Dec. 23, 1941. R. W. JOHNSON 2,266,974

OIL CONTROL DEVICE

Filed Aug. 10, 1939 2 Sheets-Sheet 1

Fig. 2.

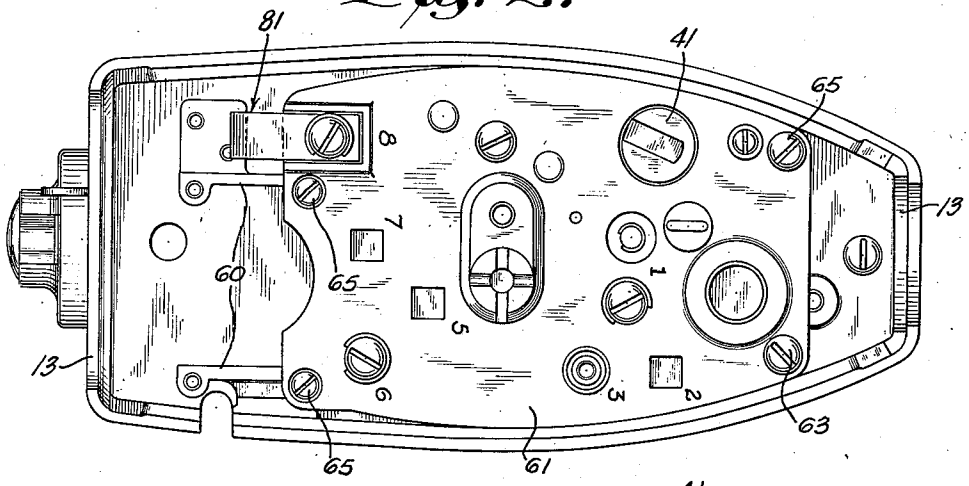


Fig. 1.

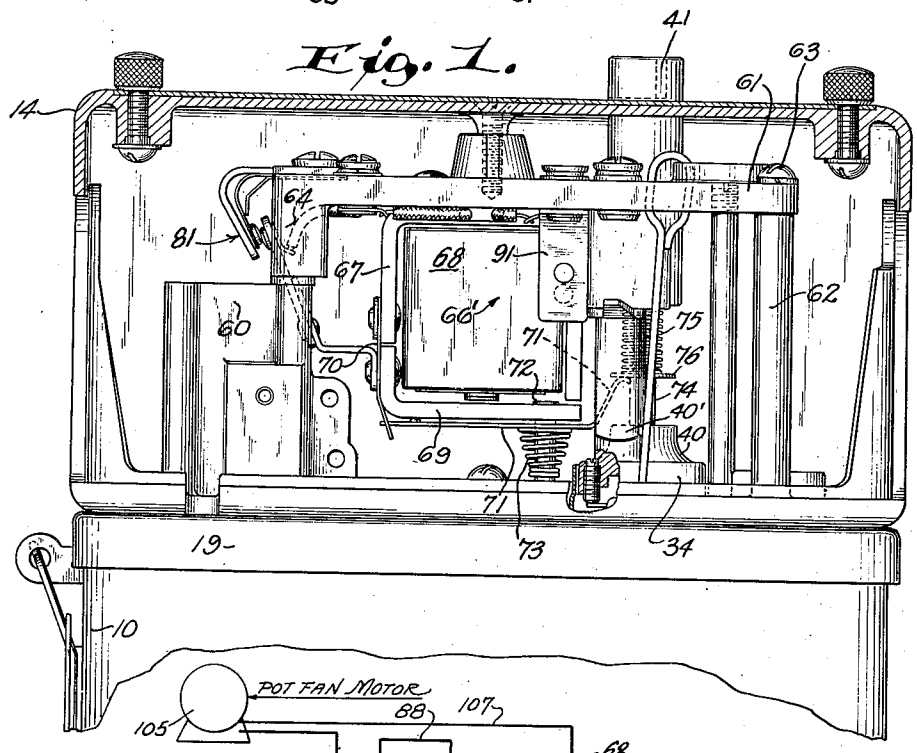
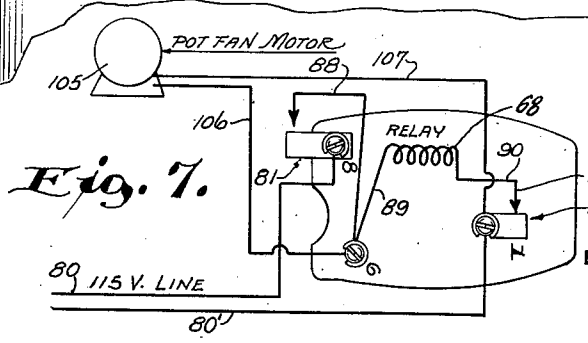


