Dec. 27, 1960 F. J. RAYFIELD, JR 2,966,295

LOW OIL LEVEL CONTROL

Filed Oct. 11, 1956 2 Sheets-Sheet 1

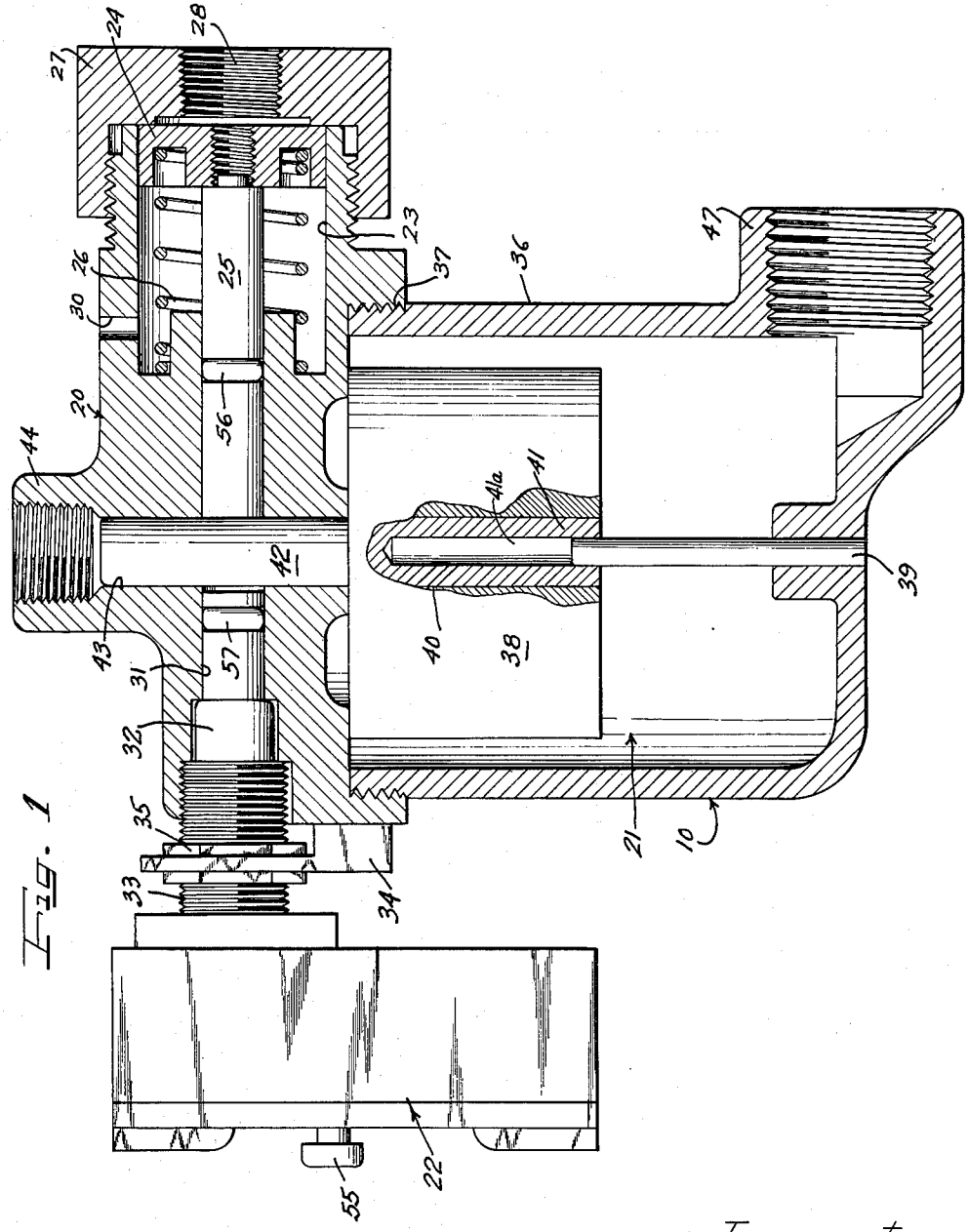


Fig. 1

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Filed Oct. 11, 1956 2 Sheets-Sheet 2

