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THERMALLY RESPONSIVE CONTROL SWITCH FOR LIQUID FUEL LINES

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2 Sheets-Sheet 1

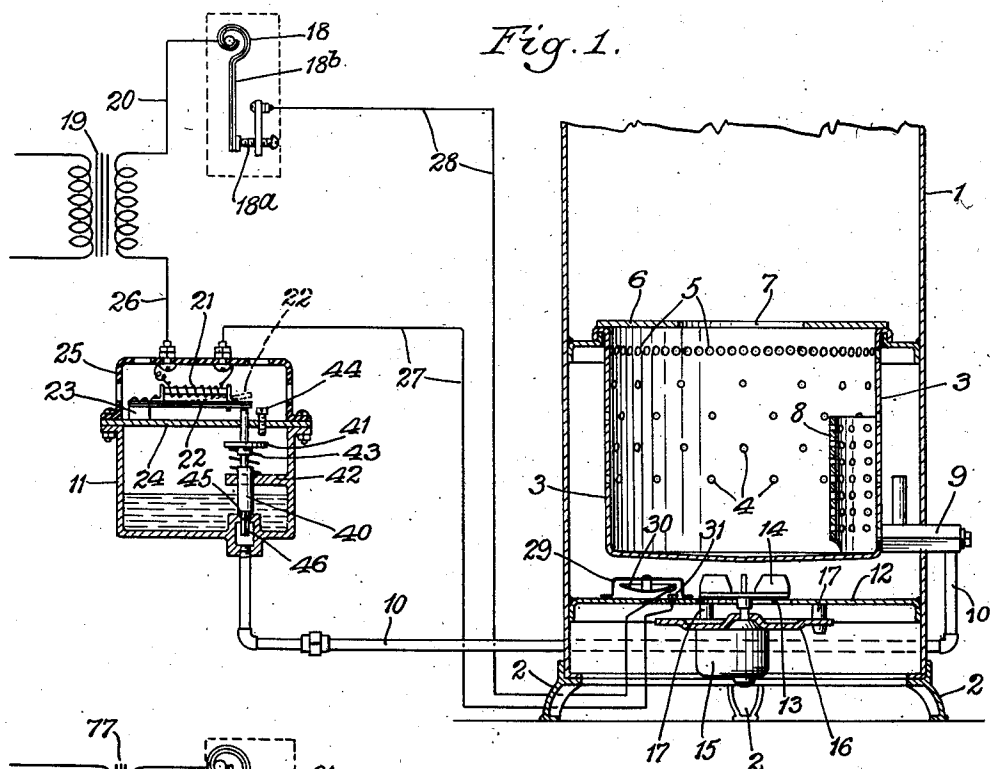
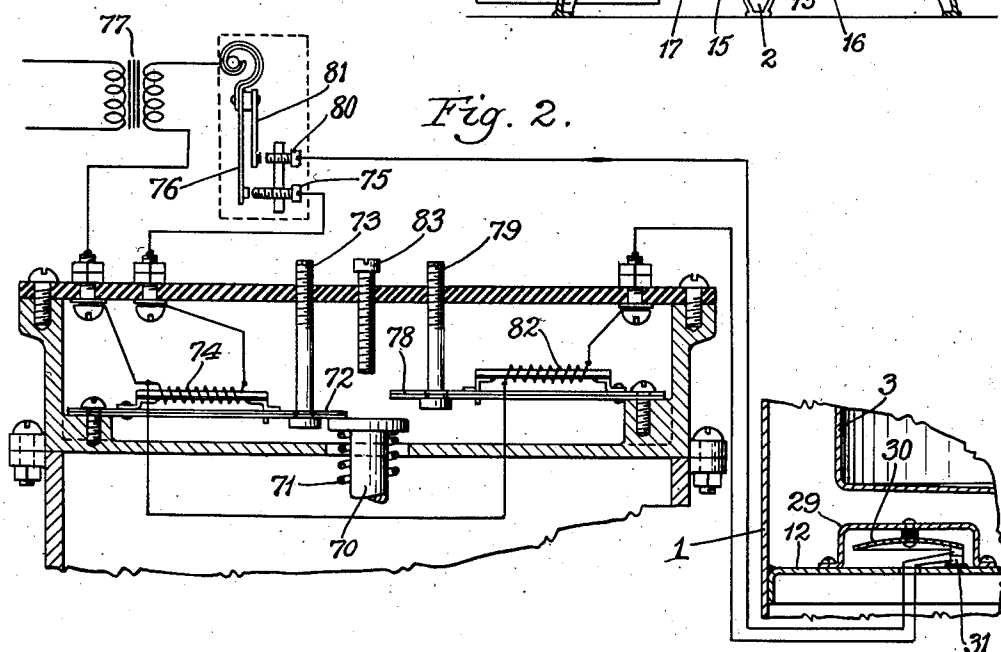