Fig. 7.



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Filed Aug. 10, 1939 2 Sheets-Sheet 2

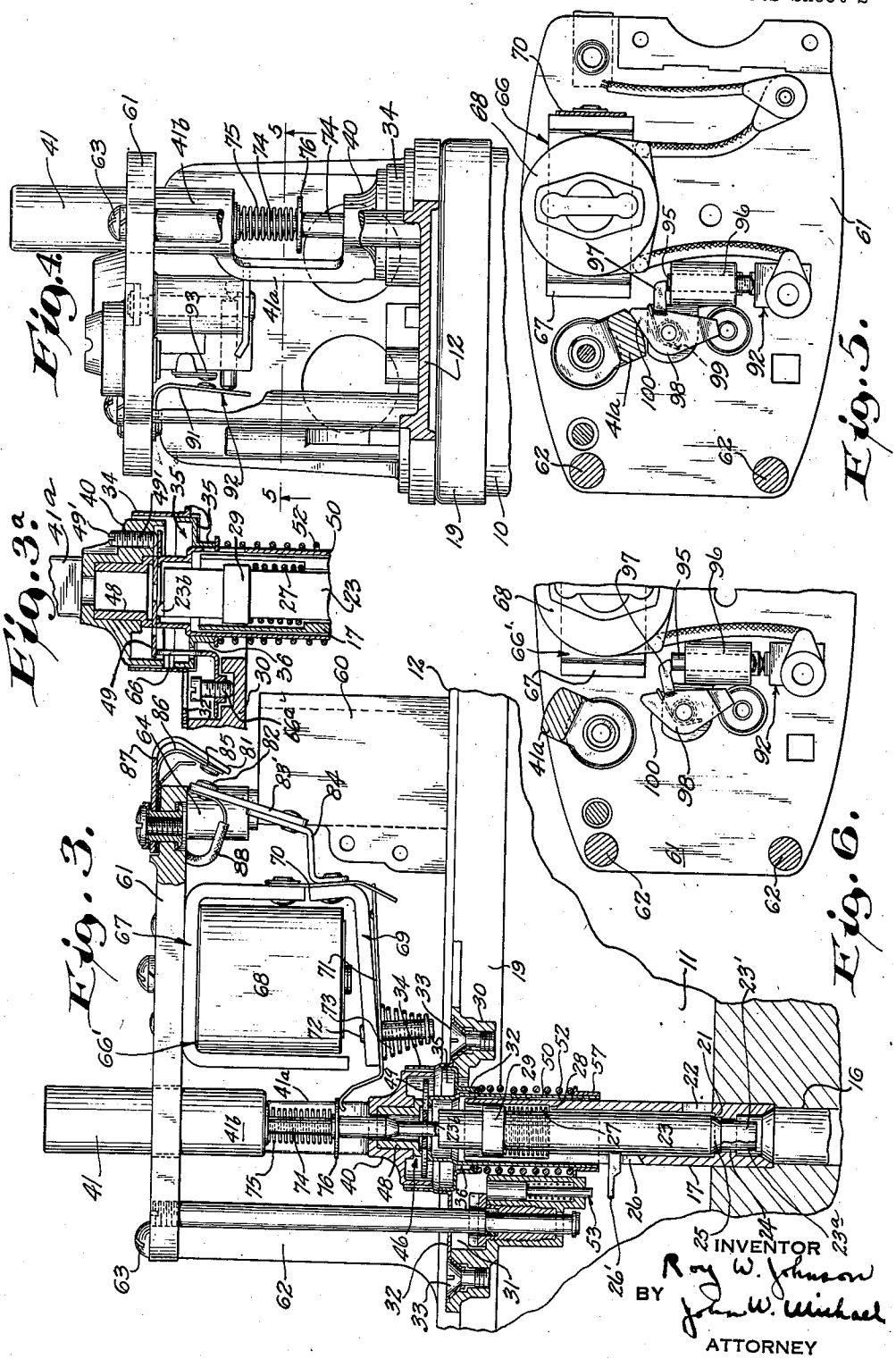

Fig. 4.

Fig. 5.

Fig. 3a.

Fig. 6.

Fig. 3.

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Patented Dec. 23, 1941

2,266,974

UNITED STATES PATENT OFFICE

2,266,974

OIL CONTROL DEVICE

Roy W. Johnson, Milwaukee, Wis., assignor to Automatic Products Company, Milwaukee, Wis., a corporation of Wisconsin

Application August 10, 1939, Serial No. 289,373

9 Claims. (Cl. 158—28)

This invention relates to an oil control device of the type incorporated in the fuel line between an oil reservoir and the burner, and where the liquid fuel is fed by gravity to the burner.

In certain types of power, range, or floor furnaces, air is supplied to the fire pot or combustion chamber of the furnace by means of a pot fan which is driven by an electric motor, and an electro-magnet or relay is provided to effect the opening and closing of the metering valve embodied in the oil burner. In such installations there is always the danger that the momentary current failure will cause the metering valve to shut off the supply of oil a short time, thereby allowing the fire to go out. Then, if the supply of current comes on again soon enough after the fire has gone out, and while the pot is still warm, and the metering valve is opened, there is a possibility of an explosive mixture forming in the combustion chamber or fire pot.

One of the objects of the present invention is to provide an oil control device, which may be readily adjusted to properly meter the flow of oil, and which, in the event of momentary current failure, will shut off the supply of liquid fuel to the burner entirely, and will accomplish this in such a way that even though the current comes quickly on again, the metering valve will remain closed, and will stay closed until the control device is manually reset. This avoids the possibility of an explosive mixture forming in the fire pot or combustion chamber of the furnace.

