C. DAY & G. E. WINDELER.

ENGINE.

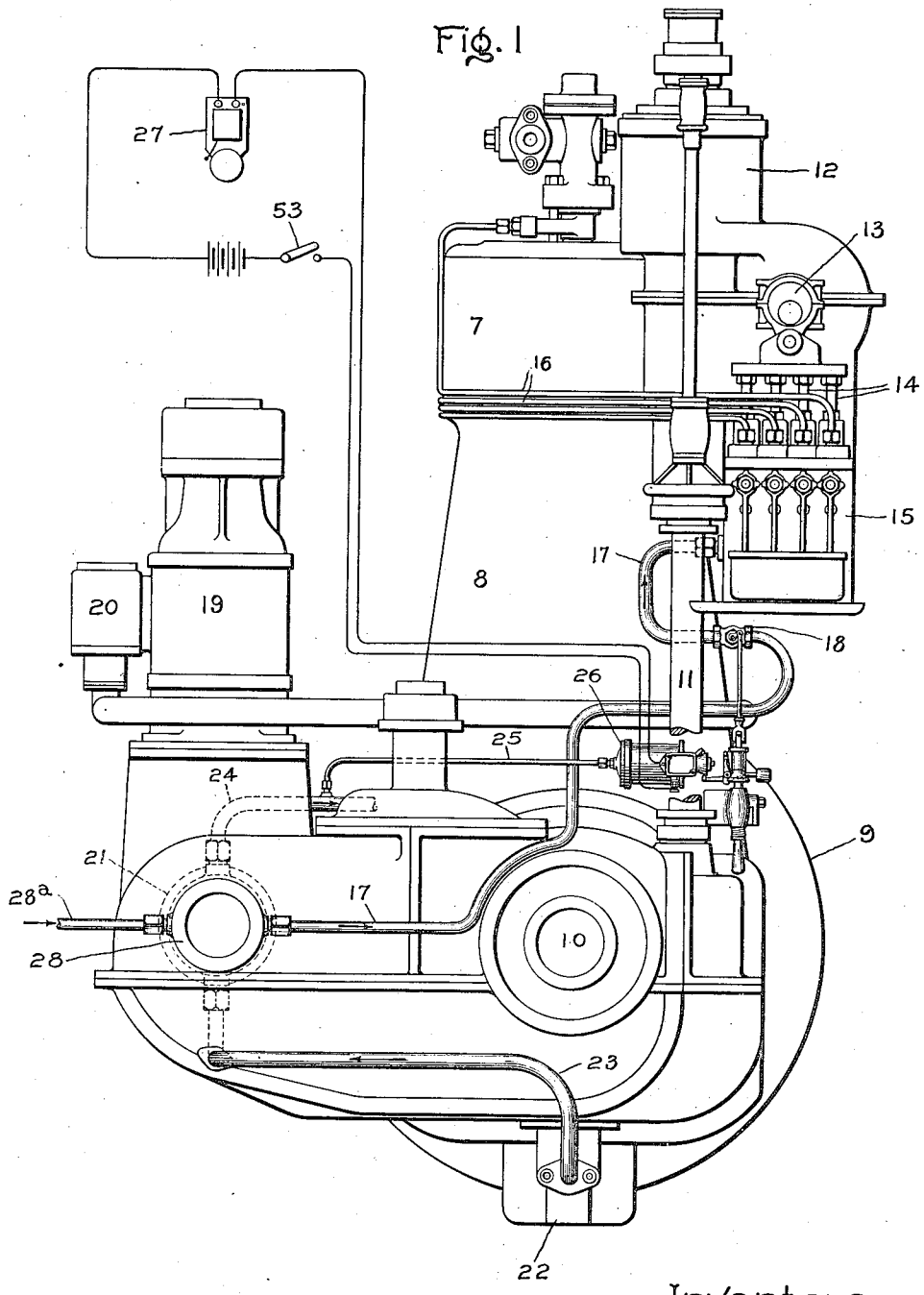
APPLICATION FILED DEC. 19, 1914.

1,173,415.

Patented Feb. 29, 1916.

2 SHEETS—SHEET 1.

Fig. 1



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2 SHEETS—SHEET 2.

