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(54) Titre : TYRE FAULT WARNING DEVICE.

(57) Abrégé :

A tyre fault warning device comprises a fault warning means (1) to be coupled or incorporated in a tyre valve. The fault warning means includes, in the foot part of the valve, switch means (4,7) responsive to pressure and/or temperature conditions and radio signal means (10,8c) to transmit a signal for reception by receiver means (2).

Said switch means (4,7) are housed in a chamber (12) including a wall (12a) which moves in response to changing pressure and/or temperature conditions and comprises a convex disc of bimetal material. A battery (9) may be housed in a removable cap (8) and provide power via electrical leads (21A,21B) to the radio signal means (10,8c) incorporated in the valve body (16).

010074

"TYRE FAULT WARNING DEVICE"

DESCRIPTION:

The present invention relates to a tyre fault warning device, especially but not exclusively for the tyres of motor-cars and light commercial vehicles.

As is well known, the maintenance of the tyres of a vehicle at the correct operating pressure is of paramount importance to the safety of the vehicle when driving -: indeed to this end manufacturers recommend that the vehicle tyres are checked for the correct pressure prior to commencing a journey. However, due to various reasons e.g. slow punctures, deformed wheel rims, etc, tyres can lose pressure. Also, where there is overheating at a wheel a dangerous situation can arise.

Up until now there has been no satisfactory and convenient means of warning drivers of these tyre fault situations, while the vehicle is on the move.

It is the principal object of the present invention to provide a tyre fault warning device which can be conveniently installed, but which is satisfactory and reliable in operation.

According to the present invention, a tyre fault warning device comprises a fault warning means adapted to be fitted at or incorporated in a tyre valve, said fault warning means including radio signal means to transmit a radio signal for reception by receiver means, said receiver means including fault indicating means, and switch means responsive to pressure and/or temperature conditions in a tyre to activate said radio signal means for the issue of a radio warning signal.

Preferably said switch means are located in a foot part of a tyre valve; and preferably said switch means are housed in a chamber at said foot part, said chamber including a wall which is movable on changing pressure and/or temperature conditions in a tyre to actuate said switch means. Preferably said wall is carried by a flexible ring member, and preferably said wall comprises a convex disc of bi-metal material.

In a preferred embodiment, electrical power means for the radio signal means includes a battery housed in a removable cap of the tyre valve, electrical leads to the radio signal means being incorporated in the valve body and the cap. The cap can be secured to the valve body by a fitting means adapted to ensure that the leads to the radio signal means are com-

plete when the cap is fitted. Preferably the cap carries an aerial of the radio signal means.

The receiving means can include suitable warning means such as a light or aural warning (e.g. buzzer), and preferably these means include a latching device to maintain the warning indication, even when the radio warning signal ceases.

An embodiment of the present invention will now be described by way of example with reference to the accompanying drawings wherein:

Fig. 1 shows a side-view of a high performance motor-car fitted with a tyre-fault warning system in accordance with the present invention;

Fig. 2 shows schematically the radio transmission arrangement for warning signals in the warning system of Fig. 1;

Fig. 3 shows a cross-sectional elevational view of a tyre and wheel rim portion including a tyre fault transmitting device of the system;

Fig. 4 shows a cross-sectional view of the fault transmitting device of Fig. 3 to a larger scale;

Fig. 5 shows a detail of Fig. 4 to a larger scale; and

Fig. 6 shows the instrument panel of the car of Fig. 1 fitted with tyre fault warning indicators.

Referring to the drawings, a system for indicating tyre fault conditions, specifically pressure loss and overheating in the tyres, comprises tyre inflation valves which are in the form of special fault sensing and signal transmitting valves 1, and an aerial pick-up 11 which runs between the wheels 15 of the vehicle and which transmits fault signals from the valves 1 to fault indicating means 2 installed, for example, on the vehicles instrument panel or at some other position where it will be possible for the driver of the vehicle to see a fault warning indication issued by the indicating means 2. The indicating means 2 comprises a radio signal receiver (Fig. 2) and warning indicating means, such as a light or a buzzer. A separate warning light can be provided for each tyre so that the faulty tyre can be precisely identified. The valves 1 have the functions of sensing when tyre pressure falls by a predetermined amount and transmitting a warning radio signal when this reduced pressure condition is reached, and similarly transmitting a warning signal when there is overheating at the tyre.

