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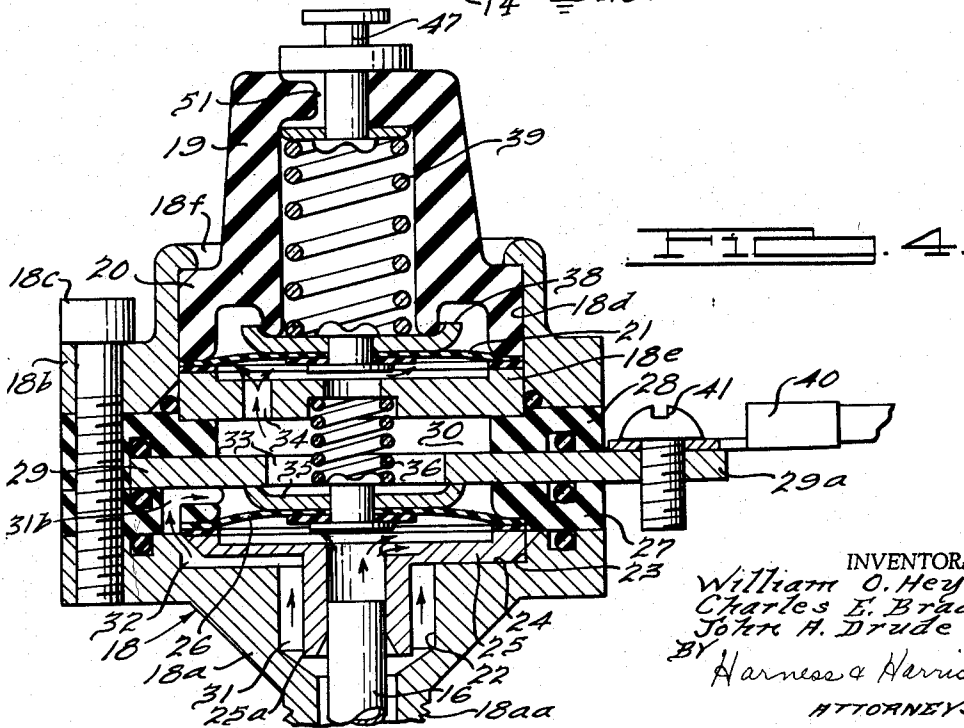
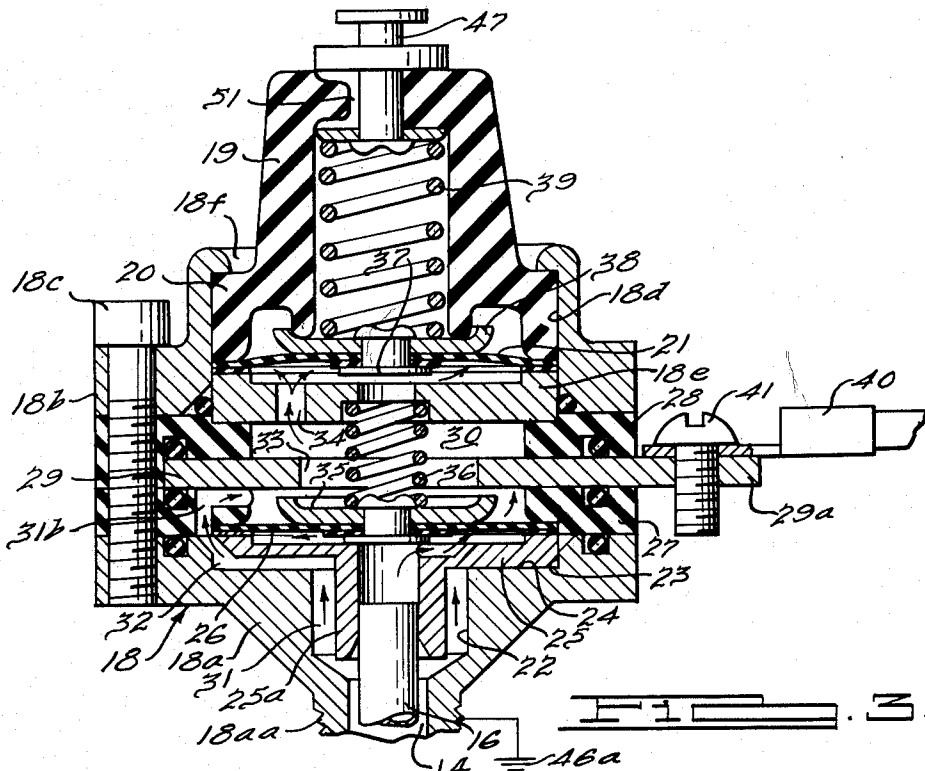
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LUBRICATION WARNING SIGNAL

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LUBRICATION WARNING SIGNAL

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This invention relates to improvements in a warning signal particularly adapted for use with an automobile engine lubricating system wherein a pump forces lubricating oil or fluid through a filter and thence to a distribution gallery which distributes the lubricating oil to the engine parts to be lubricated.