Fig. 2

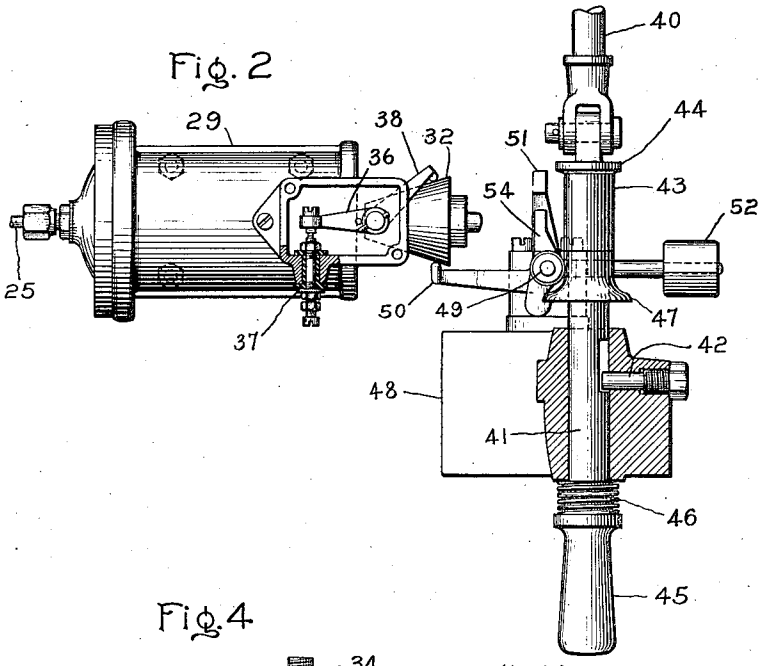


Fig. 3

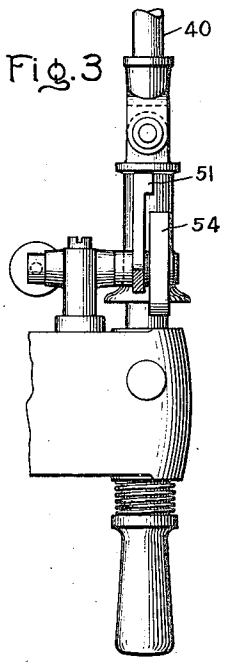


Fig. 4

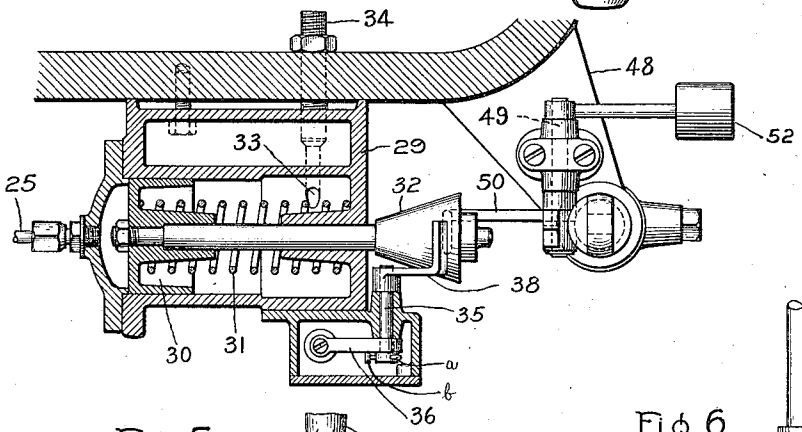


Fig. 5

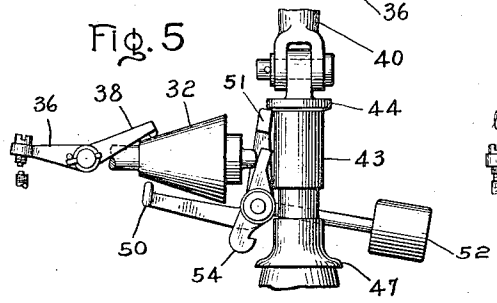
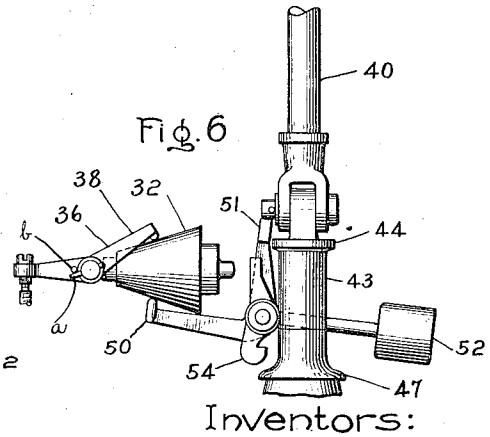


Fig. 6



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UNITED STATES PATENT OFFICE.

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ENGINE.

1,173,415. Specification of Letters Patent. Patented Feb. 29, 1916.

Application filed December 19, 1914. Serial No. 878,052.

