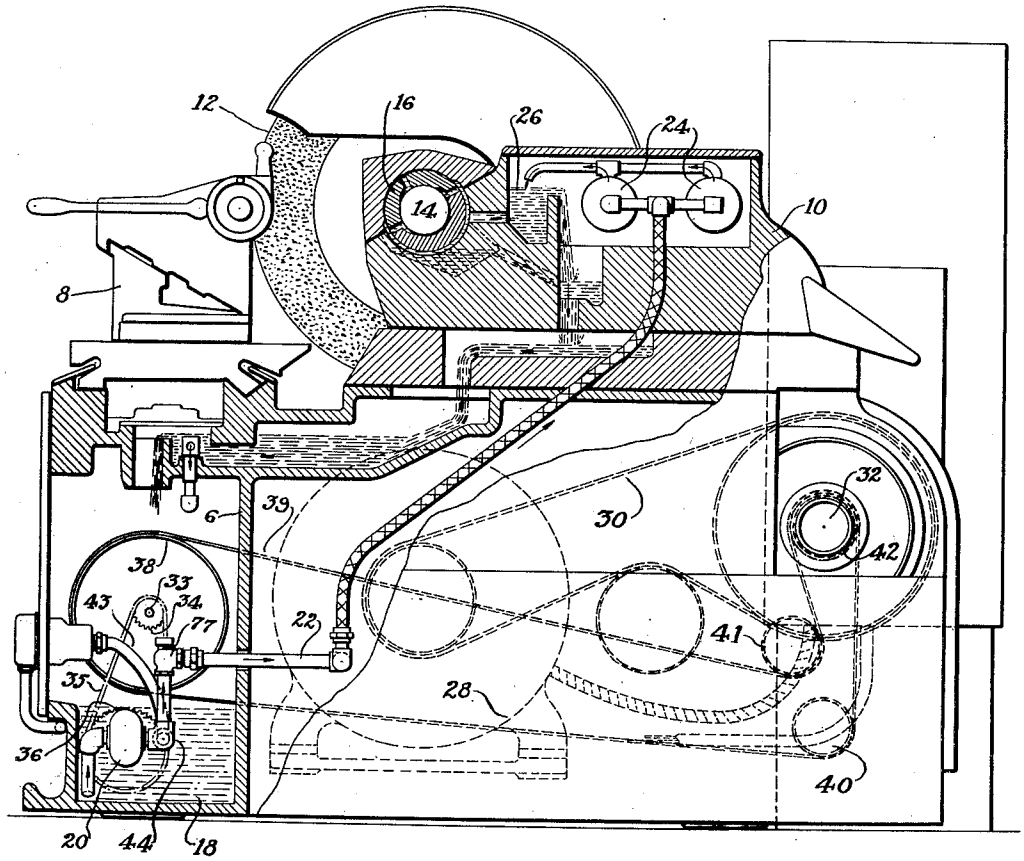
Jan. 2, 1934. H. E. MARTIN 1,942,180

LUBRICATING SYSTEM

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Fig. 1



Witness
Paul F. Bryant

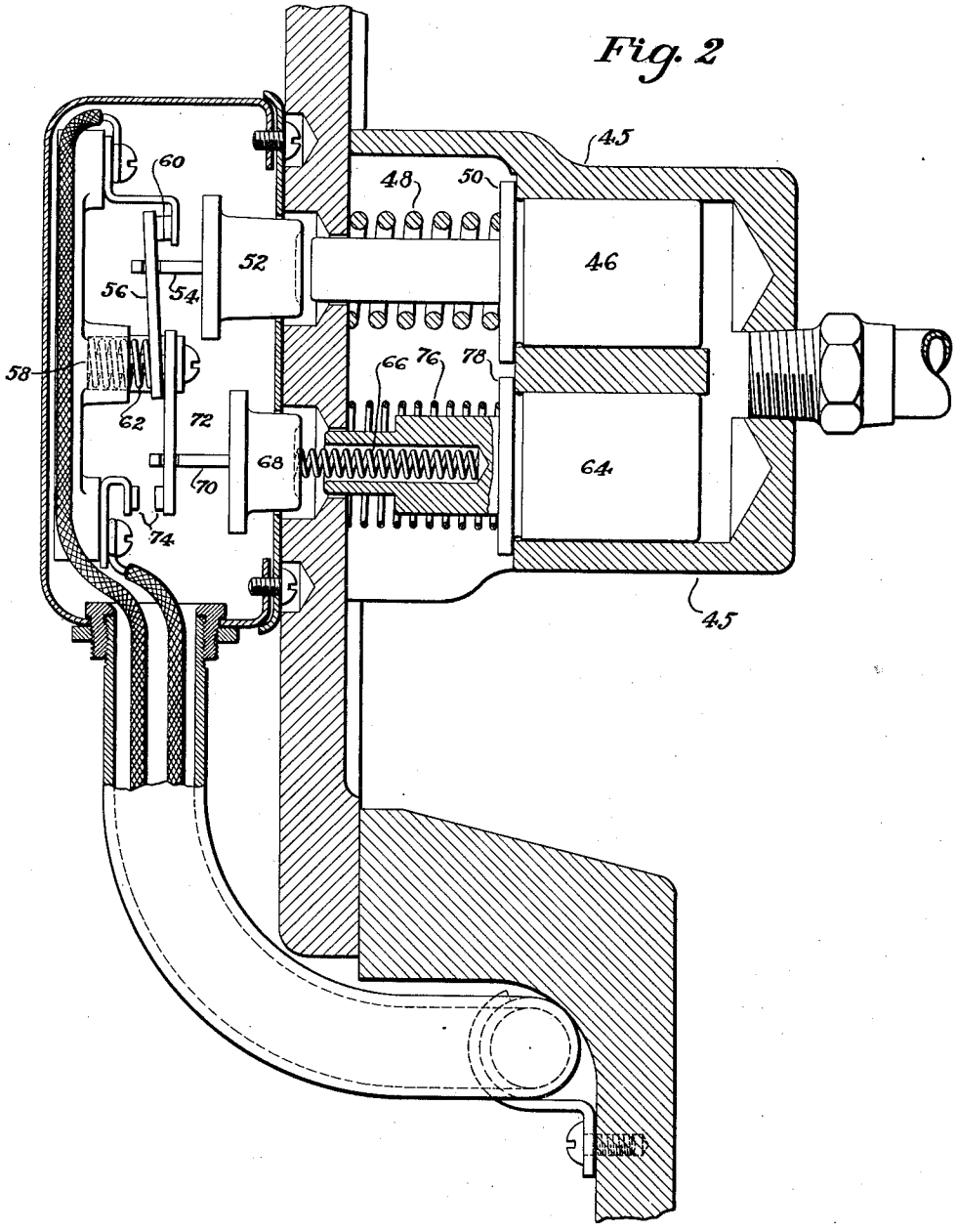
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LUBRICATING SYSTEM

