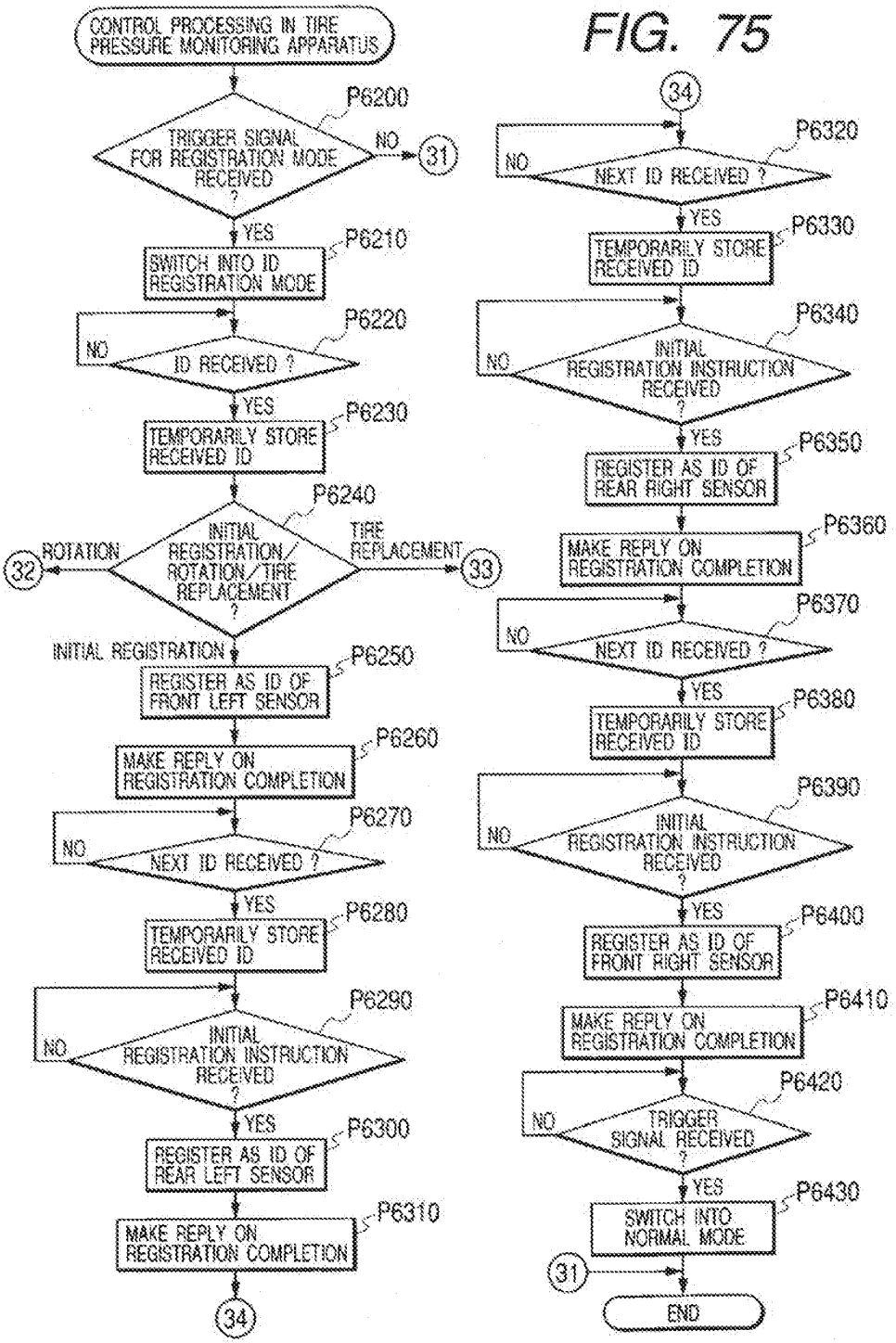
Orange Exhibit No. 2004
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FIG. 74



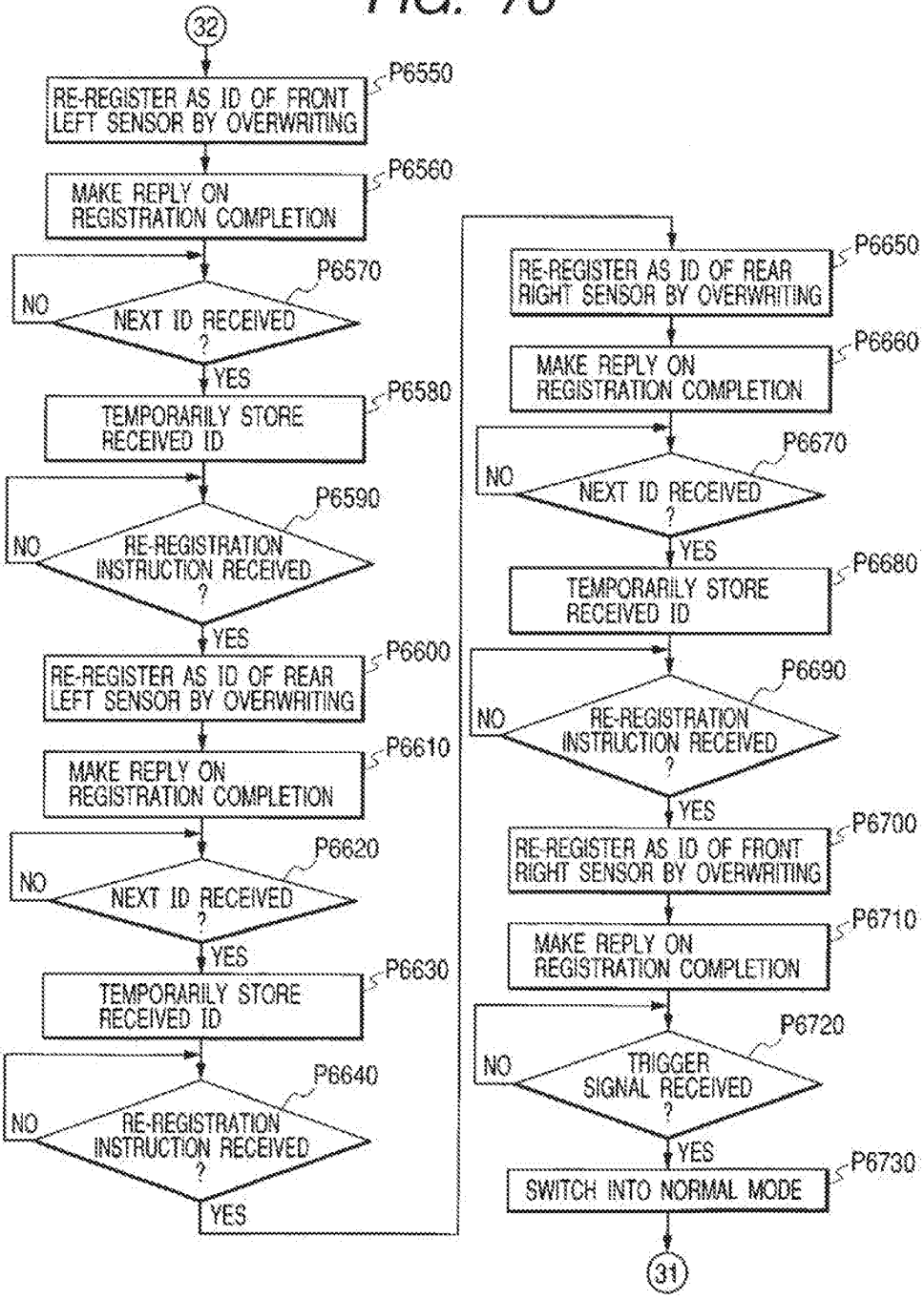
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FIG. 75



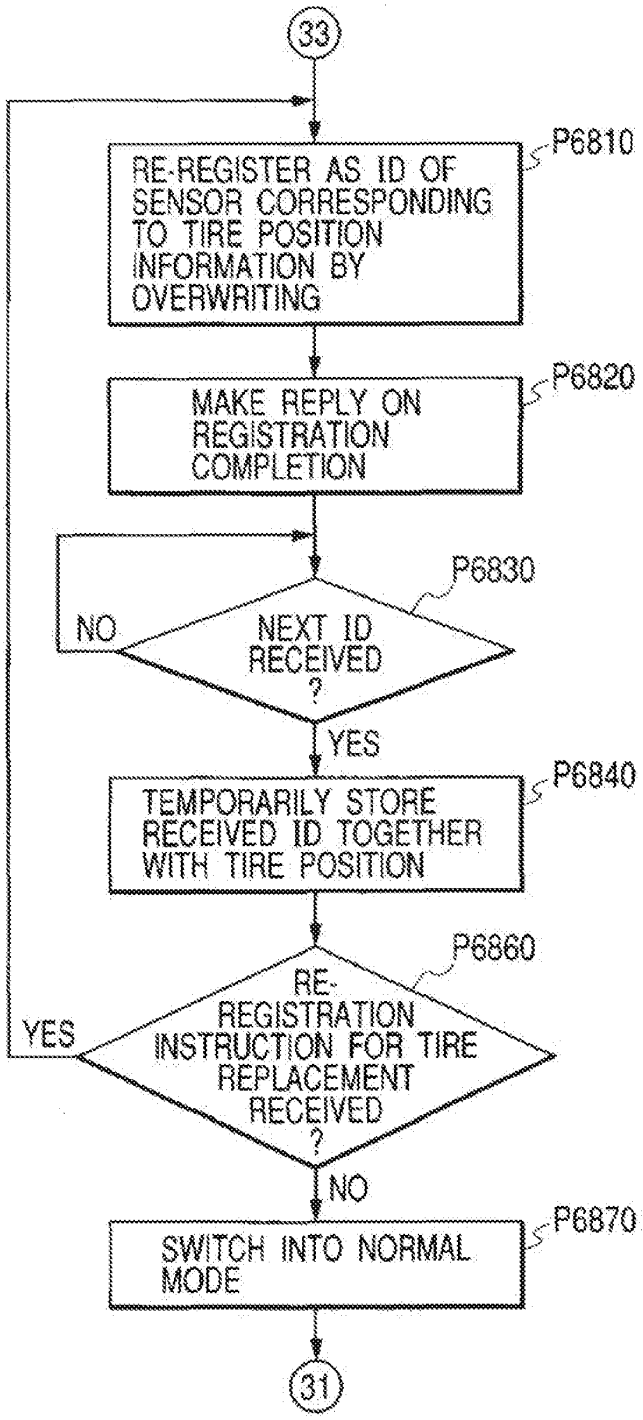
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FIG. 76



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FIG. 77



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FIG. 78
(PRIOR ART)

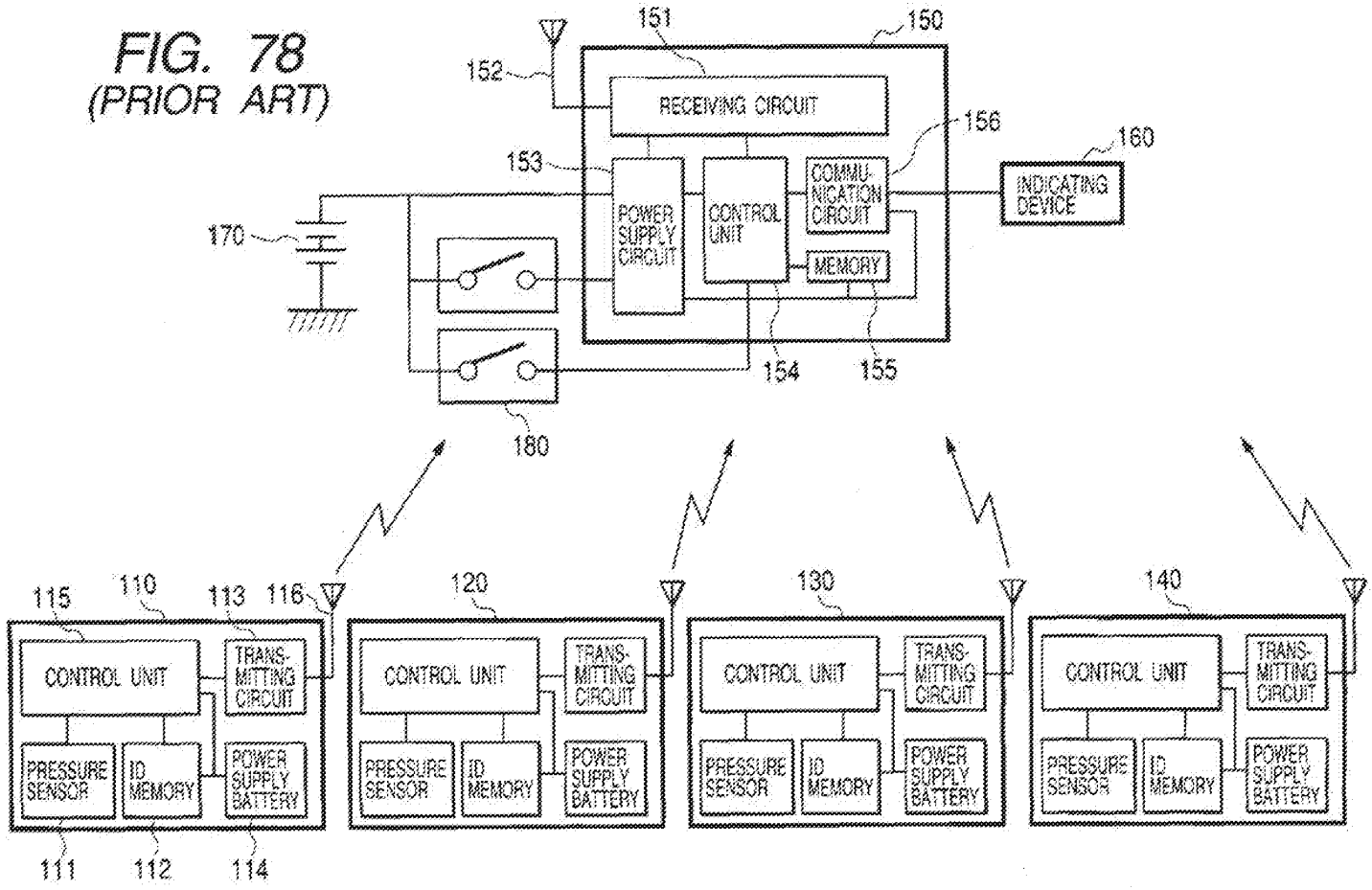
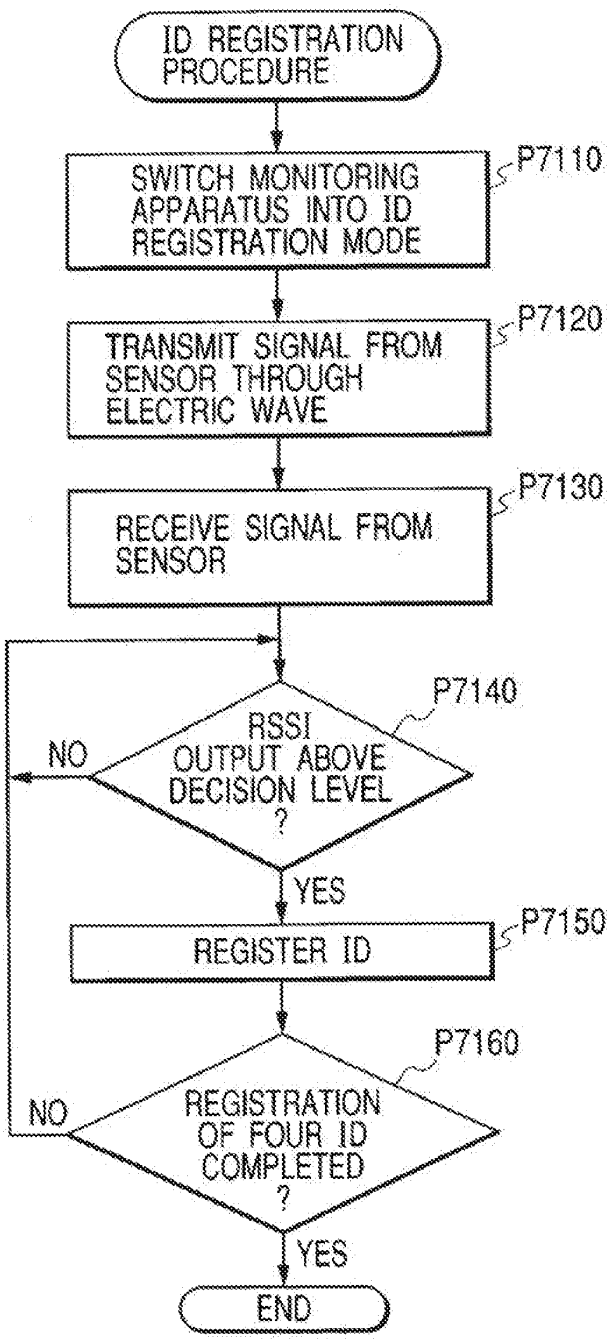


FIG. 79
(PRIOR ART)



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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 (**S10**), and a decision is made as to whether or not it is the initial registration (**S20**). In the case of the initial registration (**S20**: YES), the IDs are read from the bar codes **5**, **6**, **7** and **8** through the use of the ID registration tool **60** (**S30**), and are transmitted from the ID registration tool **60** to the tire pressure monitoring apparatus **50** (**S40**). The tire pressure monitoring apparatus **50** registers the received IDs in the memory **55** (**S50**). Moreover, it makes a decision as to whether or not the necessary number of IDs are put in its memory **55** (**S60**). If the registration of the necessary number of IDs does not reach completion (**S60**: NO), the step **S40** and subsequent steps are implemented repeatedly. If the registration of the necessary number of IDs has reached completion (**S60**: YES), the monitoring apparatus **50** is switched into a normal mode, then terminating the ID registration operation (**S70**).

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 (**S20**: NO), the ID is read out from the bar code adhered onto the detached tire through the use of the ID registration tool **60** (**S80**), and is transmitted from the ID registration tool **60** to the tire pressure monitoring apparatus **50** (**S90**). Upon receipt of this ID, the tire pressure monitoring apparatus **50** deletes an ID corresponding to the received ID from the memory **55** (**S100**). 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** (**S110**), and is transmitted from the ID registration tool **60** to the tire pressure monitoring apparatus **50** (**S120**). The tire pressure monitoring apparatus **50** registers the received ID in the memory **55** (**S130**). Following this, a decision is made as to whether or not the ID re-registration in the tire pressure monitoring apparatus **50** reaches completion (**S140**). If the ID re-registration does not come to an end (**S140**: NO), the step **S80** and subsequent steps are executed repeatedly. On the other hand, if the ID registration of the necessary number of IDs reaches completion (**S140**: YES), the monitoring apparatus **50** is switched into a normal mode (**S70**), 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 (**S210**), 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** (**S220**).

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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 transmittal 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**(S1370). If the reply does not come within a predetermined period of time (S1370:NO), the operational flow returns to the step S1350. On the other hand, if the registration completion reply comes (S1370: 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** (S1380), and an instruction command for the ID registration is then transmitted to the air pressure sensor **20** and the monitoring apparatus **50**(S1390). 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** (S1400). If the reply does not come within a predetermined period of time (S1400:NO), the operational flow returns to the step S1380. On the other hand, if the registration completion reply comes (S1400: 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** (S1410), and an instruction command for the ID registration is then transmitted to the air pressure sensor **30** and the monitoring apparatus **50** (S1420). 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** (S1430). If the reply does not come within a predetermined period of time (S1430:NO), the operational flow returns to the step S1410. On the other hand, if the registration completion reply comes (S1430: 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** (S1440), and an instruction command for the ID registration is then transmitted to the air pressure sensor **40** and the monitoring apparatus **50**(S1450). 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** (S1460). If the reply does not come within a predetermined period of time (S1460: NO), the operational flow returns to the step S1440. On the other hand, if the registration completion reply comes (S1460: 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** (S1470), 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 (S1220: 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** (S1530), and a decision is made as to the completion of the readout (S1540). If the decision shows the completion of the readout (S1540: YES), the readout result is stored in the memory **66** in a state associated with the tire position (front left) (S1550). Subsequently, an instruction message on the readout of the bar code **91**RL' thereon is displayed (S1560), and a decision is made as to the completion of the readout (S1570). If the decision shows the completion of the readout (S1570: YES), the readout result is stored in the memory **66** in a state associated with the tire position (rear left) (S1580). Moreover, an instruction message on the readout of the bar code **91**RR' thereon is displayed (S1590), and a decision is made as to the completion of the readout (S1600). If the decision shows the completion of the readout (S1600: YES), the readout result is stored in the memory **66** in a state associated with the tire position (rear right) (S1610). Still moreover, an instruction message on the readout of the bar code **91**FR' thereon is displayed (S1620), and a decision is made as to the completion of the readout (S1630). If the decision shows the completion of the readout (S1630: YES), the readout result is stored in the memory **66** in a state associated with the tire position (front right) (S1640).

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** (S1650), and an instruction command for the ID re-registration is then transmitted to the air pressure sensor **10** and the monitoring apparatus **50** (S1660). 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** (S1670). If the reply does not come within a predetermined period of time (S1670: NO), the operational flow returns to the step S1650. On the other hand, if the registration completion reply comes (S1670: 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** (S1680). An instruction command for the ID re-registration is then transmitted to the air pressure sensor **20** and the monitoring apparatus **50** (S1690). 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** (S1700). If the reply does not come within a predetermined period of time (S1700: NO), the operational flow returns to the step S1680. On the other hand, if the registration completion reply comes (S1700: YES), the ID corresponding to the air pressure sensor of the rear right tire is read out from the memory **66** and is transmittal to the air pressure sensor **30** and the monitoring apparatus **50** (S1710). An instruction command for the ID re-registration is then transmitted to the air pressure sensor **30** and the monitoring apparatus **50** (S1720). 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** (S1730). If the reply does not come within a predetermined period of time (S1730: NO), the operational flow returns to the step S1710. On the other hand, if the registration completion reply comes (S1730: 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** (S1740). An instruction command for the ID re-registration is then transmitted to the air pressure sensor **40** and the monitoring apparatus **50** (S1750). 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** (S1760). If the reply does not come within a predetermined period of time (S1760: NO), the operational flow returns to the step S1740. On the other hand, if the registration completion reply comes (S1760: 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** (S1470), 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 (S1800). In the case of the reception of the trigger signal indicating the switching into the ID registration mode (S1800: YES), the switching into the ID registration mode is carried out (S1810), 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 **91**FL, **91**RL, **91**RR and **91**FR 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 **91**FL 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 **91**RL 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 **91**RR 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 **91**FR 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 (P2780, P2790).

Thereafter, the processing similar to the step P1210 and subsequent processing in the fifth embodiment is implemented as shown in FIGS. **52** and **53** (P2810 to P2930, P3010 to P3130).