It is customary in such a system to provide signal means responsive to the pump discharge pressure to indicate when the lubricating oil pressure falls below a predetermined safe minimum. However, when the customary filter for the lubricating fluid becomes clogged after prolonged use, no simple means has been available to indicate this condition. The motorist must resort to guesswork to determine when it is necessary to change his oil filter. Inasmuch as the rate of filter clogging varies greatly with driving conditions, it is impossible to state with accuracy that the filter should be changed after a predetermined time interval, or after a predetermined mileage. Accordingly the overcautious motorist tends to change his filter too often and incurs unnecessary expense, whereas the careless motorist tends to allow his filter to become clogged and might drive for several months without filter protection, frequently causing serious engine damage.

An object of the present invention is to provide an improved warning means for a fluid lubricating system comprising signals responsive to both the pressure drop across the filter, to indicate when the filter is clogged, and to the pressure downstream of the filter to indicate when the pump is not developing sufficient fluid pressure for adequate lubrication. A particular advantage of such a signal is that it not only indicates when the filter should be changed, but it also indicates when the lubricating gallery pressure, which is the actual pressure effective for lubricating purposes is inadequate.

Another object is to provide such a signal which is characterized by compactness in design and economy of construction, yet which is particularly efficient and positive in operation and enables the motorist to obtain the optimum service from his oil filter regardless of varying driving conditions.

Another object is to provide such a signal comprising a pair of independently movable pressure actuated diaphragms. One diaphragm is responsive to the lubricating fluid pressure drop across the filter and is associated with electrical switch means in an operative electrical circuit to actuate a warning signal light when the aforesaid pressure drop exceeds a predetermined maximum value, thereby to indicate that the filter is undesirably clogged and should be changed. The other diaphragm is responsive to the gallery pressure and is associated with electrical switch means in said circuit to actuate a warning signal light when the gallery pressure drops below a predetermined allowable minimum value required for adequate lubrication.

Another and more specific object is to provide such a signal means wherein the two diaphragms are spaced to define a pressure chamber therebetween in communication with the gallery pressure. The pump discharge pressure upstream of the filter is conducted to the aforesaid one diaphragm exteriorly of the chamber and in opposition to the gallery pressure within the chamber. Thus the one diaphragm is responsive to the differential in pressures acting thereon from within the chamber and exteriorly there-

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of respectively. The other diaphragm is responsive only to the gallery pressure within the chamber.

The switch means employed with the above structure includes a terminal having an electrical conducting extension which projects into the chamber and is engageable by a movable electrical contact carried by the one diaphragm to close a circuit between the movable contact and extension upon actuation of the aforesaid one diaphragm by means of a pressure differential acting thereon in excess of the predetermined maximum allowable value. An electrical conducting spring support grounded to the engine also extends into the chamber and is electrically connected with said movable contact by means of a biasing spring under compression between the one diaphragm and support, the biasing spring being also located within the chamber and serving to hold the movable contact out of engagement with said extension until the differential in pressure across the one diaphragm exceeds the predetermined maximum value.

The switch means also includes a second movable electrical contact carried by the other diaphragm and urged by means of a second electrical conducting biasing spring into engagement with the support to maintain electrical contact between the latter and second contact until the gallery pressure exceeds a predetermined minimum value adequate for lubricating purposes. The second biasing spring is located exteriorly of said chamber and serves as an electrical connection between the associated parts of the switch means and a second electrical terminal. The two terminals are electrically connected with separate signal lights respectively to selectively illuminate the latter in accordance with closing of the associated parts of the switch means.

By virtue of the foregoing, an unusual compactness of design, economy of construction, and simplicity of assembly are achieved. The use of the more expensive differential area plunger is avoided, by way of example, and a positive make and break between the contacts of the switch means is enabled with a minimum extent of movement to assure rapid responsiveness to pressure changes that cannot be readily obtained by means of a dual-rate spring for example.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

FIGURE 1 is an end elevational view of an automobile engine with parts broken away to illustrate an application of a signal means embodying the present invention.