Fig. 2.



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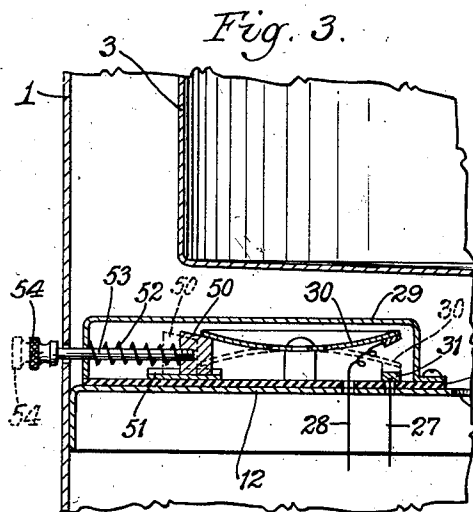
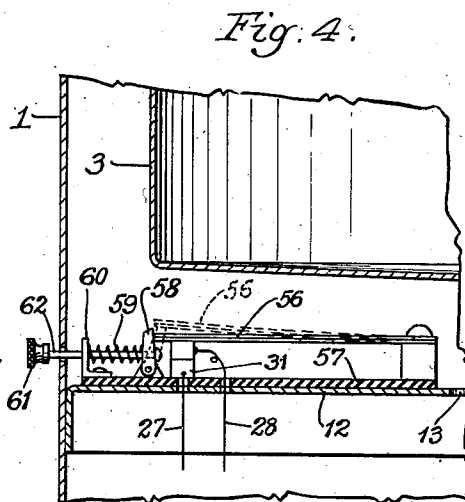
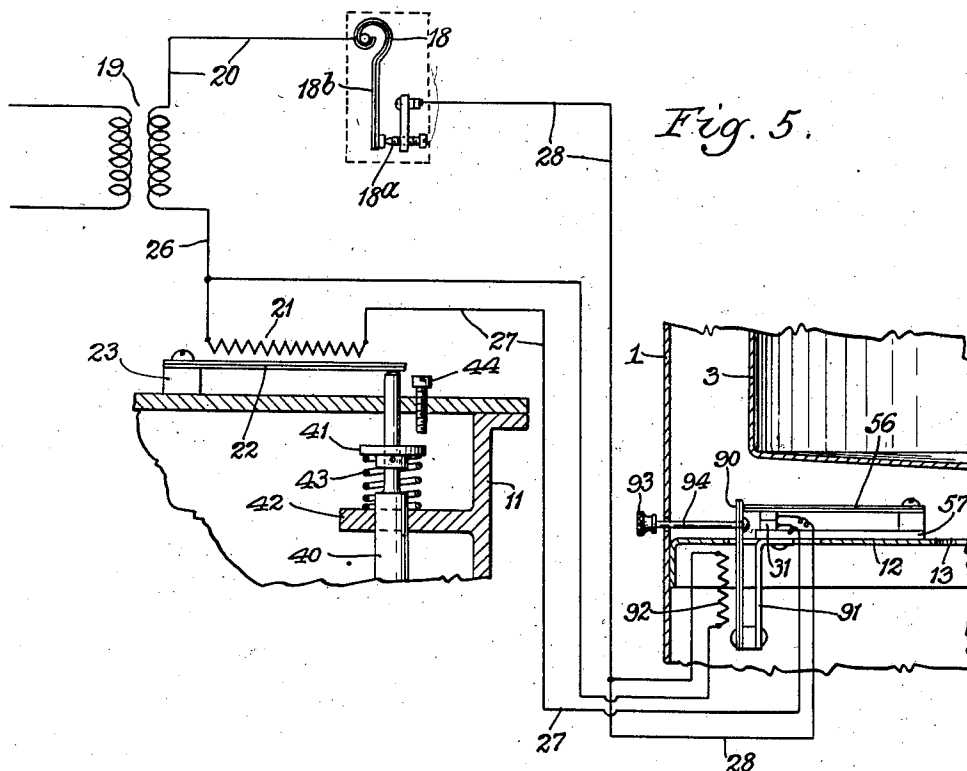
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UNITED STATES PATENT OFFICE