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**, (P3210). 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 (P3210: 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 (P3220).

Following this, an instruction message to the effect of inputting a vehicle body number is displayed on the display **69** (P3230), and a decision is made as to the input of the vehicle body number (P3240). If the decision indicates the input of the vehicle body number (P3240: YES), the vehicle body number is stored in the memory **66** (P3250).

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** (P3260), 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** (S3270). 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** (P3280). If this reply does not come within a predetermined period of time (P3280: NO), the operational flow returns to the step P3260. On the other hand, if the registration completion reply comes therefrom (P3280: 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** (P3290), and the processing comes to an end.

On the other hand, the decision at the program activation indicates the re-registration(P3210: 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* (P3310). Subsequently, an instruction message to the effect of inputting a vehicle body number is displayed on the display **69** (P3330), and a decision is made on the input of the vehicle body number (P3340). If the decision indicates the input of the vehicle body number (P3340: YES), this vehicle body number is stored in the memory **66** (P3350).

Following this, the vehicle body number is read out from the memory **66** and is transmitted through the signal line **63***a* (P3360), and an instruction command for the ID registration is transmitted through the signal line **63***a* (P3370). 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* (P3380). If this reply does not come within a predetermined period of time (P3380: NO), the operational flow returns to the step P3360. On the other hand, if the registration completion reply comes therefrom (P3380: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted through the signal line **63***a* (P3390), 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 (P3400). If the decision indicates the reception of the trigger signal calling for the switching into the ID registration mode (P3400: YES), the switching into the ID registration mode is made (P3410), and a decision is made on the reception of an ID (P3420). In the case of the ID reception (P3420: YES), this ID is temporarily stored in a work area of the RAM (P3430), and a decision is made on the reception of an instruction on the ID registration (P3440). In the case of the reception of the ID registration instruction (P3440: YES), the ID temporarily stored in P3430 is registered as an ID of the air pressure sensor in the memory **55** (P3450), and a reply indicative of the ID registration completion is made (P3460). 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 (P3470). In the case of the reception of the trigger signal calling for the switching into the normal mode (P3470: YES), the switching into the normal mode is made (P3480), 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**4148**. 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 tire 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 (P4900: 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** (P5400), and the control waits for the panel manipulation (P4540). In the case of the panel manipulation for the rotation (P5410: 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** (P5412), and the control waits for the panel manipulation for the indication of the connection completion (P5414). If there is the panel manipulation for the indication of the connection completion (P5414: 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 (P5414, P5420).

Following this, a random-number generating unit is activated to generate a random number (P5430), 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 (P5450), 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 (P5460, P5470, P5480, P5490).

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** (P5510), and an instruction command for the ID re-registration at the time of the rotation is then transmitted to the air pressure sensor **10** (P5520). 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** (P5530). If the reply does not come within a predetermined period of time (P5530: NO), the operational flow returns to the step P5510. On the other hand, if the registration completion reply comes therefrom (P5530: 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** (P5540), and an instruction command for the ID re-registration in the case of the rotation is transmitted to the air pressure sensor **20** (P5550). 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** (P5560). If the reply does not come within a predetermined period of time (P5560: NO), the operational flow returns to the step P5540. On the other hand, if the registration completion reply comes therefrom (P5560: 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** (P5570), and an instruction command for the ID re-registration at the rotation is transmitted to the air pressure sensor **30** (P5580). 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** (P5590). If the reply does not come within a predetermined period of time (P5590: NO), the operational flow returns to the step P5570. On the other hand, if the registration completion reply comes therefrom (P5590: 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** (P5600), and an instruction command for the ID re-registration at the rotation is transmitted to the air pressure sensor **40** (P5610). 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** (P5620). If the reply does not come within a predetermined period of time (P5620:NO), the operational flow returns to the step P5610. On the other hand, if the registration completion reply comes therefrom (P5620: 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** (P5630).

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** (P5710), and an instruction command for the ID re-registration in the case of the rotation is then transmitted to the monitoring apparatus **50** (P5720). 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** (P5730). If the reply does not come within a predetermined period of time (P5730: NO), the operational flow returns to the step P5710. On the other hand, if the registration completion reply comes therefrom (P5730: 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** (P5740), and an instruction command for the ID re-registration at the rotation is transmitted to the monitoring apparatus **50** (P5750). 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** (P5760). If the reply does not come within a predetermined period of time (P5760: NO), the operational flow returns to the step P5740. On the other hand, if the registration completion reply comes therefrom (P5760: 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** (P5770), and an instruction command for the ID re-registration at the rotation is transmitted to the monitoring apparatus **50** (P5780). 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** (P5790). If the reply does not come within a predetermined period of time (P5790: NO), the operational flow returns to the step P5770. On the other hand, if the registration completion reply comes therefrom (P5790: 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** (P5800), and an instruction command for the ID re-registration at the rotation is transmitted to the monitoring apparatus **50** (P5810). 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** (P5820). If the reply does not come within a predetermined period of time (P5820: NO), the operational flow returns to the step P5800. On the other hand, if the registration completion reply comes therefrom (P5820: YES), a trigger signal for giving instruction for the restoration to the normal mode is outputted to the monitoring apparatus **50** (P5830).

Moreover, if the re-registration button is pushed (P4900: re-registration) and the tire replacement is designated (P5410: 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** (P5902), and the control waits for the panel manipulation indicating the completion of the connection (P5904). In response to the panel manipulation indicating the connection completion (P5904: YES), for the confirmation of the connection, a request signal is transmitted to each of the sensor signal lines **63***a* to **63***d* (P5906), and the control waits for a reply to the request signal (P5908). If the reply takes place (P5908: YES), only the sensor signal line providing the reply is set in an active state (P5910), 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 (P5920).

Following this, a random-number generating unit is activated to generate a random number (P5930), 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 (P5950), 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 (P5960, P5970, P5980, P5990).

Thereafter, as shown in FIG. **74**, one of the signal lines made active is specified (P6000), and an ID set value at a tire position corresponding to this signal line is read out from the memory **66** (P6010), and this ID set value is transmitted through this signal line (P6020). Then, an instruction command for the ID re-registration at the tire replacement is transmitted to the ID sending signal line (P6030). 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 (P6040). If the reply does not come within a predetermined period of time (P6040: NO), the operational flow returns to the step P6010. On the other hand, if the reply indicative of the registration completion comes therefrom (P6040: YES), a trigger signal is outputted through this signal line for restoring the air pressure sensor to the normal mode (P6050), and this signal line is setting-changed from the active state to the non-active state (P6060). Then, the ID set value read out in the step P6010, together with the tire position information, is transmitted to the tire pressure monitoring apparatus **50** (P6070). Subsequently, an instruction command for the ID re-registration at the tire replacement is transmitted to the tire pressure monitoring apparatus **50** (P6080), 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** (P6090). If the reply does not come within a predetermined period of time (P6090: NO), the operational flow returns to the step P6070. On the other hand, if the reply indicative of the registration completion comes therefrom (P6090: YES), a decision is made as to whether signal lines set in the active state in the step P6010 remain or not (P6100). If they are still left (P6100: YES), one of the signal lines left is specified (P6110), and the operational flow returns to the step P6010. On the other hand, if there is no signal line set in the active state (P6110: NO), a trigger signal is outputted to restore the tire pressure monitoring apparatus **50** to the normal mode (P6120), 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 (P6200). In the case of the reception of the trigger signal calling for the switching into the ID registration mode (P76200: YES), the switching into the ID registration mode is made (P6210), and a decision is made on the reception of an ID (P6220). In the case of the reception of the ID (S6220: YES), this ID, together with tire position information, is temporarily stored in a work area of the RAM (P6230). 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 (P6240). In the case of the reception of the ID initial-registration instruction (P6240: initial registration), the ID temporarily stored in the step S6230 is registered as the ID of the air pressure sensor of the front left tire in the memory **55** (P6250), and a reply is made which is indicative of the completion of the ID registration (P6260). Subsequently, a decision is made on the reception of an ID (P6270). In the case of the reception of the ID (S6270: YES), this ID is temporarily stored in a work area of the RAM (P6280). Then, a decision is made on the reception of an instruction for the ID initial-registration (P6290). In the case of the reception of the ID initial-registration instruction (P6290: YES), the ID temporarily stored in S6280 is registered as the ID of the air pressure sensor of the rear left tire in the memory **55** (P6300), and a reply is made which is indicative of the completion of the ID registration (P6310). Following this, a decision is made on the reception of an ID (P6320). In the case of the reception of the ID (S6320: YES), this ID is temporarily stored in a work area of the RAM (P6330). Then, a decision is made on the reception of an instruction for the ID initial-registration (P6340). In the case of the reception of the ID initial-registration instruction (P6340: YES), the ID temporarily stored in S6330 is registered as the ID of the air pressure sensor of the rear right tire in the memory **55** (P6350), and a reply is made which is indicative of the completion of the ID registration (P6360). Moreover, a decision is made on the reception of an ID (P6370). In the case of the reception of the ID (S6370: YES), this ID is temporarily stored in a work area of the RAM (P6380). Then, a decision is made on the reception of an instruction for the ID initial-registration (P6390). In the case of the reception of the ID initial-registration instruction (P6390: YES), the ID temporarily stored in S6380 is registered as the ID of the air pressure sensor of the front right tire in the memory **55** (P6400), and a reply is made which is indicative of the completion of the ID registration (P6410). 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 (P6420). In the case of the reception of the trigger signal calling for the switching into the normal mode (P6420: YES), the mode is switched into the normal mode (P6430), and the processing comes to an end.

Still furthermore, in the step P6240, in the case of the reception of the ID re-registration instruction for the rotation (P6240: rotation), as shown in FIG. **76**, the ID temporarily stored in the step P6230 is re-registered by overwriting as the ID of the air pressure sensor of the front left tire in the memory **55** (P6550), and a reply is carried out which is representative of the ID registration completion (P6560). Then, a decision is made on the reception of an ID (P6570). In the case of the reception of the ID (P6570: YES), this ID is temporarily stored in a work area of the RAM (P6580). A decision is made on the reception of an ID initial-registration instruction (P6590). In the case of the reception of the ID initial-registration instruction (P6590: YES), the ID temporarily stored in the step P6580 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** (**P6600**), and a reply is made which is representative of the ID registration completion (**P6610**). Then, a decision is made on the reception of an ID (**P6620**). In the case of the reception of the ID (**P6620**: YES), this ID is temporarily stored in a work area of the RAM (**P6630**). A decision is made on the reception of an ID initial-registration instruction (**P6640**). In the case of the reception of the ID initial-registration instruction (**P6640**: YES), the ID temporarily stored in the step **P6630** is re-registered by overwriting as an ID of the air pressure sensor of the rear right tire in the memory **55** (**P6650**), and a reply is made which is representative of the ID registration completion (**P6660**). subsequently, a decision is made on the reception of an ID (**P6670**). In the case of the reception of the ID (**P6670**: YES), this ID is temporarily stored in a work area of the RAM (**P6680**). A decision is made on the reception of an ID initial-registration instruction (**P6690**). In the case of the reception of the ID initial-registration instruction (**P6690**: YES), the ID temporarily stored in the step **P6680** is re-registered by overwriting as an ID of the air pressure sensor of the rear right tire in the memory **55** (**P6700**), and a reply is made which is representative of the ID registration completion (**P6710**). 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 (**P6720**). In the case of the reception of the trigger signal calling for the switching into the normal mode (**P6720**: YES), the switching into the normal mode is done (**P6730**), and the processing comes to an end.

Yet furthermore, in the step **P6240**, in the case of the reception of the ID re-registration instruction for the tire replacement (**P6240**: tire replacement), as shown in FIG. **77**, the ID temporarily stored in the step **P6230** 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 **P6230** (**P6810**), and a reply is carried out which is representative of the ID registration completion (**P6820**). Then, a decision is made on the reception of an ID (**P6830**). In the case of the reception of the ID (**P6830**: YES), this ID, together with the tire position information, is temporarily stored in the RAM (**P6840**), and a decision is made on the reception of an ID re-registration instruction at the tire replacement (**P6850**). In the case of the reception of the ID re-registration instruction at the tire replacement (**P6850**: YES), the operational flow returns to the step **P6810**. On the other hand, in the case of no reception of an ID (**P6830**: 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 (**P6860**). In the case of the reception of the trigger signal calling for the switching into the normal mode (**P6860**: YES), the switching into the normal mode is done (**P6870**), 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 connectal 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 connectal 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 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.

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, PDP417, 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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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

Orange Exhibit No. 2004
IPR2024-00744

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.

* * * * *

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:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	6000

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)	

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	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	no	10
Warnings:					
Information:					
3	Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party	US6414592.pdf	608003	no	8
Warnings:					
Information:					
4	Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party	US6927679.pdf	1933288	no	35
Warnings:					
Information:					
5	Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party	US6941801.pdf	526738	no	6
Warnings:					
Information:					
6	Reexam - Affidavit/Decl/Exhibit Filed by 3rd Party	US7079033.pdf	6040556	no	115
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	29733	no	2
Warnings:					
Information:					

Total Files Size (in bytes):	10552140

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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.

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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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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	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☐ no 35 USC 119 (a-d) conditions met ☐ yes ☐ no ☐ Met after Allowance Verified and Acknowledged _____ Examiner's Signature Initials			13	1

ADDRESS

24728

TITLE

Tire Pressure Detecting Apparatus And Tire Pressure Detector Identification Copying Method For The Same

FILING FEE RECEIVED	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
6000		

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.

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

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. 2004
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 [redacted]	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	113978		

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New Applications Under 35 U.S.C. 111
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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.

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
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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

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

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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

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. 2004
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 8031864 4/ 8/ 2014

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1. 8,031,064, EX PARTE REEXAMINATION CERTIFICATE (9826th), 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
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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
View: Cite
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
1600 ATLANTA FINANCIAL CENTER
ATLANTA, GA 30326

EXAMINER	
NGUYEN, LINH M	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
04/09/2014	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.

PTOL-90A (Rev. 04/07)

Orange Exhibit No. 2004
IPR2024-00744

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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. 2004
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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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

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Order Granting / Denying Request For Ex Parte Reexamination	Control No.	Patent Under Reexamination
	90/013,169	8031064
	Examiner	Art Unit
	Linh M. Nguyen	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 6031064	
	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.	

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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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

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EXAMINER	
NGUYEN, LINH M	

ART UNIT	PAPER NUMBER
3992	

MAIL DATE	DELIVERY MODE
07/11/2014	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.

PTOL-90A (Rev. 04/07)

Orange Exhibit No. 2004
IPR2024-00744

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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Alexandria, VA 22313-1450
www.uspto.gov

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(THIRD PARTY REQUESTERS 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. 2004
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.

Requester's Proposed Rejections/SNQs

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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 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.

Orange Exhibit No. 2004
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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

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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. 2004
IPR2024-00744

/JENNIFER MCNEIL/

Supervisory Patent Examiner, Art Unit 3992

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.
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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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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	8031604.RE	1047

24728 7590 07/31/2014

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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.

PTOL-90A (Rev. 04/07)

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(THIRD PARTY REQUESTERS CORRESPONDENCE ADDRESS)

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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)

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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

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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.

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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.

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.)

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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

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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).

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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

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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,

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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***

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).

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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

Orange Exhibit No. 2004
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		

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



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Attorney for Patent Owner on the Record

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Phone: 404-233-7000
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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

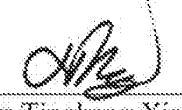
PATENT OWNER STATEMENT OF THE INTERVIEW UNDER 37 C.F.R. 1.560,

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



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Orange Exhibit No. 2004
IPR2024-00744

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 [illegible]	no	18
Warnings:					
Information:					

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2	Reexam Miscellaneous Incoming Letter	26223982115tmtOfInterview.pdf	124304	no	2
Warnings:					
Information:					
3	Reexam Certificate of Service	26223982115CertificateOfService.pdf	108677	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.

PTOL-90A (Rev. 04/07)

Orange Exhibit No. 2004
IPR2024-00744

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
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)).

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.

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"*.

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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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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.

Orange Exhibit No. 2004
IPR2024-00744

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

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.

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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 modole and a receiving module;

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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;

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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

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> 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

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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	262239821 1ResponseReExamFOA.pdf	157759	no	11
			[illegible]		
Warnings:					
Information:					

Orange Exhibit No. 2004
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.

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**.

Orange Exhibit No. 2004
IPR2024-00744

Respectfully submitted,
MORRIS, MANNING & MARTIN, LLP



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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	26223982111CertificateOfService.pdf	108630	no	2
			[illegible]		
Warnings:					
Information:					

Orange Exhibit No. 2004
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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.

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:

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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.

Orange Exhibit No. 2004
IPR2024-00744

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. 2004
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***

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IPR2024-00744

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.

Orange Exhibit No. 2004
IPR2024-00744

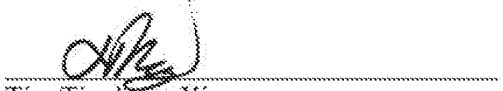
CONCLUSION

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
Attorney for Patent Owner on the Record

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Atlanta, Georgia 30326-1044
Phone: 404-233-7000
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



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Reg. No. 45,242
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Atlanta, Georgia 30326-1044
Phone: 404-233-7000
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	26223982115upplementalResponseReExamFOA.pdf	159005	no	11
			[illegible]		
Warnings:					
Information:					

2	Reexam Certificate of Service	2622398211CertificateOfService.pdf	108629 [illegible]	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	267634		

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New Applications Under 35 U.S.C. 111
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
90/013,169	02/28/2014	8031964	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)).

Notice of Intent to Issue Ex Parte Reexamination Certificate	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 --

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. 2004
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:

Orange Exhibit No. 2004
IPR2024-00744

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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. 2004
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		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

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												
70	146	148.5												

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

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		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

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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
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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	FEES: Authority has been given in Paper	☐ All Fees
6000	No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ 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.

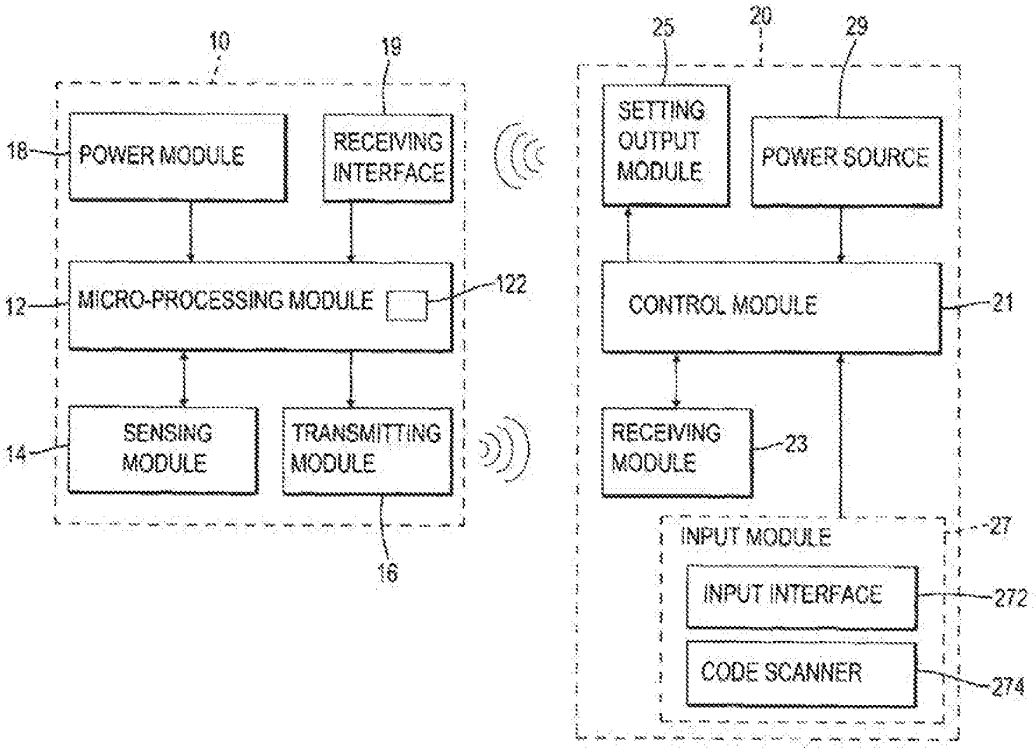
(56) **References Cited**

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.



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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:

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;

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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.

