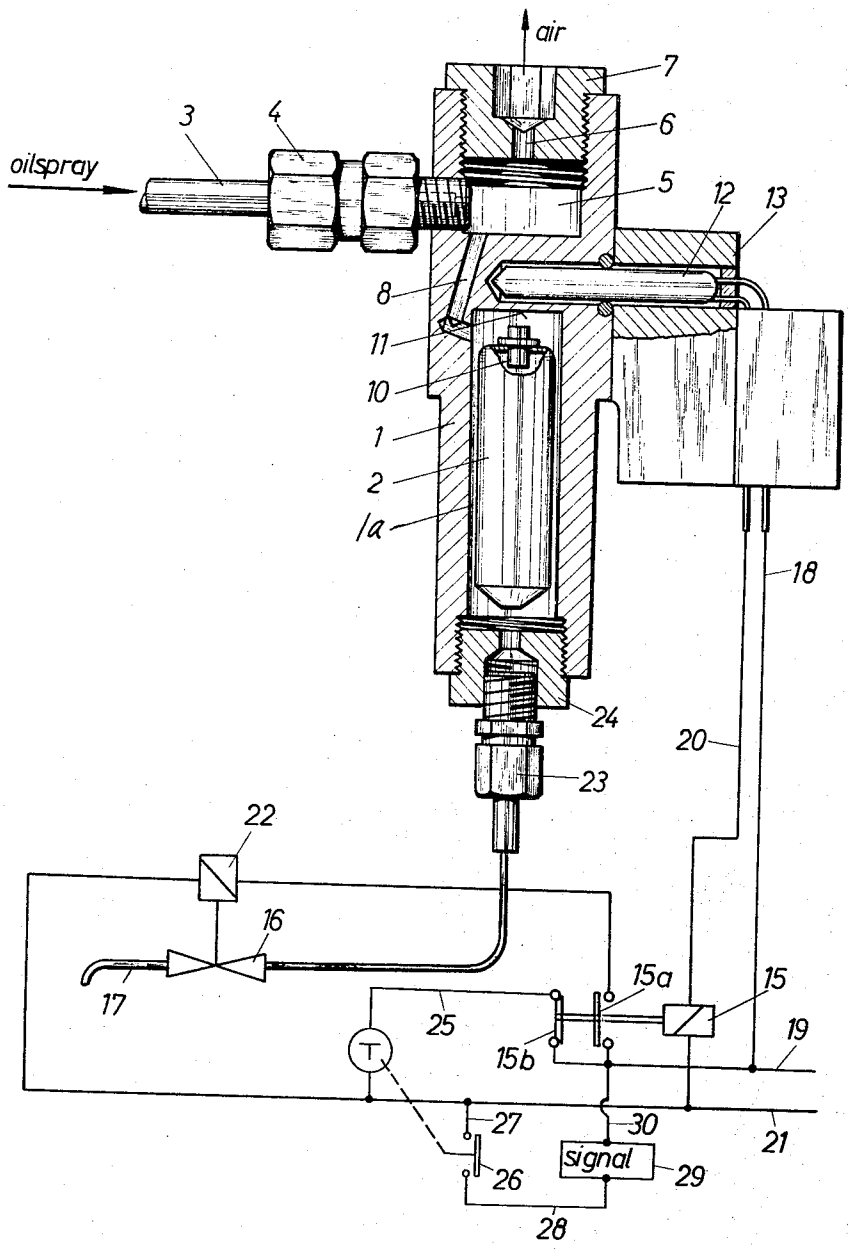
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WARNING DEVICE FOR OIL SPRAY LUBRICATION APPARATUS

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WARNING DEVICE FOR OIL SPRAY LUBRICATION APPARATUS

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ABSTRACT OF THE DISCLOSURE

The invention is a warning device to indicate when the supply of aerosol lubricant to a part drops below an adequate amount, and comprises a sampling chamber in communication with the lubricant supply line, the chamber being provided with a float carrying on its top a switch actuating means operative to actuate a switch adjacent the top of the chamber, the switch operative to control opening and closing of a drain valve for the chamber upon activation and deactivation, respectively, by the switch actuating means moving up and down with the level of liquid in the chamber, and a warning device operative to provide a signal upon failure of the chamber to refill with actuation of the switch within a given time after closing of the drain valve, the result being that so long as the proper amount of lubricant is being supplied within the required time, the chamber will be intermittently drained and refilled without a warning signal, but if the chamber is not refilled in the required time due to an inadequate supply of lubricant in the supply line a warning signal will be given.

