

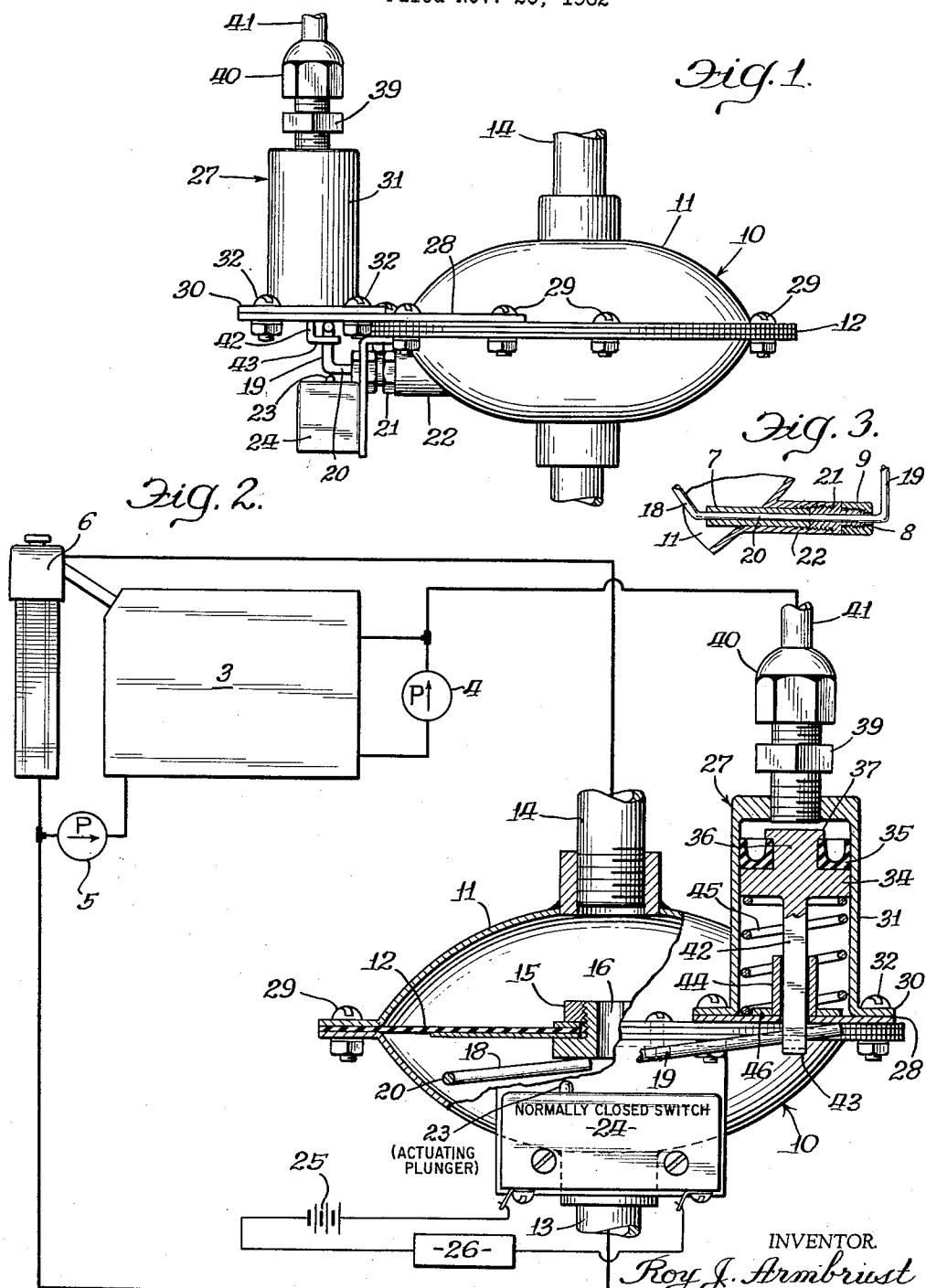
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PROTECTIVE APPARATUS FOR INTERNAL COMBUSTION ENGINES

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1

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PROTECTIVE APPARATUS FOR INTERNAL COMBUSTION ENGINES

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The present invention relates to an apparatus for signaling a malfunction of either the coolant circulatory system or the pressure lubricating system of a liquid cooled internal combustion engine, and the following disclosure thereof is offered for public dissemination upon the grant of a patent therefor.

