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VALVE AND SWITCH UNIT

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FIG. 1

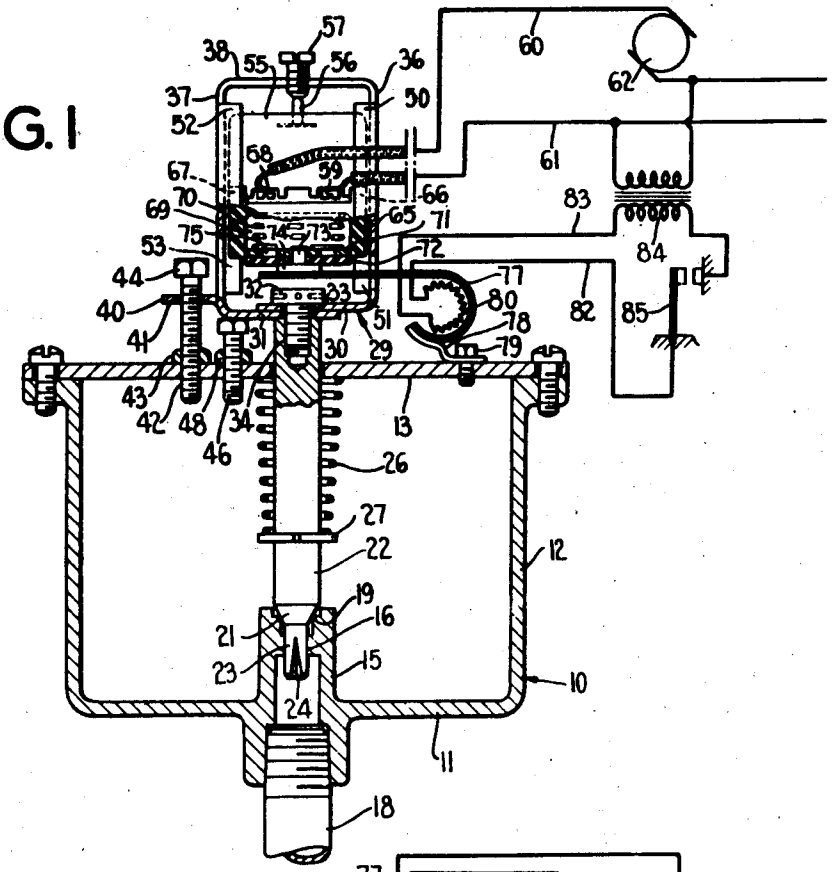
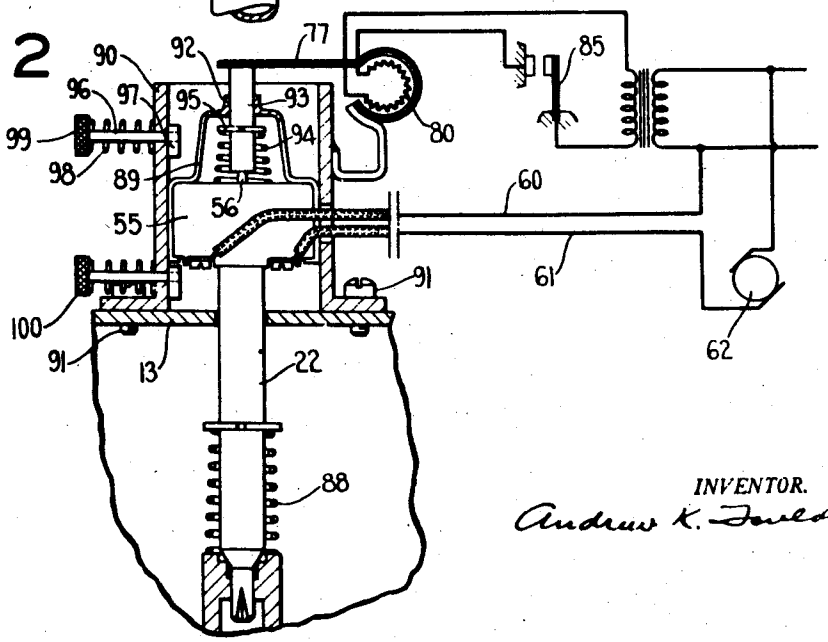


FIG. 2



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VALVE AND SWITCH UNIT

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The invention relates to a fuel burning system such as an oil burner and it has particular relation to a valve and switch unit for controlling the flow of fuel and operation of a fan or blower forming part of the system.