The present invention relates to a warning device for aersosol systems to indicate when less than the required amount of liquid in the aerosol is being transferred per unit of time through a conduit. The invention is illustrated herein by its application to an aerosol lubricating system in which the liquid in the aerosol is oil and the aerosol is used to lubricate an operating unit, such as, a plurality of compressed air operated devices on one line. The invention is not limited to this application as it can be used with any aerosol system as a warning device.

In systems wherein operating units are being lubricated with aerosols in which oil is the liquid, it is essential to insure that a sufficient amount of oil is supplied to the remotest operatng units, such as, those at the end of the line. Prior art warning devices to indicate whether or not the operating units are receiving the required amount of lubrication, such as, pressure sensing devices, are not satisfactory because they indicate only pressure in the aerosol line and there is no correlation between pressure and the percentage of oil in the aerosol so that they do not give any indication of the amount of lubricant ultimately supplied to the operating units unless the percentage of oil in the aerosol is maintained constant at all times.

Accordingly, it is the principal object of the present invention to provide a warning device for aerosol supply systems which provides a reliable indication of when a deficient amount of liquid in the aerosol is being supplied to an end location, such as, an operating unit.

The present invention will now be described in connection with its application as a warning device for aerosol systems supplying oil in an aerosol through a supply pipe or conduit to operating units.

The warning device of the invention comprises a housing including a chamber connected through a reclassifier to the aerosol supply conduit, the chamber being provided with a drain valve at its lower end and containing a float adapted by its movement with changes in the level of the liquid in the chamber to close and open a switch controlling electrical circuit means for opening and closing the drain valve. The circuit controlled by the switch includes a relay which controls an electrical circuit for opening and closing the valve. The relay also controls a circuit including a timing device so that when the relay actuates the valve control circuit to close the valve it also actuates the circuit including the timing device to start the operation of this device. The timing device is operatively connected to a normally open switch in a circuit including a warning device so that this warning circuit will be closed within the time interval set into the timing device. This time interval is greater than that required for normal refilling of the chamber after closing of the drain valve. The timing device is automatically reset to zero each time the relay actuates the circuit to open the drain valve. The timing device in the warning circuit can be constructed and arranged so that the time interval within which the warning signal operates includes a plurality of intervals for the chamber to drain and refill.

It can be seen from the above description that if the chamber does not refill after draining within the time interval set into the timing device, the timing device will be actuated. The time interval required to refill the chamber after draining will of course depend upon the size of the reclassifier, the service pressure of the aerosol, and the percentage of oil in the aerosol. The size of the reclassifier is, of course, constant so that a variation in either the pressure or the percentage of oil in the aerosol, with consequent deficient supply of oil to the operating parts, will result in failure of the chamber to be filled within the set time, with consequent actuation of the warning signal. The warning device operates to provide a warning when an inadequate supply of oil is being furnished to the operating unit whether this is due to a drop in aerosol pressure or a drop in the percentage of oil in the aerosol, or both.

The accompanying drawing shows a sectional view of an embodiment, by way of example, of the warning device according to the present invention.

Referring now to the drawing in detail, the apparatus shown therein comprises a housing **1** with a bore **1***a* having movably mounted therein a float **2**. The upper end of bore **1***a* communicates through a passage **8** with a collecting chamber **5** the upper end of which is closed by a plug **7** having a venting passage **6** therein. Threadedly connected to housing **1** and leading into the collecting chamber **5** is a reclassifier **4** which is connected to an oil spray conveying line **3**. The reclassifier **4** is of conventional construction and its purpose is to effect separation of oil from the air so that the oil will settle in collecting chamber **5** and the air escape through air escape channel **6** in plug **7**. The reclassifier **4** is of conventional type wherein the aerosol is passed through a long small diameter chamber at high velocity so that the oil collects in large droplets too large for the airstream to carry and falls down into the collecting chamber.

Float **2** is provided at its upper end with a permanent magnet **10** so that movement of the upwardly float **2** brings it into contact with an abutment or upper end face of bore **1***a*.

In spaced relationship to and above float **2** there is provided a switch **12** in a control circuit for the drain valve, for instance an inert gas type contact means or so-called well known proximity switch **12** extending into housing **1** and is supported by a holding member **13**. The said proximity switch has connected thereto an electrical conductor **18** leading to a main line **19** connected to an electrical current supply source, while another conductor **20** connected to proximity switch **12** leads to one terminal of a relay **15** the other terminal of which is connected to the other main line **21** leading to

an electrical current supply source. Relay **15** has a pivoted control blade **15***a* associted therewith which, in response to the energization of relay **15**, closes a circuit through a relay **22** which in turn controls a two-way valve **16** interposed in drain conduit **17**. The arrangement is such that energization of relay **22** causes valve **16** to open for draining lubricant from chamber **1***a*, whereas deenergization of relay **22** causes valve **16** to close. Conduit **17** is connected by means of a nipple **23** and nut **24** to the float containing bore **1***a*.