FIGURE 2 is an enlarged fragmentary view showing a vertical midsection through the signal means in condition to indicate that the lubricating pump is not operating properly.

FIGURE 3 is a view similar to FIGURE 2, illustrating the condition of the signal means when both the lubricating pump and filter are operating satisfactorily.

FIGURE 4 is a view similar to FIGURE 2, illustrating the condition of the signal means when the lubricating pump is operating satisfactorily, but the filter is clogged.

It is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings, a particular embodiment of the present invention is illustrated by way of example in application with an automobile engine 10 having a lubricating pump 11 and filter 12 for lubricating

oil. A conduit 13 connects the discharge side of the pump 11 with the upstream side of filter 12, whereby pressurized lubricating oil is forced through the filter 12 into conduit 14 downstream of filter 12 and thence to a lubricating gallery 15 from which the oil is distributed to the engine parts to be lubricated. The discharge oil pressure from pump 11, at a location upstream of the filter 12, is communicated via duct 16 to a pressure actuated switch assembly 17 of a warning means adapted to be actuated as described below in the event of failure of the lubricating system.

The switch assembly 17 includes a housing portion 18 of electrical conducting material comprising a lower tubular base member 18a having an exteriorly threaded lower extension 18aa screwed into the upper end of conduit 14 in electrical contact with the engine 10. An upper annular member 18b of housing portion 18 is suitably secured to the member 18a and electrically connected therewith by means of a plurality of bolts 18c. The interior cylindrical bore 18d of member 18b contains an electrical conducting spring support 18e pressed securely into position in electrical contact with the member 18b. Also inserted into bore 18d above support 18e is a closure cap 19 of insulating material retained snugly in position by an annular inturned flange 18f of member 18b engaging a lower annular shoulder 20 of cap 19.

A flexible diaphragm or pressure actuated member 21 of insulating material is retained tightly around its periphery between support 18e and the lower annular rim of cap 19 to provide a peripheral fluid seal between these elements. The bore of member 18a enlarges upwardly at 22 and again at 23 to provide an annular platform 24 for an annular electrical conducting support 25 tightly interfitting in electrical contact with the member 18a. A flexible diaphragm 26 is retained tightly around its periphery between support 25 and an overlying gasket 27 of insulating material. A similar annular gasket 28 in cooperation with gasket 27 clamps an inward extension 29 therebetween to provide a fluid pressure chamber 30 between the diaphragms 21 and 26. The extension 29 is of electrical conducting material extending from within the chamber 30 to an outer terminal 29a.

A depending tubular extension 25a of support 25 is connected with the upper end of conduit 16 whereby the aforesaid discharge pressure from pump 11 is communicated to the underside of diaphragm 26. The annular space between extension 25a and enlargement 22 of member 18a comprises a conduit 31 connecting the upper end of conduit 14 with the interior of chamber 30 by means of a conduit 32 formed in portions of support 25 and gasket 27. Openings 33 and 34 in extension 29 and support 18e respectively communicate the pressure of chamber 30 to the underside of diaphragm 21. Inasmuch as conduit 14 is in unrestricted communication with gallery 15, the lubricating oil pressure in gallery 15 is thus communicated to both the upper side of diaphragm 26 and the underside of diaphragm 21.

An electrical conducting movable contact 35, secured to the upper side of diaphragm 26 to move therewith within chamber 30, is shiftable into electrical contact with extension 29 as described below in accordance with actuation of diaphragm 26. A biasing spring 36 under compression between support 18e and contact 35 yieldingly urges the latter downwardly out of contact with extension 29 with a force determined by the maximum allowable pressure differential at opposite sides of diaphragm 26. The contact 35 is suitably secured to diaphragm 26 to prevent fluid leakage thereacross.

An upper movable contact 37 is suitably secured to diaphragm 21 to prevent fluid leakage thereacross and is adapted to move with diaphragm 21 into contact with support 18e in accordance with actuation of diaphragm 21 as described below. Contact 37 is electrically connected with an upper spring retainer 38 of electrical con-

ducting material, which in turn is electrically connected with electrically conducting biasing spring 39. The latter is effective to maintain an electrical connection between contact 37 and support 18e whenever the gallery pressure within chamber 30 falls below a predetermined minimum value required for effective lubricating purposes.