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Fig. 2



Witness

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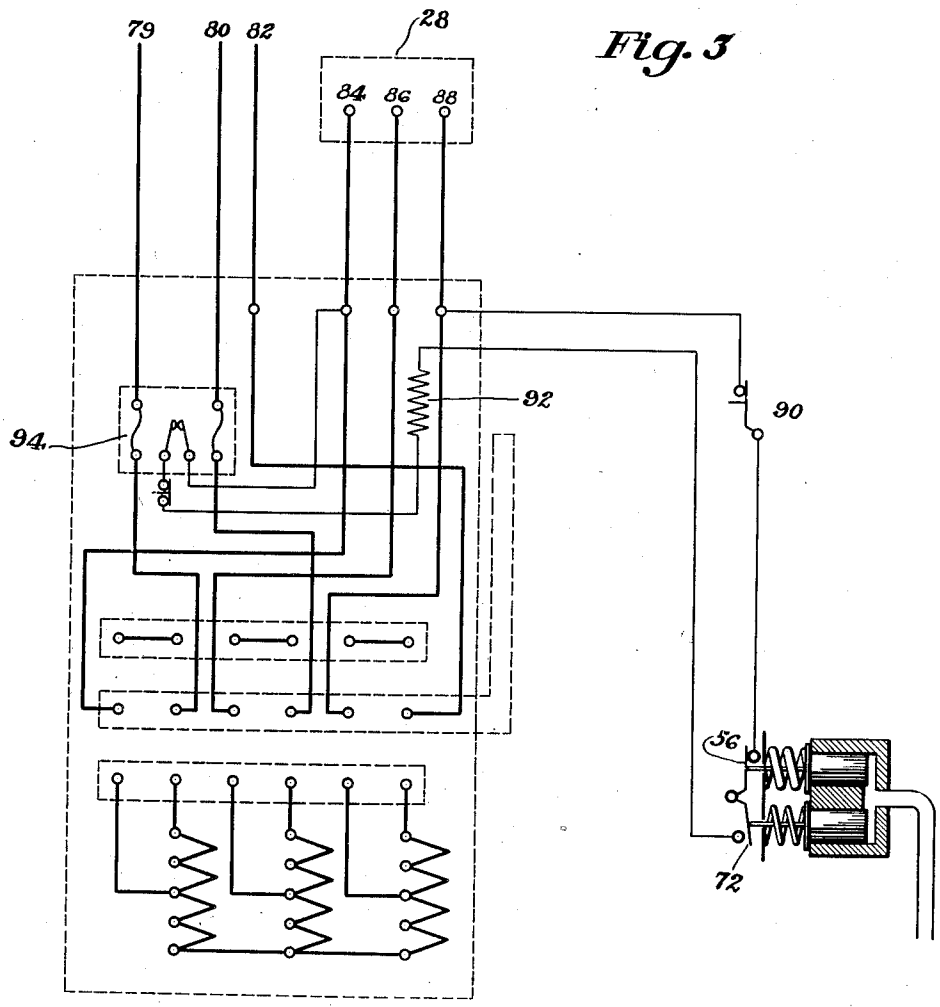
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LUBRICATING SYSTEM