In one type of oil burner, oil is supplied to the burner through a valve which is adjustably controlled in a manner depending upon the type of fire required. For instance, if the space to be heated requires heat, more oil is supplied to the burner and when the temperature of the space increases sufficiently the amount of oil supplied is reduced so that only a small fire is maintained. Generally, in this type of burner a fan or blower is controlled in such manner that more air flows to the burner when the larger amount of oil is being supplied and when the amount of oil is reduced the flow of air is reduced. Equipment of this type is controlled by a valve and an electrical switch governing operation of the fan.

One object of the present invention is to provide improvements in the equipment for the purpose indicated wherein the electrical switch controlling the fan operation forms an operating part of the valve controlling device.

Another object of the invention is to provide the improved arrangement such as designated wherein the electrical switch is embodied in a casing which acts as an operating part of the valve device so that forces controlling the valve operation are imparted through the switch casing.

Another object of the invention is to provide an arrangement of the character indicated wherein opening of the electrical switch controlling the fan operation is delayed if the valve is operated to reduce the full fuel so as to permit a temporary continued operation of the fan until oil already supplied to the burner is reduced in quantity.

Another object of the invention is to provide a valve operating and switch control unit which may be easily attached to existing forms of float valve casings so as thereby to permit use of the invention in connection with existing equipment.

Another object of the invention is to provide equipment such as indicated which may be manufactured and assembled inexpensively.

Other objects of the invention will become apparent from the following description, from the drawing to which it relates and from the claims hereinafter set forth.

For a better understanding of the invention reference may be had to the accompanying drawing wherein:

Figure 1 is a vertical section of a control device

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constructed according to one form of the invention; and

Fig. 2 is a similar view showing another form of the invention.

Referring to Fig. 1, a float valve casing is indicated at 10 and this comprises a body having a bottom 11, side wall 12 and a cover 13. The bottom 11 has an upwardly extending projection 15 which is apertured as indicated at 16 to permit fuel to flow downwardly therethrough and below this projection, a conduit 18 is connected to the bottom. This conduit leads to an oil burning device which in this case may be a pot type of burner having a pilot fire. Above the opening 16, a valve seat 19 is provided at the upper end of the projection 15 and this seat is adapted to cooperate with a frusto-conical surface 21 on a valve stem 22. Below the frusto-conical surface 21, the valve stem has a smaller portion 23 movable through the opening 16 and this smaller portion has tapered grooves 24.

The valve is shown in its closed position but it will be seen that as it is raised from the seat 19, the amount of oil that will flow through the valve will depend upon the extent the tapered groove 24 projects above the upper end of the opening 16. Depending upon the position of the valve stem 22, therefore, the amount of oil which will flow downwardly and to the burner may be relatively large so as to support a high fire or small so as to support a low fire or the flow of oil may be entirely cut off.

A spring 26 is provided on the valve stem and this spring at its upper end engages the cover 13 while at its lower end it engages a collar 27 on the valve stem. Thus, the stem normally urges the valve towards a closed position. The stem projects through an opening in the cover 13, and at its upper end it is connected to a sheet metal frame 29 which has inwardly turned legs or flanges 30 and 31 at its lower end which overlap and lay over the upper end of the stem. A screw 32 extending downwardly through an opening 33 in the flanges, and which is threaded into an opening 34 in the upper end of the stem, connects the latter to the frame. The casing or frame 29 includes side walls 36 and 37 and a top wall 38 and it is evident that the frame may be readily constructed from sheet metal.