Various devices are available for warning of a malfunction of the cooling system of internal combustion engines. Also devices are available for warning of a lack of pressure in the forced lubrication systems of such engines. Such devices are useful and desirable on large and small diesel engines, as for example those used on locomotives and trucks, as well as on gasoline engines such as those used in various motor vehicles. In the main, such devices operate independently using two sensors as well as two indicating lights or other instruments.

My invention is directed to providing a simple and inexpensive unit for detecting a failure in the coolant circulatory system and/or pressure lubricating oil system to provide a warning signal should a failure occur in either or both of these systems. An important feature of my invention is that it requires the use of only a single signaling or indicating instrument. This simplifies the installation of the warning system and the cost of the installed unit. Should a malfunction in either of these occur, an inspection of the engine should be made promptly. That inspection will reveal the source of the trouble and it is not necessary that the warning system itself indicate in which area the malfunction has occurred.

An important aspect of the device of my invention is that it is fail-safe in its operation. For all practical purposes, malfunctions in the detecting and sending unit that I have devised will result in a warning signal rather than causing the device to fail to signal a warning.

A further important feature of my invention is that while there are two sensors operating a common signal indicator, they do so independently of each other; that is, there is no cumulative operation of two devices to produce a signal, but, rather, even though one sensor (whichever it may be) does not detect a malfunction, the other can act independently to signal a malfunction. This is important since it eliminates the adjustment and balancing difficulties that can be present in a device of the type wherein two sensors are cumulative in their action with a signal being present when an imbalance occurs as a result of one sensor detecting improper operation of its respective system.

As hereinafter described, one of the sensors of the present invention is disclosed and claimed in my prior Patent No. 3,007,461. Devices of this type have found substantial acceptance, particularly among industrial users of internal combustion engines, e.g. the owners of trucks, busses, locomotives, etc. The present invention permits the present users of these devices to add pressure lubricating oil system detectors to their existing coolant detector apparatus without requiring any modification of

2

their existing apparatus (other than the affixation of an attachment). No changes in the electrical wiring, etc., already present need be made.

Further objects and advantages of my invention will be apparent from the following description taken in conjunction with the drawings in which:

FIGURE 1 is an elevational view of an embodiment of my invention;

FIGURE 2 is an elevational view as viewed from the left side of FIGURE 1, with portions broken away, and also illustrating diagrammatically the connections of the embodiment to the engine, etc.; and

FIGURE 3 is a fragmentary sectional view approximately along the axis of the crank rod of the coolant flow detector shown in FIGURES 1 and 2.

My invention is for use with an internal combustion engine 3 having a pump 4 for circulating the engine lubricating oil, and a pump 5 for circulating the engine coolant, e.g. water. The coolant is circulated through the engine and a radiator 6, the top portion of which forms a reservoir for the coolant. From the disclosure hereof the application of the invention to various types of internal combustion engines will be readily apparent to those skilled in the art.

The illustrated embodiment includes a coolant failure sensor generally 10. Sensor 10 has a housing 11 divided by an inner diaphragm 12 into an upper and lower chamber. The lower chamber normally is placed in communication with the intake of the coolant circulating pump 5 by a pipe 13. The upper chamber is placed in communication with the reservoir for the coolant by a pipe 14. A fitting 15 on diaphragm 12 defines a restricted passage 16 communicating between the upper and lower chambers and providing the only internal communication therebetween.