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Fig. 3



Witness

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UNITED STATES PATENT OFFICE

1,942,180

LUBRICATING SYSTEM

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Application December 27, 1929
Serial No. 416,801

12 Claims. (Cl. 184—6)

The present invention relates to lubricating systems and more particularly to the lubricating systems of grinding machines and other machine tools.

The invention is herein disclosed as embodied in a grinding machine provided with a lubricating system comprising an oil pump whch forces oil from a reservoir in the base of the machine up through oil filters to a reservoir in the grinding wheel spindle carriage from which the oil is distributed by a gravity feed to various parts of the machine and is finally returned to the reservoir in the base.

Particularly in the case of the bearings for the grinding wheel spindle which is operated at comparatively high speeds, it is essential that a sufficient supply of oil be maintained at all times to lubricate the bearings while the machine is in operation since even a momentary rupture of the oil film which insulates the rotating spindle from the bearings is likely to cause irreparable damage to the parts.

Such a contingency is likely to arise in the operation of the machine where for any reason the pump ceases to function or if the oil pipe line to the reservoir in the wheel spindle carriage becomes obstructed, as for instance, by the clogging of the filters above referred to.

It is, therefore, a primary object of the present invention to provide means which will be rendered operative upon interruption of the supply of oil to the bearings to stop the machine.

With this object in view, a feature of the invention consists in the provision in a machine equipped with a pressure oil feed of a pressure oil gauge and means actuated or controlled thereby adapted, upon a variation of the pressure of oil in the lubricating system beyond a specified limit, to stop the machine.

More specifically, another feature of the invention consists in the provision of an oil pressure measuring device which is adapted whenever the oil pressure drops below a predetermined minimum limit or exceeds a predetermined maximum limit to cause the machine to be thrown out of operation.

The several features of the invention consist also in the devices, combinations, and arrangement of parts hereinafter described and claimed which, together with the advantages to be obtained thereby, will be readily understood by one skilled in the art from the following description taken in connection with the accompanying drawings in which Fig. 1 is a view in side elevation, partly in section, of a grinding machine, illustrating particularly the oiling system; Fig. 2 is a detail sectional view of the oil pressure measuring safety device; and Fig. 3 is a diagrammatic view of the wiring from the safety switch to the starting and control box for the driving motor of the machine.

The grinding machine and lubrication system herein disclosed are those more fully illustrated and described in the patent to Maxwell I. Mathewson, No. 1,870,857, dated August 9, 1932. In embodying the several features of the present invention in this machine, an oil pressure measuring device has been provided which comprises two spring pressed plungers connected to the outlet of the oil pump and adapted to operate switch connections controlling the current supply of the driving motor of the machine and thus throw the machine out of operation. One plunger is provided with a comparatively heavy spring which yields when the oil pressure reaches a predetermined maximum to break an electrical contact to stop the machine. The other plunger is provided with a comparatively light spring which is normally pressed by the pressure of the oil from the pump to maintain a closed contact in the electric circuit but is permitted to act when the pressure falls below a predetermined minimum to break the circuit.