Towards its lower end, the side wall 37 has a struck out finger 40 and this finger has an opening 41 through which a screw 42 passes. The lower end of the screw is threaded into the cover 13 so as to be adjustable and the screw may be locked in any position of adjustment by a lock

nut 43 adapted to be turned tightly against the upper side of the cover. At its upper end, the screw has a head 44 and it is now evident that upward movement of the valve stem 22 may be adjustably limited by adjustment of the screw 42 so as thereby to limit the amount the valve can be opened. Thus, this screw controls the high fire position of the valve stem.

A similar screw 46 threaded through the cover 13 is disposed below the flange 31 of the frame so as to limit downward movement thereof and hence downward movement of the valve stem. Therefore, whether or not the valve is fully closed or is almost closed so as to supply a small amount of fuel for low fire depends upon the position of the screw 46. A lock nut 48 holds the screw 46 in position.

Opposite side edges of the vertical wall 36 have inwardly turned legs 50 and 51 respectively so as to provide a vertical channel or guideway and similar legs 52 and 53 on the wall 37 provide a guideway at the opposite side of the frame. These channels or guideways slidably receive a switch casing 55 which may be formed from suitable insulating material as will be readily understood. The switch may be of a standard snap action type having a pin or element 56 projecting above its upper surface for engagement with a screw 57 in the wall 38 and when this pin is moved downwardly, the switch is closed in a snap action manner and when the pin is allowed to move upwardly by spring action of the switch construction, the switch opens in a snap action manner. A switch known in the trade as the "ACRO snap" switch is satisfactory for this purpose.

At its lower side, the switch casing is provided with terminals 58 and 59 and these are connected to wires 60 and 61 in the circuit of a motor 62 which operates a blower or fan adapted to supply air to the burner. When the pin 56 is moved downwardly relative to the switch casing the switch closes and the motor 62 operates the blower or fan and then when the switch element moves upwardly relative to the switch casing the motor 62 is stopped.

Below the switch casing, an insulating frame element 65 is also mounted for sliding movement in the channels and this frame element has opposite legs 66 and 67 abutting the bottom of the switch casing. The element 65 has a downwardly open recess or well 69 and within this well a spring 70 is provided which, at its upper end, abuts the bottom wall of the recess and at its lower end a disc element 71 slidably but closely fitting in the well. A flexible rubber diaphragm 72 is connected to the center of the disc by means of a rivet 73 having a substantially large head 74 for supporting the central and underside of the diaphragm and the diaphragm is slightly smaller than the disc 71 and is movable upwardly into the well 69.

One or more openings 75 are provided in the disc so as to be covered by the diaphragm 72 and these openings serve as valve apertures. Now, if the head 74 on the rivet element is moved upwardly, the disc and diaphragm move upwardly against the action of the spring 70 and any air within the well can escape through the openings 75 as the edge portions of the diaphragm 72 will flex downwardly so as to allow the air to flow outwardly between the diaphragm and disc. The disc and diaphragm are allowed to move downwardly by slight air leakage either past the edges of the disc and diaphragm or, if desired, a small opening may be provided in the wall of the element 65. It should be understood from this that the structure thus described provides a dashpot which allows rapid movement of the disc upwardly into the well but only a relatively slow return movement.

A bi-metallic element 77 is mounted on a bracket 78 secured to the cover 13 by a screw 79 and this bi-metallic element extends inwardly through an opening in the frame 29 and under the rivet head 74. A heating element 80 is attached to the bi-metallic element and the arrangement is such that when electric current flows through the heating element 80 the bi-metallic element moves so as to press upwardly against the rivet head 74 and when the heating element 80 cools, reverse movement of the parts occurs. The heating element 80 is connected to wires 82 and 83 forming part of a circuit including a transformer 84 and a thermostat 85. This thermostat may be located in the room to be heated.

With the parts as shown, the thermostat is open. No oil is flowing to the burner, and the blower motor 62 is not operating. When heat is required in the room, the thermostat 85 closes and this causes the element 80 to become heated and the bi-metallic element 77 to move upwardly against the rivet head 74. The first part of this movement causes the dashpot element 65 and switch casing 55 to move upwardly so as to press the switch operating element 56 against the screw 57 in the upper wall 38 of the frame 29. Thus, the switch is closed thereby causing the motor 62 to operate.