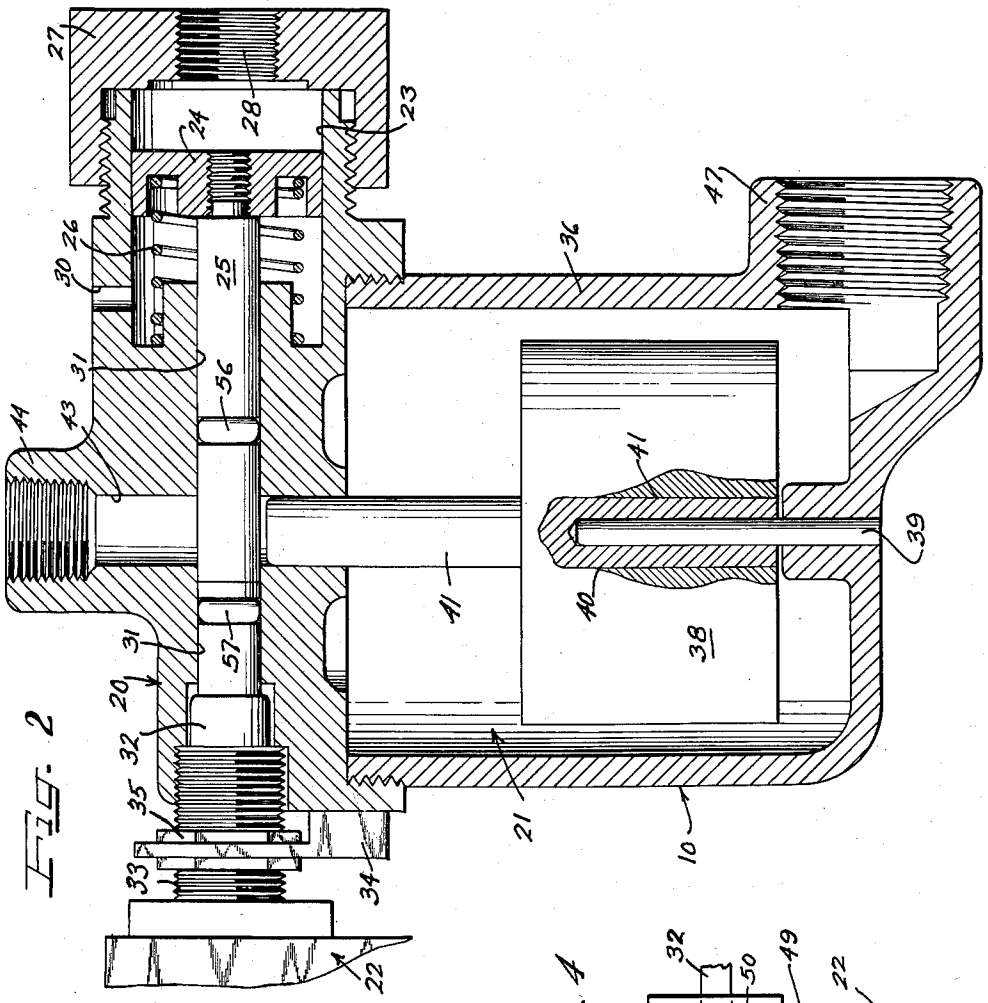


Fig. 2

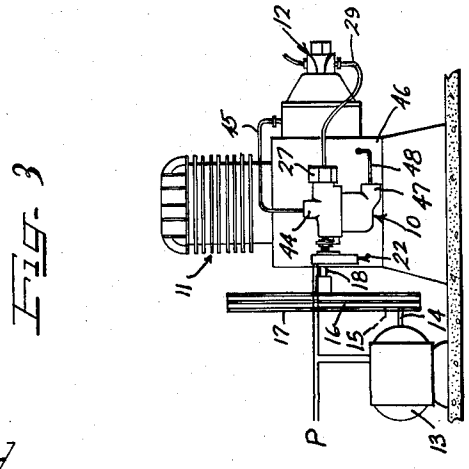


Fig. 3

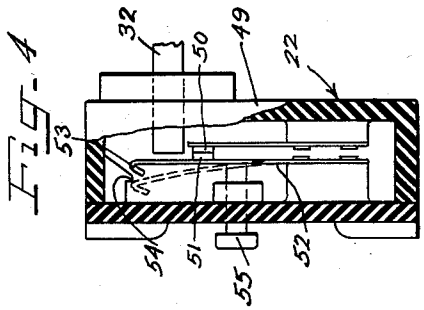


Fig. 4

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LOW OIL LEVEL CONTROL

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13 Claims. (Cl. 230—18)

This invention relates generally to a fluid level controlled device.