In accordance with the present invention, relay **15** has associated with it a blade **156** which, in response to the deenergization of relay **15** closes a circuit comprising a conductor **25** having arranged therein a timer T. Timer T is operatively connected to a blade **26** adapted when the timer has run for the period it has been set, to close a circuit through lines **21**, **27**, blade **26**, line **28**, a signal device **29**, line **30** and line **19**.

Operation

The apparatus according to the present invention operates in the following manner. Oil spray in the form of an aerosol is conveyed from the main lubricating line through reclassifier **4** where oil is separated from air and settles into collecting chamber **5**, the air in the spray being vented into the atmosphere through passage **6**. From collecting chamber **5**, the oil passes through passage **8** into bore **1***a* and gradually with the filling of bore **1***a* raises float **2** until the permanent magnet **10** engages the abutment surface **11**. When this occurs, the proximity switch **12** closes and thereby closes the energizing circuit for relay **15**. As a result thereof, blade **15***a* closes the energizing circuit for relay **22** which in turn causes valve **16** to open. As a result thereof, oil from bore **1***a* passes through conduit **17** to partially drain chamber **1***a*. Simultaneously with the closure of blade **15***a* in view of the energization of relay **15**, blade **15***b* interrupts the circuit through line **25** and timer T so that the timer T is deenerized and resets itself to its zero or starting position, and the timer T can start running again only after the circuit through timer T has been closed again. In view of the draining of oil from bore **1***a*, float **2** with permanent magnet **10** will move away from abutment **11** so that after float **2** has moved downwardly by a certain distance, proximity switch **12** will open. This, in turn, interrupts the energizing circuit for relay **15** so that blade **15***a* opens and blade **15***b* occupies its closing position to start the operation of the timer. Opening of blade **15***a* causes deenergization of relay **22**. As a result thereof, valve **16** closes and no further lubricant is drained through conduit **17**. Consequently, oil passing from collecting chamber **5** into bore **1***a* again begins to fill the latter and to raise float **2**, and the cycle described above repeats itself. In this way, lubricant is drained through line **17** at certain intervals provided that oil is continuously furnished into collecting chamber **5** in the required amount per unit time. The number of the intervals over a certain time unit depends on the size of the reclassifier, the pressure of the oil spray ahead of the control device and the percentage of oil in the aerosol.

Timer T together with blade **26**, signalling device **29** and the associated circuitry forms the warning device proper according to the present invention. Timer T is set to run for an interval I′ which is, of course, greater than the interval I required under normal conditions for refilling of the chamber after the valve **16** is closed.

From the above it will be evident that as long as the lubricating system functions properly and the required amount of oil per unit time is being supply to chamber **5**, relay **15** will be energized at intervals I after valve **16** is closed which are shorter than the intervals I′ for which the timer has been set, so that under these conditons, the timer circuit will be interrupted before the timer can initiate a signal. If, however, due to failure of the collector chamber to receive a sufficient amount of oil from the line, or for any other reasons, the float **2** with its permanent magnet **10** is not moved to close the proximity switch at intervals I, and thus the relay **15** is not activated to close relay **22** and set the timer back to zero during the interval I, the timer circuit will through blade **15***b* remain closed for the time interval I′ for which it has been set, and at the end of said time interval I′, blade **26** will close the circuit to activate the signal device **29** thereby indicating to the operator that the lubricant system is working faultily.

Of course, if the drain time is practically insignificant the interval "I" can be considered as including both the drain and the refill time.

It is, of course, to be understood that the present invention is, by no means limited to the particular construction shown in the drawing, but also comprises any modifications within the scope of the appended claims. The term "aerosol" as used herein includes a suspension of other type liquids than oil in other type gases than air. The term "drain" when used herein in any form as a verb means partial or complete draining.