This arrangement is well adapted to meet two important contingencies in the operation of the oil system while the machine is running. If the driving connections for the oil pump should be broken or the pump for any other reason should stop pumping oil to the reservoir in the wheel spindle carriage, the loss of pressure in the pump line will at once cause the safety device above described to shut off the machine as the oil pressure falls below the predetermined minimum. On the other hand, if the pipe line from the pump to the distributing reservoir in the head of the machine should become obstructed, as for instance, where the oil filters become clogged, the rapid increase in the pressure of the oil from the pump will cause the safety device to shut off the machine as the pressure reaches a predetermined maximum. In the event, therefore, of any interruption of the oil supply, the machine will be stopped before any appreciable amount of oil has been drawn from the distributing reservoir in the wheel spindle carriage so that the chance of injury to the machine from insufficient lubrication is reduced to a minimum.

Referring to the drawings, the frame of the grinding machine is disclosed at 6 on which are movably mounted the work supporting table 8

and the wheel spindle slide 10, which carries the grinding wheel 12 and spindle 14 adapted to turn in bearings 16 on the slide 10. The oiling system, as indicated generally in Fig. 1, comprises the oil reservoir 18 in the base of the machine from which oil is forced by means of the oil pump 20 through the connecting pipe 22 to oil filters 24 mounted in the slide 10 from which the oil is carried to the overflow reservoir 26 for supplying oil to the wheel spindle bearings 16. From this point oil is permitted to drain by gravity feed down through a system of reservoirs and conduits to lubricate other parts of the machine and is finally returned to the reservoir 18 in the base, as more fully described in the Mathewson application above referred to.

The electric motor for the machine is indicated at 28 in dotted lines and is connected by means of a belt 30 to actuate the driving shaft 32 of the machine. The pump 20 is driven during the operation of the machine from the driving shaft 32 through connections comprising a counter shaft 33 which carries a sprocket 34 adapted to receive a sprocket chain 35 which meshes in turn with a second sprocket 36 directly connected to drive the pump. The counter shaft 33 also carries a pulley 38 to receive a driving belt 39 which is guided around the idler pulley 40, tension pulley 41, and a driving pulley 42 mounted on the driving shaft 32.

In order to reduce as far as possible the danger of the bearings in the machine running dry through some defect in the oiling system, mechanism has been provided to detect any interference with the even flow of oil through the system and thereupon to automatically stop the machine.

The chief sources of difficulty in the oiling system which are likely to result in dry bearings and consequent damage to the parts, are in the obstruction of the oil connections through the clogging of the oil filters and in the stopping or breakdown of the oil pump. In case of obstruction of the oil line, the oil pressure will be built up at once to an abnormally high level, whereas in the second case, the oil pressure will drop below the minimum required to force the oil up through the connections to the distributing reservoir. In order, therefore, to detect any interruption in the supply of oil to the distributing reservoir in the wheel spindle slide, a high and low pressure oil measuring device or gauge is connected to the outlet side of the pump which is adapted when the oil pressure varies beyond predetermined maximum and minimum limits to stop the machine. This device comprises a pipe connection 43 which is connected by means of a coupling 44 to the pipe connection 22 on the outlet side of the pump 20 and is connected at its other end to the casing 45 containing the pressure chamber as shown in detail in Fig. 2. When the oil pressure reaches a predetermined maximum amount, an electric circuit controlling the circuits of the driving motor 28 is opened to stop the machine by the action of a plunger 46 which is normally held in advanced position against the pressure of the oil by means of a comparatively heavy compression spring 48 which is coiled about a reduced portion of the plunger between the flange 50 formed thereon and a portion of the machine frame. The movement of the plunger 46 to the right, as shown in Fig. 2, is limited by the engagement of the flange 50 with a corresponding shoulder formed on the casing 45. At its inner or left-hand end the plunger is adapted to engage with a switch button 52 which carries a rearwardly extending arm 54 connected to the electric switch member 56 by means of a slot or notch through which the member 56 passes. The switch member 56 is loosely mounted on a pin 58 so as to be capable of a pivotal or swinging movement and is normally held with the contact points 60 closed by means of a compression spring 62 coiled about the pin 58. When through any obstruction in the oil pipe line the pressure of the oil exceeds the amount necessary to force the plunger 46 backwards or to the left, as shown in Fig. 2, against the pressure of its spring 48, the plunger 46 will come into contact with the switch button 52 and will cause the switch member 56 to be forced to open position against the pressure of its spring 58 to break the electric circuit and stop the machine.