* * * * *

Orange Exhibit No. 2004
IPR2024-00744

EXHIBIT
PA-SB/08

Orange Exhibit No. 2004
IPR2024-00744

PTO/SB/08a (07-09)
Approved for use through 11/30/2020. OMB 0651-0031
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	Not yet assigned
Filing Date	August 9, 2019
First Named Inventor	Hung-Chih Yu
Art Unit	
Examiner Name	
Attorney Docket Number	

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1	US- 6,927,679 B2	08-09-2005	Taguchi et al.	
	2	US- 6,920,785 B2	07-26-2005	Toyofuku	
	3	US- 2006/0208864 A1	09-21-2006	Nantz et al.	
	4	US- 6,941,801 B2	09-13-2005	Lemense et al.	
	5	US- 7,079,033 B2	07-18-2006	Itou	
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]–Number[4]–Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature		Date Considered	

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EXHIBIT
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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); **Shintaroo 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**

US 2005/0099282 A1 May 12, 2005

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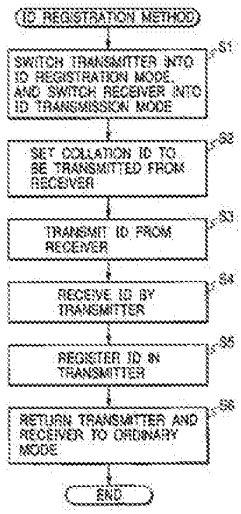
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Primary Examiner—Daveeta W. Goins
(74) *Attorney, Agent, or Firm*—Posz Law Group, PLC

(57) **ABSTRACT**

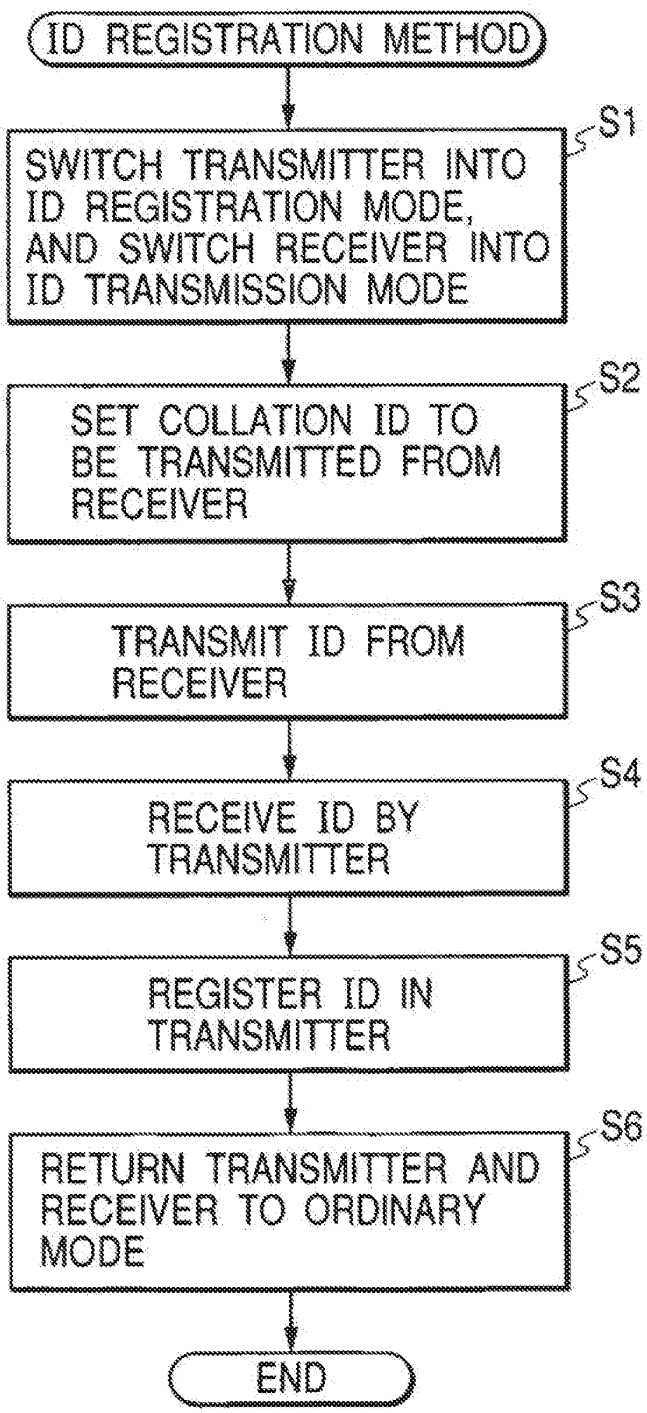
A transmitter mode switching apparatus switches a transmitter into an ID registration mode, while a receiver mode switching apparatus switches a receiver into an ID transmission mode (step S1). Then, a collation ID to be transmitted from the receiver is set based on an ID assigned inherently to the receiver (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



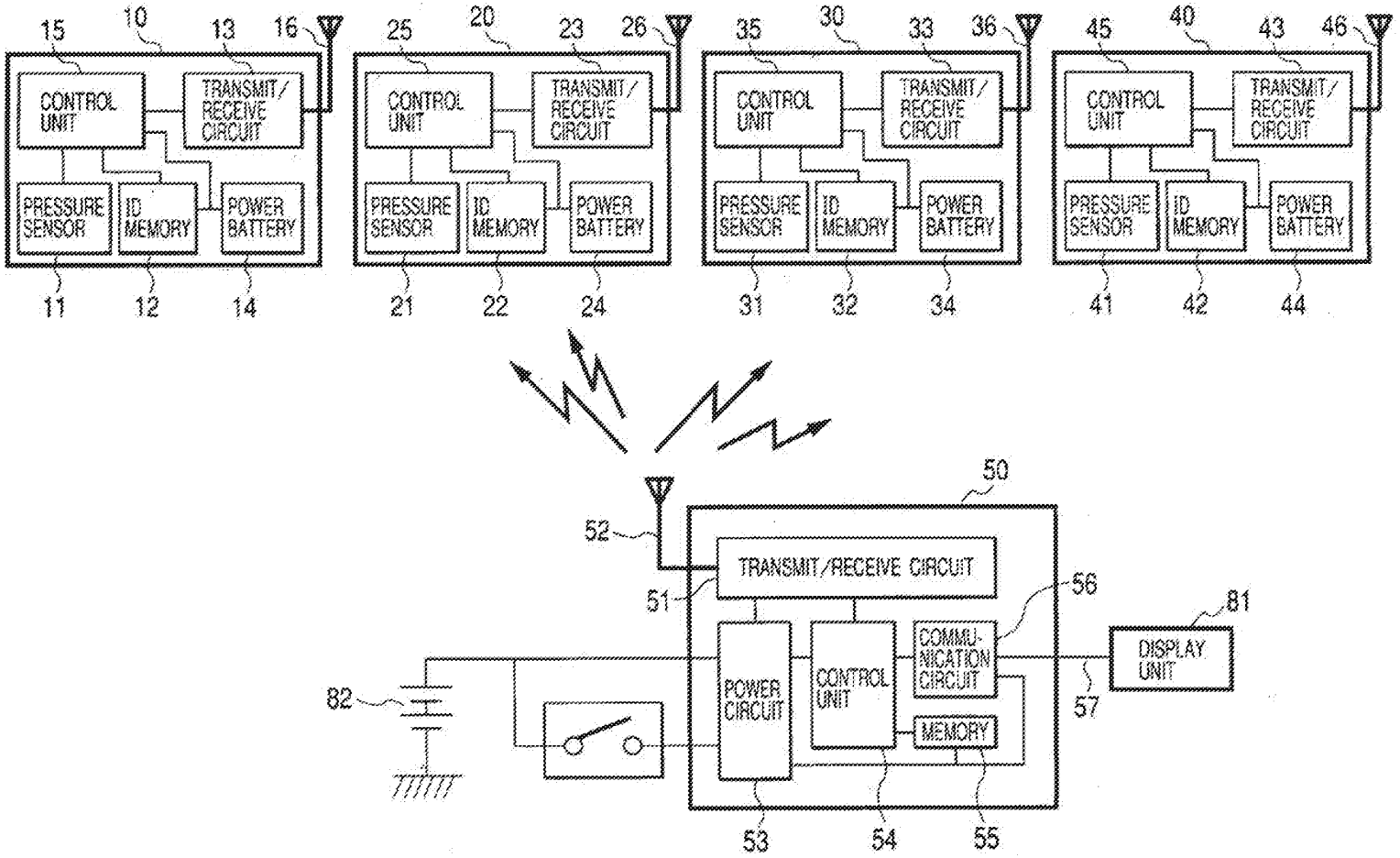
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FIG. 1



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FIG. 2



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FIG. 3A

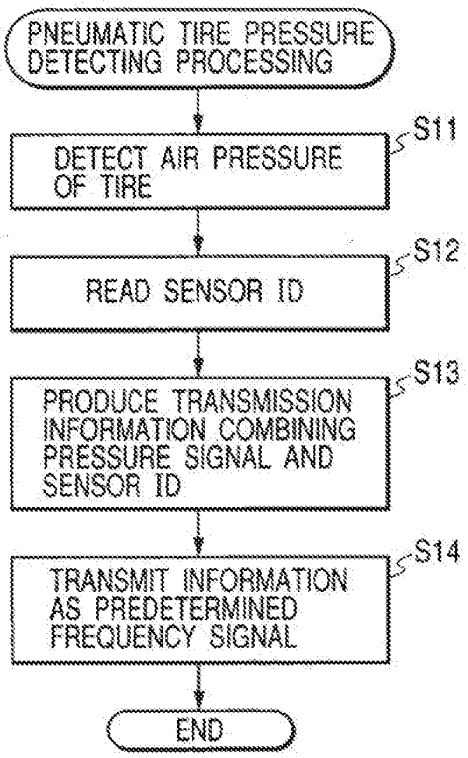
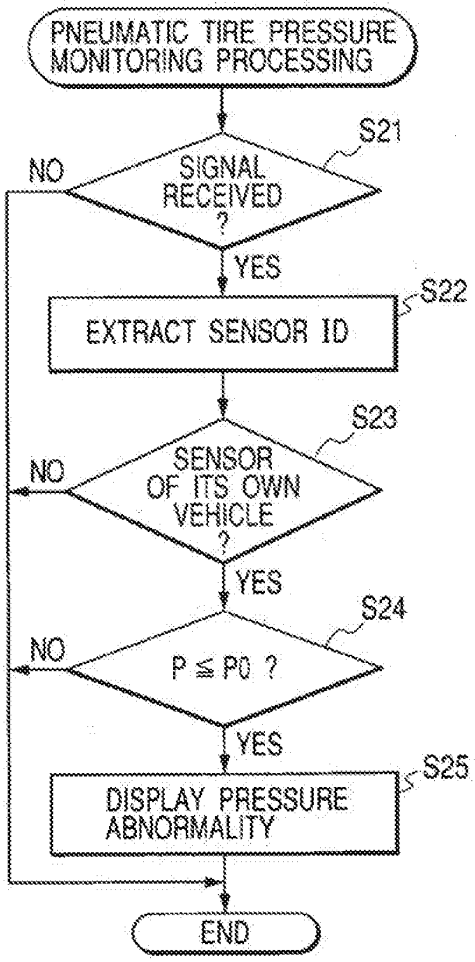
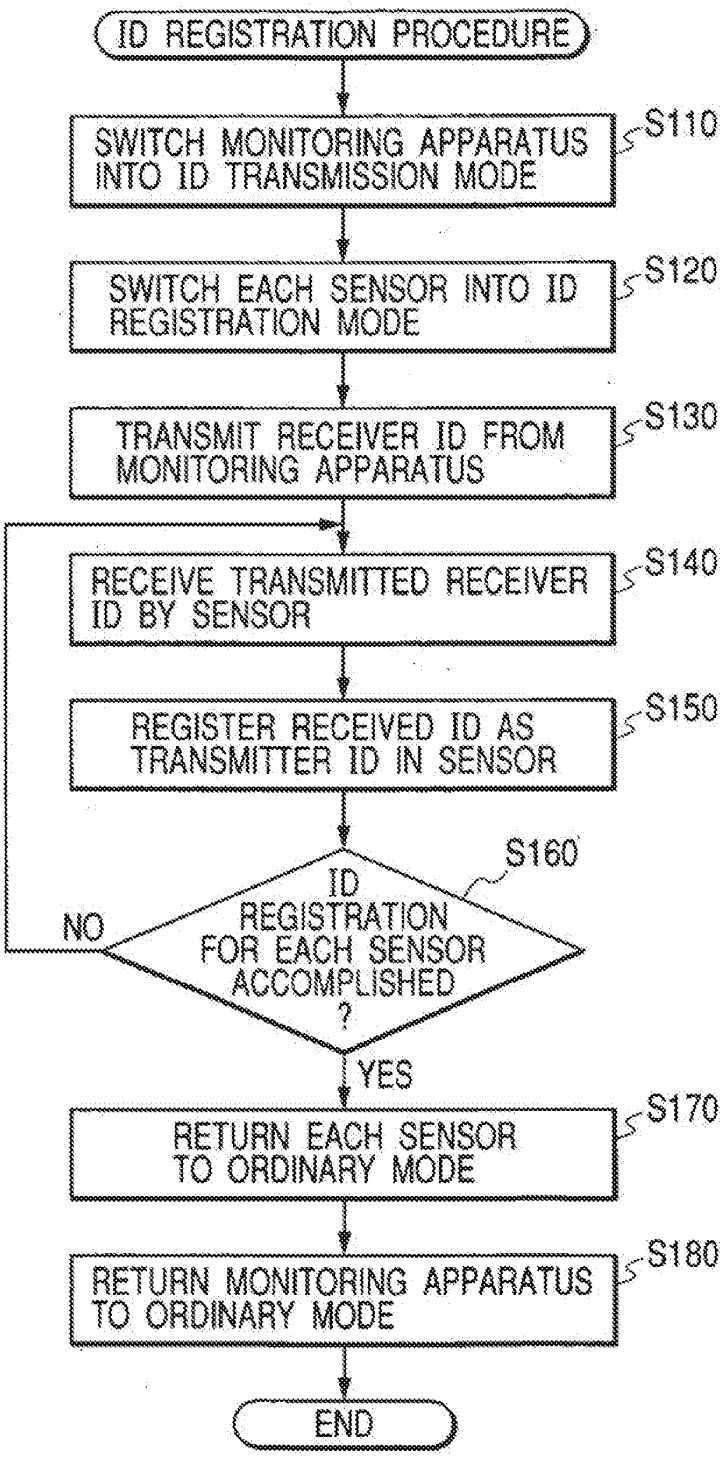


FIG. 3B



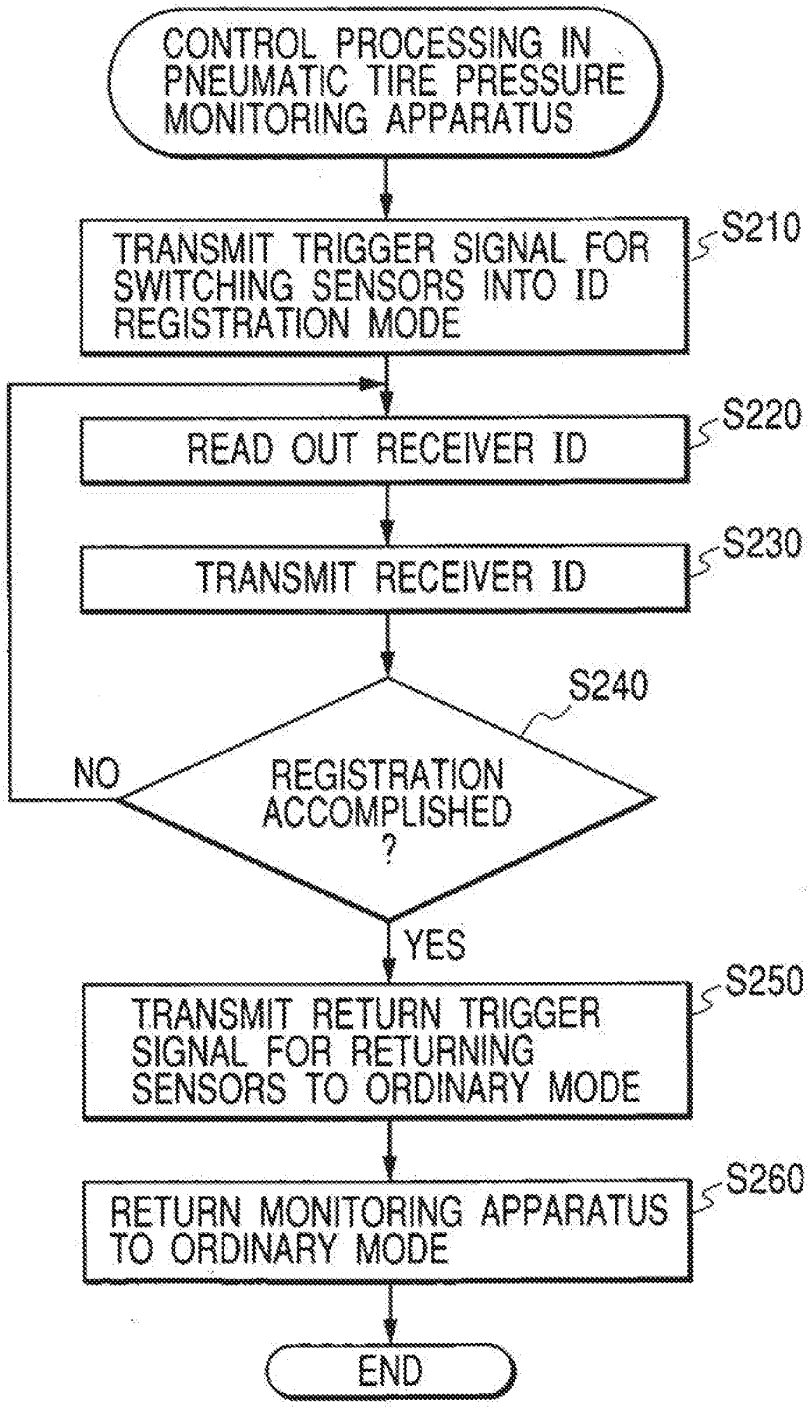
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FIG. 4



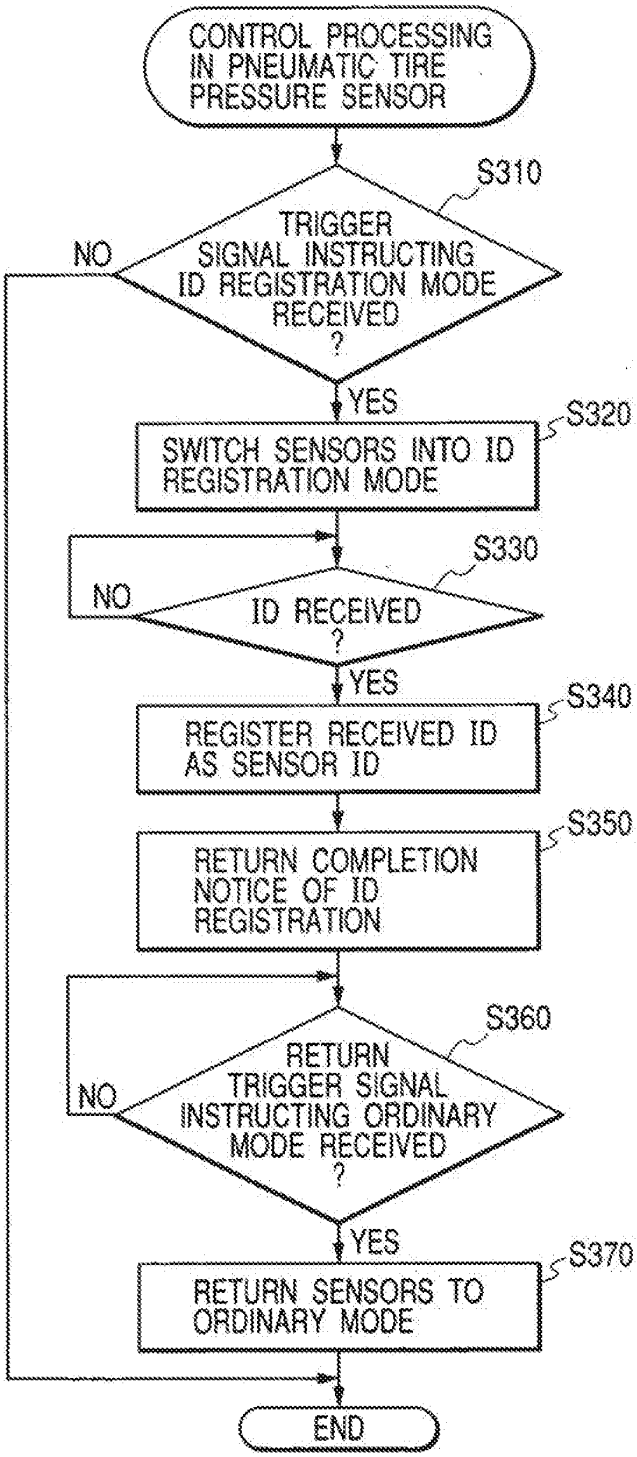
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FIG. 5