As the bi-metallic element continues to move upwardly, the disc 71 moves upwardly into the well 69 thereby compressing the spring 70 and during this time, the switch casing 55 is held against upward movement by the pin 56 having reached the lower limit of movement within the switch casing. If desired, a separate stop might be provided between the upper wall 38 of the frame 29 and the switch casing 55 so that the switch casing 55 would abut the stop directly after the pin 56 has been moved to close the switch. The same result might be accomplished by having stops on the upper ends of the guideways so that the switch casing could only move so far upwardly but sufficiently for causing the switch to close.

When resistance to movement of the disc upwardly in the well 69 becomes sufficient such as when the spring reaches a closed condition, further movement of the bi-metallic element will cause the entire frame 29 to move upwardly thereby overcoming the spring 26 on the valve stem and elevating the stem to open the valve. This opening movement continues until the adjusting screw 42 stops the movement. The burner now operates at a high fire stage with a larger quantity of oil being supplied. When the room is heated sufficiently to cause the thermostat to open, bi-metallic element 77 begins a return movement as it cools and the spring 26 first returns the valve to its lower position. When the valve stem reaches its lower position, the spring 70 pressing against the bottom surface of the well 69 holds the pin 56 in a switch closed position and as the bi-metallic element continues its return movement, the disc will gradually move while still holding the switch closed. Finally, the force of the expanding spring is less than the switch spring action and the switch opens so as to stop the fan motor 62. From this, it will be seen that

there is a delayed action in the opening of the switch as the valve is closed or moved to its lower position. This is desirable since the blower will continue to operate and supply air to the burner so as to support high fire combustion until the relatively large amount of oil in the burner is consumed to a low fire stage.

In the form of the invention shown by Fig. 2 the valve stem 22 is urged upwardly to an open position by a spring 88 and the open end of the stem above the cover 13 abuts the switch casing 55 directly. This casing is held in a metal frame 89 which is slidable in a guide element 90 secured by screws 91 to the cover. The frame 89 above the casing 55 is shaped to provide a tubular guide 92 and in this guide a pin 93 is slidably mounted for movement in a vertical direction. The lower end of the pin 93 contacts the switch pin 56 while the upper end of the pin contacts the bi-metallic element 77. For normally urging the pin 93 upwardly a spring 94 is provided which abuts at its lower end the casing 55 and at its upper end a collar 95 on the pin. In this assembly, the bi-metallic element 77 is fastened to the element 90 instead of to the cover 13 so as to place the bi-metallic element above the switch.

For limiting movement of the switch casing 55 and valve stem 22 upwardly, a turnable pin 96 extends through the side wall of element 90 and is provided with an eccentrically mounted head 97 disposed in the path of the switch casing and frame 89. A spring 98 around the pin 96 and abutting the element 90 and a knurled head 99 on the outer end of the pin frictionally holds the pin in position. It is evident that when the pin is turned, the head 97 may be changed so as to vary the distance the switch casing may move upwardly. A similar pin 100 below the switch casing 55 limits the amount the valve stem can move downwardly so that the valve can be held slightly open for low fire.

When the thermostat 85 closes so as to require heating of the heating element 80, this causes the bi-metallic element 77 to function and as a result the element moves upwardly. The spring 94 is stronger than the spring 88 and the first movement of the bi-metallic element causes the pin 93 to move upwardly relative to the switch casing thereby allowing the switch pin 56 to move so as to close the switch. It should be stated here that in this form of the invention the electrical connections on the switch are such that upward movement of the pin closes the switch across the terminals, whereas in Fig. 1, the downward movement of the pin closes the switch across the terminals. Two switches are really present, one closed when the pin is moved downwardly and the other when it is moved upwardly and in Fig. 1 one of the switches is used and in Fig. 2 the other is used.

Continued movement of the bi-metallic element and expansion of spring 94 finally may press the collar 95 against the frame 89 and then spring 88 opens the valve so as to supply oil for the high fire stage. When the thermostat opens, a reverse movement occurs and the valve first closes or moves to its low fire position. Then the spring 94 is compressed and finally the switch is opened.