More specifically, this invention relates to a safety device in association with an air compressor machine and the like such that when the oil level in the crank case of the machine falls below a predetermined level, the electric power circuit for the machine is broken and the operation of the air compressor machine is ceased. This invention also relates to a method of venting an air compressor machine and utilizing the air moving to the vent to shut off the air compressor when the oil falls below a desired level.

The illustrated form of fluid level controlled device comprises an attachment which readily lends itself to being installed upon new or already installed air compressor machines and the like with a minimum effort and which serves as a relatively inexpensive means for protecting the air compressor by shutting off the electrical power when the lubricant supply therefor falls below a predetermined minimum level.

Accordingly, an object of this invention is to provide a new and improved fluid level controlled protective device.

Another object of this invention is to provide an oil level controlled device for an air compressor machine and the like which may be readily installed with a new air compressor or one already in use.

A further object of this invention is to provide means for an air compressor and the like which not only detects when the air compressor is being improperly lubricated, but in addition, prevents further operation by breaking the electrical circuit upon discovery of the inadequate lubrication.

Still another object of this invention is to provide a fluid level controlled device which lends itself to being economically manufactured on a large production scale.

According to the general features of this invention there is provided a method of operating an air compressor having an energizing circuit and shutting down the air compressor when improperly lubricated. The method includes the steps of passing an electrical current through the circuit and thereby operating the air compressor machine, controlling the flow of pressurized air from the air compressor machine in the exhaust cycle of the air compressor when the oil in the machine falls below a selected level, and utilizing the air thus controlled to open the energizing circuit thereby interrupting the movement of electrical current through the circuit shutting down the air compressor machine.

Other features of the present invention relates to the provision of a fluid level controlled device for association with an air compressor machine and the like comprising a housing having a cylinder therein, a reciprocal piston and piston rod in the cylinder actuated by pressurized air directed against the piston, the cylinder having

a vent through which the pressurized air may be vented, a switch actuating lever movable by the piston, and the device having means responsive to variations in fluid level so that when the fluid level is satisfactory the piston rod is prevented from moving the lever to open the switch and responsive when the fluid level is unsatisfactory to permit the piston rod to move the lever and open the switch.

Other objects and features of this invention will more fully become apparent in view of the detailed description taken in conjunction with the accompanying sheets of drawings illustrating therein a single embodiment and in which:

Figure 1 is an enlarged fragmentary cross-sectional view with parts shown in elevation showing my fluid level control device with a float positioned to show its position when the oil level is above the minimum desired level;

Figure 2 is an enlarged fragmentary cross-sectional view similar to Figure 1 only showing the operation of my fluid level controlled device and with its float positioned to show its position after the oil level has dropped below the minimum desired level;

Figure 3 is a diagrammatic view of an air compressor machine installation having the fluid control device in assembly therewith; and

Figure 4 is a schematic cross-sectional detail view of the switch showing in full and dotted lines how the switch is operated.

As shown on the drawings:

The reference numeral **10** indicates generally my fluid level controlled device which is shown in Figure 3 mounted on a conventional air compressor machine **11**. Disposed at one end of the air compressor machine **11** is a conventional centrifugal unloader valve **12** which valve is disposed upon most of the machines in the 3/4 to 20 H.P. range. This conventional valve may be operated by a fly ball arrangement and its purpose is to unload the pressurized air within the cylinders and air coolers up to the check valve, at the end of each pumping cycle or during the compressing cycle, so that at the beginning of a subsequent pumping cycle, the compressor is not required to start against pressure. It is this unloaded air which is the motive power for the operation of the fluid level control device as will be hereafter discussed in detail.

A typical centrifugal type compressor unloader valve will be found in the LeValley Patent 1,899,002.

Associated with the air compressor machine is a motor **13** having a drive shaft **14** upon which is carried a stepped pulley **15**. The pulley **15** carries an endless pulley belt **16** which is supported at its other end by another stepped pulley **17**. The pulley **17** is carried on crank shaft **18** which is in guiding connection through a connecting rod (not shown) with a piston (not shown) for reciprocating the piston in the compression chamber of the air compressor **11**.