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FIG. 6



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FIG. 7

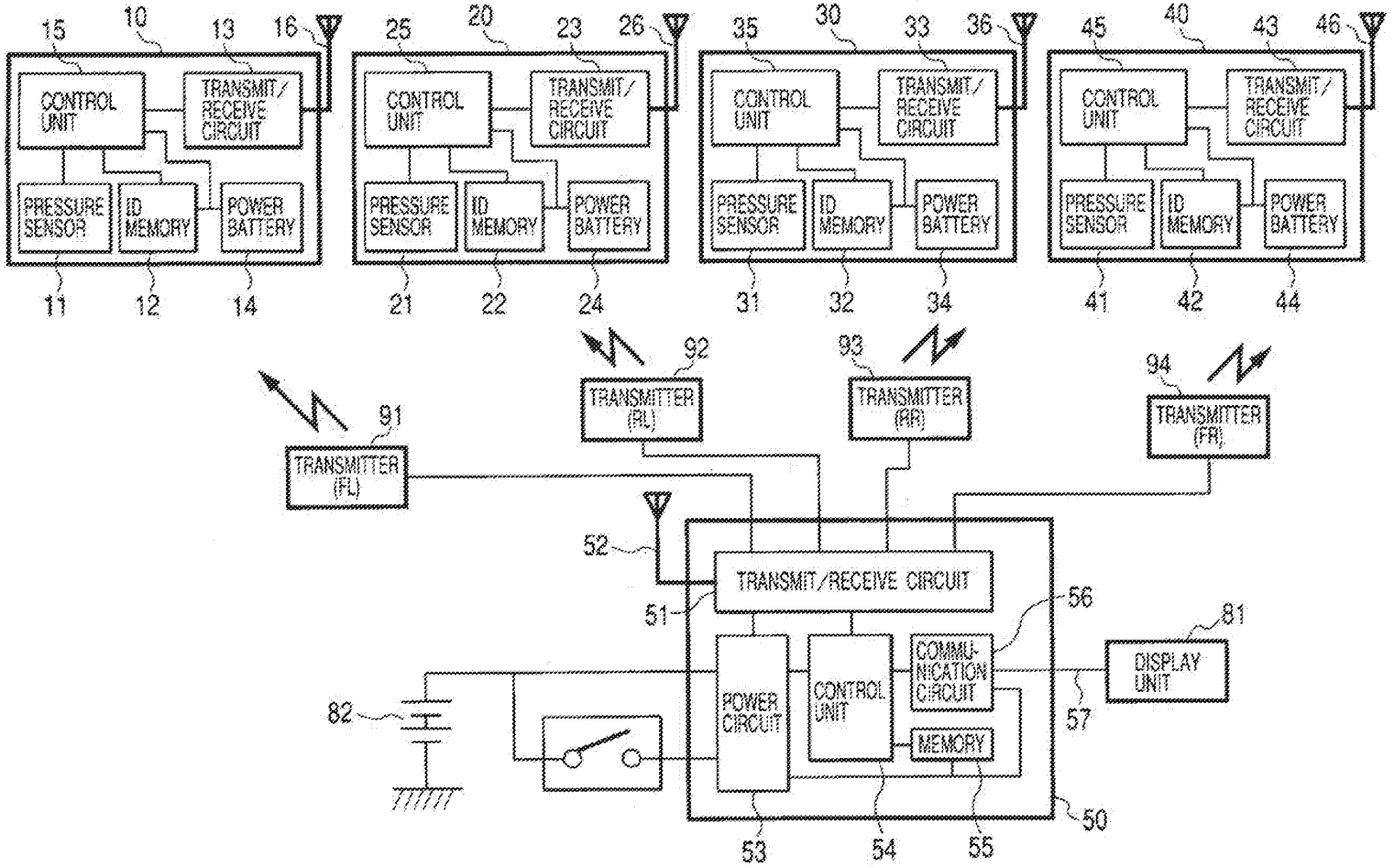
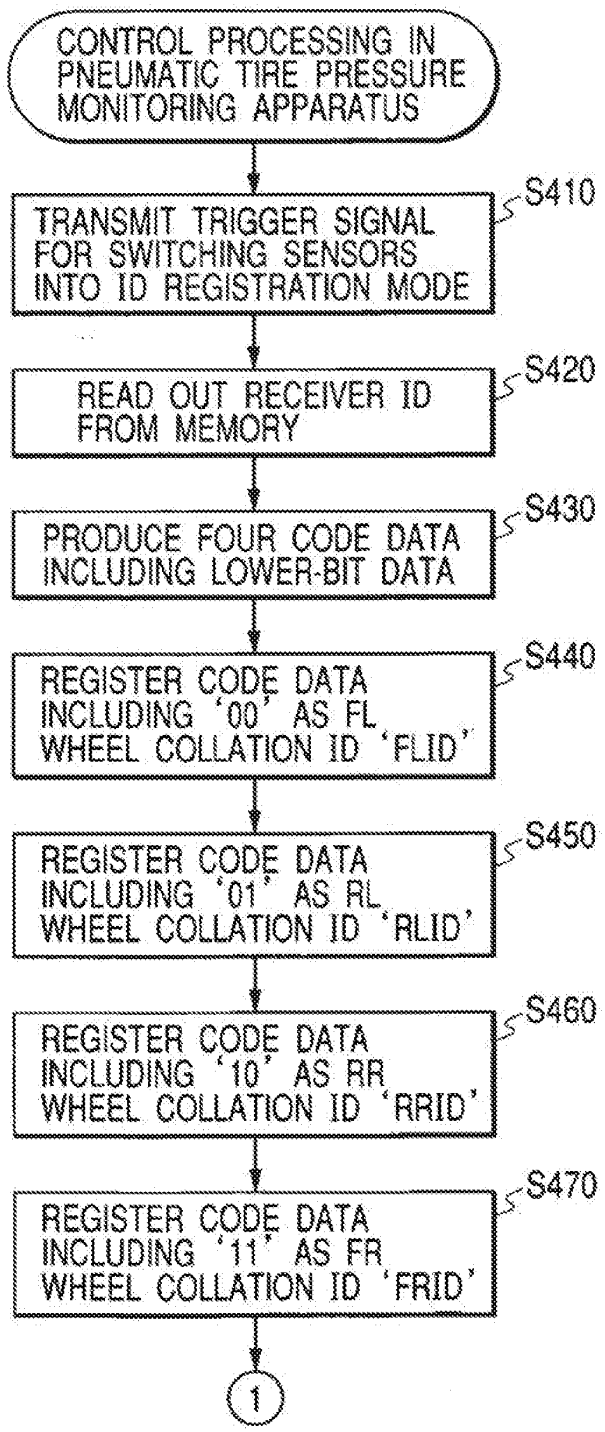
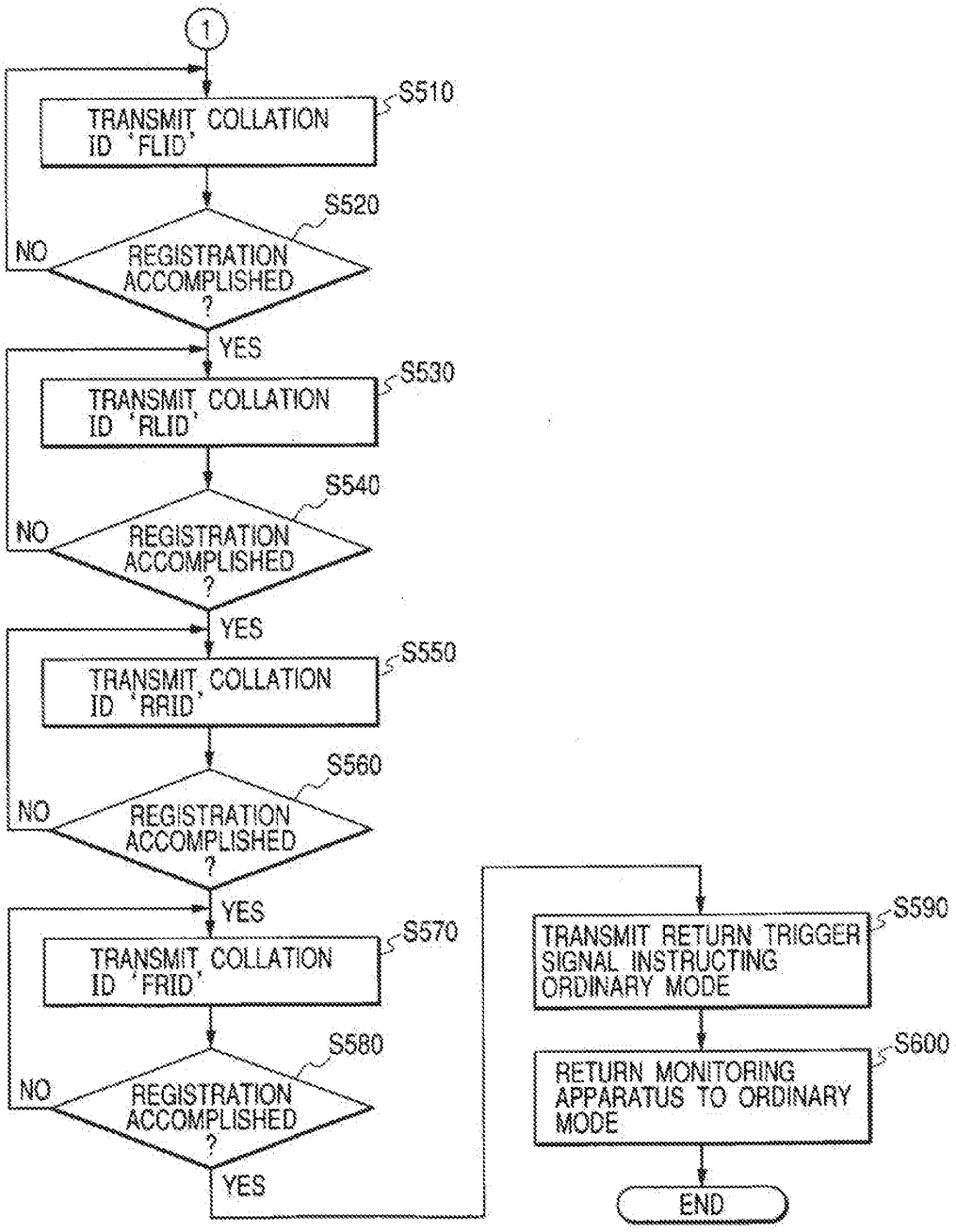

15
10
13
16
CONTROL UNIT
TRANSMIT/ RECEIVE CIRCUIT
PRESSURE SENSOR
ID MEMORY
POWER BATTERY
11
12
14
25
20
23
26
21
22
24
35
30
33
36
31
32
34
45
40
43
46
41
42
44
91
TRANSMITTER (FL)
92
TRANSMITTER (RL)
93
TRANSMITTER (RR)
94
TRANSMITTER (FR)
52
TRANSMIT/RECEIVE CIRCUIT
51
56
81
DISPLAY UNIT
COMMU-NICATION CIRCUIT
POWER CIRCUIT
CONTROL UNIT
MEMORY
82
57
50
53
54
55

FIG. 8



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FIG. 9



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FIG. 10

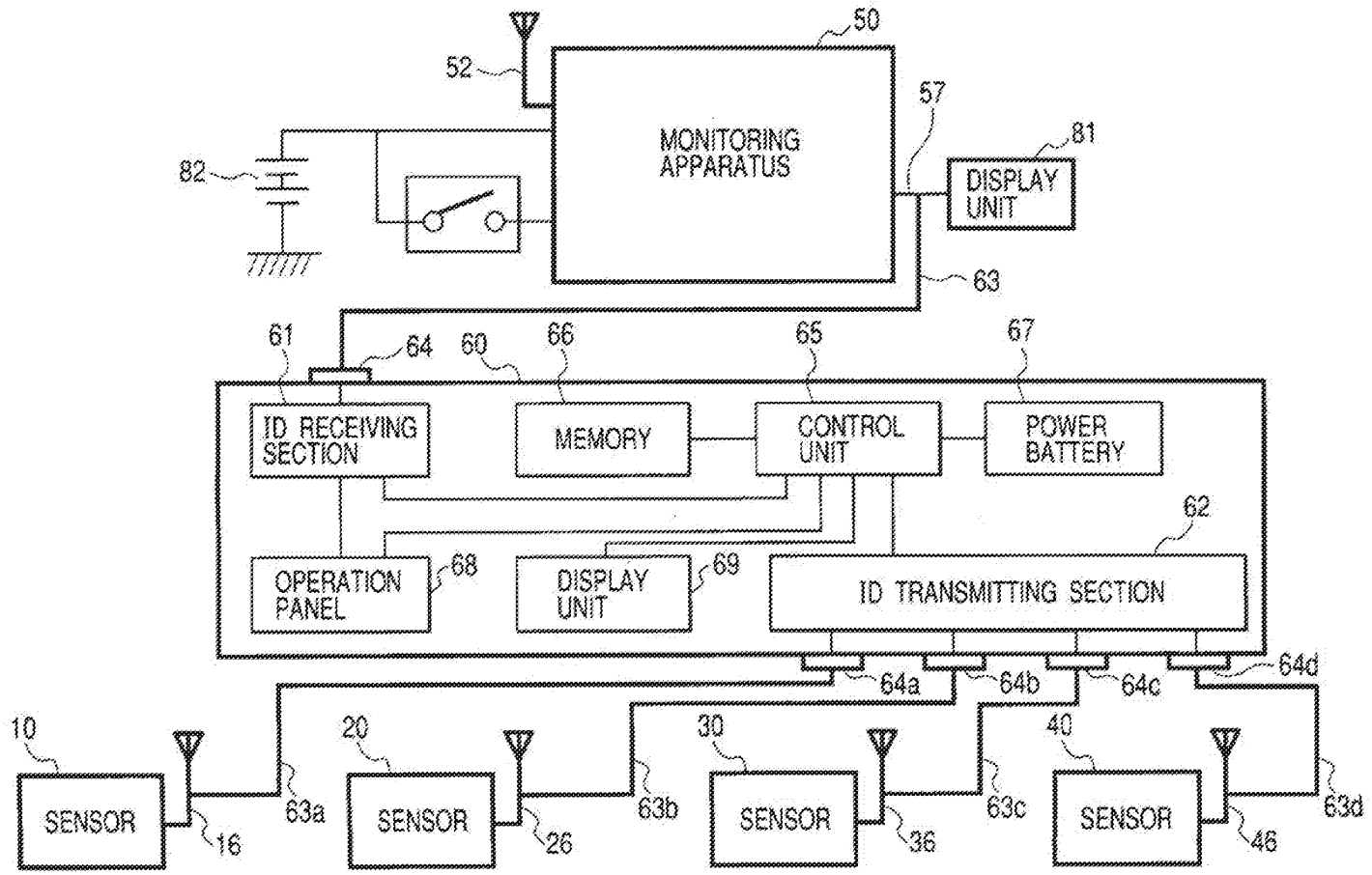
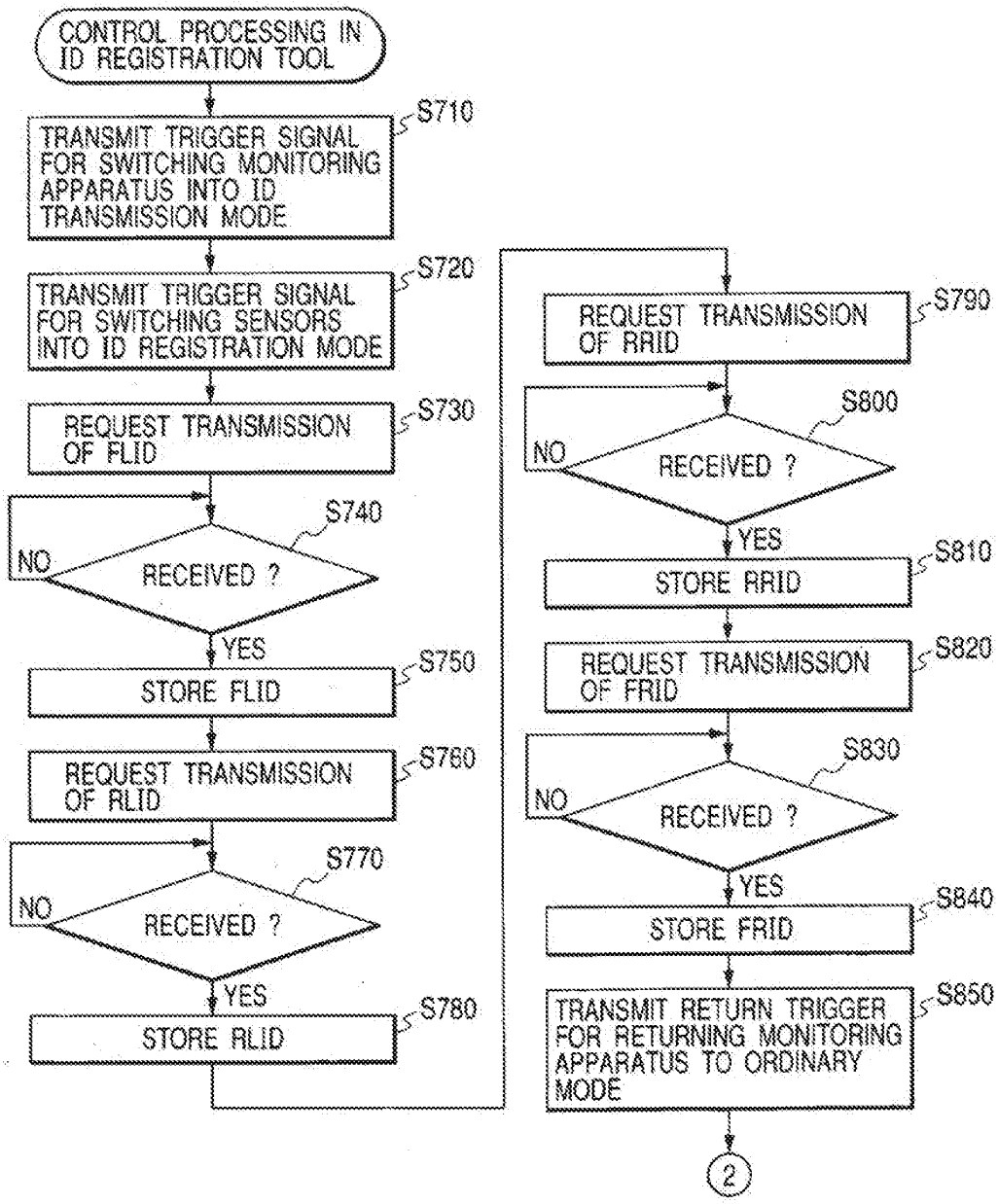
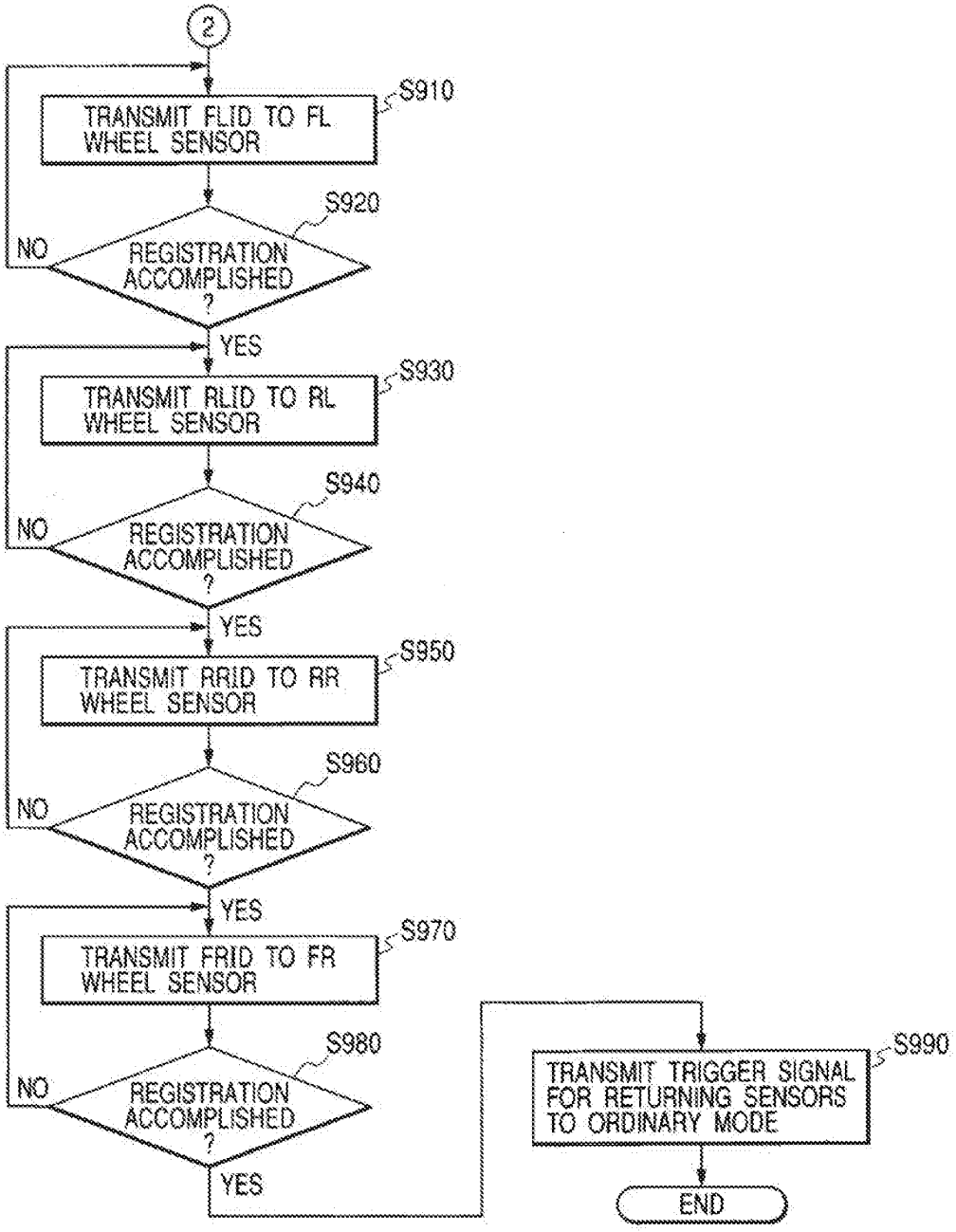

50
52
57
81
MONITORING APPARATUS
DISPLAY UNIT
82
63
61
64
60
66
65
67
ID RECEIVING SECTION
MEMORY
CONTROL UNIT
POWER BATTERY
62
OPERATION PANEL
68
DISPLAY UNIT
69
ID TRANSMITTING SECTION
64a
64b
64c
64d
10
20
30
40
SENSOR
SENSOR
SENSOR
SENSOR
16
26
36
46
63a
63b
63c
63d

FIG. 11



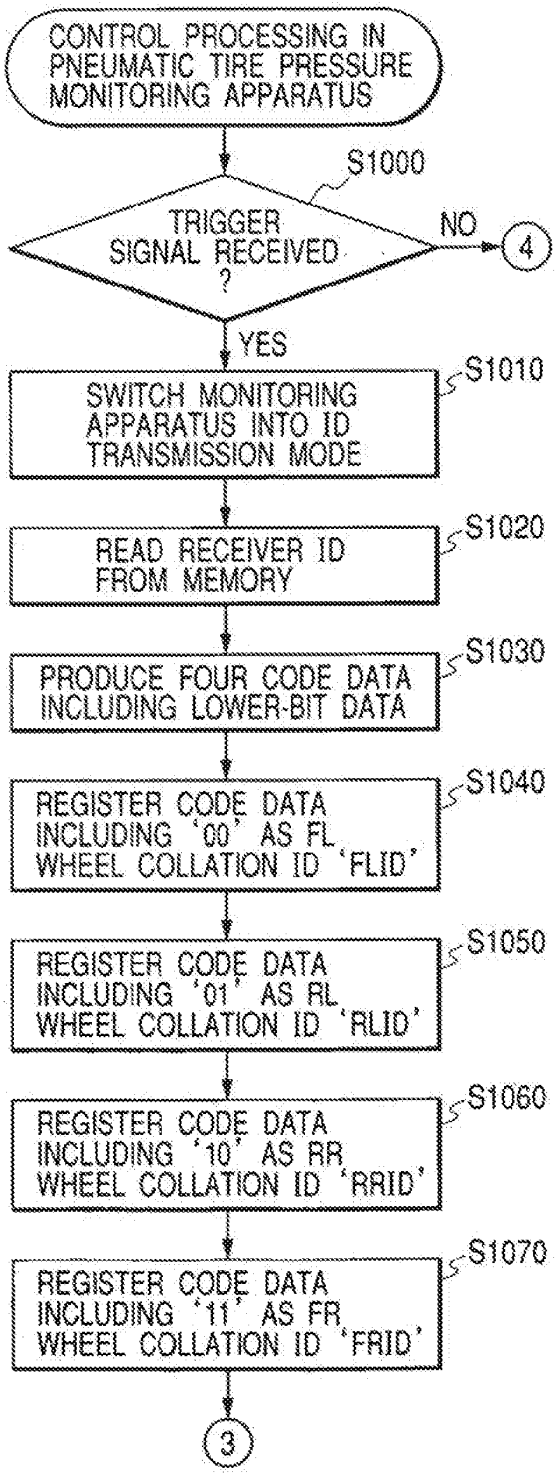
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FIG. 12