Where for any reason, the pump is rendered inoperative to pump oil up to the distributing reservoir 26, the oil pressure will drop. In order to provide for this contingency, a second plunger 64 is mounted in the oil pressure gauge casing 44 and is provided at its left-hand end as shown in Fig. 2, with a recessed portion into which is fitted a comparatively light compression spring 66 which is adapted at its free end to bear against a switch button 68. The button is provided with an extending arm 70 which is slotted to receive a switch member 72 loosely mounted on the pin 58. An additional light compression spring 76 is coiled about the plunger 64 between a flange 78 on the plunger and a portion of the machine frame and tends to supplement the action of springs 62 and 66 in tending to force the plunger 64 to the right as seen in Fig. 2 against the pressure of the oil. During the operation of the machine with the oil feed at normal pressure, the plunger 64 will be moved to the left, compressing the springs 66 and 76 and thus causing the switch 72 to be closed against the pressure of the spring 58 to maintain a closed circuit. If, however, the oil pressure falls below a predetermined minimum which will allow the plunger 64 to be moved to the right, as shown in Fig. 2, by the pressure of the springs 62, 66 and 76, the switch 72 will be moved to open position to break the electric circuit and stop the machine.

A check valve 77 is provided in the pipe connection 22 to prevent the oil in the system from draining into the reservoir when the machine is stopped. The check valve is placed above the coupling 44 for the pressure gauge pipe connections 43 and is adjusted to provide a back pressure about equal to the minimum pressure at which the low pressure plunger 64 can be moved to close the electric circuit, so that in starting the machine, the pressure will be built up at once to this amount by the pump and thus allow the electric circuit to remain closed.

Any well known system of wiring may be utilized to connect the safety switch herein disclosed in the motor circuit. In the present instance, the switches of the safety oil device are connected into the control box of the machine so that upon breaking the circuit, the motor is automatically brought to a stop. In the somewhat diagrammatic Fig. 3 of the drawings, wiring connections are shown for a three-phase alternating circuit, in which the lead-in wires are indicated at 79, 80 and 82, the corresponding leads to the motor from the box being indicated at 84, 86 and 88 respectively. As shown in the diagram, the

oil pressure control switches 56 and 72 and the usual stop switch 90 mounted on the front of the machine are connected in series with the under voltage coil 92 and under voltage safety shut-off switch 94 which are adapted when the potential across the motor leads falls to a point which will place an excessive load on the motor to break the motor circuit. Since this form of starting box for three-phase motor including the under voltage safety shut-off is well known and widely used commercially, a further showing of this mechanism is not included herein. With a stopping and starting switch of the type described, the switch is thrown to starting position by the operator to bring the motor up to speed, after which the switch can be thrown to running position. While the motor is being brought up to speed, the pump driven from the motor will rapidly bring the oil pressure up above the minimum required to close the low pressure switch. The starting switch can now be thrown to running position for the continued operation of the machine.

The nature and scope of the invention having been indicated and a specific embodiment of the invention having been described, what is claimed is:

1. A lubricating system for a machine having, in combination, a bearing lubricated by said lubricating system, a pressure oil feed for the machine, and means for detecting a failure of oil in the bearing to prevent injury thereto while the machine is in operation comprising a device responsive to variations in oil pressure connected to said feed, and means controlled by said device for stopping the machine when the oil pressure varies beyond predetermined maximum and minimum limits.

2. In a lubricating system for a machine, the combination with a bearing lubricated by said system of a pressure oil feed for lubricating the machine, driving means for the machine, and means for detecting a failure of oil in the bearing to prevent injury thereto while the machine is in operation comprising a device responsive to variations in oil pressure connected to said feed, and means controlled by said device for rendering inoperative said driving means when the oil pressure varies beyond predetermined maximum and minimum limits.

3. A lubricating system for a machine having, in combination, driving means for the machine, a bearing lubricated by said system, an oil reservoir in the base of the machine, a distributing reservoir placed at a higher point in the machine, connections for transferring oil from the said reservoir to the distributing reservoir including a pipe connection, oil filters, an oil pump for forcing the oil through said connections to the distributing reservoir, and means for detecting a failure of oil in the bearing to prevent injury thereto while the machine is in operation comprising a device responsive to variations in oil pressure, and means controlled by said device for rendering inoperative said driving means when the oil pressure in said connections varies beyond predetermined maximum and minimum limits.

4. A lubricating system for a machine having, in combination, electrically controlled driving means for the machine, a bearing lubricated by said system, a pressure oil feed, and means for detecting a failure of oil in the bearing to prevent injury thereto while the machine is in operation comprising a switch connection acting when rendered operative to stop the machine, and a device responsive to variations in oil pressure connected to said feed acting when the oil pressure varies beyond predetermined maximum and minimum limits to render operative said switch connection to stop the machine.

