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(71) Applicant *(for all designated States except US)*: **IL JIN GLOBAL CO., LTD.** [KR/KR]; 128-5 Samseong 2-dong, Gangnam-gu, Seoul 135-785 (KR).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **YUN, Han Soo** [KR/KR]; 128-5 Samseong 2-dong, Gangnam-gu, Seoul 135-785 (KR).

(74) Agents: **CHANG, Soo Kil** et al.; Kim & Chang, Seyang B/D, 223, Naeja-dong, Jongno-gu, Seoul 110-720 (KR).

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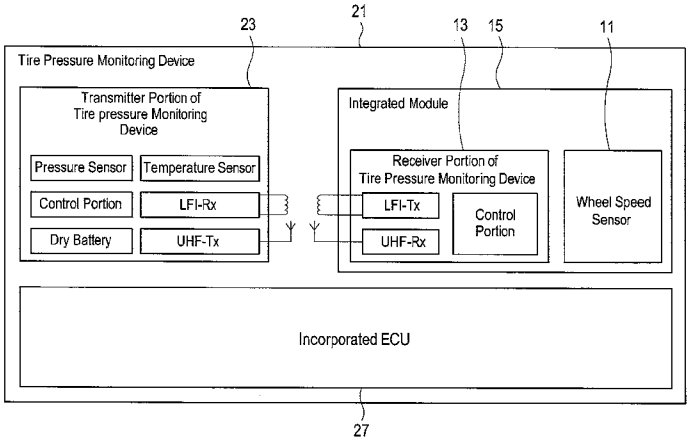
(54) **Title:** DEVICE FOR MONITORING TIRE PRESSURE

Figure 5



(57) **Abstract:** There is provided a tire pressure monitoring device, which measures temperature and pressure in the inside of a tire during vehicular traveling and informs a driver of tire abnormality. The tire pressure monitoring device includes: a transmitter portion inserted into one or more of vehicular tires for sensing tire status and then transmitting tire status data signal; and a receiver portion for receiving the tire status data signal from the transmitter portion. The receiver portion is integrated into a wheel speed sensor module of an ABS device, which is mounted to a wheel bearing. Since the receiver portion of the tire pressure monitoring device and a wheel speed sensor of the ABS device are integrated into one module, the transmitter portion and the receiver portion of the tire pressure monitoring device can be installed very closely to each other without greatly modifying a vehicular body design.

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DEVICE FOR MONITORING TIRE PRESSURE

TECHNICAL FIELD

The present invention generally relates to a tire pressure monitoring device, which measures temperature and pressure inside of a tire during traveling of a vehicle and informs a vehicular driver of tire status information. More particularly, the present invention relates to a tire pressure monitoring device capable of improving performance and reducing manufacturing costs by integrating a receiver portion of the tire pressure monitoring device into a wheel speed sensor module of an ABS positioned closely to a vehicular tire.

BACKGROUND ART

A tire pressure monitoring device is generally used as a device for monitoring tire pneumatic pressure of a traveling vehicle in real time and informing a vehicular driver of tire status information in real time.

The tire pressure monitoring device can be classified into an indirect type device based on an ABS and a direct type device wherein sensors are directly mounted to vehicular tires.

The indirect type tire pressure monitoring device monitors pressure status of tires using a principle in which as the pneumatic pressure of one tire becomes lower, the effective radius of the tire becomes small and the rotational speed of the tire becomes relatively high. Such an indirect type tire pressure monitoring device, however, has not been used gradually due to a problem in which erroneous alarm can easily occur due to excessive measurement errors and only relative comparison between pressures is possible.

On the contrary, in case of the direct type tire pressure monitoring device, since a sensor is disposed inside a vehicular tire, actual pneumatic pressure and temperature are sensed during vehicular traveling and tire status information obtained by calculating temperature-compensated pressure value are provided to a driver. Thus, the direct type tire pressure monitoring device has high measurement accuracy. Fig. 1 schematically shows a constitution directed to a wireless transmission/reception of a conventional direct type tire pressure monitoring device. The inside of each of the four tires is provided with a sensor. Signals of temperature and pressure value measured through the sensors are transmitted to a single receiver portion positioned at a central portion of a vehicular body.