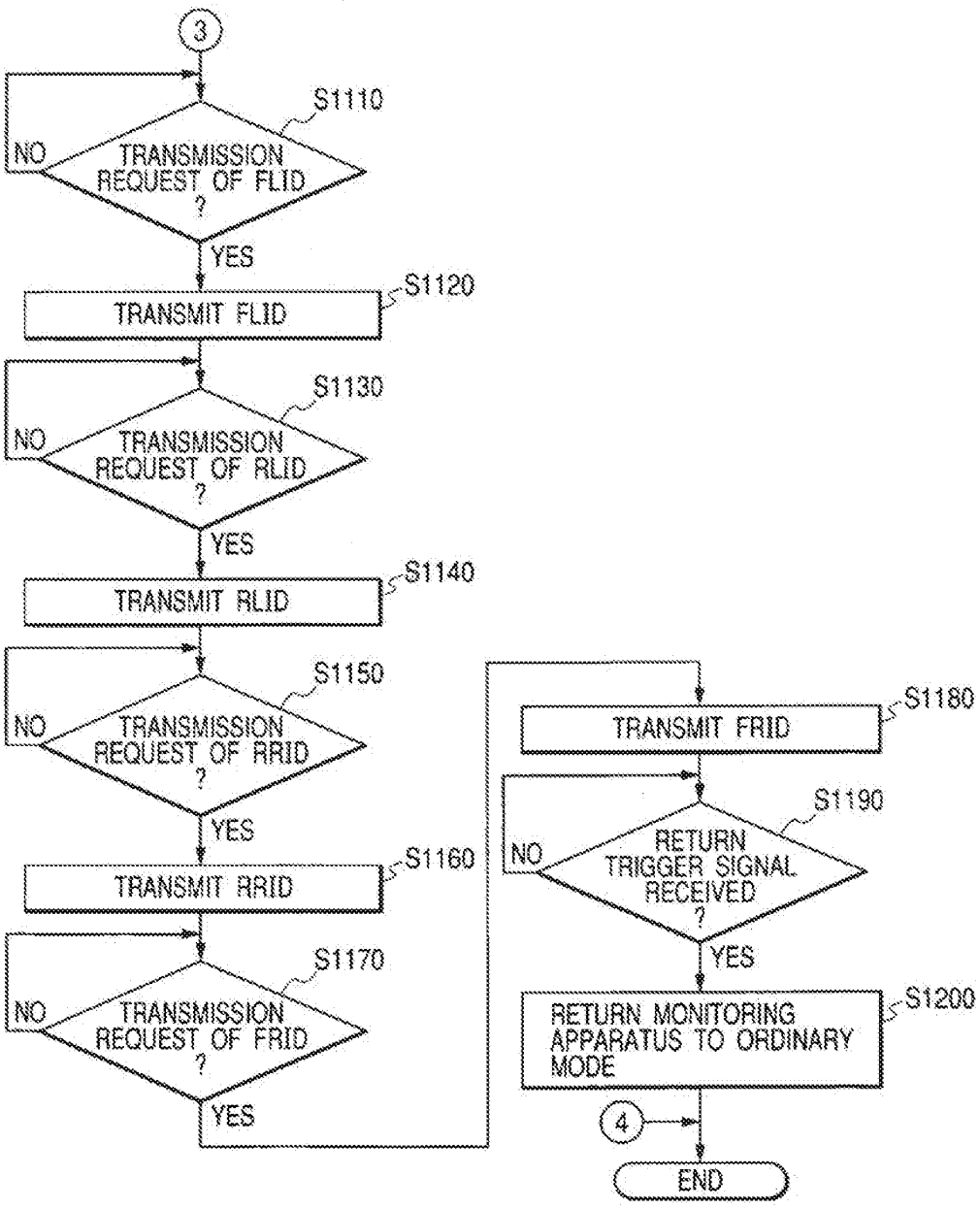
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FIG. 13



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FIG. 14



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FIG. 15

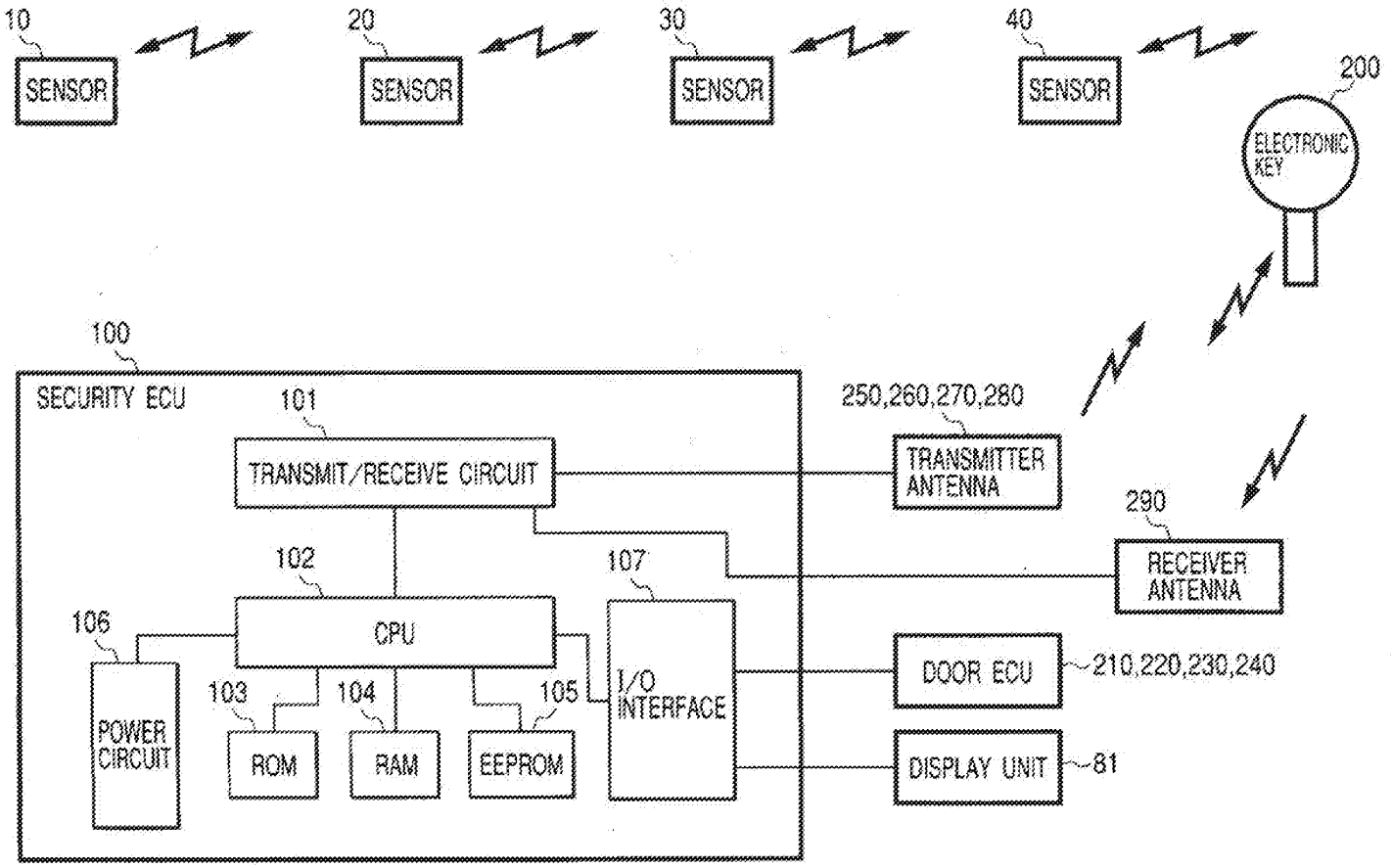
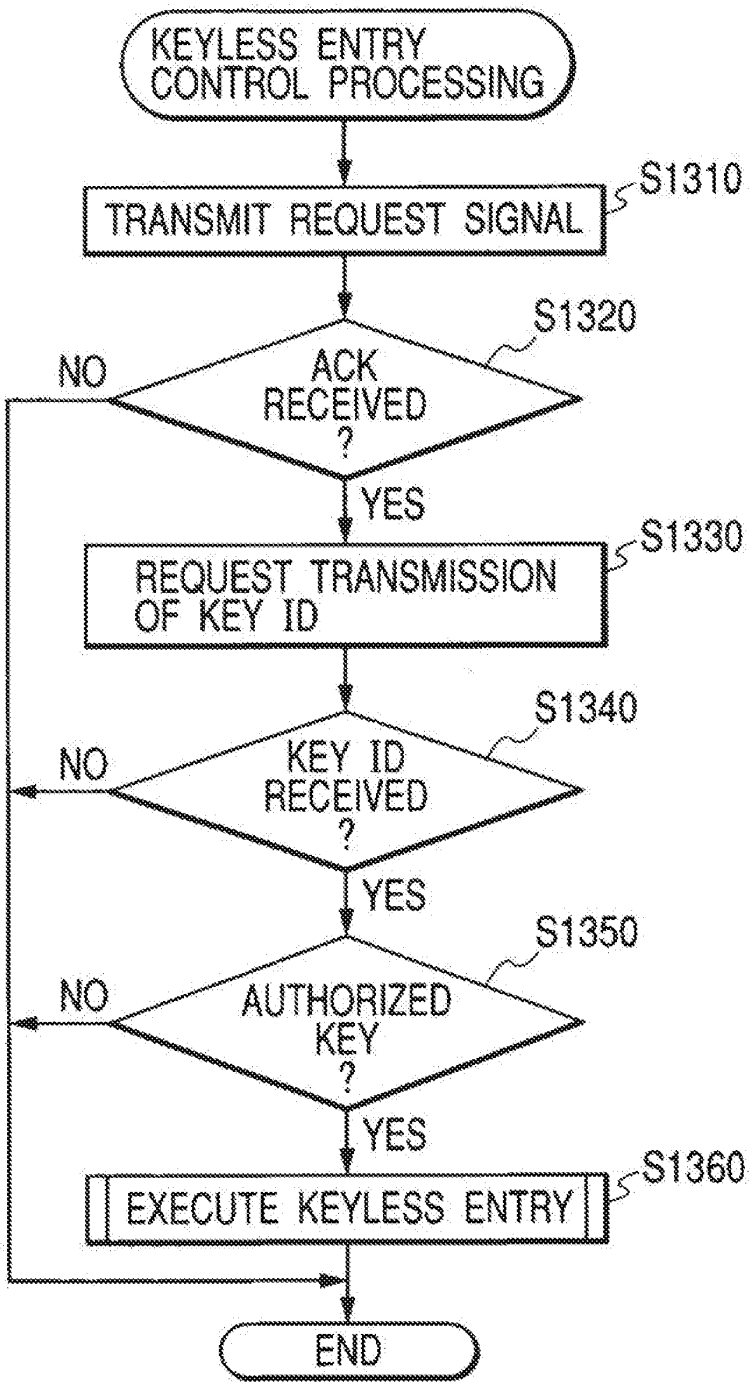
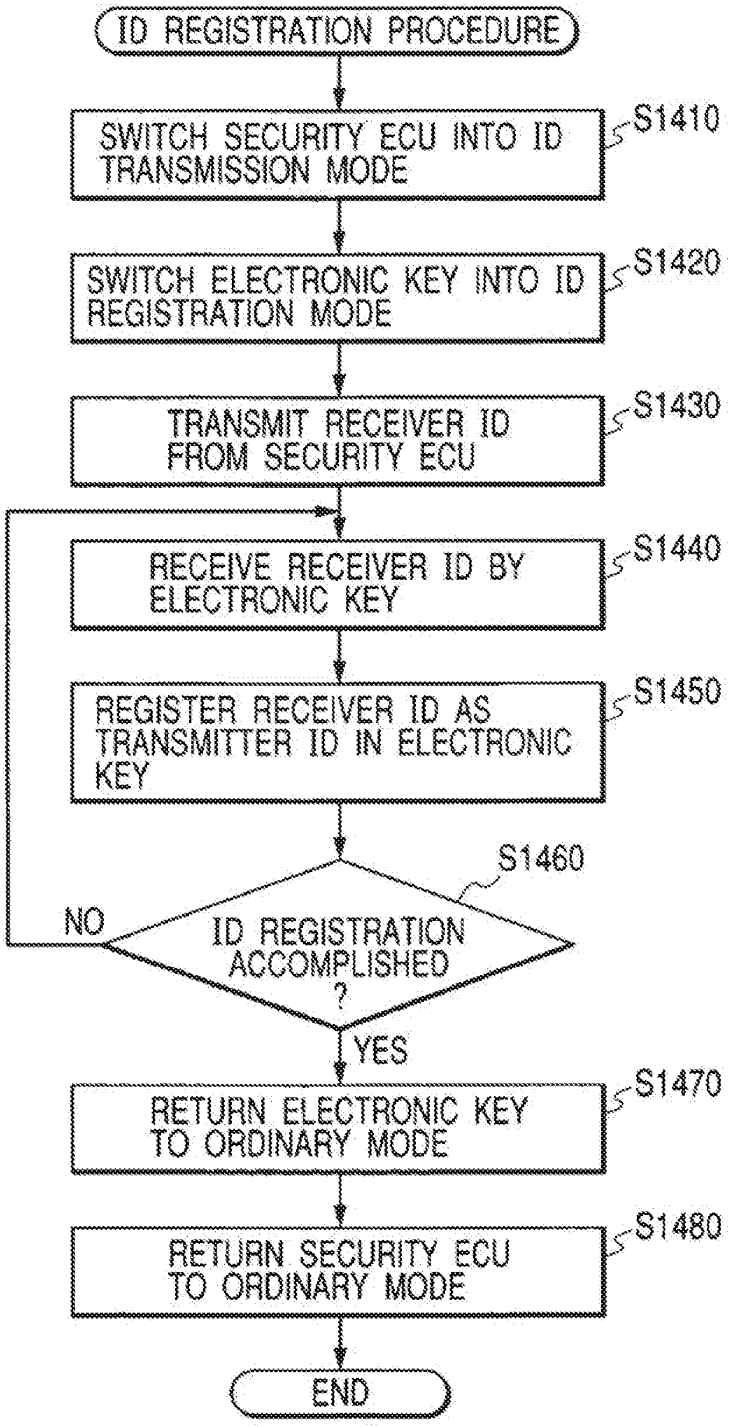

10
SENSOR
20
SENSOR
30
SENSOR
40
SENSOR
200
ELECTRONIC KEY
100
SECURITY ECU
101
TRANSMIT/RECEIVE CIRCUIT
250,260,270,280
TRANSMITTER ANTENNA
290
RECEIVER ANTENNA
102
CPU
107
I/O INTERFACE
106
POWER CIRCUIT
103
ROM
104
RAM
105
EEPROM
DOOR ECU
210,220,230,240
DISPLAY UNIT
81

FIG. 16



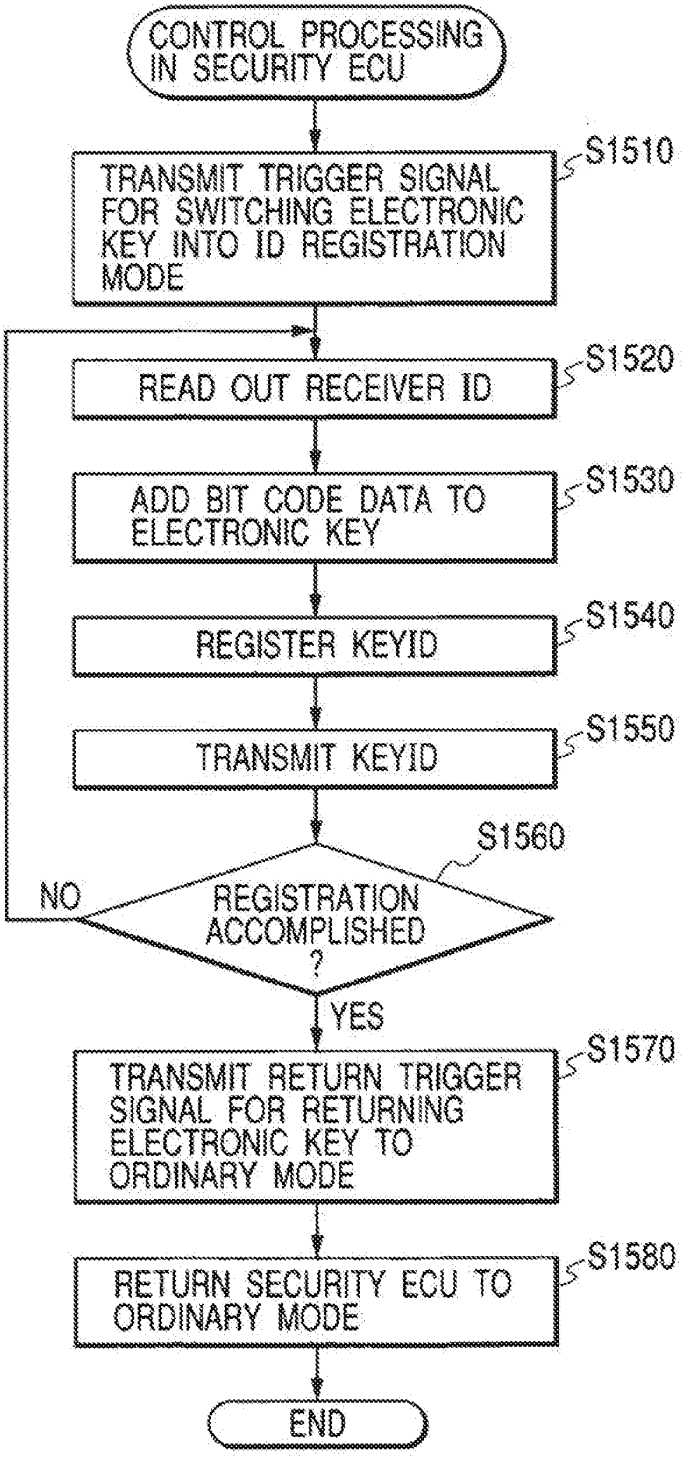
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FIG. 17



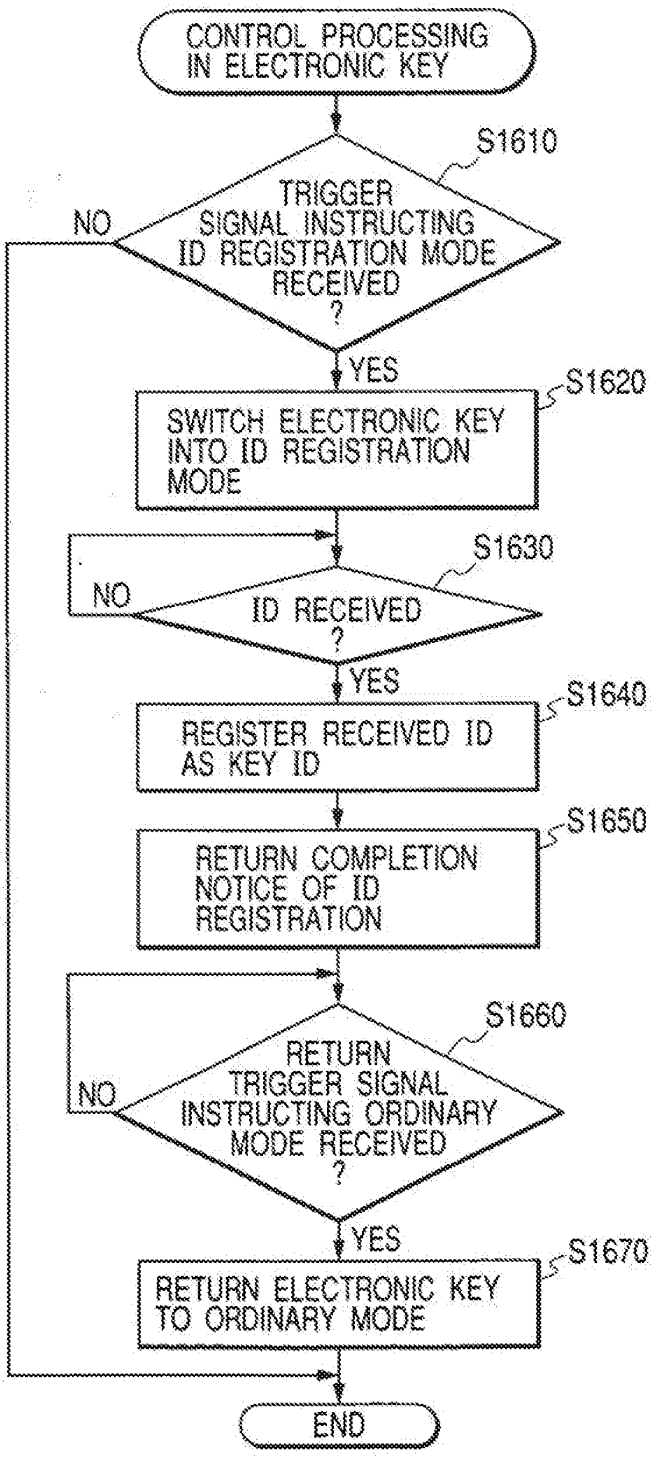
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FIG. 18



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FIG. 19



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FIG. 20
(PRIOR ART)

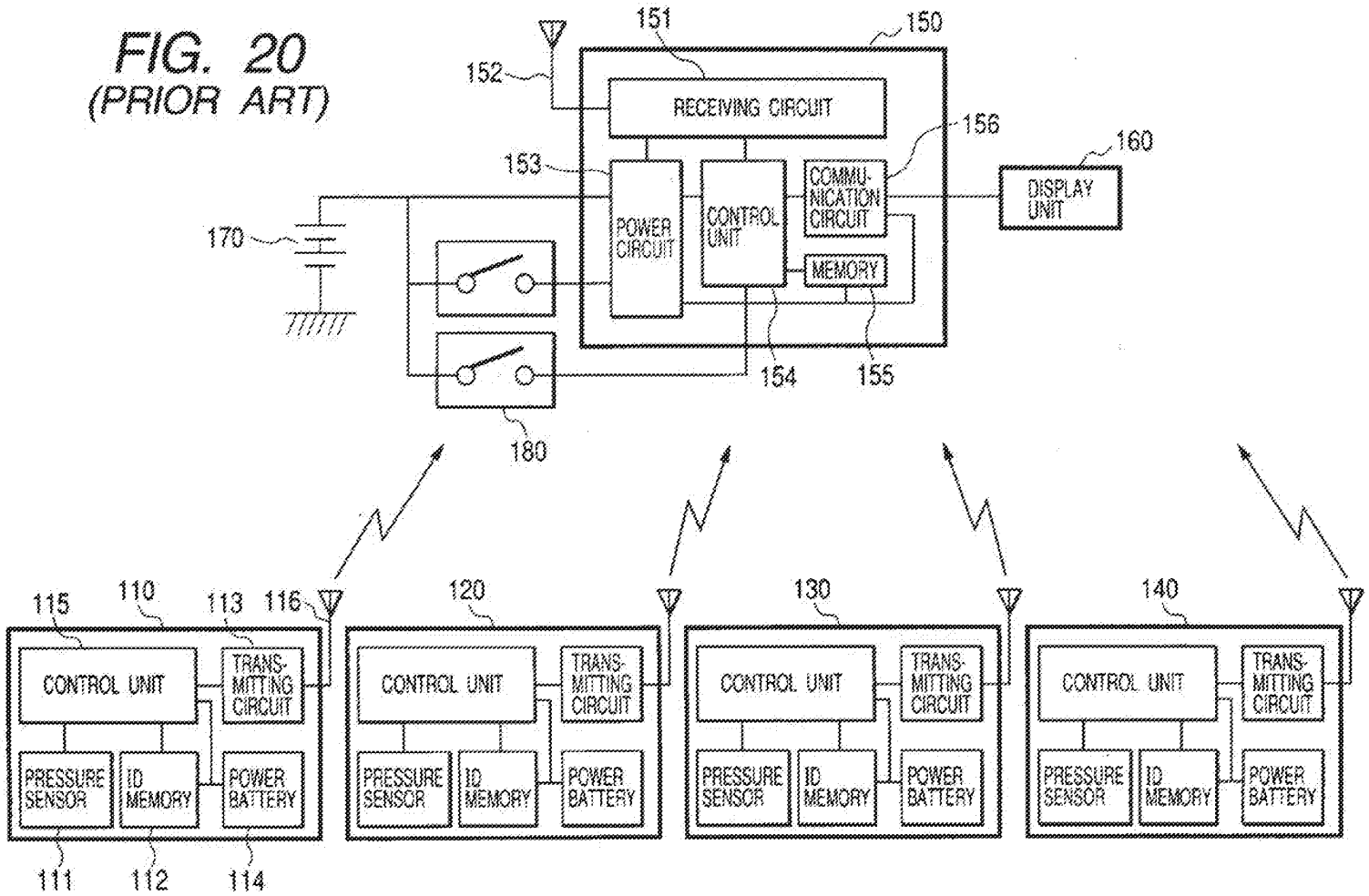
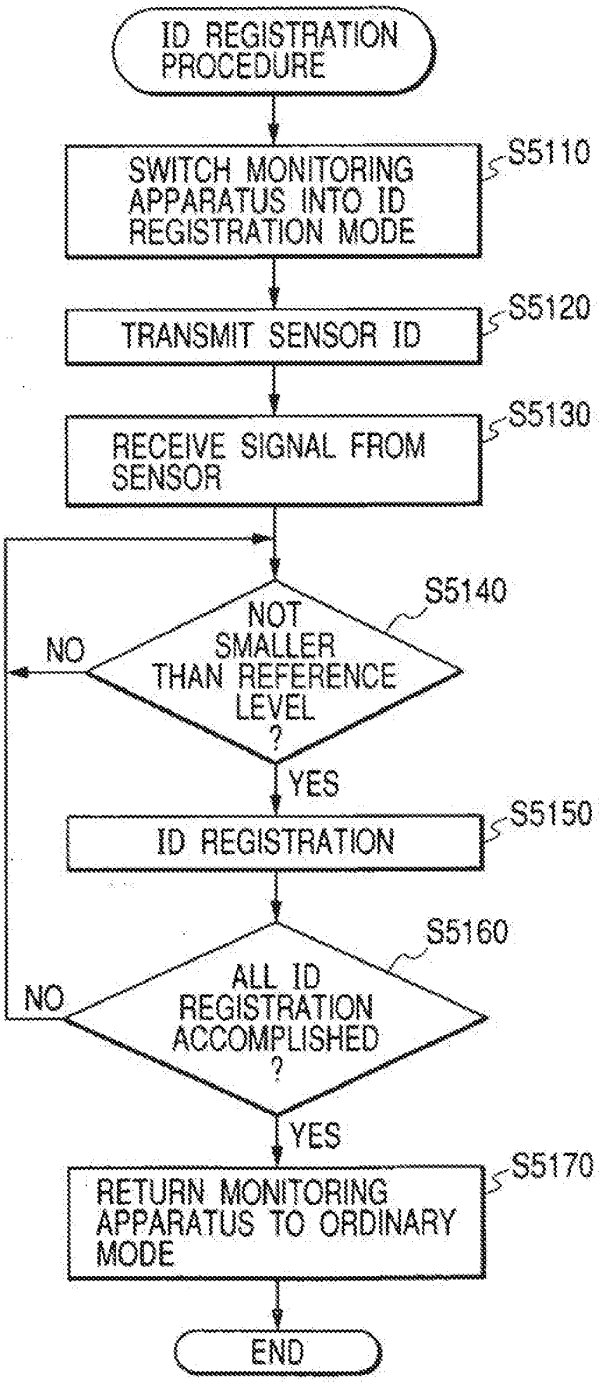