Another object of the invention is to provide a device of this character, which is simple, compact, and closely organized in its construction, reliable and safe in operation, and easy and comparatively inexpensive to manufacture and install.

Other objects and advantages reside in certain novel features of the construction, arrangement, and combination of parts, which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings forming a part of this specification, and in which:

Figure 1 is a view partly in side elevation and partly in longitudinal vertical section, showing an oil control device embodying the present invention.

Figure 2 is a top plan of the oil control device illustrated in Figure 1, but showing the cover of the control case removed.

Figure 3 is a fragmentary view partly in side elevation and partly in longitudinal vertical section, showing the metering valve and associated instrumentalities.

Figure 3A is a fragmentary sectional view further illustrating the manually operable control knob and cam for the metering valve illustrated in Figure 3;

Figure 4 is a fragmentary view of the oil control device embodying the present invention, the device being viewed looking toward the left-hand side of Figure 3, and parts being broken away and parts shown in section for the sake of illustration.

Figure 5 is a view in horizontal section taken on line 5—5 of Figure 4, showing the metering valve in its fully closed position.

Figure 6 is a fragmentary view similar to Figure 5, showing the metering valve partially open; and

Figure 7 is a diagram of the electric circuits employed in the control.

Referring to the drawings, and more particularly to Figure 3, it will be seen that the control device embodying the present invention comprises a casing, designated generally at 10, and having a main liquid supply chamber 11 therein. Liquid is supplied to the chamber 11 and is maintained at a constant level therein by a mechanism, which per se forms no part of the present invention, and hence is not shown. For an understanding of the mechanism which is employed for this purpose, reference is made to my prior Patent No. 2,068,138, granted January 19, 1937.