In such a tire pressure monitoring device, the single receiver portion is

located remotely from the transmitter portions inserted into each tire. Thus, in order to accurately transmit the signals to the receiver portion, the transmitter portion must transmit intensified signals. Accordingly, there is a problem in that a dry battery (i.e., an electricity source of the transmitter portion) is fast consumed. Further, there is another problem in that the intensified signals transmitted from the transmitter portion can interfere with other signals generated from other vehicles or wireless devices.

In order to solve such problems, there has been developed a tire pressure monitoring device intended to enhance the efficiency of receiving signals from the transmitter portions located inside the tires and to reduce electric power needed for signal transmission by disposing receiver portions of the tire pressure monitoring device in close proximity with each tire. However, such a tire pressure monitoring device still has a similar problem occurring due to a distance between the transmitter portion and the receiver portion because the receiver portion is positioned at a vehicular frame. Further, since installing the receiver portion separately in close proximity with each tire needs other parts for such installing and separate wiring, there is a further problem such as a rise in manufacturing and installation costs.

Further, in order to solve the problem that an electricity source of the transmitter portion (e.g., dry battery) is fast consumed in the direct type tire pressure monitoring device, there has been recently developed another tire pressure monitoring device capable of saving electricity consumption, wherein its receiver portion receives information on vehicle movement from a wheel speed sensor and its transmitter portion inserted into a tire can be turned on or off according to vehicular traveling states. However, there is a problem even with such a tire pressure monitoring device in that its receiver portion and a wheel speed sensor of a vehicle are separately positioned to thereby complicate a wiring that is necessary for exchange of information on vehicular traveling, and that an ECU (Electronic Control Unit) of the tire pressure monitoring device and an ECU of the wheel speed sensor of a vehicle must be separately provided to thereby increase the manufacturing costs.

DISCLOSURE

TECHNICAL PROBLEM

The present invention is directed to solving the foregoing problems of the prior art. It is an object of the present invention to provide a device for monitoring tire pressure, which cannot only minimize electricity consumption related to signal generation of a transmitter portion but also reduce manufacturing and installation

costs of the device by installing a receiver portion in close proximity with the transmitter portion without modifying an existing vehicular body design.

TECHNICAL SOLUTION

In order to achieve the above object, according to the present invention, a receiver portion of a tire pressure monitoring device is integrated into a wheel speed sensor module of an ABS (Anti-Lock Brake System) device.

ADVANTAGEOUS EFFECTS

According to the present invention, since a receiver portion of a tire pressure monitoring device is integrated into a wheel speed sensor module of an ABS device, the receiver portion of the tire pressure monitoring device can be installed in close proximity with a tire without any design modification, thereby reducing manufacturing and installation costs of the device. Further, since the receiver portion and the transmitter portion of the tire pressure monitoring device are positioned very closely to each other, electricity consumption related to signal generation of the transmitter portion is reduced and possibility of wireless signal interference with other electronic devices can be eliminated.

Further, in case a wiring for the wheel speed sensor of the ABS device and an ECU of the ABS device are used as a wiring and an ECU of the tire pressure monitoring device, installation costs can be reduced. Also, in such a case, vehicular traveling information, which is necessary for selectively actuating the transmitter portion of the tire pressure monitoring device, can be directly transmitted from the wheel speed sensor of the ABS device to the receiver portion of the tire pressure monitoring device, thereby enhancing signal transmission efficiency in information exchange.

Further, according to the present invention, as a separate wiring for the receiver portion of the tire pressure monitoring device is decreased, the number of connectors and connection points to be used is decreased accordingly and a failure rate is thus lowered.

DESCRIPTION OF DRAWINGS

Fig. 1 shows a constitution of wireless transmission/reception of a conventional direct type tire pressure monitoring device.

Fig. 2 shows a constitution of an ABS device.

Fig. 3 is a partially cross-sectional view showing a conventional wheel speed

sensor module of an ABS device, which is mounted to an outer ring of a wheel bearing.

Fig. 4 is a partially cross-sectional view of a module having the wheel speed sensor and a receiver portion of a tire pressure monitoring device according to the present invention.