It is evident, that in either form of the invention a unit is provided including a switch, which may be quickly and easily attached to the valve casing and to the valve stem, and that the switch itself forms an intermediate part of the means for moving the valve and hence it is operatively between the bi-metallic element and the valve

stem. It is also evident that in either case, the motor operating the fan continues operating for a period after the valve is moved to its closed or low fire position and hence that air will be supplied for consuming oil present in the burner. Furthermore, in the construction shown by Fig. 1, a further delay occurs before the blower ceases operating so as to allow more time for consuming the oil in the burner. The simplicity of the invention is such that it may be manufactured inexpensively and then assembled with existing forms of valve controls, merely by attaching it to the covers of valve casings now in use.

Although more than one form of the invention has been illustrated and described in detail, it will be apparent to those skilled in the art that various modifications may be made without departing from the scope of the appended claims.

What is claimed is:

1. In a combined valve and switch device, a valve member, a bodily movable switch casing having a switch operating pin projecting therefrom, operating means for said valve member and said switch pin, and means including said switch casing for transmitting movement from said operating means to said valve member.

2. In a combined valve and switch device, a valve member, a bodily movable switch casing having a switch operating pin projecting therefrom, operating means for said valve member and said switch pin, means including said switch casing for transmitting movement from said operating means to said valve member, and means cooperable with said operating means to actuate said pin prior to opening movement of said valve member.

3. In a combined valve and switch control device, a bodily movable switch casing having a switch operating pin projecting from the casing, a valve member operatively connected to said casing for movement thereby, means acting through said casing to move said valve member, and means to actuate said pin.

4. In a combined valve and switch device, a valve member, a bodily movable switch casing, means operable to transmit movement from said switch casing to said valve member, a switch operating pin projecting from said switch casing, operating means for moving said casing and said pin, and resilient means operable to transmit movement from said last-named operating means to said switch casing.

5. In a combined valve and switch device, a valve member, a bodily movable switch casing having a switch operating pin projecting therefrom, operating means for said valve member and said switch pin, and means including said switch casing and said pin for transmitting movement from said operating means to said valve member.

6. In a combined valve and switch device, a valve member, a bodily movable switch casing having a switch operating pin projecting therefrom, a frame carried by said valve member and slidably supporting said switch casing, an abutment on said frame engageable by and for actuating said switch pin, said pin transmitting movement from said casing to said frame, and an operating member for moving said switch casing to actuate said pin and to move said frame.

7. In a combined valve and switch device, a valve member, a bodily movable switch casing having a switch operating pin projecting therefrom, a frame carried by said valve member and slidably supporting said switch casing, an abutment on said frame engageable by and for ac-

tuating said switch pin, said pin transmitting movement from said casing to said frame, an operating member for moving said switch casing to actuate said pin and to move said frame, and a dash-pot interposed between said operating member and said switch casing.

8. In a combined valve and switch device, a valve member, a spring urging said valve member toward one position, a frame secured on said valve member, means engageable with said frame to limit valve member movement, a snap switch casing slidably supported in said frame and having a switch operating pin projecting from said casing, said pin being engageable with said frame to operate said pin, operating means to move said casing in said frame to actuate said pin and being operable to move said valve member against the force of said spring, and means including said casing, said pin and said frame to transmit the movement of said operating means to said valve member.

9. In a device of the character described, a valve member having a stem, an operating means to move said valve member, a bodily movable switch casing having a switch operating pin projecting therefrom, a spring bearing against said casing, said spring and said casing being interposed between said operating means and said stem and being operable to transmit movement from said operating means to said stem, said spring being compressible upon limitation of movement of said valve member, means to limit closing movement of said valve member, and

means operable upon compression of said spring to actuate said switch operating pin.

10. In a combined valve and switch device, a valve member, a switch casing supported on said valve member and having a switch operating pin projecting from said casing, a thrust member engageable with and for operating said pin, a spring interposed between said thrust member and switch casing to oppose operation of said pin by said thrust member and to transmit valve member operating movement from said thrust member to said switch casing, means to move said thrust member to actuate said valve and said switch pin, and means to limit movement of said switch casing so that said thrust member can actuate said pin.

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