The device **10** has a valve body **20** which supports a float chamber **21** and a switch **22**. The motor, switch and electrical power are linked by suitable electrical wires (Figure 3). Within the valve body **20** is a cylinder **23** with a piston **24** reciprocal within the cylinder **23**. The piston **24** is connected at one end to a piston rod **25**. The piston **24** and the piston rod **25** are normally held in the position shown in Figure 1 by a spring **26** mounted within the cylinder **23** closely adjacent one end of the cylinder. Overlying the piston **24** and the valve body **20** is a cap **27** which is in threaded engagement with the valve body.

The cap 27 has a central passageway 28. The passageway 28 is connected to the centrifugal unloader valve 12 by means of a connecting line 29 (Fig. 3). As soon as the compressor 11 starts, the fly ball weights of the unloader valve 12, as shown in the LeValley patent (supra) move out allowing this valve to close. The tube 29 connecting the cylinder to the unloader valve 12 remains pressurized throughout the pumping cycle. When the pressure in the air storage tank reaches the cut-out point the engine or motor stops and the compressor ceases to rotate. The fly ball weights of the unloader valve 12 are no longer able to maintain the unloader valve closed and the unloader valve opens allowing the pressurized air on top of the cylinder and in the piping to the tank to be exhausted through the unloader valve 12 to the atmosphere. Thus when the centrifugal unloader valve is discharging, the air is caused to be moved through the connecting line 29, and the passageway 28 against the piston 24. Due to the fact that the piston 24 is loosely disposed within the cylinder bore, the pressurized air is permitted to escape at the perimeter of the piston and out through vent 30 at the other end of the cylinder 23.

Extending transversely or horizontally through the valve body 20 is a passageway 31 in which the piston rod is lodged. Opposite the piston rod 25 and also movable in the passageway 31 is a plunger 32. As will be noted in Figure 2, in one stage of operation of the device 10, the pressurized air moving into the cylinder causes the piston 24 and piston rod 25 to move in an opposite direction away from the cylinder 23 and with the piston rod 25 engaging the plunger 32 to open the switch 22.

A tubular extension 33 is provided which is threaded at its outer periphery and is in threaded engagement with the switch 22 at one end and with the valve body 20 generally at the passageway 31 at the other end. To further support the switch 22 on the valve body, a depending arm 34 is carried on the valve body 20. The arm 34 is provided with a threaded opening 35 and the tube 33 is threaded through the thread opening 35 and thereby provides an additional support for the switch 22.

Below the valve body 20 is located the float chamber 21 which is defined by float housing 36 in threaded assembly at 37 with the valve body 20. Within the chamber 21 is an oil level indicator in the form of a float 38 which is supported upon a stem 39 permanently fixed at the bottom of the housing 36. The float 38 has a central passageway 40 into which extends a vertical extension or stem 41 in interlocked assembly.

The extension 41 has a central passageway 41*a* into which the stem 39 extends and the stem acts as a guide in the movement of the float 38 up and down in response to variations of fluid in the chamber 21. It will be appreciated the extension 41 extends out and above the float 38 and into a vertical passageway 43 in the valve body 20.

The passageway 43 leads to a nipple 44 which is in threaded connection with a connecting line 45 (Fig. 3). The connecting line 45 extends at its other end to the crank case 46 (Fig. 3) and acts as a vent. The lower housing 36 has a threaded nipple 47 connected to a connecting line 48 (Fig. 3) which connecting line is connected at its other end to the crank case. Thus, the oil flows from the crank case into the chamber 21 and is disposed in the chamber 21 at the same level that it is disposed in the crank case 46.

As will be noted in Figure 1, when the oil in the crank case is adequate the float 38 rides high in the chamber 21 and the extension 42 extends between the piston rod 25 and the plunger 32 since the passageways 31 and 43 intersect one another. Hence when there is a satisfactory amount of oil in the crank case the piston rod 25 is prevented from actuating the plunger 32 to shut off the power. When there is an insufficient amount in the crank case 46 the float 38 falls and the extension 42 no longer intersects and interferes with the piston 25. In this stage of operation, when the pressurized air is flowed through the unloader valve 12 into the fluid line 29, the piston 24 is caused to move toward the plunger 32 with the result that the piston rod 25 engages the plunger 32 and causes the plunger 32 to open the switch 22. When movement of the piston 25 is blocked by the stem 42, the unloader valve exhausts the pressurized air to atmosphere through the fluid line which is directed upwardly of the unloader valve 12 in Figure 3.