To all whom it may concern:

Be it known that we, CHARLES DAY and GEORGE E. WINDELER, subjects of the King of Great Britain, residing at Hazel Grove, near Stockport, England, have invented certain new and useful Improvements in Engines, of which the following is a specification.

The present invention relates to engines and more especially to those of the internal combustion type, the main parts of which are lubricated by a system of forced lubrication.

The object of our invention is to provide a simple and reliable apparatus adapted to give a signal or warning, preferably audible, when the pressure in the lubricating system falls below what is considered the desirable minimum for continuous working and for automatically cutting off the supply of motive fluid to the engine, thereby stopping it when the pressure in the lubricating system falls below what is considered safe even for periods of short duration.

In the accompanying drawings which illustrate one of the embodiments of our invention, Figure 1 is a view in end elevation of an engine equipped with our improved apparatus; Fig. 2 is a view in side elevation with certain of the parts in section of the means responsive to changes of pressure of the lubricant; Fig. 3 is an end view of the same; Fig. 4 is an axial section through the pressure-responsive means; and Figs. 5 and 6 are detailed views showing the positions of the different parts under different operating conditions.

Our invention may be applied to any engine wherein the main parts are lubricated by a system of forced lubrication. As shown, however, it is applied to an internal combustion engine of the high compression type in which 7 represents the cylinder and 8 the supporting column or frame therefor, the latter being seated on a base casing 9 that incloses the crank shaft and contains more or less lubricant. The main shaft 10 drives the vertical shaft 11 through suitable gearing, the latter driving the cam shaft for actuating the valves and also the speed governor, the latter being inclosed in the casing 12. On the end of the cam shaft is an eccentric 13 which actuates the plungers 14 of the fuel pump 15. Fuel under high pressure is conveyed from the pumps to the injectors discharging fuel into the combustion chambers by the pipes 16. Fuel is admitted to the supply chamber of the pump by the pipe 17 and contained therein is a valve 18 for shutting off the supply of fuel to the engine under emergency conditions, as will appear more fully hereinafter.

On the left-hand side of the engine is a reciprocating air compressor 19 of any suitable construction, which supplies air for injecting fuel into the cylinders.

20 indicates the valve chest of the compressor. The compressor is driven from the main shaft of the engine through suitable means. The shaft of the compressor drives a suitable lubricating pump 21, indicated in dotted lines, which receives lubricant from the sump 22 by the pipe 23. Lubricant under the desired pressure passes by the pipe 24 and branches thereof to the main parts of the engine, such as the bearings, etc. From the pipe 24 extends a small pipe 25 to a pressure-responsive device 26 which controls the operation of a signal device 27, in this case illustrated as an electric bell, and also the fuel supply valve 18 previously referred to.

28 indicates a fuel supply pump of suitable construction that receives fuel from a tank by the pipe 28^a and delivers it to the pipe 17 leading to the supply chamber in pump 15. Any excess fuel thus delivered is returned to the source by a suitable drain.

Referring now to Figs. 2 to 4, 29 indicates a cylinder supported by the engine frame and to which lubricating oil is admitted by the pipe 25. Inside of the cylinder is a piston 30, whose movement to the right is opposed by a coiled compression spring 31. This spring is so calibrated that the piston assumes definite positions for certain definite and predetermined changes of pressure in the lubricating system. The piston is mounted on a rod that extends through the cylinder at one end and mounted thereon is a cam 32 of suitable configuration. In the present instance it takes the form of a truncated cone. As it is possible that some slight amount of lubricant will creep past the piston into the cylinder space on the right, a drain 33 is provided which communicates with the interior of the crank case through the pipe 34.

Mounted on one side of the cylinder is a small box or casing in which is supported a rock shaft 35. Loosely mounted on one end of the shaft is an arm 36 which carries a contact screw at its free end that is adapted to make contact with a stationary contact member 37 carried by the lower wall of the box. When the two parts of the circuit are closed at this point the bell 27 will ring. To actuate the contact arm, an L-shaped lever 38 is mounted on the rock shaft, which extends into the path of movement of the conical cam 32. The weight of this lever slightly overbalances that of the contact arm so that as the cam moves to the right, indicating an increase of pressure in the lubricating system, the circuit will be broken. On the other hand, when it moves a predetermined amount in the opposite direction the circuit will be closed. Between the rock shaft 35 and contact arm 36 is a lost motion connection comprising in the present case a pin *a* carried by the shaft 35, and a pin *b* carried by the arm 36 and extending perpendicularly to the pin *a*. This permits the lever 38 to continue its movement under the action of cam 32 after the bell or alarm circuit has been closed. In other words, when the contact between the parts 36 and 37 is closed the rock shaft 35 and lever 38 can continue their movements.