5. In a lubricating system for a machine, the combination of a bearing lubricated by said system, a pressure oil feed for lubricating the machine including connections for conveying oil under pressure to said bearing, driving means for the machine, and means for detecting a failure of oil in the bearing to prevent injury thereto while the machine is in operation comprising a device responsive to variations in oil pressure connected with said connections, and means controlled by said device acting when the oil pressure varies beyond a predetermined maximum limit through the obstruction of said feed to render inoperative said driving means.

6. In a lubricating system for a machine, the combination of a bearing lubricated by said system, a pressure oil feed for lubricating the machine, connections for conveying oil to said bearing including oil filters through which the oil is forced by the pressure feed, and means for detecting a failure of oil in the bearing to prevent injury to said bearing while the machine is in operation comprising a device responsive to variations in oil pressure connected with said feed and means controlled by said device acting when the oil pressure varies beyond a predetermined maximum limit through the obstruction of said feed to stop the machine.

7. In a lubricating system for a machine, the combination of driving and stopping mechanism for the machine, a bearing lubricated by said system, a pressure oil feed for lubricating the machine, and means for detecting a failure of oil in the bearing to prevent injury thereto while the machine is in operation comprising a device responsive to variations in oil pressure connected to said feed including a high pressure and a low pressure plunger, and means actuated by said plungers when the oil pressure varies beyond predetermined maximum and minimum limits to stop the machine.

8. In a lubricating system, the combination of a pressure oil feed, an electric circuit, an oil pressure chamber, a piston mounted for movement in the chamber, a switch actuated by said piston, a spring arranged when the oil pressure is reduced beyond a predetermined minimum limit to retract the plunger and open the switch, a second oil pressure chamber, a piston, and a switch controlled thereby for said latter chamber, and spring means arranged normally and within a predetermined maximum limit to overcome the pressure in the chamber to maintain said latter switch in closed position.

9. In a lubricating system for a machine, the combination of a pressure oil feed for lubricating the machine, an electric circuit controlling the continued operation of the machine, a device responsive to variations in oil pressure, comprising a high pressure plunger, a switch controlled thereby to break the circuit when the oil pressure exceeds a predetermined maximum limit, a low pressure plunger, and a switch actuated thereby arranged to maintain a closed circuit while the oil pressure is maintained above a predetermined minimum limit.

10. A lubricating system for a machine having, in combination, driving and stopping means for the machine, a bearing lubricated by said

system, an oil reservoir in the base of the machine, supply connections between the oil pump driven by the machine for supplying oil from said reservoir to the bearing, means for detecting a failure of oil in the bearing to prevent injury thereto while the machine is in operation comprising a device responsive to variations in oil pressure connected to said connections acting when the oil pressure varies beyond predetermined maximum and minimum limits to stop the machine, and a check valve arranged to cause the pressure upon starting the motor to be immediately built up in said device to substantially the minimum limit of said pressure measuring device.

11. In a lubricating system for a machine, the combination of a pressure oil feed for lubricating the machine, an electric circuit controlling the continued operation of the machine, a device responsive to variations in oil pressure connected to said feed and comprising a high pressure plunger, a switch controlled thereby to break the circuit when the oil pressure exceeds a predetermined maximum limit, a low pressure plunger, a switch actuated thereby arranged to maintain a close circuit while the oil pressure is maintained above a predetermined limit, and a check valve in said feed adjacent said oil pressure measuring device to maintain the pressure in said device at substantially the said minimum limit during the operation of the pressure feed.

12. A lubricating system for a machine having, in combination, driving and stopping means for the machine, a bearing lubricated by said system, an oil reservoir in the base of the machine, a distributing reservoir from which oil is returned by gravity to the said first-mentioned reservoir, a pipe connection and an oil filter between the said reservoirs, an oil pump for forcing oil from the base to the distributing reservoir through the said connections, a check valve in the pipe connection arranged upon starting said pump to build up pressure in the pipe connection between the valve and the pump immediately to a predetermined minimum value, and means for detecting a failure of oil in the bearing to prevent injury thereto while the machine is in operation comprising a device responsive to variations in oil pressure connected to said pipe connection between the pump and the check valve, and means controlled by said device for rendering operative said driving and stopping means to stop the machine when the oil pressure varies beyond predetermined maximum and minimum limits.

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