The operation of the switch 22 is shown in greater detail in Figure 4. The switch 22 includes a switch housing 49 having a fixed contact 50 and a resiliently movable contact 51. The contact 51 is carried upon a resilient arm 52 and has a hooked end 53 which is biasable over an abutment 54 in the interior of the housing 49. Thus when the plunger 32 is actuated it moves the arm resiliently away from the contact 50 so that the circuit is broken and until the hook end 53 is engaged behind the abutment 54. At this stage in the operation of my device 10, the motor 13 shuts off and when the air pressure in the cylinder 23 is diminished the spring 26 moves the piston back to its normal position. Thus when the operator desires to continue the operation of the air compressor not withstanding the insufficiency of the oil in the crank case he may merely press reset button 55 on the switch to cause the contacts to engage again with one another. It will be appreciated that in addition to reengaging the contacts 50 and 51, the reset button may if desired again force the plunger 32 back into the passageway 31. If the contacts are reengaged, the compressor will run through only one cycle before becoming inoperative once again unless the crank case is filled since the plunger will again be activated to separate the contacts.

Disposed on the piston rod 25 and the plunger 32 are O rings 56 and 57. These O rings act as seals so the pressure conditions within the chamber 21 and the crank case are maintained the same. This assures a like oil level within the chamber 21 and the crank case. The O ring 56 on the piston rod 25 also acts as a seal against the entry of operating air from the cylinder 23.

The spring 26 is preloaded to assure the return of the piston 24 and the piston rod 25 back to normal position as shown in Figure 1 so that the piston rod 25 does not interfere with the movement of the float extension or stem 42.

The switch rod or plunger 32 also may be returned back into the passageway 31 to its normal position as is shown in Figure 1 by any suitable means.

The switch 22 used may be of any suitable construction and may be placed directly in the line to the motor (Fig. 3).

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In combination, an air compressor machine including a crank case adapted to contain oil and a motor for operating the machine, a centrifugal unloader valve connected to and cooperable with said machine to unload excess pressurized air so that at the beginning of the compressing cycle, the air compressor machine may start free from interference from the pressurized air remaining in the machine at the completion of the compressing cycle, an oil level controlled device connected to said valve and being in communication with said crank case, a power switch connected to said motor and associated with said device, oil level responsive means on said device in communication with said crank case and responsive to variations of the oil in the crank case, and said device having means responsive to the air discharged from said valve to vent the air and cooperable with said oil level responsive means and said switch to open said switch only when the oil level in the crank case has fallen below a predetermined level, said means including a cylinder having a piston and piston rod therein movable in response to the pressurized air and an air discharge vent, and a switch

lever adjacent said cylinder and associated with said switch and operable by said cylinder for opening and closing said switch, and a compression spring in said cylinder to return the piston to its normal position prior to its movement in response to the pressurized air thrust thereagainst.

2. A fluid level controlled device comprising a valve body, a transverse passageway through said body, said body having a vented cylinder for venting pressure including a piston and piston rod in said passageway with the piston and piston rod being actuated by pressure directed thereagainst, a circuit breaker lever in said passageway opposite and movable by said piston rod, a housing connected to said valve body defining a float chamber adapted to contain fluid, a float in said chamber responsive to fluid fluctuations in said chamber, and a second passageway extending from said float chamber and intersecting said transverse passageway with said float movable in said second passageway to interfere with the actuation of said lever by said piston rod during one stage of operation and movable out of said second passageway to permit actuation of said lever by said piston rod during another stage of operation.

3. In combination, an air compressor machine including a crank case adapted to contain oil and a motor for operating the machine, air unloader means connected to and cooperable with said machine to unload excess pressurized air so that at the beginning of the compressing cycle, the air compressor machine may start free from interference from the pressurized air remaining in the machine at the completion of the compressing cycle, an oil level controlled device connected to said unloader means and being in communication with said crank case, a power switch connected to said motor and associated with said device, said device comprising a valve body, a transverse passageway through said body, said body having a vented cylinder for venting pressure unloaded from said means including a piston and piston rod in said passageway with the piston and piston rod being actuated by pressure directed by said means thereagainst, a circuit breaker lever in said passageway opposite and movable by said piston rod, a housing connected to said valve body and in communication with said crank case defining a float chamber, a float in said chamber responsive to oil fluctuations in said chamber, and a second passageway extending from said float chamber and intersecting said passageway with said float movable in said passageway to interfere with the actuation of said lever by said piston rod when a predetermined oil level is registered by said float and movable out of said second passageway to permit actuation of said lever by said piston rod when the oil level and float falls under a predetermined minimum level.