FIG. 21
(PRIOR ART)



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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 monitoriag 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 S11), read the sensor ID registered in their associated ID memories **12**, **22**, **32**, and **42** (step S12), produce transmission information as a combination of a detected pressure signal and the sensor ID (step S13), and transmit this transmission information as a signal of predetermined frequency at predetermined time intervals (step S14). 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 S21). When the signal of predetermined frequency is received (i.e., YES in step S21), the pneumatic tire pressure monitoring apparatus **50** extracts the sensor ID from the received signal (step S22), 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 S23). 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 S23), 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 P0 (step S24). When the momentary tire pressure P is less than the judgment value P0 (i.e., YES in step P24), 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 S25). When the judgment is NO in each of the steps S21, S23, and S24, 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 S110). Respective pneumatic pressure sensors **10**, **20**, **30**, and **40** are switched into an ID registration mode (step S120). Then, the pneumatic tire pressure monitoring apparatus **50** transmits the receiver ID (step S130). The receiver ID having been thus transmitted from the monitoring apparatus **50** is received by respective sensors **10**, **20**, **30**, and **40** (step S140). 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 S150). The above processing in the steps S140 and S150 is repeated until the ID registration of all sensors **10**, **20**, **30**, and **40** is accomplished (step S160). After the ID registration of respective sensors **10**, **20**, **30**, and **40** is accomplished (i.e., YES in step S160), the sensors **10**, **20**, **30**, and **40** are returned to the ordinary mode (step S170). The monitoring apparatus **50** is returned to the ordinary mode, too (step S180). 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 S210). 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 S220). The readout receiver ID is transmitted as a signal having the same frequency as that used in the pneumatic tire pressure monitoring processing (step S230). 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 S240). When no reply has arrived during a predetermined period of time (i.e., NO in step S240), the control procedure returns to the above step S220. On the other hand, when the reply with respect to completion of the ID registration has arrived (i.e., YES in step S240), a return trigger signal for returning respective sensors **10**, **20**, **30**, and **40** to the ordinary mode is transmitted (step S250). The monitoring apparatus **50** is changed to the ordinary mode (step S260). 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 S310). When no trigger signal is received (i.e., NO in step S310), this control processing is terminated. When the trigger signal is received (i.e., YES in step S310), each of respective sensors **10**, **20**, **30**, and **40** is switched into the ID registration mode (step S320). Then, it is checked whether or not the ID has been received (step S330). When the sensors **10**, **20**, **30**, and **40** have received the ID (i.e., YES in step S330), the received ID is registered as sensor ID, i.e., transmitter ID, in their ID memories **12**, **22**, **32**, and **42**, respectively (step S340). Then, the completion notice of the ID registration is returned (step S350). This notice is returned as a signal combined with the transmitter ID registered in the above step S340. Thereafter, it is checked whether or not the return trigger signal for returning the operation to the ordinary mode has been received (step S360). When the return trigger signal has been received (i.e., YES in step S360), the sensors **10**, **20**, **30**, and **40** are returned to the ordinary mode (step S370). Thus, the control processing of respective sensors **10**, **20**, **30**, and **40** is accomplished.

In the above step S340, 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 **S710**). Furthermore, the trigger signal for switching respective pneumatic pressure sensors **10**, **20**, **30**, and **40** into the ID registration mode is transmitted (step **S720**).

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 **S730**). When the FLID is received from the monitoring apparatus **50** (i.e., YES in step **S740**), the received data (i.e., FLID) is stored in the memory **66** in connection with the corresponding tire position FL (step **S750**). 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 **S760**). When the RLID is received from the monitoring apparatus **50** (i.e., YES in step **S770**), the received data (i.e., RLID) is stored in the memory **66** in connection with the corresponding tire position RL (step **S780**). 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 **S790**). When the RRID is received from the monitoring apparatus **50** (i.e., YES in step **S800**), the received data (i.e., RRID) is stored in the memory **66** in connection with the corresponding tire position RR (step **S810**). 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 **S820**). When the FRID is received from the monitoring apparatus **50** (i.e., YES in step **S830**), the received data (i.e., FRID) is stored in the memory **66** in connection with the corresponding tire position FR (step **S840**). Then, the return trigger signal is sent to the pneumatic tire pressure monitoring apparatus **50** to return its operation to the ordinary mode (step **S850**).

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 **S910**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **10** (step **S920**). When no notice is returned from the sensor **10** within a predetermined period of time (i.e., NO in step **S920**), the control procedure returns to the above step **S910**. When the completion notice of the ID registration is returned from the sensor **10** (i.e., YES in step **S920**), the RLID is read out from the memory **66** and is transmitted to the pneumatic pressure sensor **20** of the rear left wheel (step **S930**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **20** (step **S940**). When no notice is returned from the sensor **20** within a predetermined period of time (i.e., NO in step **S940**), the control procedure returns to the above step **S930**. When the completion notice of the ID registration is returned from the sensor **20** (i.e., YES in step **S940**), the RRID is read out from the memory **66** and is transmitted to the pneumatic pressure sensor **30** of the rear right wheel (step **S950**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **30** (step **S960**). When no notice is returned from the sensor **30** within a predetermined period of time (i.e., NO in step **S960**), the control procedure returns to the above step **S950**. When the completion notice of the ID registration is returned from the sensor **30** (i.e., YES in step **S960**), the FRID is read out from the memory **66** and is transmitted to the pneumatic pressure sensor **40** of the front right wheel (step **S970**). Then, it is checked whether or not the completion notice of the ID registration is returned from the pneumatic pressure sensor **40** (step **S980**). When no notice is returned from the sensor **40** within a predetermined period of time (i.e., NO in step **S980**), the control procedure returns to the above step **S970**. When the completion notice of the ID registration is returned from the sensor **40** (i.e., YES in step **S980**), 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 **S990**).

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 **S1000**). When no trigger signal is not received (i.e., NO in step **S1000**), this processing is terminated. When the trigger signal is received (i.e., YES in step **S1000**), the pneumatic tire pressure monitoring apparatus **50** is switched into the ID transmission mode (step **S1010**). Then, the receiver ID is read out from the memory **55** (step **S1020**). 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 **S1030**). The code data including the lower-bit '00' is registered as front-left wheel collation ID (i.e., FLID) into the memory **55** (step **S1040**). The code data including the lower-bit '01' is registered as rear-left wheel collation ID (i.e., RLID) into the memory **55** (step **S1050**). The code data including the lower-bit '10' is registered as rear-right wheel collation ID (i.e., RRID) into the memory **55** (step **S1060**). 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 **S1070**).

Next, it is checked whether or not the command instructing transmission of the front left wheel's transmitter ID 'FLID' has been received (step **S1110**). When this command has been received (i.e., YES in step **S1110**), the FLID is read out from the memory **55** and is transmitted to the ID registration tool **60** (step **S1120**). 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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Toyofuku

(10) **Patent No.: US 6,920,785 B2**
(45) **Date of Patent: Jul. 26, 2005**

(54) **TIRE PRESSURE SENSOR UNIT, TIRE PRESSURE MONITORING SYSTEM, AND METHOD OF REGISTERING IDENTIFICATION CODE OF TIRE PRESSURE SENSOR UNIT**

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(73) Assignee: **Bridgestone Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 69 days.

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(51) **Int. Cl.**[7] **G01M 17/02**

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

(58) **Field of Search** 73/146–146.5; 340/442–447

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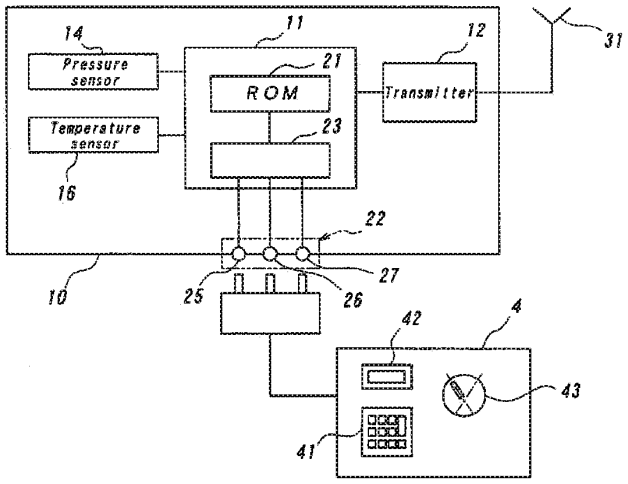
* cited by examiner

Primary Examiner—Max Noori
Assistant Examiner—Jermaine Jenkins
(74) *Attorney, Agent, or Firm*—Sughrue Mion, PLLC

(57) **ABSTRACT**

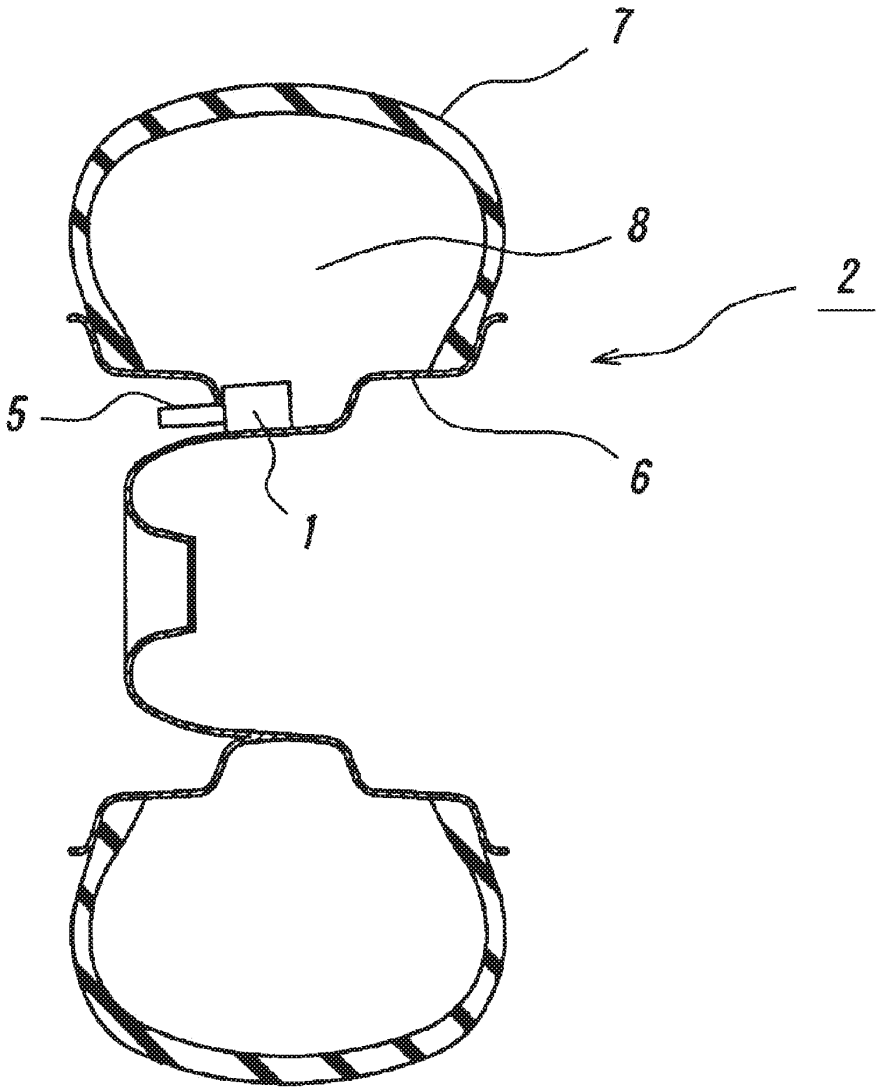
A sensor unit body **10** of a tire pressure sensor unit **1** is provided with external signal-importing terminals **22** for rewriting data of self-identification code stored in a ROM **21**, so that a complex operation of associating the self-identification code of the sensor unit with its mounting position in the vehicle is eliminated by rewriting the self-identification code of the sensor unit **1** after the replacement to be identical to the self-identification code of the sensor unit **1** before the replacement, when a tire wheel is replaced due to a breakdown of the tire unit or a replacement between a summer tire and a winter tire.

6 Claims, 5 Drawing Sheets



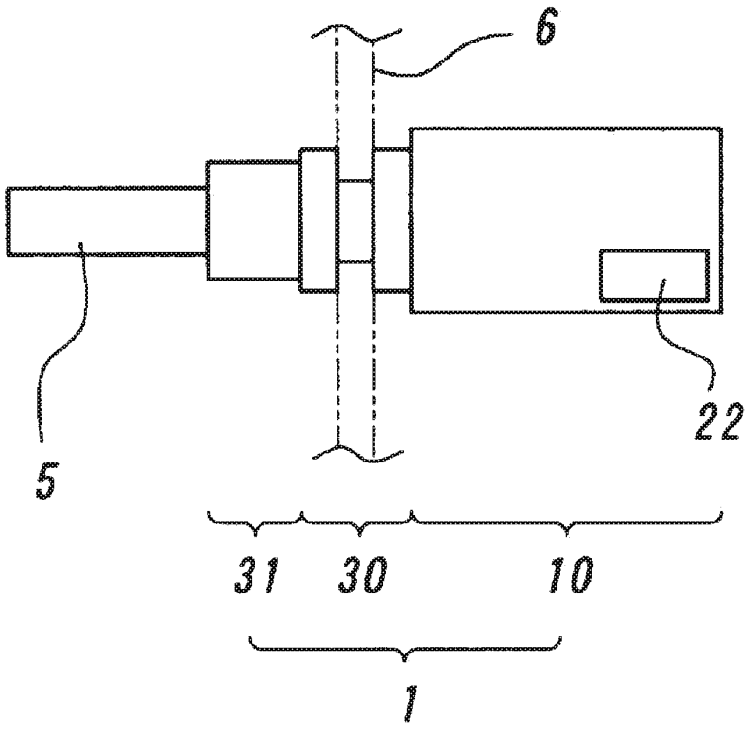
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FIG. 1



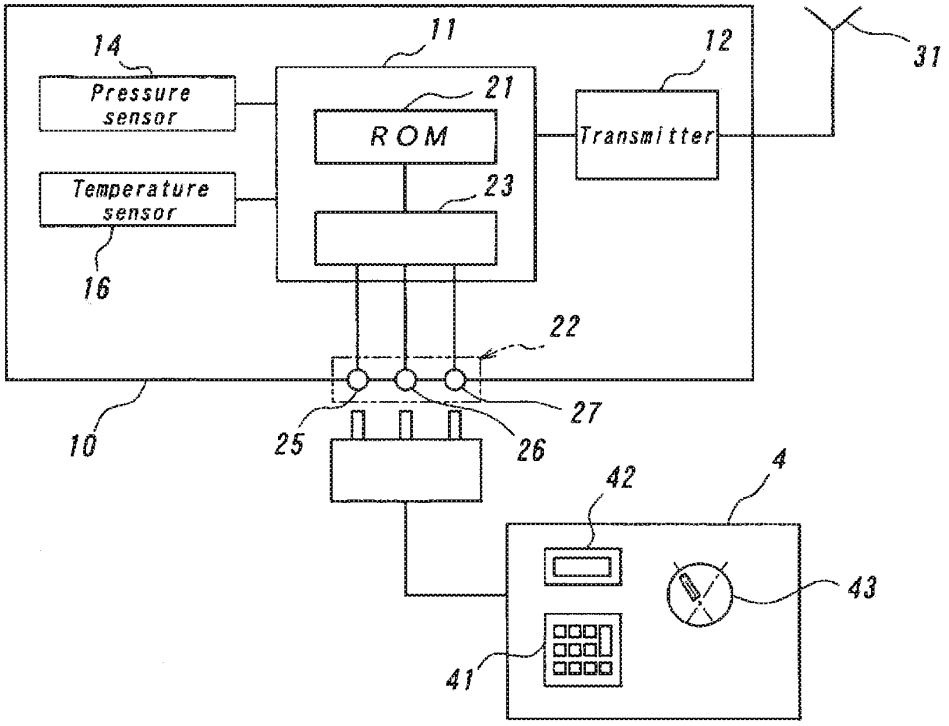
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FIG. 2



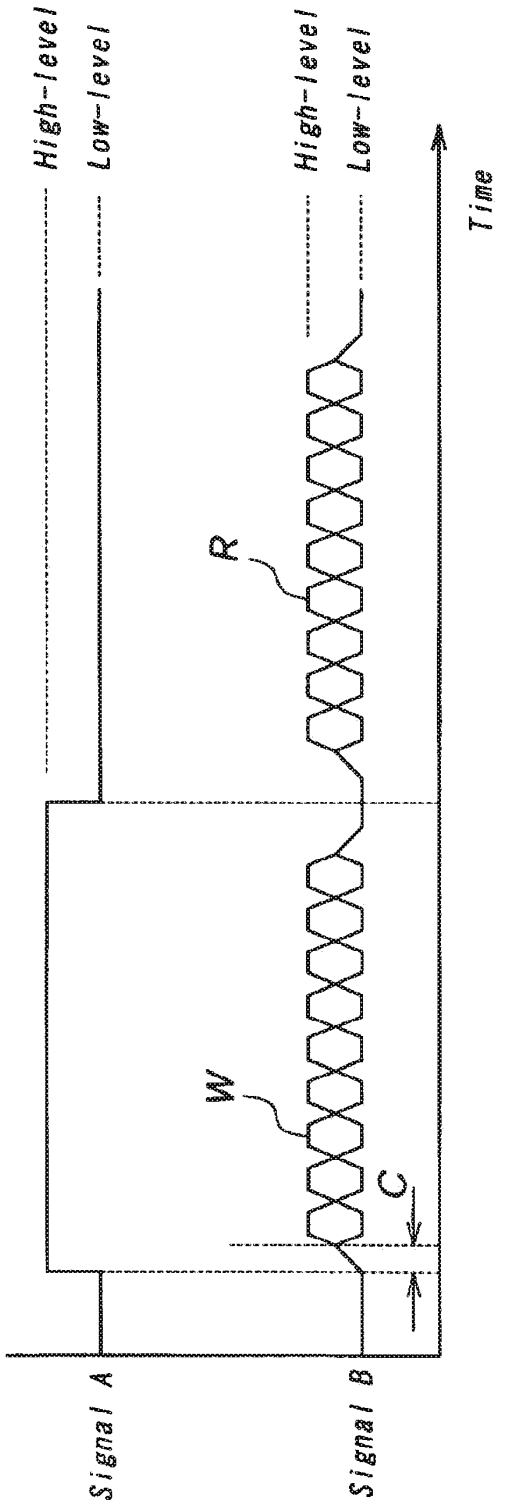
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FIG. 3



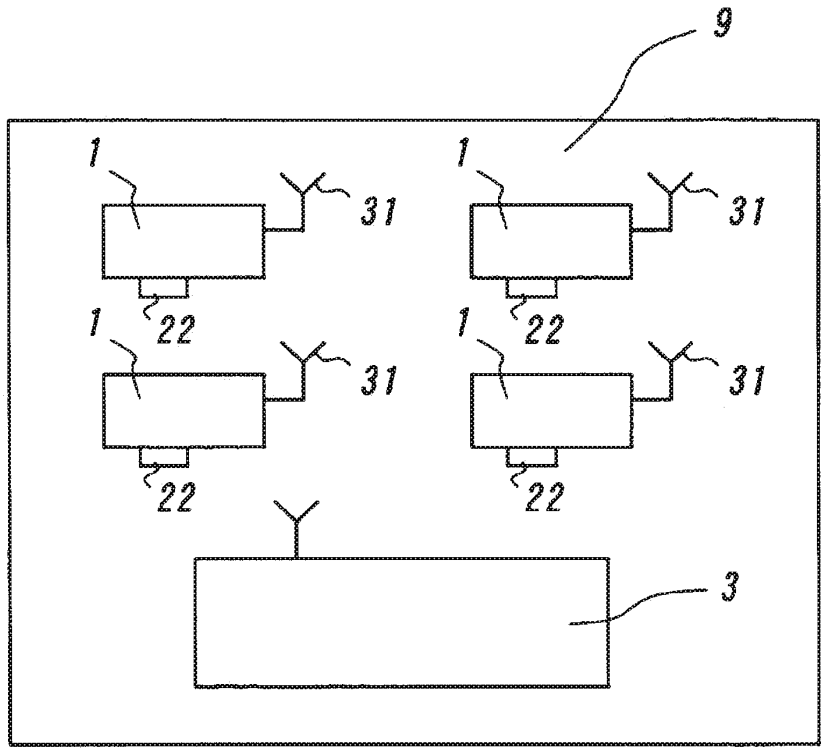
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FIG. 4



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FIG. 5



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TIRE PRESSURE SENSOR UNIT, TIRE PRESSURE MONITORING SYSTEM, AND METHOD OF REGISTERING IDENTIFICATION CODE OF TIRE PRESSURE SENSOR UNIT

TECHNICAL FIELD

The present invention relates to a tire pressure sensor unit for monitoring tire pressure of a vehicle and notifying a driver of a trouble (hereinafter referred to as the "sensor unit"), a tire pressure monitoring system using same, and a method of registering a self-identification code of the tire pressure sensor unit.