The means for operating the fuel shut-off or supply valve 18 to the engine will now be described. To the stem of the valve, which is of the plug type, is attached a short arm and this in turn is connected to an actuator or motor, in this case shown as a rod 40, the lower end of which is pivotally connected to a sliding member 41, the latter being provided with a shouldered notch into which projects the stop 42. When the upper shoulder engages the stop the valve 18 should be closed, and when the lower shoulder engages the stop the valve should be opened. Mounted on the member is an enlargement 43 having a flange or shoulder 44 on its upper end which acts as a stop or means to restrain the actuator against movement. The weight of the actuator, parts 40, 41, 43 and handle 45, is sufficient when released to close the valve 18. To insure prompt closing the actuator may, however, include the coiled compression spring 46. Surrounding the member 41 and free to slide thereon is a sleeve 47 having an enlarged lower end. Mounted in suitable bearings carried by a bracket 48 is a rock shaft 49, shown in dotted lines, Fig. 4, and mounted thereon is a three-arm lever, of which arm 50 is arranged to engage the conical cam 32, while arm 51 is adapted to pass under the flange or shoulder 44 and act as a prop or support to hold the actuator in its raised or restrained position. The third arm of the lever carries an adjustable weight 52, the latter moving the lever arm or device 51 under the flange 44 when permitted to do so by the position of the cam 32.

When the engine is at rest the switch 53 in the bell circuit, Fig. 1, is kept open. When it is desired to start the engine the valve actuator is raised first by the handle 45 and then the sleeve 47 by hand. When this is done the latch 54 is caused to engage the lower edge of the sleeve 47. This may be done automatically or by hand as desired. If the lower end is heavy, as shown, it will engage automatically. After the engine commences to work the pressure of the lubricating system rises because of the fact that the lubricating pump 21 is driven by it, and the piston 30 of the pressure-responsive device is forced to the right, the spring 31 being so proportioned that when the required lubricating pressure is attained the cam 32 allows the support or prop 51 to pass under the collar 44, thus preventing the actuator from moving downward. In this position the rounded end of the piston rod, due to its engagement with the upper end of the latch 54, has caused the latter to withdraw its hook from the under side of the sleeve 47 and the latter drops and rests on the bracket 48. Under these conditions the valve actuator is supported solely by the lever arm or device 51, as shown in Fig. 5. This same movement of the piston and the cam has also opened the circuit of the electric bell. The switch 53 should now be closed. It will be understood that the switch can be closed before setting the other parts into operating conditions if desired.

If the pressure in the lubricating system falls the piston 30 moves to the left and the parts are so proportioned and arranged that the circuit of the bell 27 is first closed, thus giving an alarm. This takes place when the pressure in the system falls below what is considered desirable for continuous working. Should the pressure continue to fall and reach a point where the absence of the proper amount of lubricant will be likely to cause damage, the cam 32, acting on the lever arm 50, removes the support 51 from under the flange 44 and allows the actuator to shut valve 18 in the supply pipe.

In accordance with the provisions of the patent statutes, we have described the principle of operation of our invention, together with the apparatus which we now consider to represent the best embodiment thereof; but we desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What we claim as new and desire to secure by Letters Patent of the United States, is,—

1. In combination with an engine having a system of forced lubrication, of a means

movable in response to changes of pressure in the system, a signal device which is started into operation by said means upon a predetermined change of pressure in said system, and means responsive to the action of said pressure-responsive means for shutting off the supply of motive fluid to the engine upon a further and predetermined change of pressure in said system.

2. In combination with an engine having a system of forced lubrication, of a cylinder and piston, the former communicating with said system and the latter moving in response to changes of pressure in said system, a signal device which is set into operation by a certain movement of the piston, and a valve which is set into operation by the piston when it has moved a predetermined distance for shutting off the supply of motive fluid to the engine.

3. In combination with an engine having a system of forced lubrication, of a member movable in response to changes of pressure in the system, a cam which is moved by the member, a signal controlling device that is actuated by the cam when it has moved a predetermined distance, a valve in the motive fluid supply system of the engine, and a means actuated by the cam after it has caused the signal to operate for causing the valve to shut off the supply of motive fluid to the engine.

4. In combination with an engine having a system of forced lubrication, of a member movable in response to changes of pressure in the system, a cam which is moved by the member, a signal device, a lever moved by the cam for causing the signal device to act, a valve in the motive fluid supply system of the engine, and a lever also moved by the cam for causing the valve to shut off the supply of motive fluid to the engine.