4. In combination, an electrical circuit including a switch and a fluid level controlled device for opening and closing the circuit, a valve body having a cylinder therein, a reciprocal piston and piston rod in the cylinder being movable by pressurized air directed against the piston, said cylinder having a vent through which the pressurized air may be vented, a switch actuating lever movable by said piston and connected to the switch, and fluid level means for engagement with a body of fluid, said fluid level means being connected to the valve body and being responsive to variations in the level of the fluid and cooperable with said piston rod so that when the fluid level is satisfactory the piston rod is prevented from moving the lever and responsive when the fluid level is unsatisfactory to permit the piston rod to move the lever whereby the electrical switch may be opened and closed in response to the movement of the switch actuating lever.

5. The method of controlling an oil lubricated air compressor provided with an oil reservoir and having an energizing electrical circuit, comprising the steps of passing an electrical current through the circuit and thereby operating the air compressor machine, controlling the flow of pressurized air from the air compressor machine in the unloading of the air compressor, and utilizing the air thus controlled to open the energizing circuit for thereby interrupting the movement of the electrical current through the circuit and thus shutting down the air compressor machine when the oil in the machine falls below a selected level.

6. In a method of controlling an air compressor machine when it becomes improperly lubricated, which compressor is unloaded by a discharge of air therefrom, is energized by an electrical current and is lubricated by oil from an oil reservoir, the steps of controlling the flow of pressurized air being unloaded from the air compressor, and opening an electrical energizing circuit for the machine with the controlled air to interrupt the operation of the machine when the oil level in the machine oil reservoir falls below a selected level until a satisfactory oil level is restored.

7. In combination, an air compressor machine including a crank case adapted to contain oil and a motor for operating the machine, a centrifugal unloader valve connected to said machine to unload pressurized air therefrom at the end of each air compressing cycle so that at the beginning of the compressing cycle the air compressor machine may start free from interference from the pressurized air remaining in the machine at the completion of the compressing cycle, a safety device, a power switch connected to said motor and cooperable with said device, oil level responsive means on said device in communication with said crank case and responsive to variations of the oil in the crank case, and said device having means connected to the valve responsive to the air discharged from said valve cooperable with said oil level responsive means and said switch to operate said switch only when the oil level in the crank case has fallen below a predetermined level.

8. The combination of claim 7 further characterized by the switch having reset means to close the circuit and permit the machine to operate through an additional cycle before being shut down again.

9. The combination of claim 7 further characterized by the means including a cylinder having a piston and piston rod therein movable in response to the pressurized air and an air discharge vent, and a switch lever adjacent said cylinder and associated with said switch and operable by said piston rod for opening and closing said switch.

10. The combination of claim 7 further characterized by the oil level controlled device including a movable float, said float being disposed in a float chamber with said chamber in communication with said crank case to register the same oil level in the chamber as in said crank case and said movable float cooperable with said means and by its movement determining whether said switch is opened or closed.

11. The combination of claim 7 further characterized by the oil level controlled device including a movable float, said float being disposed in a float chamber with said chamber in communication with said crank case to register the same oil level in the chamber as in said crank case, and said movable float movable into the path of said piston rod only when there is adequate oil to prevent actuation of the lever by the cylinder.

12. A safety device for use with an air compressor machine and the like, said device including a power switch for connection with an air compressor motor, oil level responsive means on said device for communication with crank case oil adapted to be contained within an air compressor crank case and adapted to be responsive to variations of oil in an air compressor crank case, and said device having means adapted to be connected to an air compressor unloader valve responsive to air discharged from such valve cooperable with said oil level responsive means and said switch to operate said switch when oil in a crank case has fallen to an unsatisfactory level.

13. In combination, a safety device for use with an air

compressor machine, and an air compressor unloader valve, said device including a power switch for connection with an air compressor motor, oil level responsive means on said device for communication with crank case oil adapted to be contained within an air compressor crank case and adapted to be responsive to variations of oil in an air compressor crank case, and said device having means connected to said air compressor unloader valve responsive to air discharged from such valve and cooperable with said oil level responsive means and said switch to operate said switch when oil in a crank case has fallen to an unsatisfactory level.

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