BACKGROUND

There has conventionally been known a tire pressure monitoring system having a tire pressure monitor provided on a vehicle body for notifying a driver of a trouble in tire pressure, and a sensor unit installed in a tire wheel of the vehicle for sensing pressure of a tire and transmitting information about the sensed tire pressure to the tire pressure monitor via radio waves.

There has also been proposed a system in which, in order to notify the driver of information about a mounting position in the vehicle of the sensor unit detecting a trouble of the tire, for example, the right front wheel of the vehicle as well as the tire pressure in case of detecting a trouble in tire pressure, a self-identification code specific for each sensor unit is stored in a fixing memory of the sensor unit at each mounting position and a corresponding relation between each sensor unit and mounting position in the vehicle is set and stored in the tire pressure monitor beforehand, so that, when the sensor unit detect a trouble, the sensor unit transmits the self-identification code as well as the information about tire pressure to the tire pressure monitor while the tire pressure monitor specify the corresponding mounting position in the vehicle based on the transmitted self-identification code to notify the driver of the position.

In this conventional system, the self-identification code of the sensor unit is usually configured to be written in its fixing memory during the manufacturing of the sensor unit and unable to be rewritten after shipment to prevent the data from rewriting by a malfunction or the like.

The above-mentioned operation of setting the corresponding relation between the self-identification code and the mounting position in the vehicle of the sensor unit is usually performed during the manufacturing stage of the vehicle prior to the shipment. The operation is performed by, for example, actually reducing each tire pressure to tentatively cause a trouble, subsequently recovering the tire pressure, associating the transmitted self-identification code with the position in the vehicle of the tire, storing the association in the tire pressure monitor, and repeating this sequence, which operation is extremely complex.

The conventional tire pressure sensor unit has the following problems. That is, when any one of sensor units in the respective mounting position in the vehicle is replaced with a new unit due to a breakdown or the like, the replacing sensor unit has a different self-identification code from that of the sensor unit having been installed before the replacement, so that an operation of setting a relation between the new self-identification code and a mounting position in the vehicle of the sensor unit has to be further performed, which is extremely complex and time consuming.

Moreover, when a replacement between summer tires and winter tires is conducted, the summer tires and the winter tires both of which are attached in a certain mounting position in the vehicle have respectively different self-identification code since these tires are stored and replaced in such a state that they are assembled in rims, so that an operation of associating the self-identification code with the mounting position in the vehicle of the tire pressure sensor unit is needed in every replacement between the summer tires and the winter tires. Due to the necessity of the time consuming operation, it is an actual condition that no tire pressure monitoring system notifying a mounting position in the vehicle of tire with which a trouble is detected has been made for practical use yet.

The present invention has been made in view of these problems, and its object is to provide a sensor unit capable of eliminating the operation of associating the self-identification number with the tire wheel to which the sensor unit is attached and facilitating a replacement operation of tire wheels when the tire wheel is replaced.

DISCLOSURE OF THE INVENTION

The present invention has been completed to achieve the above-mentioned object, and its gist, constitution and operation will be described below.

(1)

The sensor unit of the present invention is a sensor unit having a pressure sensor installed in a tire wheel of a vehicle to sense tire pressure of the tire wheel, a transmitter transmitting information at least about the tire pressure to a pressure monitor provided on the vehicle and a fixing memory for storing data including data of a self-identification code specific for the sensor unit, which comprises an interface for importing signals from external sources, wherein the fixing memory is so configured that the data can be rewritten by the external input imported via the interface.

According to this sensor unit, when the tire wheel is replaced, as the fixing memory is so configured that the data can be rewritten and the sensor unit has the interface for importing an external input signal which rewrites data in the fixing memory, a self-identification code identical to that of the sensor unit attached to the tire wheel before the replacement can be written in the sensor unit after the replacement via the interface. Consequently, when a trouble in tire pressure happens, the same self-identification code before the replacement can be used for the sensor unit after the replacement to specify a mounting position in the vehicle of the sensor unit where trouble is happening, so that the above-mentioned operation of newly associating the self-identification code of the sensor unit with its mounting position in the vehicle is not necessary.

Similarly, when winter tires are used instead of summer tires, a self-identification code of the sensor unit in a mounting position in the vehicle where the winter tire is to be mounted is registered with making it identical to the code of the sensor unit of the corresponding summer tire mounted in the respective mounting position in the vehicle, so that the self-identification code being identical to that at the time of using the summer tire can be used for the winter tire to be associate with the respective mounting position in the vehicle and the above-mentioned complex operation of associating the self-identification code with the mounting position in the vehicle is not necessary. In this way, once the self-identification code of the winter tire is registered, in a subsequent replacement between summer tires and winter tires, the complex operation of associating the self-

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identification code with the mounting position in the vehicle or the operation of re-registering the self-identification code are not necessary, so that the tire can be very easily replaced.

Since the sensor unit can rewrite or add data after the manufacturing of the sensor unit, data other than the self-identification code can be rewritten or added. As an example of such a use, when a lower set value of tire pressure written in the fixing memory of the sensor unit is intended to be used as a value for determining an occurrence of a trouble in the tire pressure monitoring system, the sensor unit provided for a replacement is desired to be adaptable for tires in broad sizes with different proper pressure, whereby the lower set value of tire pressure is written after a tire for a combination with the sensor unit is determined. As the sensor unit of the present invention can rewrite the data in the fixing memory, it can satisfy this needs and provide a new application of the sensor unit.

(2)

The tire pressure sensor unit of the present invention is according to the invention mentioned in (1), wherein the interface is consisted of external signal-importing terminals capable of being connected to external devices by means of wires.

The sensor unit can import an external signal via the external signal-importing terminals, so that, in addition to the above-mentioned action, it can write more reliable data than other methods using radio waved or magnetism do. Simultaneously, the data can be prevented from being unintendedly rewritten by a malfunction or a wrong operation.

Moreover, although a dedicated rewriting device is required as an external device used for rewriting the data, the writing operation takes place in connection with a rim assembly operation and thus, as far as tire stores, auto repair shops and the like own the dedicated rewriting devices and carry out rewriting operation, the operation can be carried out at a low cost and easily becomes into practical use.

(3)

The tire pressure sensor unit of the present invention is according to the invention mentioned in (1) or (2), wherein the information at least about the tire pressure is transmitted to a tire pressure monitor via radio waves.

In this tire pressure sensor unit, the information including information about tire pressure is transmitted to the tire pressure monitor via radio waves, so that, in addition to the above-mentioned action, the information from a plurality of sensor units located in mutually spaced position can be readily gathered at the tire pressure monitor.

In contrast, the method of transmitting signals by means of hard wires involves complex wiring, while the mounting position in the vehicle of the sensor unit can be easily specified since separate wires are used in the respective mounting positions in the vehicle of the sensor units. In comparison with this, it is difficult for the method of transmitting signal via radio waves to specify the mounting positions in the vehicle of the respective sensor units.

However, the sensor unit according to the present invention can register the self-identification code corresponding to the mounting position in the vehicle, so that the mounting position in the vehicle of the sensor unit can be specified to overcome the drawback of the method of transmitting signals via radio waves as well as to well utilize the convenience of transmission via radio waves.

(4)

The tire pressure sensor unit of the present invention is according to the invention mentioned in any one of (1) to (3), wherein a temperature sensor is provided.

According to this tire pressure sensor unit, information about tire temperature as well as the tire pressure can be transmitted to the tire pressure monitor, so that, in addition to the above-mentioned action, more detailed conditions of the tire pressure can be grasped to improve the reliability of the tire pressure monitoring system.

(5)

The tire pressure monitoring system of the present invention is characterized in that the tire pressure sensor units mentioned in any one of (1) to (4) is installed in a plurality of tire wheels of the vehicle, and that the tire pressure monitoring system comprises a tire pressure monitor receiving information from the sensor units and transmitting the information about the tire pressure to a driver.

In this tire pressure monitoring system, the data to be stored in the fixing memory can be rewritten after the manufacturing of the sensor unit constituting the system, so that, when the sensor unit breaks down or the replacement between a summer tire and a winter tire is conducted, the operation of associating the self-identification code with the mounting position in the vehicle can be omitted, as mentioned above.

(6)

The method of registering a self-identification code for a sensor unit of the present invention is characterized in that when a tire or a sensor unit is replaced and the tire is fitted onto a rim, a self-identification code is registered on a sensor unit mentioned in any one of (1) to (4), the self-identification code being identical to that of a sensor unit installed prior to the replacement on the mounting position of the vehicle where the former sensor unit is to be installed.

With the method of registering a self-identification code for a tire pressure sensor unit, when the sensor unit breaks down or the replacement between a summer tire and a winter tire is conducted, the operation of associating the self-identification code with the mounting position in the vehicle can be omitted, as mentioned above.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a schematic diagram of a sensor unit showing an installed state;

FIG. **2** is an outline diagram showing the sensor unit according to the present invention;

FIG. **3** is a schematic block diagram showing the electric circuit device of the sensor unit body;

FIG. **4** is a wave form diagram showing a sequence of rewriting the self-identification code; and

FIG. **5** is a schematic block diagram showing the tire pressure monitoring system using the sensor unit.

BEST MODE FOR CARRYING OUT THE INVENTION

Hereinafter, inventive embodiments of the present invention will be described with reference to FIGS. **1** to **5**. FIG. **1** is a schematic diagram showing in the state where a sensor unit **1** is installed in a tire wheel **2**. The sensor unit **1** is coupled with a cylindrical valve device **5** for introducing air to be installed in a wheel rim **6**. The wheel rim **6** and a tire **7** form a tire pressure part **8** and also constitute the tire wheel **2**.

FIG. **2** is an outline diagram showing an outline of the sensor unit. The tire pressure sensor unit **1** is composed of a sensor unit body **10** having a external signal-importing terminal **22** for importing signals from external sources, a rim-attaching part **30** and an antenna part **31**. The sensor unit **1** is also coupled with the valve device **5** to be installed in the wheel rim **6**.

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The sensor unit body **10** incorporates an electric circuit device shown in FIG. **3** as a schematic block diagram. The electric circuit device is composed of a pressure sensor **14** for detecting tire pressure, a temperature sensor **16** for detecting the temperature of the tire pressure part **8**, a controller **11**, and a transmitter **12** for converting a signal from the controller into a transmitting signal from the antenna **31**.

The controller **11** imports pressure data and temperature data detected by the pressure sensor **14** and the temperature sensor **16**, respectively, and outputs the self-identification code and the lower set value of tire pressure stored in a ROM **21** as a fixing memory along with the pressure data and the temperature data at a given time. Note that the temperature sensor **16** is provided for alert a driver to a condition of the tire pressure part more specifically. It is preferable, but not always indispensable.

Moreover, the controller **11** is provided with the ROM **21** and an external input signal controller **23**, so that the signal imported from the external signal-importing terminal **22** can be written in the ROM **21** via the external input signal controller **23**. The external signal-importing terminal **22** has a ground terminal **25**, a data signal terminal **26**, and a data input/output control signal terminal **27**.

A dedicated writing device **4** is connected to the external signal terminal **22** to write data from the dedicated writing device **4**. The dedicated writing device **4** has a data input section **41**, a data display **42**, and a operation switching lever **43** for switching the operation between an "input mode" and a "rewriting mode", so that data can be written through these sections.

FIG. **4** shows a wave form chart during the writing of the self-identification code. A sequence of writing data is described with reference to this figure. In FIG. **4**, the signal A designates a data input/output control signal input to the data input/output control signal terminal **27**, and the signal B designates a data signal input to/output from the data signal terminal **26**.

At the initial state, both of the signals A and B are at the low level. From this state, the dedicated writing device **4** is connected to the external signal-importing terminal **22** of the sensor unit body **10**. The switching lever **43** of the dedicated writing device **4** is switched to the "input mode" side. A new self-identification code to be rewritten is input with the data input section **41** of the dedicated writing device **4**. After that, the switching lever **43** is switched to the "rewriting mode" side, and then the signal A turns to the high level, so that, in response to the change of the signal A, the external input signal controller **23** performs a control for a preparation of importing the data signal. After a preparation time C has passed since the signal A turns to the high level, the dedicated writing device **4** outputs the self-identification code stored in the data input section **41** as the W part of the signal B to the external input signal controller **23**, and, as the external input signal controller **23** is ready for importing the data, the data can be written in the ROM **21**.

When the outputting the data to the external input signal controller **23** is finished, the dedicated writing device **4** outputs a signal for turning the signal A to the low level, whereby the external input signal controller **23** confirms a completion of the input, and outputs the imported self-identification code as the R part of the signal B to the dedicated writing device **4** for a verification. The dedicated writing device **4** automatically verity the signal, and if the verification is O.K., a sign of the completion of writing is displayed on the data display **42**.

As the writing operation takes place in connection with a rim assembly operation, it is preferred that tire stores, auto repair shops and the like own the dedicated writing device **4** to perform the rewriting at these stores according to the above-mentioned sequence.

An example of a tire pressure monitoring system **9** using the sensor unit **1** is shown in FIG. **5** as a schematic block diagram. The tire pressure monitoring system **9** is composed of each sensor unit **1** attached to the respective tire wheel **6**, and a tire pressure monitor **3** which receives data transmitted from the antenna **31** of the tire pressure sensor unit **1** and alert the driver to a condition of the tires. In this system, the sensor unit **1** is provided with the external signal importing terminal **22**, so that stored data in the ROM **21** of the sensor unit **1** can be rewritten by the dedicated writing device **4**.

In the next, a method of registering a self-identification code of a tire pressure sensor unit according to the present invention is exemplified. In a case where a sensor unit, for example, in the right front mounting position in the vehicle breaks down and is to be replaced, if an unique self-identification code registered before shipment is used as it is, a complex associating operation is necessary, as mentioned above. Since the self-identification code of the broken sensor unit has already been known, a corresponding relation between the self-identification code and the mounting position in the vehicle identical to that before the replacement can be maintained even after the replacement by registering an identification code identical to that of the broken sensor unit to a new sensor unit after the replacement. Thus, a complex operation of newly associating is eliminated, so that the productivity of the operation of replacing the sensor unit can be improved.

INDUSTRIAL APPLICABILITY

As having been clearly shown in the above description, according to the present invention, the tire pressure sensor unit is provided with an interface which allow the data in the fixing memory to be externally rewritten, so that, when a sensor unit breaks down and is to be replaced, or when a replacement between summer tires and winter tires is conducted, the operation of associating the self-identification code of the sensor unit with the mounting position in the vehicle with respect to the replacement can be saved by registering an identification code identical to that of the sensor unit before the replacement as the identification code of the sensor unit after the replacement.

In addition, according to the mounting situation of the sensor unit after the manufacturing, information other than the self-identification code such as a lower limit set value of tire pressure can be newly adding to the fixing memory, and it can be rewritten, which enlarges a versatility and applicability of the sensor unit.

What is claimed is:

1. A tire pressure sensor unit having a pressure sensor installed in a tire wheel of a vehicle to sense tire pressure of the tire wheel, a transmitter transmitting information at least about the tire pressure to a pressure monitor provided on the vehicle, and a fixing memory for storing data including data of self-identification code specific for the sensor unit, characterized in that

said tire pressure sensor unit comprises an interface for importing signals input from external sources, and is so configured that the data stored in the fixing memory can be rewritten by the external signal imported from the interface.

2. The tire pressure sensor unit according to claim **1**, wherein the interface is consisted of external signal-

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importing terminals capable of being connected to external input devices by wires.

3. The tire pressure sensor unit according to claim 1, wherein the information at least about the tire pressure is transmitted to a tire pressure monitor via radio waves.

4. The tire pressure sensor unit according to claim 1, wherein a temperature sensor is provided.

5. A tire pressure monitoring system, characterized in that the tire pressure sensor units according to claim 1 is provided in a plurality of tire wheels of the vehicle, and that said tire pressure monitoring system comprises a tire pressure monitor receiving information from the tire pressure sensor units and transmitting the information about the tire pressure to a driver.

6. A method of registering a self-identification code for a tire pressure sensor unit, characterized in that when a tire or a tire pressure sensor unit is replaced and the tire is fitted onto a rim, a self-identification code is registered on the tire pressure sensor unit claim 1, the self-identification code being identical to that of a sensor unit mounted prior to the replacement on the mounting position in the vehicle where the former sensor unit is to be installed.

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(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2006/0208864 A1**

Nantz et al. (43) **Pub. Date: Sep. 21, 2006**

(54) **TIRE PRESSURE MONITORING SENSOR DIAGNOSIS VIA VEHICLE ANTITHEFT AND ENTRY SYSTEM**

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(22) Filed: **Nov. 22, 2005**

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(63) Continuation-in-part of application No. 10/697,742, filed on Oct. 30, 2003, now abandoned.

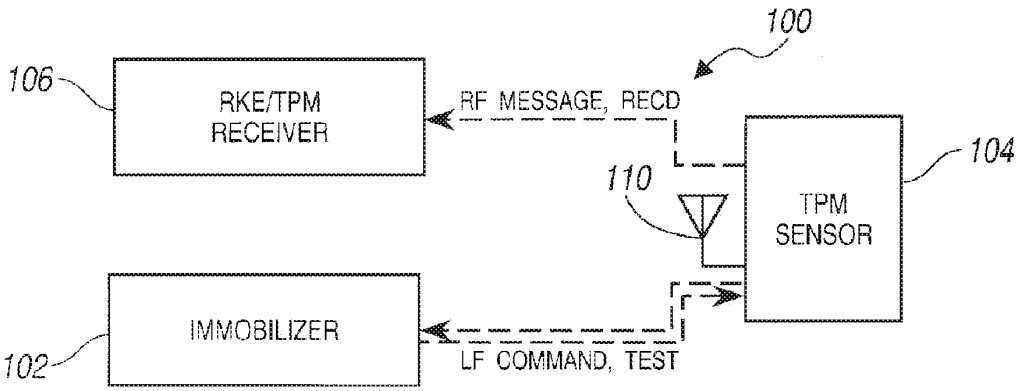
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(57) **ABSTRACT**

A vehicle tire pressure monitoring (TPM) system, the system including an immobilizer transmitter that transmits at least one low frequency (LF) sensor diagnostic signal, at least one TPM sensor, wherein the at least one TPM sensor includes a transceiver that receives the at least one LF sensor diagnostic signal and, when the at least one TPM sensor is operating properly, presents at least one radio frequency (RF) message signal, and a TPM receiver that receives the at least one RF message signal and provides an indication to an operator when the at least one RF message signal is received, wherein the LF sensor diagnostic signal is transmitted to determine proper operation of the at least one TPM sensor.



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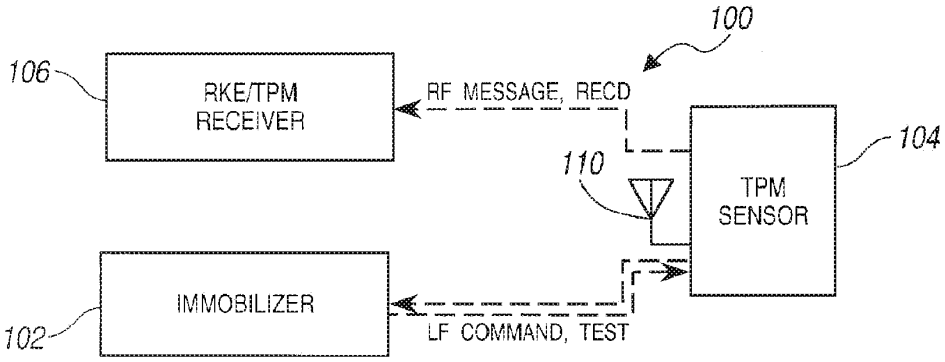


FIG. 1

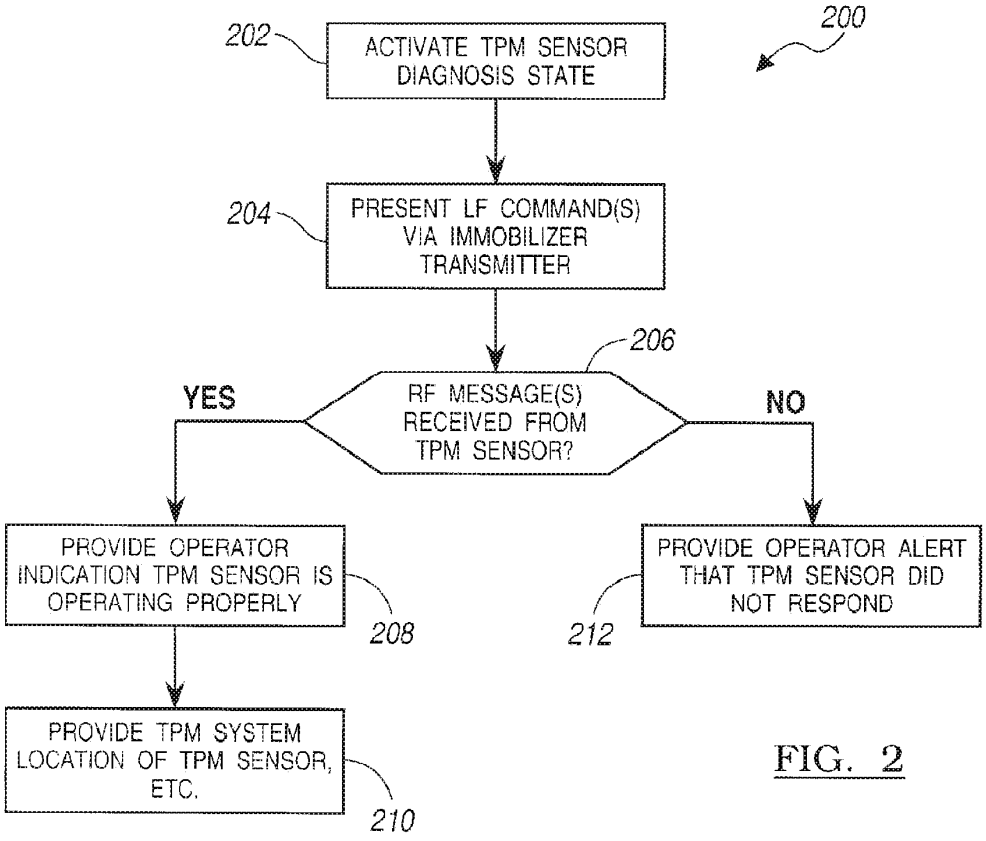


FIG. 2

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TIRE PRESSURE MONITORING SENSOR DIAGNOSIS VIA VEHICLE ANTITHEFT AND ENTRY SYSTEM

CROSS REFERENCE TO RELATED PATENT APPLICATIONS

[0001] This patent application is a continuation-in-part of prior patent application Ser. No. 10/697,742 filed on Oct. 30, 2003, which is incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a system and a method for tire pressure monitoring sensor diagnosis via a vehicle antitheft and entry system.