Liquid fuel flows out of the main supply chamber 11 through one or more outlet passages 16, which are connected up to the burner (not shown). A tubular valve guide 17, which may be constituted of a brass tube, has its lower end press-fitted in, or otherwise suitably secured, to the upper portion of the outlet passage 16, the valve guide standing vertically in the casing and terminating a short distance below the removable cover frame 19 thereof. A valve seat 21 is machined in and constituted as an integral part of the tube 17. Above the valve seat the tube 17 is provided with a lateral opening 22 affording communication between the interior of the guide tube and the liquid supply chamber 11.

A metering valve, designated generally at 23, is fitted in the guide tube, and has a reduced lower end 23' provided with a metering slot 23a. The reduced lower end portion 23' has a sliding fit in a correspondingly formed portion 24 of the tube 17, the portion 24 being of reduced internal diameter and functioning as a guide for the lower end of the valve. Just above the reduced portion 23' the metering valve is formed with a beveled portion 25 which coacts with the valve seat

to shut off the flow in the fully closed or shut-off position of the metering valve.

The upper portion of the tubular guide 17 is formed with a vertical guide slot 26, in which a guide pin 26', secured to the metering valve stem and projecting laterally therefrom, slides, whereby the body portion of the valve, as well as its lower end, is positively guided. The metering valve is biased to open position by means of an expansible coil spring 27, surrounding a portion of its stem and interposed between an internal shoulder 28 on the valve tube 17 and a collar or annular flange 29 fixed on the metering valve stem adjacent its upper end.

The cover frame 19 has an integral transverse web 30 provided with an opening 31, through which the upper end of the metering valve stem projects. A sheet metal bracket plate 32 is seated in a recess provided therefor in the web 30, and is releasably secured in position by two screws 33. The bracket plate 32 is provided with a flanged opening which registers with the opening 31 of the cover web 30, the flange of the opening in the bracket plate being designated at 34. An annular spring seat 35, which may also be stamped from sheet metal, is interfitted with and secured to the flanged opening of the bracket plate 32, and its horizontal portion is provided with a flanged opening 36, somewhat smaller than but coaxially with the flanged opening of the bracket plate 32. These parts provide the mounting and partial enclosure for the assembly provided for manually adjusting the metering valve.

A control casing base plate 12 is releasably fastened by screws to the cover frame 19. The base plate 12 has integral end uprights 13, which coact with the shell-like cover 14 to provide the enclosure or casing for the parts constituting the control. The manual adjusting means for the metering valve comprises a knob 40, which is loosely interfitted with the flange 34 so as to be rotatable as well as longitudinally movable with respect thereto. The knob 40 is disposed above the top of the control casing base plate 12, and has integral therewith an elongated stem or handle 41, which extends up through the top of the control casing cover 14 so as to be accessible and operable from the exterior. A sleeve and cam assembly, designated generally at 46, is interconnected with the knob 40, and extends downwardly therefrom. This assembly includes a short upper sleeve 48, which is a press fit in or otherwise secured to the hub of the knob. The cam of the assembly, designated at 49, is constituted of sheet metal plate, and is interposed between the short upper sleeve 48 and a longer and larger lower sleeve 50, and is welded to both of these sleeves so that the two sleeves and the cam are all rigidly interconnected as well as rigidly interconnected with the short knob. The lower and longer sleeve 50 loosely telescopes over the guide tube 17, and is in rotating and longitudinally sliding fit in the flange 36 of the spring seat 35.