Fig. 5 is a block diagram of the tire pressure monitoring device according to the present invention.

MODE FOR INVENTION

Fig. 2 illustrates a constitution of an ABS device. Wheel speed sensors 1 of the ABS device detect speeds of wheels and then transmit their speed information to an ECU 3 of the ABS via a wiring 7. The ECU 3 of the ABS monitors the speed information transmitted from the wheel speed sensors. When one of the wheels having abnormal difference in rotational speed is detected, the ECU determines that a lock phenomenon takes place at such a wheel and then sends an ABS operation signal. Fig. 3 is a partially cross-sectional view showing a conventional wheel speed sensor module of the ABS device. The wheel speed sensor 1 is generally mounted to an outer ring 9 of a wheel bearing.

Among electronic device modules of a vehicle, a wheel speed sensor module of an ABS device is mounted in closest proximity with a tire. Accordingly, when a receiver portion of a tire pressure monitoring device is integrated into such a wheel speed sensor module, the receiver portion of the tire pressure monitoring device can be positioned in close proximity with transmitter portions thereof, which are located within one or more of vehicular tires without greatly modifying an existing vehicular body design.

According to one embodiment of the present invention, a tire status data signal received at the receiver portion of the tire pressure monitoring device is transmitted to an ECU of the tire pressure monitoring device via a wiring for the wheel speed sensor of the ABS device. In the present invention, the wiring comprises a signal transmission line for CAN (Controller Area Network) communication, which may be constituted using two strands of twist pair wire. Further, the wiring means arrangement of all types of electric wires to be used for signal transmission. Furthermore, according to another embodiment of the present invention, the ECU of the tire pressure monitoring device may be incorporated to the ECU of the ABS device.

The receiver portion of the tire pressure monitoring device according to the

present invention may be inserted into insides of one or more tires of a plurality of tires mounted to a vehicle. Preferably, it is inserted into the inside of at least one of one or more tires placed closely to each other outside of a wheel bearing of a vehicle.

The tire pressure monitoring device of the present invention will now be described in detail with reference to the accompanying drawings.

Fig. 4 shows an integrated module 15 wherein the receiver portion 13 of the tire pressure monitoring device according to the present invention and the wheel speed sensor 11 of the ABS device are integrated on a substrate 17. A wiring 19, which is connected to the receiver portion 13 of the tire pressure monitoring device and the wheel speed sensor 11 of the ABS device located on the substrate 17, further extends outward of the integrated module 15 and is thus used to signal transmission related to operations of the tire pressure monitoring device and the ABS device.

According to the present invention, since the receiver portion 13 of the tire pressure monitoring device is integrated into a module for the wheel speed sensor 11 of the ABS device and is thus positioned in the closest proximity with a tire, a distance between the transmitter portion and the receiver portion of the tire pressure monitoring device becomes shortened, thereby allowing smooth signal transmission and reception in spite of low intensity of wireless signal between the transmitter portion and the receiver portion. This further diminishes signal interference phenomenon with external devices and lowers electricity consumption related to signal transmission.

Fig. 5 is a block diagram of the tire pressure monitoring device 21 according to the present invention. The transmitter portion 23 of the tire pressure monitoring device is inserted into each tire. The transmitter portion includes a pressure sensor, a temperature sensor, a control portion, a dry battery, a LFI (Low Frequency Initiator) reception portion LFI-Rx, and a UHF (Ultra High Frequency) transmission portion UHF-Tx. The integrated module 15 includes the receiver portion 13 of the tire pressure monitoring device and the wheel speed sensor 11. The receiver portion 13 of the tire pressure monitoring device includes a LFI transmission portion LFI-Tx, a UHF reception portion UHF-Rx, and a control portion.

The UHF transmission portion and the UHF reception portion serve to transmit and receive the pressure and temperature information of the tire measured through the pressure sensor and the temperature sensor of the transmitter portion of the tire pressure monitoring device by means of ultra high frequency (UHF).

The incorporated ECU 27 performs the function of an ECU for processing signals of the tire pressure monitoring device and the function of the ECU of the

ABS at the same time. Thus, one wiring would suffice for connection from the integrated module 15 to the incorporated ECU 27. In the present invention, signal processing means all processing relevant to signal such as signal detection necessary for operation of the tire pressure monitoring device, signal generation, calculation related to temperature-compensated pressure, etc.