Referring more especially to Figs. 3 to 5, the special tyre valve 1 includes a main valve body 16 which is of high grade plastics material housing a conventional one-way valve device (i.e. Schrader) 17 in an air

duct 3, and the body 16 has a larger diameter foot portion 16A which enables the body 16 to be tightly secured to the wheel rim 18 by a locknut 19, the body 16 being inserted through the normal valve hole in the wheelrim 18 such that the foot 16A is internally located. A sealing ring 20, positioned between the foot 16A and the wheelrim 18 ensures the desired sealing effect, while foot 16A includes externally opening air passages 3A communicating with duct 3. A special plastics cap 8 is fitted on the body 16 and includes lugs 8a whereby the cap is fitted to the body 16 by a half turn bayonet action, and by this means the cap 8, can be fitted in only one posistion on the body 16. The radio signal, indicating a tyre fault condition, is generated by a radio circuit on a printed circuit board 10, and the power for this circuit is taken from a small battery 9 (e.g. mercury cell type) located at the inner end of the cap 8 via electrical circuit leads 21A, 21B, electrical contacts 8B being provided between the cap 8 and the body 16 on this circuit. Further, a switch is located in this circuit 21A/B at the foot 16A comprising switch contacts 4 and a switch closing head 13A. A tension spring 22 ensures good contact between the battery 9 and the feed and return lines of the circuit 21A/B.

Operation of the closing head 13A is effected by a pressure sensitive actuator 12, responsive to tyre pressure. The pressure sensitive actuator 12 comprises a flexible ring seal 6 carried by a lower rim of the foot 16A, while a convex bi-metal disc 12A is fitted to the ring seal 6 whereby a sealed chamber 5, at atmospheric pressure is formed at the foot 16A. A rod member 13 has one end resting on the disc 12A while the other end carries the closing head 13A, compression spring 7 urging the rod member 13 against the disc 12A.

Incorporated on the cap 9 is an aerial member 8c for the transmission of radio signals 5 to be picked up by aerial 11 (Fig. 2), and this aerial member 8c is connected to the radio circuit at board 10 by lead 24. The warning indicating means 2 (Fig. 2), includes the radio receiver 25, to which the aerial 11, is fitted and which is powered by the vehicle's battery (not shown) via leads 26A, 26B, a latching unit 14, and fault indicator 27, including ON- indicator lamp 28 and buzzer 29. The latching unit 14 has the function of maintaining the fault warning signal at lamp 28, even when the warning radio signal ceases.

Existing tyres can be converted to the new system simply by removing the existing valves and replacing these with the special valves. 1.

To place the warning system in an operating mode, before inflation of each tyre 18A, the contacts 4 encased in chamber 5 are closed and when the tyre is inflated to a pre-set pressure (say 26 psi/1828 gm/cm^2), the flexible ring seal 6 compresses and pushes against the spring 7 to move the head 13A, and thereby open the contacts 4 making a normally open circuit. The tyre is then inflated by a further amount (say 3 psi/211 gm/cm^2 to 29 psi/2039 gm/cm^2) to the normal running pressure of the tyre in question.

When inflation is completed the special cap 8 containing the pwer cell 9 is fitted to the valve body 16.

This cap 8 can only be fitted in one position by means of the half turn bayonet cap action to locate lugs 8a. The fitting of the cap 8 energises the line from the battery 9 through the contacts 8b between the cap and the valve stem, then down to the open switch contacts 4.

The vehicle is then ready for normal use, but if a tyre fault develops, causing a predetermined deflation (say 3 psi/211 gm/cm^2 or more), then the contacts 4 close which energises the radio transmitter circuit 10 which in turn sends a radio signal via the aerial 8c, which is incorporated in the valve cap 8. This signal is picked up by the aerial 11 and passed to the receiver 25 which causes the warning light 28 for the appropriate wheel to flash, and the buzzer 29 to sound.

If, on the other hand, a fault develops which causes the tyre to overheat rather than lose pressure, the bi-metal disc 12 will flex and cause the rod 13 to move down to close the contacts. 4. ,thus sending a warning signal to the driver, in the manner described above.

When a fault develops while the vehicle is parked, the driver shall be warned as soon as he turns the ignition key on, by virtue of the latching device 14 incorporated in the warning means 2, setting the warning signal.

Briefly therefore, with the tyre at the correct pressure and a safe temperature there is an open circuit, but with a drop in pressure or a rise in temperature, then the circuit is closed and warns the driver through a radio link.