[0004] 2. Background Art

[0005] Conventional automotive industry remote keyless entry (RKE) approaches have been implemented to communicate with a vehicle through the use of a hand held transmitter. The hand held transmitter is commonly implemented in connection with a key fob. Currently available conventional RKE transmitters may be separate units (i.e., key fobs), or the RKE transmitter assembly may be part of an ignition keyhead, preferably along with a vehicle immobilization transponder. Such RKE key fobs and keyheads generally utilize an antenna to transmit radio frequency (RF) signals to a vehicle in order to lock or unlock vehicle doors, open or close a vehicle sliding door, unlock a vehicle trunk, activate internal and/or external vehicle lights, and/or activate a "panic" alarm. Remote access systems using such RKE fobs and keyheads typically employ on-off keying (OOK) or amplitude shift keying (ASK) modulation schemes for the RF signals.

[0006] Conventional approaches for wireless monitoring of vehicle tire parameters, particularly tire pressure have been implemented. An exemplary tire monitoring system is described and shown in U.S. Pat. Nos. 5,600,301 and 5,463,374, which also describes a vehicle remote access device. In such tire monitoring systems, RF transmitters mounted inside each tire, typically adjacent the inflation valve stem, transmit information concerning tire pressure to a receiver located on-board the vehicle. The information delivered by the RF signals from the transmitters is subsequently conveyed to a vehicle operator, typically in the form of a display. Like conventional vehicle remote access systems, such conventional tire monitoring systems also typically employ OOK or ASK modulation schemes for the RF signals. When such modulation schemes are used, however, there can be strong adverse effects on reception of the RF signal, because the amplitude of a signal transmitted from a rotating tire can vary significantly during the period of the transmission.

[0007] Conventional vehicle immobilization approaches, in order to deter vehicle theft, are also known in the automotive industry. U.S. Pat. No. 5,670,933 illustrates an example of such an immobilization system. Such vehicle anti-theft devices typically employ low frequency (LF) transponders in a vehicle ignition keyhead. In such systems, upon insertion of the vehicle ignition key into the vehicle ignition keyhole, an interrogation signal is sent (i.e., transmitted, broadcast, presented, etc.) by the vehicle. In response, the keyhead transponder transmits an encrypted code to a control unit, such as a microprocessor, on-board the vehicle. When the code sent by the transponder is valid (i.e., the control unit authenticates the received code), the control unit generates a signal operative to permit the vehicle to be activated. However, when the code is not received by the control unit, or when the code is not valid (i.e., the control unit cannot authenticate the received code), the control unit generates a signal operative to immobilize the vehicle, for example, by cutting off power to the fuel supply for the vehicle engine.

[0008] Conventional approaches for shared vehicle remote access, tire monitoring and vehicle immobilization are also known in the automotive industry. U.S. Pat. No. 6,420,967 illustrates an example of such an immobilization system. Such a system and method employs a combined RKE, tire monitoring and vehicle immobilization receiver and a single microprocessor controller. Such a system and method uses an OOK or ASK modulation scheme for RKE, while employing frequency shift keying (FSK) modulation scheme for tire monitoring. Still further, such a system and method provides an RF link for implementation in the vehicle immobilization.

[0009] A number of conventional vehicle TPM systems implement an existing RF interface (e.g., an RKE interface) to the TPM receiver. Increasingly, conventional vehicle TPM systems implement LF command signals. A number of conventional TPM sensors implement an LF command interface that is configured to provide sensor testing and diagnosis. The LF command interface is typically implemented such that the TPM sensor manufacturer and service personnel (e.g., vehicle dealership personnel, etc.) using specialized (sometimes vehicle specific) tools can perform the TPM sensor testing and diagnosis during manufacture, retrofit, replacement, etc. operations without the service personnel mounting the TPM sensor in a wheel assembly and mounting the wheel assembly on the respective vehicle prior to the testing and/or diagnosis. The TPM sensor testing and diagnosis can be performed without having to mount the TPM sensor in a wheel and mount the wheel on a vehicle via the specialized equipment that is available to the TPM sensor manufacturer and authorized service personnel such as vehicle dealership personnel.

[0010] However, when personnel other than dealership mechanics or manufacturer technicians have a need to determine if a TPM sensor is working properly, the TPM sensor typically must first be installed in the wheel assembly, the wheel assembly is balanced, then the wheel is installed on the vehicle. The vehicle TPM system is then operated in a test mode to determine TPM sensor operation. However, when the TPM sensor is not working properly (e.g., due damage from a flat tire, or the like), a significant amount of time and cost are expended prior to determination of proper TPM sensor operation. When the TPM sensor does not work properly and must be repaired or replaced, the time and cost are wasted.

[0011] Thus, there exists a need and an opportunity for a system and a method to quickly perform TPM sensor test and diagnosis before the TPM sensor is fastened to a wheel and the wheel is installed on a vehicle. Such a system and method may implement a new and innovative TPM sensor test and diagnosis, and result in the saving of a significant

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amount of time and cost when compared to conventional approaches to TPM sensor test and diagnosis.

SUMMARY OF THE INVENTION

[0012] The present invention generally provides an improved method and an improved system for tire pressure monitoring (TPM) sensor testing and diagnosis via a vehicle antitheft and/or entry system. Such a system and method may implement a new and innovative TPM sensor test and diagnosis, and result in the saving of a significant amount of time and cost when compared to conventional approaches to TPM sensor test and diagnosis.

[0013] According to the present invention, a vehicle tire pressure monitoring (TPM) system is provided. The system comprising an immobilizer transmitter, at least one TPM sensor, and a TPM receiver. The immobilizer transmitter transmits at least one low frequency (LF) sensor diagnostic signal. The at least one TPM sensor comprises a transceiver that receives the at least one LF sensor diagnostic signal and, when the at least one TPM sensor is operating properly, presents at least one radio frequency (RF) message signal. The TPM receiver receives the at least one RF message signal and provides an indication to an operator when the at least one RF message signal is received, wherein the LF sensor diagnostic signal is transmitted to determine proper operation of the at least one TPM sensor and re-configure the operating parameters of the at least one TPM sensor.

[0014] Also according to the present invention, for use in a vehicle tire pressure monitoring (TPM) system, a method of determining proper operation of a TPM sensor is provided. The method comprising transmitting at least one low frequency (LF) sensor diagnostic signal via an immobilizer transmitter, providing at least one TPM sensor, wherein of the at least one TPM sensor comprises a transceiver that receives the at least one LF command signal and presents at least one radio frequency (RF) message signal, presenting the RF message signal when the at least one TPM sensor is operating properly, and providing an indication to an operator when the at least one RF message signal is received by a TPM receiver.

[0015] Further, according to the present invention, a vehicle tire pressure monitoring (TPM) system having self-diagnostics is provided. The system comprising an immobilizer transmitter, at least one TPM sensor, and a combination remote keyless entry and TPM receiver. The immobilizer transmitter transmits at least one low frequency (LF) sensor diagnostic signal. The at least one TPM sensor comprises a transceiver that receives the at least one LF sensor diagnostic signal, and presents at least one radio frequency (RF) message signal in response to the LF sensor diagnostic signal when operating properly. The combination remote keyless entry and TPM receiver receives the at least one RF message signal and provides an indication to an operator when the at least one RF message signal is received and an alert to the operator when the at least one RF message signal is not received.

[0016] The above features, and other features and advantages of the present invention are readily apparent from the following detailed descriptions thereof when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] **FIG. 1** is a diagram of a tire pressure monitoring system of the present invention; and

[0018] **FIG. 2** is a flow diagram of an operation of the tire pressure monitoring system of **FIG. 1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0019] With reference to the Figures, the preferred embodiments of the present invention will now be described in detail. Generally, the present invention provides a system and a method for tire pressure monitoring sensor diagnosis. In one example, the improved method and system may be implemented in connection with or via a vehicle anti-theft and entry system.

[0020] The present invention may implement vehicle immobilizer, remote keyless entry (RKE), and/or tire pressure monitoring (TPM) receiver systems to incorporate TPM sensor test and diagnosis capability, that is not available in conventional approaches (e.g., via novel and improved control software). The present invention may provide for implementation of a vehicle anti-theft immobilizer system to read, command, and control a TPM sensor when the TPM sensor is placed nearby the vehicle anti-theft immobilizer system, and for response via a vehicle RKE system, such that sensor testing, diagnosis, teaching the TPM sensor to the vehicle or a particular location on the vehicle, and the like may be performed without implementation of specialized equipment as is implemented in conventional approaches.

[0021] The present invention may provide a TPM system and method having self-diagnostics. The present invention may provide for implementation of a simple apparatus and technique (i.e., a system and a method) for an owner or independent mechanic to determine when a TPM tire sensor is faulty, to aid in the diagnosis of a faulty TPM sensor and/or TPM system, teach new/alternative sensors to the TPM system, etc. The present invention may be implemented in connection with vehicle immobilizer, TPM, and RKE systems and methodologies. The present invention may result in the saving of a significant amount of time and cost when compared to conventional approaches to TPM sensor test and diagnosis.

[0022] Referring to **FIG. 1**, a diagram illustrating a tire pressure monitoring (TPM) system **100** in accordance with the present invention is shown. The TPM system **100** generally comprises an immobilizer circuit (i.e., unit, apparatus, transmitter, transceiver, etc.) **102**, at least one TPM sensor **104**, and a TPM, remote keyless entry (RKE), or combination TPM/RKE circuit (i.e., receiver, apparatus, unit, transmitter, transceiver, etc.) **106**. The system **100** is generally implemented in connection with a vehicle (not shown, e.g., automobile, truck, sport utility vehicle, minivan, full-sized van, etc.) having a number of wheel assemblies (not shown). The wheel assemblies generally comprise at least one tire mounted on a rim where the tire is inflated with a gas (generally air). The system **100** may be implemented as a TPM system having self-diagnostics.

[0023] The TPM system **100** is generally implemented to monitor at least air pressure inside the at least one wheel and provide information to a user (or operator) regarding the tire pressure. For example, the TPM system **100** may provide at least one alert signal (e.g., an audible warning, a visual warning such as a flashing LED, etc.) when an anomalous operating condition such as tire under inflation or an over inflation is detected. Other anomalous operating conditions

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such as tire over temperature conditions, loss of TPM sensor signal, etc. may also be reported by the system **100**. The system **100** may provide the user an indication of a particular wheel that experienced the anomalous operating condition.

[0024] The immobilizer **102** may be implemented in connection with a vehicle anti-theft (or theft deterrent) system. In the present invention, the immobilizer **102** may be configured (or controlled) to present at least one LF command (e.g., TEST). The signal TEST is generally implemented as a TPM sensor diagnostic signal. The signal TEST may be implemented as a TPM system diagnostic signal. The signal TEST is generally presented in connection with operations such as a TPM sensor operation test, a TPM sensor diagnosis, a TPM system diagnosis, a TPM sensor teaching (or association) to the TPM system, a TPM sensor location teaching (or association) on the vehicle within the TPM system, and the like, independently of vehicle immobilization operation.

[0025] The immobilizer **102** is generally further configured to present (i.e., transmit, broadcast, send, etc.) at least one low frequency (LF) command (i.e., signal) in connection with vehicle theft deterrent. Such a vehicle theft deterrent command may be a signal that is presented to disable a vehicle fuel pump, enable an alarm, disable a vehicle powertrain control module (PCM), etc.

[0026] The LF command presented by immobilizer **102** may also write information to TPM sensor **104**. In some aspects, the LF command may write/re-write the identification code for TPM sensor **104**, reconfigure the operating parameters of TPM sensor **104**, and re-flash the memory of TPM sensor **104**.

[0027] The at least one TPM sensor **104** generally comprise an assembly (i.e., module, apparatus, etc.) having a unique identification code ("ID") or other appropriate identifier and including at least one sensing device (not shown) configured to determine an appropriate physical condition (e.g., gas pressure, temperature, etc.). TPM sensor **104** may include an antenna **110** that is configured to receive and present a number of signals wherein the signals may be broadcast at any appropriate frequency (e.g., low frequency, LF, radio frequency, RF, etc.) and via any appropriate protocol (e.g., on-off keying (OOK), amplitude shift keying (ASK), or frequency shift keying (FSK) modulation, etc.). Antenna **110** may be coupled to a sensor transceiver (not shown) while the sensor transceiver may be coupled to the at least one sensing device and be configured to receive and transmit the appropriate signals. As such, TPM sensor **104** may also have memory storage capabilities. Particularly, in one aspect, TPM sensor **104** may have flash memory which, as recognized by one of ordinary skill in the art, is a non-volatile type of memory.

[0028] In one aspect, TPM sensor **104** may also monitor its internal components and/or devices (e.g., a pressure device, a temperature device, etc.) and transmit corresponding signals to immobilizer **102**. For example, if an internal component, such as a pressure or temperature device, experiences an anomalous event, TPM sensor **104** may generate a signal indicating the anomalous event that is received by immobilizer **102**. As such, immobilizer **102** may activate a visual and/or audible indicator thereby notifying a vehicle occupant.

[0029] As stated in the foregoing, immobilizer **102** may generate a LF signal that causes a re-write, alteration or modification of the TPM sensor **104** ID. Re-writing the TPM sensor **104** ID may be required when, for example, TPM sensor **104** is damaged and replacement is recommended. Additionally, re-writing of the TPM sensor **104** ID may be required to properly program or re-program TPM sensor **104** for a particular vehicle or TPM system application.

[0030] In one embodiment, a bank of TPM sensor IDs is stored in the memory of TPM sensor **104**, immobilizer **102** or any other module that interfaces with immobilizer **102**. Accordingly, when immobilizer **102** transmits the LF signal, the LF signal contains data pertaining to an ID retrieved from the TPM sensor ID bank. In an alternative embodiment, where TPM sensor **104** is damaged or functioning incorrectly, immobilizer **102** may read the ID of the damaged TPM sensor and transmit an LF signal containing the ID of the damaged sensor to a replacement TPM sensor **104**. The ID of the damaged TPM sensor may be read as a result of a signal that is transmitted from the damaged TPM sensor to immobilizer **102**. In conventional TPM systems, re-writing the ID of TPM sensor **104** is accomplished by placing the entire TPM system in a "learn mode." In such a case, the operator and/or vehicle technician must take the vehicle through a sequence of events (e.g., place the ignition in the "ON" position, press the vehicle brake twice, and press a "reset" button located on the vehicle) to re-write the ID of TPM sensor **104**. Accordingly, re-writing the ID of TPM sensor **104** via the LF signal simplifies the sensor ID write/re-write process.

[0031] The LF signal from immobilizer **102** may also write data to TPM sensor **104** that causes reconfiguration of TPM sensor **104**. In one embodiment, reconfiguration of TPM sensor **104** includes updating memory registers of TPM sensor **104**. Reconfiguration of TPM sensor **104** may be desired when the TPM system is upgraded or enhanced. Regarding conventional TPM systems having TPM sensors, reconfiguration of these TPM sensors typically require the physical removal and replacement of the TPM sensor. Accordingly, the embodiments described above streamline the reconfiguration process for TPM sensor **104**.

[0032] As described above, TPM sensor **104** may have flash memory. As such, immobilizer **102**, via the LF signals, may reconfigure the operating parameters of TPM sensor **104** by "re-flashing" or erasing the flash memory of TPM sensor **104**. In such an instance, the operating parameters of TPM sensor **104** may be written/re-written for virtually any application. Conversely, conventional TPM systems having TPM sensors are incapable of on-vehicle re-flashing.

[0033] Furthermore, a target (i.e., a particular) one of the at least one TPM sensors **104** is generally positioned (i.e., placed, set, located, disposed, etc.) near the vehicle where the LF immobilizer **102** is implemented at or near the normal operation location. When the sensor **104** is to be tested for functionality, the sensor **104** may be placed at any appropriate location on, in or near the vehicle. However, the sensor **104** may be located at any appropriate location to meet the design criteria of a particular application.

[0034] When the particular (or target) TPM sensor **104** receives the signal (or command) TEST, the sensor **104** generally presents a message (or signal), (e.g., RECD). The sensor **104** is generally configured to present the signal RECD in response to the signal TEST. The message signal

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RECD is generally implemented as an RF signal in connection with an RKE system of the vehicle where the TPM system **100** is implemented.

[0035] The signal RECD generally comprises information (or data) that indicates that the signal TEST was properly received by the target TPM sensor **104** and that the TPM sensor **104** is operating properly. The signal RECD may further comprise information that provides an indication that the sensor **104** is operating properly, however, not at a location that can be particularly located, etc. The signal RECD may further comprise information regarding the unique identifier for the target sensor **104**. The message signal RECD may further comprise information that provides the system **100** an indication of proper operation of one or more of the at least one sensing devices that comprise the TPM sensor **104**.

[0036] In one example, the receiver **106** may be implemented as a TPM RF receiver. The receiver **106** is generally implemented as a combination RKE and TPM RF receiver. As such, the receiver **106** generally provides at least one RKE operation as well as at least one TPM operation. However, the receiver **106** may be implemented as any appropriate receiver to meet the design criteria of a particular application. The receiver **106** generally receives the signal RECD and provides the user (or operator) an indication of the information that may be contained in the signal RECD (i.e., the circuit **106** is generally configured to provide the user at least one indication of TPM sensor (e.g., sensor **104**) operation in response to the signal RECD). For example, the receiver **106** generally provides an indication (e.g., a visual and/or audible signal) when the signal RECD is received, and an alert (e.g., a visual and/or audible signal) when the signal RECD is not received in response to transmission of the signal TEST.

[0037] Thus, the user is generally provided the information that the sensor **104** is operating properly (or not operating properly), and, for example, the TPM sensor **104** may be installed on a wheel prior to the installation of the wheel on the vehicle with reduced concern for wasted time. The receiver **106** may be further configured to provide the operator additional information that may be contained in the at least one signal RECD (e.g., location of the sensor **104**, proper operation or failure of proper operation of the at least one sensing devices that comprise the sensor **104**, etc.). The signal RECD may "teach" (i.e., relate, associate, etc.) the sensor **104** identifier to the system **100**.

[0038] Referring to **FIG. 2**, a flow diagram illustrating an operation (e.g., method, process, routine, commands, steps, blocks, etc.) **200** in accordance with the present invention is shown. The operation **200** is generally implemented as a method that may provide for command and control of a vehicle anti-theft immobilizer system to a TPM sensor when the TPM sensor is placed nearby the vehicle anti-theft immobilizer system, and for response via a vehicle TPM, RKE, or combination TPM/RKE system, such that sensor testing, diagnosis, teaching the TPM sensor to the vehicle, associating the sensor **104** identification code to the system **100**, or a particular sensor location on the vehicle, and the like may be performed without implementation of specialized equipment as is implemented in conventional approaches. The method **200** may be implemented in connection with a TPM system such as the system **100**. However, the method **200** may be implemented in connection with any appropriate TPM system to meet the design criteria of a particular application.

[0039] An operator (e.g., user, owner, technician, mechanic, etc.) may activate (i.e., initiate, start, begin, etc.) the process **200** (step or block **202**). The process **200** may be initiated when the user desires to test the operation of a target (i.e., a particular) TPM sensor, associate a TPM sensor to a particular vehicle location, perform diagnosis on a TPM sensor, perform diagnosis on a TPM system (e.g., via implementation of a known good TPM sensor), associate a unique sensor **104** identifier to a vehicle TPM, RKE, or combination TPM/RKE system, etc., and the user does not have available the specialized equipment that is implemented in connection with conventional approaches to such processes. The step of activating the process **200** (i.e., step **202**) generally includes positioning a TPM sensor (e.g., at least one TPM sensor **104**, generally a target one of the TPM sensors **104**), at a desired location such as at or near (i.e., nearby) a normal operating position on the vehicle where the process **200** is implemented. The operator generally initiates the process **200** independently of vehicle immobilization operation.

[0040] An LF command or TPM sensor/system diagnostic signal (e.g., the signal TEST) may be presented by an immobilizer transmitter (e.g., the immobilizer **102**) (step or block **204**). The process **200** may be implemented to determine whether the signal TEST was received by the target TPM sensor and the TPM sensor presented (i.e., transmitted, sent, broadcast, etc.) a message that indicates the TPM sensor is operating properly (e.g., the signal RECD) to a RKE/TPM receiver (e.g., the receiver **106**) (decision step or block **206**). Additionally, the LF command presented at block **204** may also write information to TPM sensor **104**. As described above, in some aspects of the invention, the LF command may write/re-write the identification code for TPM sensor **104**, reconfigure the operating parameters of TPM sensor **104**, and re-flash the memory of TPM sensor **104**.

[0041] When the signal RECD is received and the target TPM sensor is operating properly (i.e., the YES leg of decision block **206**), the receiver (e.g., the receiver **106**) generally provides the operator an indication that the TPM sensor is operating properly (e.g., the signal RECD is presented by the target one of the at least one TPM sensor **104**) and an indication is presented to the operator (step or block **208**). In one example, the receiver implemented in connection with the process **200** may further (i.e., optionally) provide the operator additional information (or data) such as an indication of the location of the TPM sensor (e.g., right front tire, left rear tire, spare tire, etc.), information that the TPM sensor is properly operational, however, not at a location that can be particularly located, an indication of proper operation one or more of the at least one sensing devices that comprise the TPM sensor, association (or "teaching") of a unique sensor **104** to the system **100**, and the like (step or block **210**).

[0042] Returning to the decision step **206**, When the signal RECD is not received (i.e., the NO leg of the decision block **206**), an alert is generally presented to the operator (e.g., via the receiver **106**) (step or block **212**). The alert generally provides an indication that the target TPM sensor did not

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