An actuating member is defined by arms 18 and 19 and a connecting shaft 20. Shaft 20 is suitably journaled in bearing 21 mounted in boss 22 of housing 11. Axial positioning is achieved by a loose sleeve 7. A packing gland 8 held by a nut 9 is provided for a seal about shaft 20. Arm 18 contacts the bottom of fitting 15. Arm 19 is positioned in alignment with actuating plunger 23 of a normally closed electrical switch 24 of the snap-action type. Switch 24 is connected in series with the engine battery 25 (or other suitable source of electric power) and a suitable indicator 26, e.g. light, buzzer, etc. When plunger 23 is released, as illustrated in the drawings, the indicator 26 will be "on"—the condition indicating a malfunction.

The coolant failure sensor 10 as so far described is illustrated and described in further detail in my prior Patent No. 3,007,461. As described in that patent, when the coolant circulatory system is operating properly, diaphragm 12 will be drawn downwardly, lowering arm 19 (assuming that it is released as hereinafter described) and causing arm 19 to depress plunger 23 to open the contacts of switch 24. With the contacts of switch 24 open, the indicator is deenergized to signify a proper functioning of the coolant circulatory system. The aforesaid patent also brings out that normally the electrical system is so arranged that the energy from battery 25 is not supplied unless the conventional ignition switch of the motor is "on."

The oil pressure sensor generally 27 includes a mount-

ing plate 28. Mounting plate 28 is secured to the coolant sensor 10 by the bolts 29 that are used to assemble housing 11 of sensor 10. A flange 30 of a fluid cylinder 31 is secured to mounting plate 28 by bolts 32. Within cylinder 31 is a piston defined by a cylindrical metallic member 34 and an annular synthetic rubber member 35. Metallic member 34 has a post 36 projecting upwardly therefrom and topped by an annular flange 37. Annular member 35 is held between flange 37 and cylindrical member 34. The annular rubber member 35 serves as a piston ring and provides a fluid tight seal between the piston and the inner wall of cylinder 31.

The upper end of the cylinder is tapped to receive a connection to the oil pressure line. For example, a connecting fitting 39 is threaded therein and receives a flanged copper-tube nut 40. A copper tube 41 is thereby secured to and placed in communication with the interior of cylinder 31. Tube 41 also is connected to the oil pressure line of the lubricating oil pump 4.

A piston rod 42 is attached to the base of the metallic portion 34 of the piston and extends downwardly through an opening in mounting plate 28. At its lower end, piston rod 42 has a finger 43 which extends under arm 19 of the actuating member. A sleeve 44 is received about piston rod 42 within cylinder 31 to act as a stop. A spring 45 urges the piston rod, piston and finger 43 upwardly since it is in compression between the piston and mounting plate 28. A washer 46 centers spring 45 in the cylinder.

While the operation of the coolant sensor 10 is such that with proper coolant circulation, arm 19 is pivoted downwardly by a force supplied by diaphragm 12, spring 45 is sufficiently strong so that the downward force on arm 19 applied by the coolant sensor 10 is not sufficient to move the arm against the resistance of the spring. If normal oil pressure is present in the engine, that oil pressure, applied to the cylinder 31 through pipe 41, moves the piston (34 and 35) downwardly until the piston seats against stop 44. This downward movement correspondingly lowers finger 43 releasing arm 19 to be operated by the coolant sensor 10. If, at the same time, the proper coolant circulation is maintained, diaphragm 12 pivots arm 19 downwardly to depress button 23 of switch 24. This opens the switch contacts, deenergizing the signaling indicator 26.

Should there be a failure of proper coolant circulation, the downward force on diaphragm 12 will terminate and arm 19 will no longer have sufficient downward force to keep button 23 depressed. Button 23 will raise (by reason of the normal switch biasing) permitting the contacts of switch 24 to close to signal a malfunction on indicator 26. Similarly, should an oil pressure failure occur, the pressure within the upper portion of the cylinder 31, above the piston, will diminish to an extent such that the piston no longer is urged downwardly against the resistance of spring 45. Spring 45 will move the piston and finger 43 upwardly raising arm 19 and releasing button 23. This will occur even though the proper coolant circulation is maintained and diaphragm 12 continues to be urged downwardly thereby.