It is preferable that only when a vehicle travels above a certain speed, the transmission portion 23 of the tire pressure monitoring device transmits tire status information signals so as to reduce usage amount of the dry battery. To this end, the LFI-Rx of the transmitter portion 23 of the tire pressure monitoring device receives a low frequency signal transmitted from the LFI-Tx of the receiver portion 13 and transmission of tire status data signals from the transmitter portion 23 of the tire pressure monitoring device is converted into Sleeping/Wake up status. In such a case, when the receiver portion 13 of the tire pressure monitoring device is integrated into the wheel speed sensor module of the ABS and the tire pressure monitoring device and the ABS device share the wiring and the ECU, as taught by the present invention, the information for converting the transmission portion 23 of the tire pressure monitoring device into the Sleeping/Wake up status is allowed to be directly received from the integrated ABS wheel speed sensor, thereby performing control relevant to the status conversion through the incorporated ECU. Accordingly, separate wiring for information exchange between the receiver portion of the tire pressure monitoring device and the wheel speed sensor becomes unnecessary and signal transmission efficiency is enhanced.

Further, according to another embodiment of the present invention, the tire pressure monitoring device according to the present invention may be applied to a batteryless type tire pressure monitoring device. The batteryless type tire pressure monitoring device is configured such that the transmission portion inserted into the inside of a tire does not include a dry battery and electric power is instead wirelessly supplied thereto from the exterior. In case a transmitter portion and a receiver portion of the tire pressure monitoring device are positioned closely to each other similar to the present invention, the wireless power supply efficiency from the receiver portion to the transmitter portion is enhanced.

The tire status information, which is produced by the tire pressure monitoring device according to the present invention, may be informed to a driver by means of a display device to be mounted on a dashboard inside a vehicle, etc. The tire status information includes, but is not limited to, numeric information of data related to tire pressure, etc. and information on tire abnormality predicted from those data.

Further, it may be displayed in various manners.

The above-described embodiments and examples should not be construed as limiting the scope of the present invention. It will be understood by those of ordinary skill in the art that various changes may be made therein without departing from the scope of the present invention as defined by the following claims.

INDUSTRIAL APPLICABILITY

The present invention provides a tire pressure monitoring device, which measures temperature and pressure of the inside of a tire and informs a driver of tire status information.

CLAIMS

1. A device for monitoring tire pressure, comprising:

a transmitter portion mounted to one or more of vehicular tires for sensing a tire status and transmitting a tire status data signal; and

a receiver portion for receiving the tire status data signal from the transmitter portion;

wherein the receiver portion is integrated into a wheel speed sensor module of an ABS device, the wheel speed sensor module being mounted to a wheel bearing.

2. The device for monitoring the tire pressure of Claim 1, wherein the device further comprises an ECU for processing the tire status data signal, and

wherein the tire status data signal received at the receiver portion is transmitted to the ECU via a wiring of the wheel speed sensor of the ABS device.

3. The device for monitoring the tire pressure of Claim 2, wherein the ECU of the device for monitoring the tire pressure is incorporated into an ECU of the ABS device.

