An alarm device for oil filters responsive to the water sediment level in the filter includes a pair of electrodes which are short-circuited when the sediment reaches a predetermined level. Short-circuiting of the electrodes energizes an alarm circuit which includes an amplifier connected to the electrodes and a relay coil connected to the output of the amplifier. First and second pairs of switching contacts controlled by the relay coil complete a circuit between the amplifier and coil and a source in the normal, unactuated states thereof. These contacts, when actuated responsive to energization of the relay coil, complete a circuit to an indicating device and to a reset switch and break the circuit between the coil and amplifier. Opening of the reset switch de-actuates the switching contacts.

2 Claims, 2 Drawing Figures
ELECTRICAL ALARM DEVICE FOR OIL FILTERS RESPONSIVE TO WATER SEDIMENT LEVEL

FIELD OF THE INVENTION

This invention relates to an alarm device for oil filters, which produces an alarm signal when the water sediment in the oil filter has increased to a certain volume.

BACKGROUND OF THE INVENTION

In the engine of an automobile, for example, a lubricating oil containing water will not lubricate satisfactorily. There must be no water in the lubricating oil or trouble may occur in varied form in the engine, and therefore a means of removing water from the oil must be provided. Such a means of water removal generally utilizes the difference in specific gravity between water and oil. For instance, separation of water from the lubricating oil in recirculation can be effected in the oil filter, wherein water is allowed to settle down by sedimentation to the bottom of the filter from the passing oil. The filter must be drained to remove the water sediment before or when it has increased to a certain volume within the filter. For the device to function as an alarm, the water sediment in the oil filter must be used to form an electric circuit which can detect the increase of water sediment in the oil filter to provide an alarm.

SUMMARY OF THE INVENTION

This invention purports to eliminate the drawbacks of the conventional alarm device. The object of this invention is to provide an improved water sediment alarm device whose operation is substantially free from electrolytic decompensation. How the object is accomplished by this invention will be made clear by way of describing an embodiment thereof illustrated in the attached drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a diagrammatic cross section of the oil filter and FIG. 2 shows a circuit of an embodiment of this invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

FIG. 1 shows a cross section of an oil filter, wherein 1 is a filter lid, 2 is a cylinder serving as a side wall, 3 is a dished bottom or bowl and 4 is a metallic shaft. The lid 1 is made of a metal and has an oil inlet opening 6. An electrical terminal 12 is insulated carried by the lid 1 and extends through the lid. The cylinder 2 is made of such material as glass, whereas a material of the bowl 3 is generally a metal. The shaft 4 is centrally positioned and extends through the lid 1 and the bowl 3 at their respective centers. The top and bottom portions of the shaft 4 are so shaped as to provide an oil outlet hole 7 and a water sediment drain hole 8, respectively. The shaft 4 carries an insulator support 9 at its intermediate portion; an annual electrode 10 is mounted on this support 9. By a terminal 11 extending from the electrode 10 and by a lead wire 13 connected between a terminal 12 and the terminal 11, the annual electrode 10 is electrically connected to the terminal 12 and the lid 1 is grounded at 14. 5 is an oil baffle shaped like an inverted dish and mounted on the shaft 4 to bear against the underside of the lid 1.

In the oil filter so constructed, lubricating oil enters the filter through the inlet opening 6 and impinges on the oil baffle 5 to be splashed away against the wall of the cylinder 2. The oil within the filter flows out through the outlet hole 7 formed in the top portion of the shaft 4. Out of the oil in motion and from the inlet to the outlet, water, if any, separates and falls to the bottom because the specific gravity of water is higher than that of the oil. The falling water accumulates in the bowl 3 as water sediment 15. The surface of the sediment accumulating in the bowl is indicated at 16. As the volume of the sediment increases, the surface 16 will touch the electrode 10. When this occurs, a closed circuit comes into being through the ground 14, the lid 1, the shaft 4 which constitutes an electrode, the water sediment 15 and the electrode 10, to light up the indicating lamp.