The knob, cam, and sleeve assembly is biased downwardly by means of the coil spring 52, which surrounds the lower sleeve 50. The upper end of this spring abuts the spring seat 35 and its lower end engages an abutment 57 fixed to sleeve 50. The spring 52, in the assembly, is under suitable compression to force the control knob 40, the sleeves 48 and 50, and cam 49 downwardly with the proper pressure. The active face of the cam 49, which is adjacent its periphery, rides on the adjustable abutment or low fire stop 66 provided therefor, and supported on the cross web 30 of the cover frame. A screw 66a controls the adjustment of the low fire stop 66. A screw 49' is provided to vary the throw of the cam 49. The central portion of the cam disc while apertured presents a metering valve engaging portion around the margin of its aperture, and this portion bears against a boss 23b of the metering valve so that as the cam moves up and down when its active face rides around on the low fire stop or abutment 66, the metering valve is caused to partake of corresponding motion toward and away from its seat.

A high fire stop, designated generally at 53, is provided, and coacts with the guide pin 26' of the metering valve to limit the extent to which the valve may be open. The details of the high and low fire stop, and of the manual adjusting means, namely, the cam 49, sleeves 48 and 50, and control knob 42, are fully described and claimed in U. S. Patent No. 2,244,161, issued June 3, 1941, to Roy W. Johnson. As far as the present invention is concerned, these features illustrate one very effective and efficient way of constituting the valve and the manual control therefor, so that they may be combined in the special and advantageous manner now to be described with the electrical controls for the valve and for the pot fan motor.

The electrical control instrumentalities are mounted on the base plate 12, and are enclosed by the base plate 12, its uprights 13, and the coacting shell-like cover 14.

For this purpose a pair of transversely spaced vertical bracket plates 60 are integrally formed with the base plate 12 adjacent one end thereof. A terminal board 61 of Bakelite, or other insulating material, and generally of plate-like form, is supported on the bracket plate 60, and on vertical posts 62. The terminal board is horizontally disposed, and is secured by screws 63 to the posts 62. At one end the terminal board has a depending, transversely extending, and lug-like integral extension 64, which is engaged with and fastened by screws 65 to the bracket plates 60. The terminal board has an opening provided therein through which the extension or handle 41 of the knob 40 extends.

Supported on the under side of the terminal board 61 is an electro-magnet, designated generally at 66'. The magnet has a U-shaped metal frame 67, which is secured to the terminal board, and which serves as a support for the coil or windings 68 of the magnet and for its armature 69, and also as the flux path. An L-shaped armature 69 is swingably supported on one leg of the magnet frame 67 by means of a blade spring 70, which is riveted or otherwise suitably secured at its ends to the frame 67 and one leg of the armature, respectively. A spring finger 71 is yieldably connected to the under side of the armature by means of a stud 72 fastened to the armature and passing through an opening in the finger and having a spring 73 engaging the spring finger at one end, and at its other end abutting against a snap ring releasably secured to the stud. This connection of the spring finger of the armature is supplemented by the interengagement of one end of the spring finger with a slot provided in an extension of the blade spring 70.

The electro-magnet, together with its armature and spring finger, are employed for the purpose of controlling the position of an auxiliary valve operator 74. This valve operator is preferably in the form of a pin, which is slidably

mounted in the stem or handle 41 and in an axial opening provided in the knob 40. Its lower end is reduced and is adapted to project through an opening in the cam 49 and engage the upper end of the metering valve stem 23. The valve operating pin 74 is biased to a position to punch the metering valve completely closed, and this biasing is effected by means of a spring 75 encircling the pin and abutting the shoulder presented by the stem at the juncture of its upper portion 41b and its offset portion 41a, and also abutting a washer 76 which is held against a shoulder on the operating pin 74 by a snap ring or a C-ring. In the assembly, an angular extension of the spring finger of the armature engages under the washer 76.

To accommodate the valve operator, the stem or handle 41 has the portion 41a thereof just above the knob 40 laterally offset, while its upper portion is coaxial with the knob and is axially bored.

When the armature 69 is shifted into the effective magnetic field of the electro-magnet, and is held against the pole face of the magnet, this spring finger 71 will maintain the valve-operating pin 74 elevated and out of contact with the upper end of the metering valve stem, so as to allow the metering valve to assume the position determined by the manually adjustable means. However, when the magnet is de-energized, the armature 69 and its spring finger 71, under the influence of their own weight, and under the influence of the biasing spring of the valve-operating pin, drop downwardly, and permit the valve-operating pin to punch the metering valve to closed position.