An electrical connection 40 is connected by means of screw 41 with terminal 29a and is also connected with one terminal 42 of a warning signal light 43. The other terminal 44 of signal light 43 is connected through battery 45 to ground at 46. Similarly extension 18aa is connected through the body of engine 10 to ground as indicated at 46a, FIGURE 3. The upper end of spring 39 is electrically connected with terminal 47 which is in turn connected with one terminal 48 of a signal warning light 49. The other terminal 50 of signal light 49 is connected in parallelism with signal light 43 through battery 45 to ground. The interior of cap 19 which contains spring 39 is suitably vented to atmosphere by vent duct 51.

In operation of the device described, when the engine ignition is turned on so as to close switch 52, an electrical circuit containing warning lights 43 and 49 will be set for actuation in response to operation of the lubrication system. If the lubricating pump 11 is not operating, as will be the case prior to starting of engine 10, the gallery pressure in chamber 30 will be negligible and biasing spring 39 will close contact 37 against support 18e, FIG. 2, thereby to establish an electrical circuit from the positive side of battery 45 through warning light 49 to illuminate the latter, terminal 47, spring 39, spring retainer 38, contact 37, support 18e, and thence through housing portion 18b, bolts 18c, and housing portions 18a and 18aa to ground at 46a.

When the engine is started and lubricating pump 11 is operating to force pressurized fluid through filter 12 with sufficient force to maintain more than the minimum predetermined gallery pressure required for lubricating purposes, the gallery pressure within chamber 30 acting on the underside of diaphragm 21 will raise contact 37 upwardly against the force of spring 39, FIGURE 3, so as to break the aforesaid electrical connection with support 18e and de-energize warning light 49.

If at the same time the filter 12 is sufficiently clean so that the pressure drop thereacross is less than the predetermined maximum allowable value, the pump discharge pressure against the underside of diaphragm 26 will be insufficient to raise the latter diaphragm against the force of biasing spring 36 and the gallery pressure in chamber 30. Electrical connection between contact 35 and extension 29 will thus not be made, FIG. 3. In the event that filter 12 should become clogged by prolonged use so as to appreciably increase its resistance to the flow of lubricating oil therethrough, the pressure of the oil downstream of filter 12, that is the gallery pressure, will drop. If this pressure should drop sufficiently while pump 11 is operating so that the pressure differential at opposite sides of diaphragm 26 exceeds the predetermined maximum value determined by spring 36, thereby to indicate that the filter should be changed, the pump discharge pressure action on the underside of diaphragm 26 will urge the latter upwardly against the force of spring 36 and the aforesaid reduced gallery pressure within chamber 30 to establish electrical connection between contact 35 and extension 29. Thus an electrical circuit will be established through signal light 43 and battery 45 via terminals 40 and 29a, extension 29, contact 35, spring 36, support 18e and thence to ground at 46a as aforesaid to illuminate warning light 43, FIG. 4.

If the lubricating pump 11 is operating, the actuation or illumination of signal light 43 may take place even though the gallery pressure in chamber 30 does not drop sufficiently to enable spring 39 to move contact 37 into engagement with support 18e. As illustrated in FIGURE 4, the warning switch mechanism may indicate that the

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filter is objectionably dirty and ineffective long before the gallery pressure drops below the value required for lubricating purposes. Thus the filter 12 may be replaced when necessary and before the engine is damaged by contaminated lubricating oil.

We claim:

1. In a lubricating system for an automobile engine, a filter for lubricating fluid, a pump connected with the upstream side of said filter for pumping pressurized lubricating fluid therethrough, a gallery connected with the downstream side of said filter for distributing filtered lubricating fluid to said engine, a pair of flexible diaphragms spaced to define a chamber therebetween, means for conducting the pressure of said gallery to said chamber for applying said gallery pressure to said diaphragms, means for conducting the discharge pressure of said pump at a location upstream of said filter to one of said diaphragms exteriorly of said chamber to apply said discharge pressure to said one diaphragm in opposition to said gallery pressure within said chamber, said one diaphragm being thereby actuated by the differential in fluid pressures acting thereon from within said chamber and exteriorly thereof, an electrical warning circuit including first and second signal elements, first electrical contact means associated with said one diaphragm and first signal element for actuating the latter when said differential in fluid pressures exceeds a predetermined maximum value, and second electrical contact means associated with the other of said diaphragms and second signal element for actuating the latter when the fluid pressure within said chamber falls below a predetermined minimum value.