Figure 1

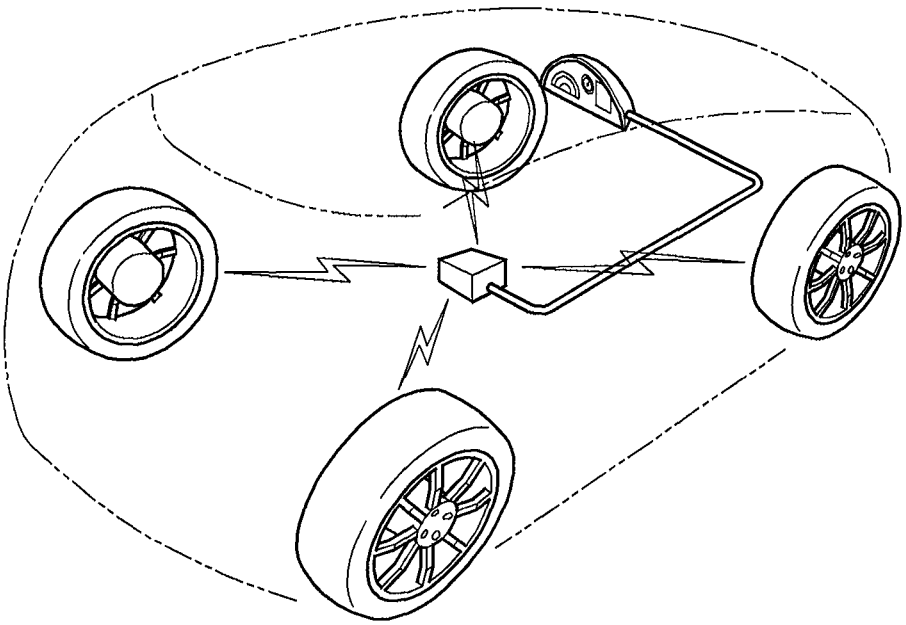

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Figure 2

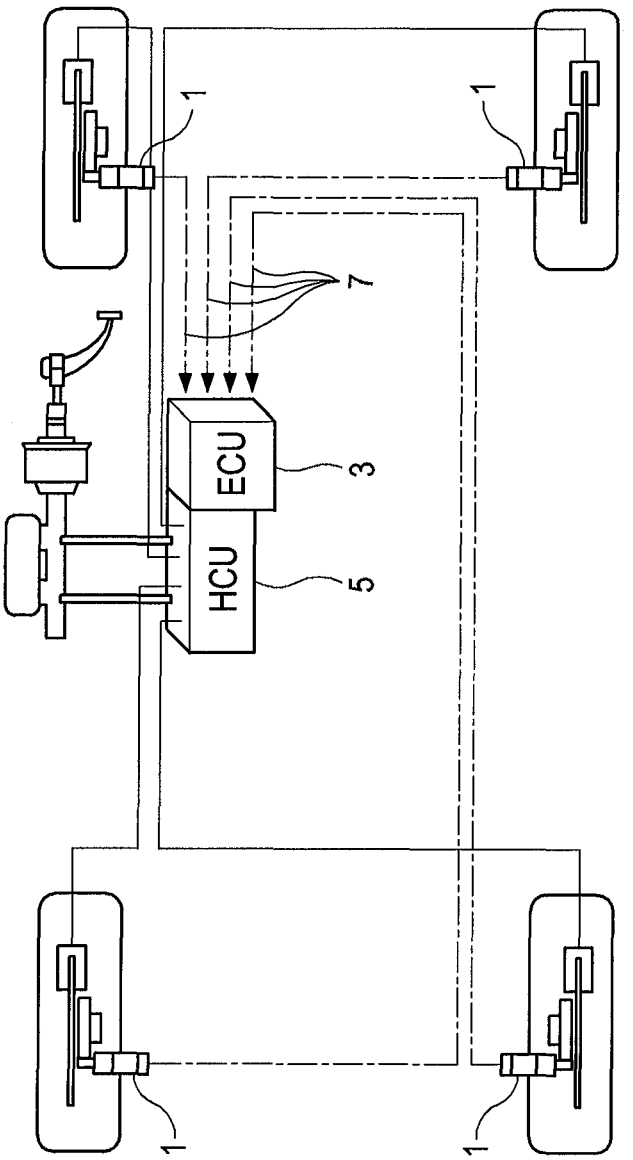


Figure 3

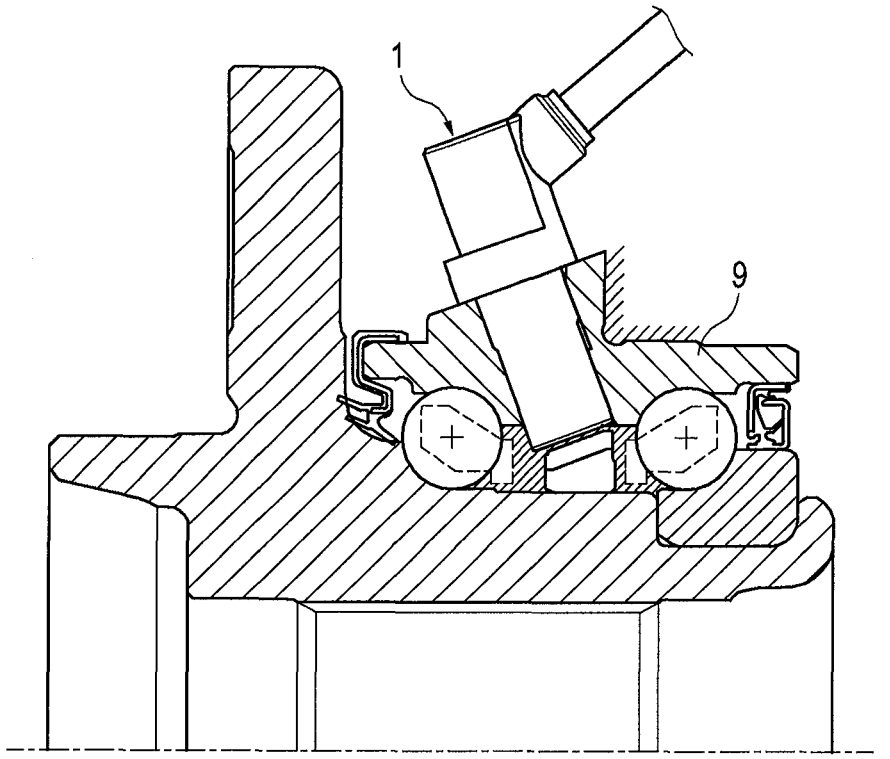


Figure 4

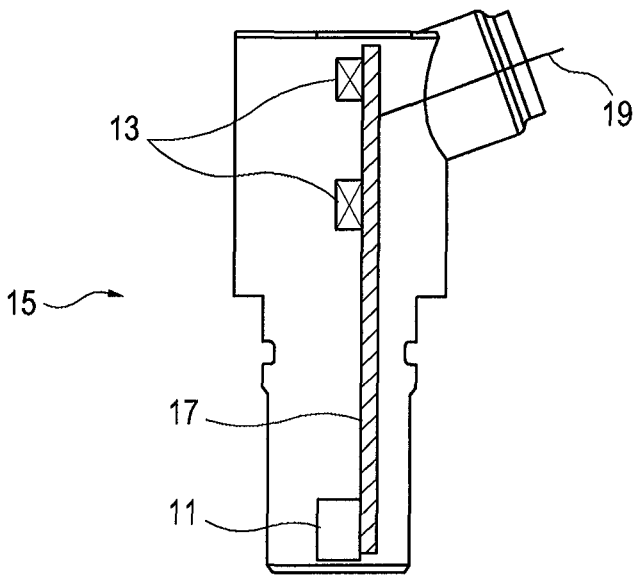
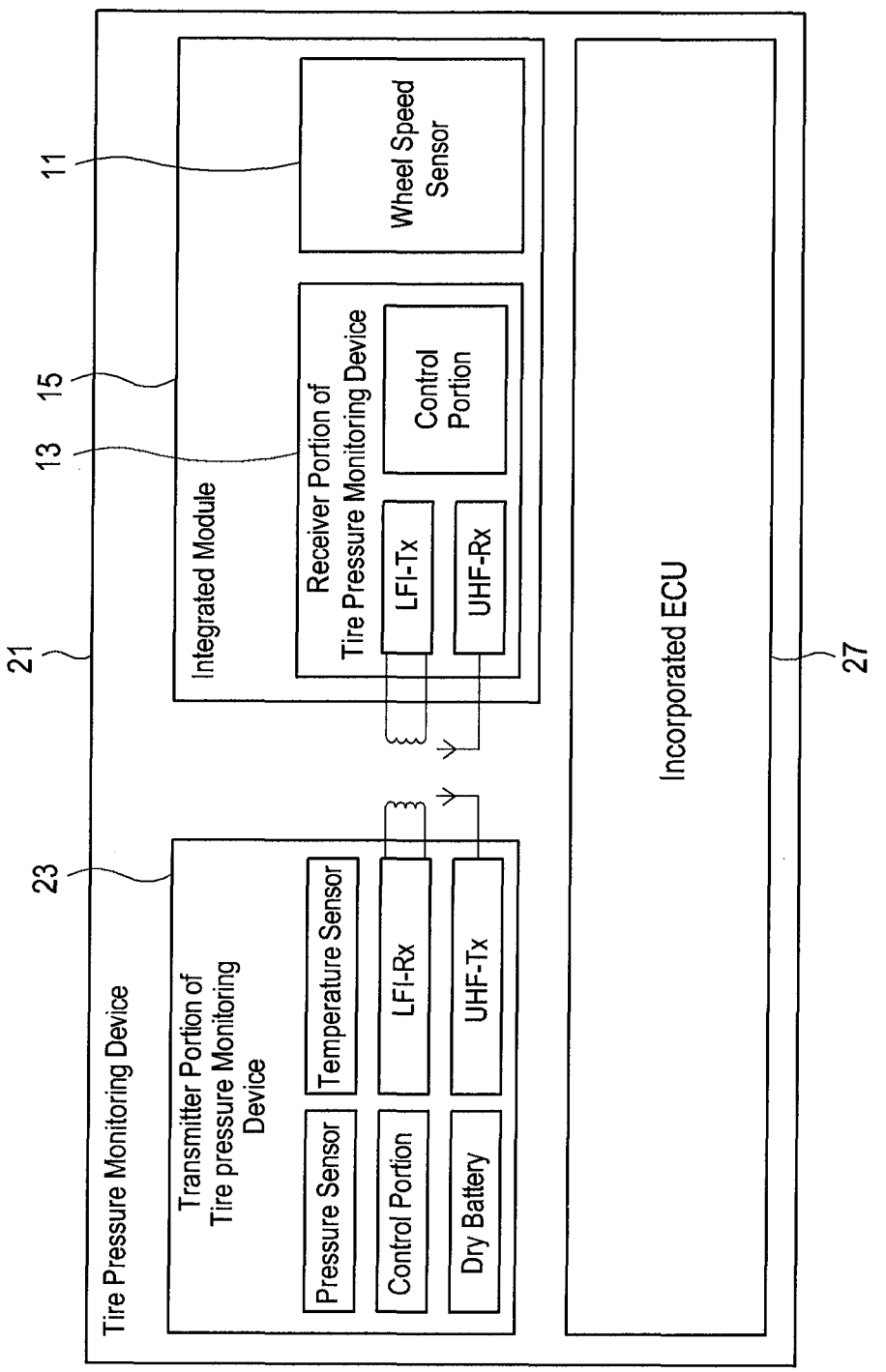


Figure 5


Tire Pressure Monitoring Device
Integrated Module
Wheel Speed Sensor
Receiver Portion of Tire Pressure Monitoring Device
Control Portion
LFI-Tx
UHF-Rx
Transmitter Portion of Tire pressure Monitoring Device
Temperature Sensor
LFI-Rx
UHF-Tx
Pressure Sensor
Control Portion
Dry Battery
Incorporated ECU
11
15
13
21
23
27

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2008/001461

A. CLASSIFICATION OF SUBJECT MATTER

B60C 23/04(2006.01)i, B60C 23/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 8 B60C 23/00, B60C 23/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Utility models and applications for Utility models since 1975
Japanese Utility models and applications for Utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKIPASS (KIPO internal)
Keywords : "TPMS","ABS","receiver","wheel speed"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,799,129 B2 (DETLEF SCHMIDT ET AL.) 28 SEPTEMBER 2004 See Figure 1 and related descriptions.	1-3
A	US 6,518,877 B1 (GENE RAYMOND STARKEY RT AL.) 11 FEBRUARY 2003 See Figure 1A and related descriptions.	1-3
A	JP 10-114207 A (PEARMAN; KEVIN PATRICK AUSTIN) 6 MAY 1998 See Figure 9B and related descriptions.	1-3

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 JUNE 2008 (24.06.2008)	**24 JUNE 2008 (24.06.2008)**

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer
JEONG JI Deok
Telephone No. 82-42-481-8420

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2008/001461

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