Thus, either the coolant detector 10 or the oil detector 27, acting independently, can release button 23 should a failure occur. The continued proper operation of one will have no effect in preventing the other from signaling a malfunction. If finger 43 is releasing arm 19, the operation of switch 24 is under the control of the coolant detector 10. At the same time, the oil detector 27 at any time can take control away from coolant detector 10 as a result of the release of the piston and the raising of finger 43.

I claim:

1. An apparatus for use with an internal combustion engine having a coolant device and a lubricating oil device, said apparatus including: a normally closed elec-

trical switch with a movable member positioned to open said switch when in a first position and permitting said switch to close when in a second position; coolant responsive means operatively connected to the coolant device to be actuated by proper operation of the coolant device; oil responsive means operatively connected to the lubricating oil device to be actuated by proper operation of the lubricating oil device; one of said means being connected to the movable member to urge the movable member from the second to the first position by a force having a predetermined maximum when that one means is actuated by the respective device; and a contactor contacting a side of the movable member, movable with respect to the movable member, and biased to urge said movable member toward the second position by an amount which is more than sufficient to overcome said maximum force; the other of said means being connected to said contactor to move it away from the movable member when actuated by the respective device to free the movable member to be responsive to the one means.

2. In a failure signaling apparatus for an internal combustion engine having a coolant circulating pump and a lubricating oil pump, the improvement comprising: an electrical switch biased to close; a pivotally mounted member positioned to contact said switch and to open said switch when in a given position and to permit said switch to close when away from said given position; coolant flow responsive means operatively connected to the coolant circulating pump to be actuated by normal coolant flow; oil responsive means operatively connected to the oil pump to be actuated by normal oil pressure; one of said means being connected to the member to urge said member toward said given position by a force having a predetermined maximum sufficient to overcome the biasing of the switch when the one means is actuated by normal pump operation; and a device operatively engaging said member and urging said member away from the given position to an extent more than sufficient to overcome the application of said maximum force thereto by said one means; the other of said means being connected to said device to render said device inoperative to overcome the application of said maximum force when said other means is actuated by normal pump operation.

3. In an apparatus as set forth in claim 2, wherein the coolant flow responsive means is said one means and the oil responsive means is said other means.

4. A low oil pressure signaling attachment for use with a water flow detector of the type having an electrical switch which is operated to signal proper water flow by a movable member occupying a given position and to signal improper water flow by the displacement of said movable member in a given direction from said one position, said attachment comprising: an oil pressure responsive means operatively engaging said member to move said member away from said given position when the oil pressure is below a given minimum regardless of the propriety of the water flow, and releasing said member to respond to water flow conditions when the oil pressure is above said given minimum.

5. An attachment as set forth in claim 4, wherein said means includes a finger positioned to contact the side of the member that is rearwardly with respect to said given direction, a spring operatively connected to the finger and urging said finger in the given direction by a force more than sufficient to overcome the operation of the member by the water flow conditions, and a fluid pressure device connected to the finger to move the finger in the reverse of the given direction against the urging of the spring when the oil pressure is above said given minimum to release the member for operation by water flow conditions.

6. A low oil pressure signaling attachment for use with a water flow detector of the type having a normally closed electrical switch and pivotally mounted arm asso-

5

6

ciated therewith with the arm opening the switch to indicate proper water flow conditions when the arm is in a given position and closing the switch by movement in a given direction along a path away from said position, said attachment comprising: a fluid cylinder with a piston movable therein, said piston being movable along a line substantially normal to said arm, said cylinder being positioned in said direction from said arm with one end thereof adjacent said arm, said cylinder having an oil line attachment in the end thereof opposite said one end; a piston rod connected to the piston and extending outwardly from the other end of the cylinder; a spring

about the rod, within the cylinder and urging said piston in said direction; and a finger projecting from the piston rod and into the path of movement of the arm, said finger being at the rearwardly side of the arm with respect to said direction.

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