As illustrated in Figure 7, the windings of the electro-magnet are connected in parallel with the motor of the pot fan. Referring now to Figure 7, it will be seen that one side of the source of current or line, designated at 80, is connected up to the terminal 8 of the terminal board. Combined with this terminal is a switch 81 controlled as to position by the armature of the electro-magnet. This switch 81 includes a movable contact 82 constituted as a button and mounted on an insulating strip 83', which is riveted or otherwise suitably secured to a mounting lug 84, supported in turn on one leg of the armature 69. Cooperable with the movable contact 82 is a fixed contact 85, which is mechanically and electrically connected to the terminal 8 by means of a spring strip 86, which is protected or guarded by a shield 87. The movable contact 82 is connected by a flexible wire 88 to the terminal 6 of the terminal board. One end of the winding or coil of the electro-magnet is also connected by a wire 89 to this terminal 6. The opposite end or terminal of the relay is connected by a wire 90 to a movable contact 91 of a valve controlled switch, designated generally at 92. Cooperable with the movable contact 91 of the valve controlled switch is a fixed contact 93, which is connected by a conductor or wire 94 with the terminal 1 of the terminal board. The movable contact 91 of the valve controlled switch is in the form of an angular strip of spring metal provided with a button for the contact proper. One leg of this angular strip of metal is fastened to the under side of the terminal board, and the strip is biased by its own resiliency to closed position. A switch-operating pin 95 is slidably fitted in a bearing 96, which may be integrally formed with the under side of the terminal board, and one end of this pin is disposed to engage the lower end of the spring strip 91. The opposite end of the pin is engaged by an operating finger 97 of the switch-operating lever 98, which is pivotally supported on the mounting pad provided therefor in the terminal board, and is biased by means of a spring 99 to swing away from the switch-operating pin. The lever 98 is formed with a cam face 100, which lies in the path of the offset portion 41a of the metering valve-operating pin, so that when this handle is turned to a position wherein the metering valve is fully closed, the curved face of this offset portion will wipe against the cam face 100 of the switch-operating lever 98 to rotate this lever about its fulcrum and cause its finger 97 to push the switch-operating pin 95 toward the contact strip of the movable contact of the valve-controlled switch, thereby flexing this strip and its contact in a direction away from the fixed contact of the switch.

Referring now again to Figure 7, the fan motor is designated at 105, and one of its terminals is connected by a wire 106 to the terminal 6 of the terminal board. The other terminal of the motor is connected by a wire 107 to the terminal 1 of the terminal board.

With this construction, when a control is combined with the burner, and is to be put into use, the operator first manually turns the stem 41 to determine the position of the metering valve that is desired under the circumstances. The operator then pulls the stem 41 upwardly, the coil spring 52 yielding to permit such movement of the stem 41. This upward movement of the stem 41, due to engagement of portion 40' of knob 40 with the overlying portion of spring finger 71 (see Fig. 1) lifts the armature 69 to engage the contacts 82 and 85, thereby closing switch 81. The moving of the metering valve away from fully closed position automatically allows the switch 92 to close. The circuits are now completed, and current flows from one side of the line 80, through the switch 81, wire 88, and terminal 6. Here the current branches and flows through wire 89, winding 68, switch 92, to the other side of the line 80', and also flows through terminal 6 through wire 106, pot fan motor 105, wire 107, terminal 1, and back to the other side of the line. The flow of current through the wires 68 of the magnet of course excites the magnet, and since the armature 61 has been lifted into its effective magnetic field, it will be held there by the magnet. This will maintain the switch 82 closed, and also lift the valve-operating pin 74 so as to allow the metering valve to occupy the position determined by the manually adjustable means. In the event of momentary current failure, the magnet is of course de-energized, and instantly the armature 69 drops away from the magnet, allowing the valve-operating pin to punch the metering valve closed, and disengaging the contacts 82 and 85 of switch 81. This breaks the circuit through the pot fan motor, as well as through the magnet, and even though the flow of current is resumed, the metering valve will remain closed, and the pot fan motor will remain off, until the operator manually re-sets the device, or in other words until he again pulls upwardly on the stem 41 and lifts the armature 69 into engagement with the magnet to close the switch contacts 82 and 85 of the switch. This, as pointed out, is a distinct advantage and prevents the possibility of an explosive mixture or charge being formed in the combustion chamber or fire pot of the burner.