It is a feature of the arrangement that the radio warning signal transmission can be restricted to a narrow envelope (e.g. 2 metres wide) along the length of the vehicle, so that interference problems with overtaking vehicles operating the same warning system can be avoided. The radio transmission frequency will of course be selected to satisfy the pertinent regulations of the country.

Thus the present invention provides a safe and relatively economic device which can be fitted easily and relatively quickly to a vehicle, by removing the tyre valves and replacing them with the special fault transmitting valves 1, the receiver for the radio signals of the valves 1, including the aerial 11 being relatively easily installed in the vehicle.

Modifications are of course possible. Thus it may be possible to use a power source other than a battery (9) in the device - for example a piezo electric generator could be used producing the required power for the device from vehicle vibration.

Reference is made to the applicants co-pending application no. 8815550.2 filed 30 June 1988 which describes a tyre fault warning device in the form of unit block fitted into an existing tyre valve, the device again issuing a radio warning signal when tyre pressure falls to a predetermined level or when unsatisfactory overheating occurs.

Claims

1. A tyre fault warning device comprising a fault warning means to be carried by a vehicle wheel wherein the fault warning means is adapted to be coupled to or incorporated in a tyre valve, the fault warning means including radio signal means to transmit a radio signal for reception by receiver means provided with fault indicating means, sensing means for location in a tyre responsive to pressure and/or temperature conditions in the tyre, and switch means actuable by said sensing means to activate said radio signal means for the issue of a radio warning signal, the switch means being located in a housing so as to be shielded from the air in the tyre.

2. A device according to claim 1, wherein said switch means are located in a foot part of a tyre valve.

3. A device according to claim 2, wherein said switch means are housed in a chamber at said foot part, said chamber including a wall constituting said sensing means which is movable on changing pressure and/or temperature conditions in a tyre to actuate said switch means.

4. A device according to claim 3, wherein said wall is carried by a flexible ring member.

5. A device according to claim 2 or 3, wherein said wall comprises a convex disc of bimetal material.

6. A device according to any one of the preceding claims, wherein electrical power means for the radio signal means are provided including a battery housed in a removable cap of the tyre valve, electrical leads to the radio signal means being incorporated in the valve body and the cap.

7. A device according to claim 6, wherein the cap is secured to the valve body by a fitting means adapted to ensure that the leads to the radio signal means are

complete when the cap is fitted.

8. A device according to claim 6 or 7, wherein the cap carries an aerial of the radio signal means.

9. A device according to any one of the preceding claims, wherein the receiving means include warning means such as a light or aural warning eg buzzer.

10. A device according to claim 9, wherein said warning means includes a latching device to maintain the warning indication, even when the radio warning signal ceases.

11. A tyre fault earning device substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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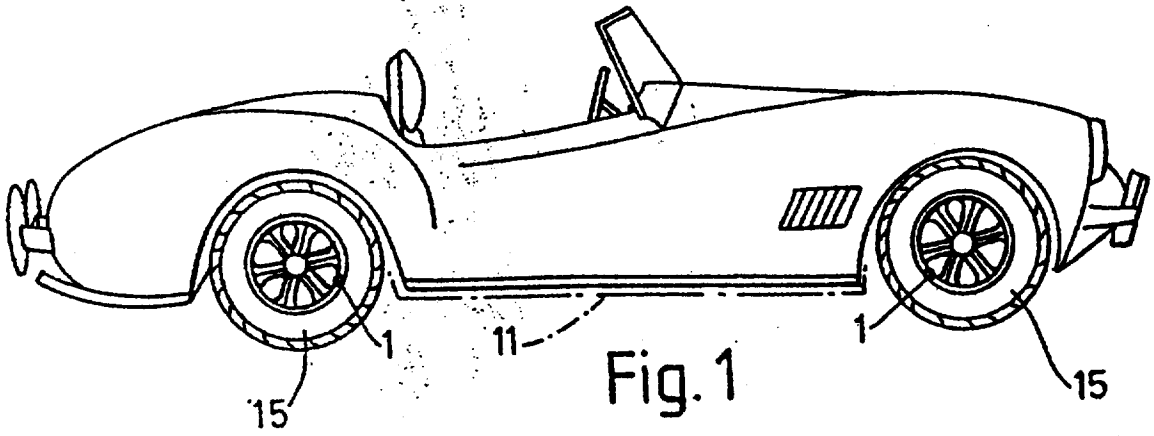