5. In combination with an engine having a system of forced lubrication, of a valve which controls the supply of motive fluid to the engine, a motor means which when released causes the valve to shut off the supply, a latch for preventing the motor from acting during the starting period of the engine, a device which acts to prevent the motor from acting during normal operation of the engine, and a device responsive to changes of pressure in the lubricating system which renders the latch inactive and the device active as the lubricant pressure builds up and which releases the device and permits the motor to operate when said pressure falls below a predetermined value.

6. In combination with an engine having a system of forced lubrication, of a means movable in response to changes of pressure in said system, a signal device controlled by the means, a controlling valve in the motive fluid supply system of the engine, a normally restrained actuator, and a device actuated by the pressure-responsive means after the signal is operated for releasing the actuator and permitting it to move the motive fluid controlling valve.

7. In combination with an engine having a system of forced lubrication, of a means movable in response to changes of pressure in said system, a controlling valve in the motive fluid supply system of the engine, an actuator which when released moves the valve, a latch for temporarily restraining it while the engine is being started, and a device that also acts to restrain the actuator and is controlled by the pressure-responsive means of the lubricating system.

8. In combination with an engine having a system of forced lubrication, of a means movable in response to changes of pressure in said system, a valve in the motive fluid supply system of the engine, an actuator arranged to move the valve when released, a latch for temporarily restraining the actuator which is released by said means when a predetermined pressure be attained, and a device for restraining the actuator when the latch is rendered inactive which is controlled in its operation by the means responsive to the pressure of the lubricant.

9. In combination with an engine having a system of forced lubrication, of a valve which controls the passage of motive fluid to the engine, an actuator arranged to move the valve when released, a pair of devices for holding the actuator in its restrained position, one being employed in starting the engine, the other under normal running conditions, and means responsive to changes of pressure in the lubricating system for rendering one of said devices inactive and the other active.

10. In combination with an engine having a system of forced lubrication, of a valve which controls the passage of motive fluid to the engine, an actuator for moving the valve when released, a latch for holding the actuator in its restrained position during the starting period of the engine, a device for restraining the actuator during normal operation that is moved to one of its positions by gravity, and means responsive to changes of pressure in the lubricating system for permitting such movement to take place and also for withdrawing the device from action when the lubricating pressure falls below a predetermined value.

11. In combination with an engine having a system of forced lubrication, of a valve which controls the supply of motive fluid to the engine, a motor means which when released causes the valve to shut off the supply, two independent means for restraining the motor from acting, a means responsive to changes in pressure of the lubricant in said system, and a cam moved thereby which acts to move one of the said means to an in-

operative position and the other to an operative position upon increase of pressure of the supply of lubricant and to move the second of said means to an inoperative position upon a predetermined decrease in pressure of said supply.

12. In combination with an engine having a system of forced lubrication, of a valve which controls the supply of motive fluid to the engine, an actuator comprising a rod that is connected to the valve for moving it, a shoulder on the rod, a sliding sleeve also on the rod, a latch adapted to engage the sleeve and support it and the rod, a device adapted to engage the shoulder and support the rod, and means responsive to changes of pressure in the lubricating system for moving the latch out of operative position and the device into operative position upon an increase in pressure of said supply and to move said device out of operative position upon a decrease in pressure of said supply.

13. In combination with an engine having a system of forced lubrication, of a valve which controls the supply of motive fluid to the engine, an actuator comprising a rod that is connected to the valve for moving it, a shoulder on the rod, a sliding sleeve also on the rod, a latch adapted to engage the sleeve and support it and the rod, a device adapted to engage the shoulder and support the rod, and means responsive to changes of pressure in the lubricating system for moving the latch out of operative position and the device into operative position upon an increase in pressure of said supply and to move said device out of operative position upon a decrease in pressure of said supply, and a stop means which determines the limit of movement of the rod in both directions.

14. In combination with an engine having a system of forced lubrication, of a cylinder to which lubricant under system pressure is admitted, a piston in the cylinder, a spring acting on the piston in opposition to the fluid pressure, a cam moved by the piston, a signal device, a shut-off valve in the motive fluid system, a lever for controlling the signal that is actuated by the cam, and a lever for controlling the action of the valve that is also actuated by the cam.

In witness whereof, we have hereunto set our hands this 1st day of December, 1914.

CHARLES DAY.
GEORGE EDWARD WINDELER.

Witnesses:
MALCOLM SMETHURST,
GEORGE WEAVER.