While I have shown and described one construction in which the invention may be advan-

tageously embodied, it is to be understood that the construction shown has been selected merely for the purpose of illustration or example, and that various changes in the size, shape, and arrangement of the parts may be made without departing from the spirit of the invention or the scope of the subjoined claims.

I claim:

1. An oil control device of the character described comprising a casing having a liquid supply chamber provided with an outlet, a metering valve for regulating flow through the outlet, means for biasing the valve to open position, manually adjustable means effective to move the valve toward its seat against the action of said biasing means and thereby control the position of the valve, an auxiliary valve operator biased to punch the valve to closed position, and electromagnetic means operatively interconnected with said auxiliary valve operator and acting when energized to maintain the valve operator in inoperative position.

2. An oil control device of the character described comprising a casing having a liquid supply chamber provided with an outlet, a metering valve for regulating flow through the outlet, means for biasing the valve to open position, manually adjustable means effective to move the valve toward its seat against the action of said biasing means and thereby control the position of the valve, an auxiliary valve operator biased to punch the valve to closed position, an electromagnet, an armature interconnected with the auxiliary valve operator and acting when in the effective field of the magnet to maintain the valve operator in inoperative position, and a circuit for said electro-magnet including a switch controlled by the armature of said magnet so as to be closed when the armature is in the effective field of the magnet and open when the magnet is deenergized.

3. An oil control device for a burner of the type having an electric motor-driven fan for supplying air to the combustion chamber of the burner, and comprising a casing having a liquid supply chamber provided with an outlet, a metering valve for regulating flow of liquid through the outlet, means for biasing the valve to closed position, manually adjustable means cooperable with the valve effective to move it toward its seat against the action of said biasing means, thereby controlling the position of the valve, an auxiliary valve operator biased to punch the valve to closed position, an electro-magnet, an armature operatively connected with the auxiliary valve operator and acting when in the effective field of the magnet to maintain the valve operator in operative position, an electrical circuit for the winding of the magnet and for the fan motor and including connections whereby the motor and winding are electrically connected in parallel, and also including a switch connected to and controlled by the armature of said magnet so as to be closed when the armature is in the effective field of the magnet and opened when the magnet is deenergized.

4. An oil control device for a burner of the type having an electric motor-driven fan for supplying air to the combustion chamber of the burner, and comprising a casing having a liquid supply chamber provided with an outlet, a metering valve for regulating flow of liquid through the outlet, means for biasing the valve to closed position, manually adjustable means cooperable with the valve effective to move it toward its seat against the action of said biasing means, thereby controlling the position of the valve, an auxiliary valve operator biased to punch the valve to closed position, an electro-magnet, an armature operatively connected with the auxiliary valve operator acting when in the effective field of the magnet to maintain the valve operator in inoperative position, an electrical circuit for the winding of the magnet and for the motor and including connections whereby the motor and winding are electrically connected in parallel, and also including a switch connected to and controlled by the armature of said magnet so as to be closed when the armature is in the effective field of the magnet and opened when the magnet is deenergized, and a valve controlled switch open when the metering valve is fully closed and closed in all other positions of the valve, said valve-controlled switch being connected in series with said armature controlled switch.

5. An oil control device of the character described comprising a casing having a liquid supply chamber provided with an outlet, a metering valve for regulating flow through the outlet, means for biasing metering valves to open position, manually adjustable means cooperable with the valve and effective to move it toward its seat against the action of said biasing means, high and low fire stops for determining the high and low fire positions of the valve, an auxiliary valve operator biased to punch the metering valve to fully closed position, and means for regulating the action of said auxiliary valve operator and including an electro-magnet, and an armature operatively interconnected with said auxiliary valve operator and acting when in the effective field of the magnet to maintain the valve operator in inoperative position.