Fig. 1

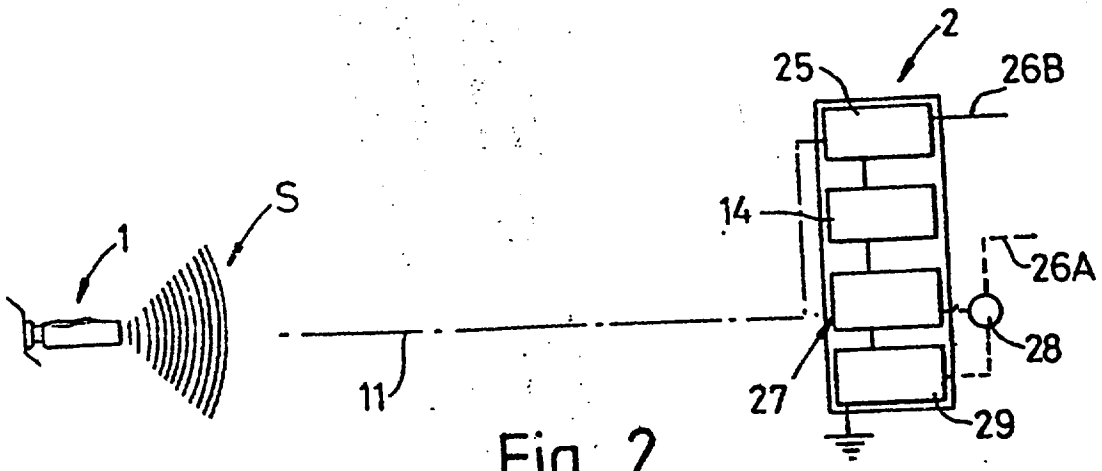

Fig. 2

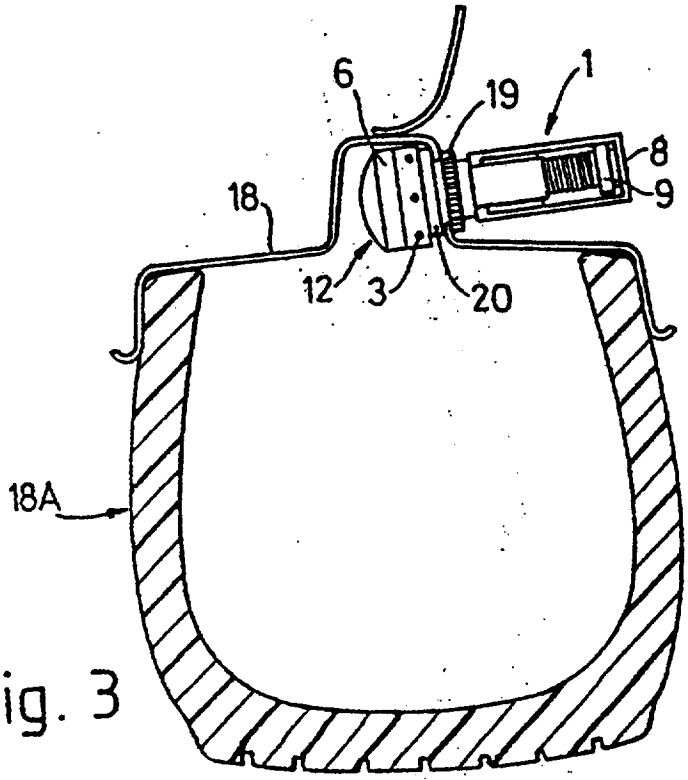

Fig. 3