What I claim is:

1. A warning apparatus for lubricating systems employing a lubricant aerosol comprising, a housing having a lubricant receiving chamber, means between an aerosol source and said chamber for separating the gas and liquid components of said aerosol before said liquid reaches said chamber, float means movably arranged in said chamber and adapted to float on lubricant therein, switch actuating means carried by said float means; means for conveying lubricant from a lubricant aerosol supply line to said chamber, conduit means connected to said chamber for draining lubricant from said chamber, valve means in said conduit means for controlling the flow of fluid therethrough, electrical control means operatively connected to said valve means for controlling its operation, proximity switch means arranged in the proximity of said chamber responsive to one location of said switch actuating means to close and thereby actuate said electrical control means to open said valve means and responsive to another location of said switch actuating means to open and thereby cause said electrical control means to close said valve means, warning means operative to provide a warning signal upon lapse of a selected time interval for movement of said switch actuating means out of and back into said one location and timing means actuated upon said electrical control means closing said valve means, operative upon operation for said selected time interval to actuate said warning means and operative to reset to its starting position upon said electrical control means opening said valve means within said selected time interval; whereby said warning means will give an alarm only upon failure of said lubricating system to supply the required amount of lubricant to said chamber within said selected time interval.

2. In a warning apparatus for lubricating systems employing a lubricating aerosol: a housing having a lubricant receiving chamber, means for conveying lubricant to said chamber from an aerosol lubricant supply line, reclassifier means between said supply line and said chamber for separating the gas and liquid components of said aerosol, float means movable in said chamber adapted to float on lubricants therein, conduit means connected to said chamber for draining it, valve means in said conduit for controlling the flow of lubricant therethrough, first electrical circuit means including switch means and relay means, said switch means operative in response to a first location of said float means to close and thereby effect energization of said relay means and operative in response to another location of said float means to open and thereby effect deenergization of said relay means, electrical actuating means operatively connected to said valve means and operable in response to the energization and deenergization and deenergization of said relay means to effect opening and closing, respectively, of said valve means, second electrical circuit means operative to be opened and closed, respectively, in response to the energization

and deenergization of said relay means, said second electrical circuit means including timing means actuated by the closing of said second electrical circuit means, and third electrical circuit means arranged in parallel with said second electrical circuit means including normally open switch means operatively connected to said timing means to be closed thereby upon the operation of said timing means for a set period, said third electrical circuit means also including signaling means operable to give a signal in response to the closing of said normally open switch means; said timing means operable to reset to its starting position upon opening, of said second electrical circuit means within said set period; whereby said signaling means will give an alarm only upon failure of said lubricating system to supply to required amount of lubricant to said chamber within the set period.

3. A warning apparatus for an aerosol supply system to indicate a deficient supplying of liquid in the aerosol from an aerosol source to an end location, comprising: a fluid chamber in communication with said aerosol source; means between said aerosol source and said fluid chamber for separating the gas and liquid components of said aerosol; outlet means for said fluid chamber including valve means; switch means; electrical circuit means responsive to closing and opening of said switch means to open and close said valve means, respectively; switch actuating means for actuating said switch means responsive to a given amount of fluid in said fluid chamber to close said switch means and responsive upon decrease of said amount to open said switch means; and signal means associated with said electrical circuit means operative to provide a warning signal upon failure of said amount of fluid to be restored from said aerosol supply to said fluid chamber within a set time, said signal means including timing means actuated upon opening of said switch means to close said valve means and operative to actuate said signal means upon operation for said set time and to reset to its starting position upon closing of said switch means to open said valve means within said set

time; whereby said signal means will give an alarm only upon failure of said aerosol source to supply the required amount of lubricant to said chamber within said set time.

4. A warning device for liquid supply system to indicate a deficient supplying of liquid from a source to an end location, comprising: a housing having a fluid chamber therein; communicating means between said liquid source and said chamber; drain means for said fluid chamber; control means for said drain means responsive to the liquid level in said fluid chamber to open said drain means at one level of said liquid and close it at a lower level of said liquid; and warning means associated with said control means for providing a warning upon failure of of said control means to open said drain means with a given time; and timing means actuated upon said control means closing said drain means and operative upon operation for said given time to actuate said warning means and operative to reset to its starting position upon said control means opening said drain means within said given time; whereby said warning means will give an alarm only upon failure of said source to supply the required amount of liquid to said chamber within said given time.

5. The warning device of claim 4 wherein said liquid is in an aerosol and including means for separating the liquid and gas components of said aerosol before said liquid reaches said chamber.

References Cited

UNITED STATES PATENTS

2,435,343	2/1948	Downey	184—1 X
2,508,132	5/1950	Aikman	137—195
2,510,049	5/1950	Neeson	55—219 X
3,216,434	11/1965	Lovendahl	137—551 X
3,246,757	4/1966	Martin	73—308 X

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