2. In a lubricating system for an automobile engine, a filter for lubricating fluid, a pump connected with the upstream side of said filter for pumping pressurized lubricating fluid therethrough, a gallery connected with the downstream side of said filter for distributing filtered lubricating fluid to said engine, a pair of flexible diaphragms spaced to define a chamber therebetween, means for conducting the pressure of said gallery to said chamber for applying said gallery pressure to said diaphragms, means for conducting the discharge pressure of said pump at a location upstream of said filter to one of said diaphragms exteriorly of said chamber to apply said discharge pressure to said one diaphragm in opposition to said gallery pressure within said chamber, said one diaphragm being thereby actuated by the differential in fluid pressures acting thereon from within said chamber and exteriorly thereof, first and second resilient biasing springs associated with said one and the other of said diaphragms respectively for biasing said one diaphragm in opposition to said pump discharge pressure and for biasing said other diaphragm in opposition to said gallery pressure, an electrical warning circuit including first and second signal elements, first electrical contact means associated with said one diaphragm and first signal element for actuating the latter when said differential in fluid pressure exceeds a predetermined maximum value determined by said first biasing spring, and second electrical contact means associated with the other of said diaphragms and second signal element for actuating the latter when the fluid pressure within said chamber falls below a predetermined minimum value determined by said second biasing spring.

3. In a lubricating system for an engine, a filter for lubricating fluid, a pump connected with the upstream side of said filter for pumping pressurized lubricating fluid therethrough, a gallery connected with the downstream side of said filter for distributing filtered lubricating fluid to said engine, pressure actuated means responsive to the differential in fluid pressure across said filter, an electrical warning circuit including a signal element, and electrical contact means associated with said pressure actuated means for actuating said signal element when the differential in said fluid pressure exceeds a predetermined maximum value.

4. In a lubricating system for an engine, a filter for

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lubricating fluid, a pump connected with the upstream side of said filter for pumping pressurized lubricating fluid therethrough, a gallery connected with the downstream side of said filter for distributing filtered lubricating fluid to said engine, a pair of independently movable pressure actuated members responsive to the fluid pressure of said gallery for movement thereby, one of said pressure actuated members being also responsive to the discharge fluid pressure of said pump upstream of said filter for movement thereby in opposition to said gallery pressure, said one member being thereby actuated by the differential in said fluid pressures acting thereon, an electrical warning circuit including a pair of signal elements, electrical contact means associated with said signal elements and members for actuating one of said signal elements when said differential in fluid pressure actuating said one member exceeds a predetermined maximum value and for actuating the other of said signal elements when said gallery pressure actuating the other of said members falls below a predetermined minimum value.

5. In a lubricating system for an engine, a filter for lubricating fluid, a pump connected with the upstream side of said filter for pumping pressurized lubricating fluid therethrough, a gallery connected with the downstream side of said filter for distributing filtered lubricating fluid to said engine, a pair of independently movable pressure actuated members spaced apart to define a pressure chamber therebetween, means connecting said chamber with the fluid pressure of said gallery for applying said pressure to said members, means for conducting the discharge pressure of said pump upstream of said filter to one of said members exteriorly of said chamber to apply said discharge pressure to said one member in opposition to said gallery pressure, said one member being thereby actuated by the differential in said fluid pressures acting thereon from within said chamber and exteriorly thereof, biasing means resisting actuation of said one member with a predetermined maximum biasing force and resisting actuation of the other of said members with a predetermined minimum biasing force, an electrical warning circuit including a pair of signal elements, electrical contact means associated with said signal elements and members for actuating one of said signal elements when the force exerted on said one member by said differential in fluid pressure exceeds said predetermined maximum biasing force and for actuating the other of said signal elements when the force exerted on said other member by said gallery pressure falls below said predetermined minimum biasing force.

6. In a lubricating system according to claim 5, said electrical warning circuit including an electrical conducting housing portion cooperable with said members to define said chamber, said housing portion including a support projecting into said chamber, a fixed electrical conducting extension projecting into said chamber, said extension being electrically connected to one terminal of said one element and being insulated from said housing portion, an electrical conductor within said chamber and movable with said one member into contact with said extension upon actuation of said one member, an electrical conducting spring within said chamber and electrically connecting said conductor and support, a second fixed electrical extension insulated from said housing portion and electrically connected with one terminal of said other element, a second electrical conductor within said chamber and movable with said other member into contact with said support upon actuation of said other member, a second spring electrically connecting said second extension and second conductor, said springs comprising said biasing means, said housing portion being electrically connected with a second terminal of each of said elements for selectively completing a closed electrical circuit through either of said elements upon actuation of the associated member.

No references cited.