6. An oil control device of the character described comprising a casing having a liquid supply chamber provided with an outlet, a metering valve for regulating flow through the outlet, means for biasing metering valves to open position, manually adjustable means cooperable with the valve and effective to move it toward its seat against the action of said biasing means, high and low fire stops for determining the high and low fire positions of the valve, an auxiliary valve operator biased to punch the metering valve to fully closed position, means for regulating the action of said auxiliary valve operator and including an electro-magnet, an armature operatively interconnected with said auxiliary valve operator and acting when in the effective field of the magnet to maintain the valve operator in inoperative position, and an electrical circuit for said magnet including a switch interconnected with the armature so as to be closed when the armature is in the effective field of the magnet and automatically opened when the magnet is deenergized.

7. An oil control device of the character described, comprising a casing having a liquid supply chamber provided with an outlet, a metering valve for regulating the flow of liquid through the outlet means for biasing the metering valve to open position, high and low fire stops cooperable with the valve to determine the high and low fire positions thereof, a manually adjustable cam also cooperable with the valve for determining the positions thereof intermediate high and low fire positions, an operating element connected to the cam to facilitate adjustment

thereof, an auxiliary valve-operating pin slidably mounted on said element and engageable with the valve to punch the same to fully closed position, a spring coacting with the pin and tending to cause the same to punch the valve closed, an electro-magnet, an armature interconnected with the pin and acting when the armature is in the effective field of the magnet to hold the pin out of engagement with the valve, and an electrical circuit for the magnet including a switch interconnected with its armature so as to be closed when the armature is in the effective field of the magnet and open when the magnet is deenergized.

8. An oil control device for burners of the type having an electric motor-driven fan for supplying air to the combustion chamber of the burner, and comprising a casing having a liquid supply chamber provided with an outlet, a metering valve for regulating the flow of liquid through the outlet means for biasing the metering valve to open position, high and low fire stops cooperable with the valve to determine the high and low fire positions thereof, a manually adjustable cam also cooperable with the valve for determining the positions thereof intermediate high and low fire positions, an operating element connected to the cam to facilitate adjustment thereof, an auxiliary valve-operating pin slidably mounted on said element and engageable with the valve to punch the same to fully closed position, a spring coacting with the pin and tending to cause the same to punch the valve closed, an electro-magnet, an armature interconnected with the pin and acting when the armature is in the effective field of the magnet to hold the pin out of engagement with the valve, an electrical circuit for the magnet including a switch interconnected with its armature so as to be closed when the armature is in the effective field of the magnet and open when the magnet is deenergized, and electrical connections for connecting the fan motor in said circuit and parallel with the magnet.

9. An oil control device for burners of the type having an electric motor-driven fan for supplying air to the combustion chamber of the burner, and comprising a casing having a liquid supply chamber provided with an outlet, a metering valve for regulating the flow of liquid through the outlet means for biasing the metering valve to open position, high and low fire stops cooperable with the valve to determine the high and low fire positions thereof, a manually adjustable cam also cooperable with the valve for determining the positions thereof intermediate high and low fire positions, an operating element connected to the cam to facilitate adjustment thereof, an auxiliary valve-operating pin slidably mounted on said element and engageable with the valve to punch the same to fully closed position, a spring coacting with the pin and tending to cause the same to punch the valve closed, an electro-magnet, an armature interconnected with the pin and acting when the armature is in the effective field of the magnet to hold the pin out of engagement with the valve, an electrical circuit for the magnet including a switch interconnected with its armature so as to be closed when the armature is in the effective field of the magnet and open when the magnet is deenergized, electrical connections for connecting the fan motor in said circuit and in parallel with the magnet, and a valve-controlled switch in said electrical circuit in series with said magnet-controlled switch and so interconnected that the valve has to be opened when the valve is fully closed and closed in all other positions of the valve.

ROY W. JOHNSON.