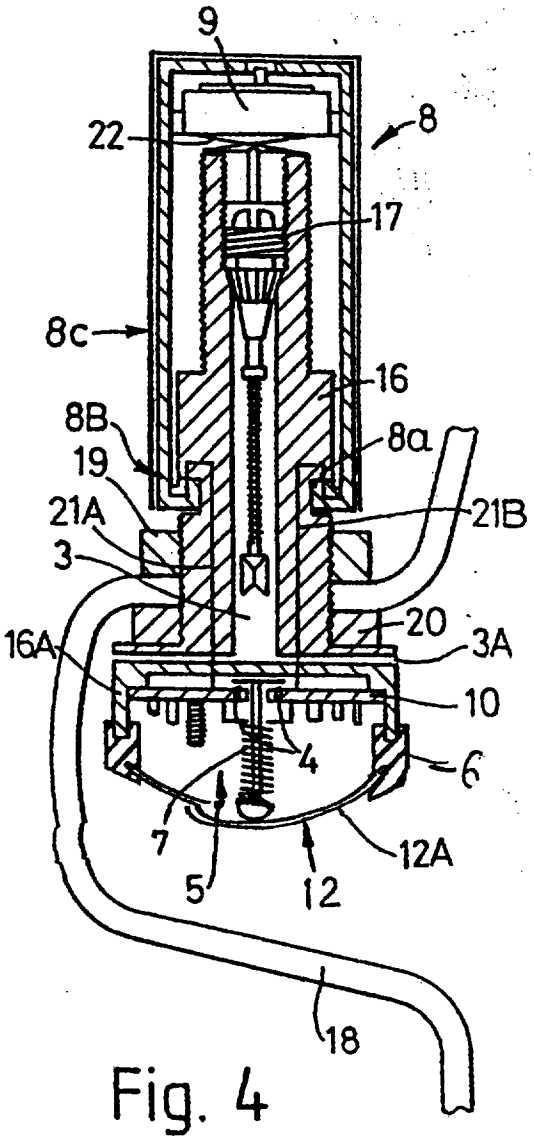

Fig. 4

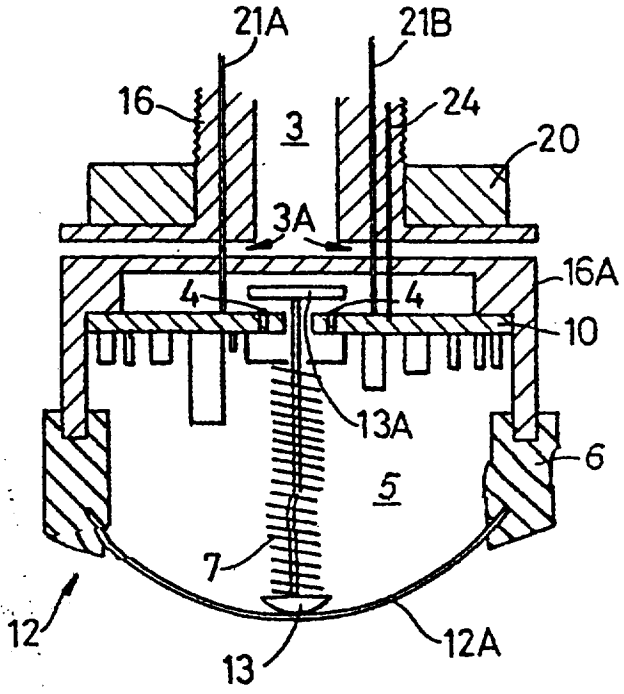

Fig. 5

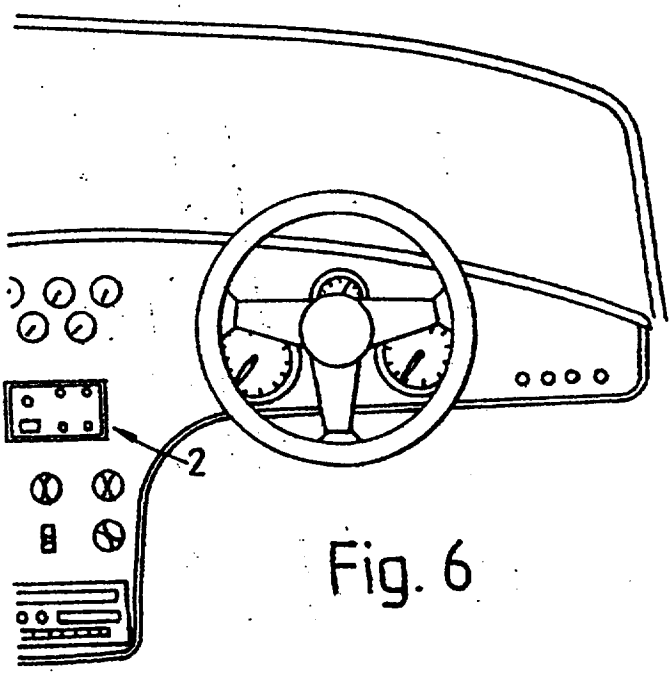

Fig. 6