The circuit for lighting the indicating lamp is diagrammatically shown in FIG. 2, wherein L is an indicating lamp, which is connected across a battery B between its positive and negative terminals through a stationary contact point a and a movable contact point c of a switch RS, R, is a relay coil, whose one end is connected to the negative terminal of the battery B and the other end to the movable contact point c of the switch RS. When de-energized, the relay coil R in the circuit, acts upon the switches RS and RS, the switch point a of the switch RS is connected to the positive terminal of the battery B through the resetting switch SW, and the other stationary contact point a is connected to the positive terminal of the battery B through the emitter-collector circuit of the transistor T, and two contact points a and c and the switch RS. The base of the transistor T is connected to the terminal 12 shown in FIG. 1. This terminal 12 becomes connected to the ground 14 when the water sediment 15 increases to raise its surface 16 to the level mentioned above. The water sediment 15 is represented in FIG. 2 by R. The battery B has its negative terminal grounded, so that the circuit as a whole is a negative ground system. C is a capacitor parallelled to the relay coil R. When the amount of the water sediment 15 increases substantially below the electrode 10, resistance R decreases the value of the resistance R decreases drastically (to the order of one kilohm, for example) to cause a current to flow through the contact points c and a, the emitter and base of the transistor T, and the resistance R. By this current, the transistor T becomes conductive, the resultant current flows through the contact points a and b, the emitter and the collector of the transistor T, the contact points a and c, and the relay coil R. Thus, the relay coil R, now energized, actuates the switches RS and RS, to make the point c and contact point b in the switch RS, and the point c and contact b in the switch RS. These switching actions are sequential: the point c separates from the point a, and then the point c separates from the point a. The moment the point c separates from the point a, the relay coil R, would become de-energized to move the points c and c to move back again into contact with the points a, and respectively, were it not for the presence of the capacitor C paralleling the relay coil R. Stated specifically, when the relay coil R becomes energized by the current established through the emitter-collector circuit of the transistor T, as mentioned above, time capacitor C becomes charged at the same above, and, just as the energized relay coil actuates the switches RS and RS to interrupt the energizing current, the capacitor C discharges to a low relay coil R energized just long enough to allow the points c, c and e to move over to the points b and b, respectively. With the point c brought into contact with the point b in the switch RS, the relay coil R draws an energizing current through the switch SW. With the point c brought into contact with the point b, a current flows in the circuit of the lamp L to make the lamp burn, thereby issuing a visual alarm. This condition
of the lamp L burning and the relay coil R energized persists until resetting the switch S is opened. It must be noted that, except for the brief initial duration in which the base current flows, the water sediment or the resistance R remains free from current at all times, and that, even when the lamp L is burning as above, no current flows in the water sediment because the point C is then off the point r.

It will be noted in the foregoing description that the device according to this invention performs the alarm issuing acting accurately and positively whenever the water sediment increases to the predetermined volume, and that the electrolytic action inherent in the conventional method is practically avoided in the present instance because it is during the short period of initiating the relay action that a current flows in the water sediment.

It will be understood that this invention is not limited to the embodiment thereof described above and illustrated in the attached drawing, but is susceptible to varied modification. For instance, the transistor T may be replaced by any other proper amplifying element, the relay coil R with its switches may be replaced by any other proper switching means, and the indicating lamp L may be supplanted by an other proper indicating means of known type. Resetting the switch S may be linked with the drain valve 17 in such a way that operating this switch to reset the system will open the valve 17 to drain out the water sediment.

What is claimed is:
1. An alarm device for water sediment in an oil filter comprising, a pair of electrodes extending within the oil filter so as to be short-circuited when the water sediment accumulated in the oil filter reaches a predetermined level, and an electrical indicating circuit comprising an amplifier having an input connected to one of said electrodes, a relay coil normally connected to the output of said amplifier and energized when the water sediment reaches said predetermined level, an electrical indicating means, a first pair of switching contacts actuated responsive to the energization of said relay coil for, in the first, unactuated state thereof, connecting the output of said amplifier to said relay coil, and for, in the second, actuated state thereof, opening the connection between the output of said amplifier and said relay coil, a second pair of switching contacts actuated responsive to the energization of said relay coil for, in the first, unactuated state thereof, completing a circuit between said amplifier and an electrical energy source, and for, in the second, actuated state thereof, completing a circuit between said indicating means and the source, and a reset switch for, when opened, de-energizing said coil, said first pair of switching contacts in the second, actuated state thereof completing a circuit between said reset switch and the source.
2. In combination an oil filter and an alarm device for water sediment in the oil filter, said oil filter comprising an electrically conductive lid, a bowl, a cylinder between said lid and said bowl, and a metallic shaft mounted on the center-line of said lid, cylinder and bowl, and said alarm device comprising electrode means insulatingly mounted on said shaft spaced from the bottom of said bowl and an electrical indicating circuit comprising an amplifier having an input connected to said electrode means, a relay coil normally connected to the output of said amplifier, an electrical indicating means, first and second pairs of switching contacts actuated responsive to the energization of said relay coil for, in the first, unactuated state thereof, connecting the output of said amplifier to said relay coil and completing a circuit between said amplifier and an electrical energy source and for, in the second, actuated state thereof, opening the connection between the output of said amplifier and said relay coil, and completing a circuit between said indicating means and the source, and a reset switch for, when opened, de-energizing said coil, one of said pairs of switching contacts in the second, actuated state thereof completing a circuit between said reset switch and the source.