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THERMALLY RESPONSIVE CONTROL
SWITCH FOR LIQUID FUEL LINESBruce Hayter, Santa Fe, N. Mex., assignor to Oil
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1 Claim. (Cl. 158-28)

My invention relates to an improvement in control devices for oil burners and the like, and has for one purpose the provision of means for controlling or varying the flow of fuel to a liquid fuel burner in response to changes in the temperature conditions adjacent the burner.

Another purpose is the provision of a control device for use with pot type burners which operates in response to an undesired increase in temperature at or adjacent the pot.

Another purpose is the provision of means for cutting off or reducing fuel flow to a pot type burner having a booster fan in response to failure of the fan or fan motor.

Other purposes will appear from time to time in the course of the specification and claim.

I illustrate my invention more or less diagrammatically in the accompanying drawings wherein:

Fig. 1 is a vertical section;

Fig. 2 is a partial vertical section on an enlarged scale of a variant form of the device;

Fig. 3 is a partial vertical section illustrating a variant form of switch;

Fig. 4 is a similar section illustrating a still further variant form of switch; and

Fig. 5 illustrates a variant form of switch control.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, 1 generally indicates a heater drum, which may for example have supporting legs 2. 3 indicates a pot located within the drum and having a plurality of primary air inlet apertures 4 and a top row of secondary air inlet apertures 5. 6 is any suitable fire ring having a central aperture 7. 8 indicates a foraminous pilot partition. 9 is a liquid fuel nozzle in communication with a liquid fuel line 10, extending from the valve housing 11. 12 is a horizontal partition in the drum 1 and herein shown as located below the bottom of the pot 3. It is provided with a central aperture 13, having in line therewith a booster fan 14, actuated by any suitable motor 15, the fan and motor, if desired, being mounted on a unitary supporting plate 16 spaced below the partition 12 as by any suitable spacers 17.

It will be understood that any suitable circuit may be provided whereby the motor 15 may be constantly operated from any suitable source of electric power. 18 indicates a thermostat, which may have a normally fixed adjustable contact 18a and a movable contact 18b, which may for example be a bimetallic strip. 19 is any suitable

source of electric power, which may for example be a transformer. 20 is a connection between the thermostatic contact 18b and the transformer.

21 is a resistance mounted on or in the valve housing generally indicated as 11, and for convenience shown as mounted adjacent a warping bar 22, both being mounted as upon a bracket 23 on the partition or support 24 within the housing cover 25. The resistance 21 is shown as in circuit with the transformer 19 as by the conductor 26. 27 and 28 indicate conductors extending respectively from the resistance 21 and the thermostatic fixed contact 18a to any suitable heat responsive member generally indicated as 29 and located for convenience adjacent the pot 3. I may find it convenient to locate it on the partition 12 below but close to the bottom of the pot 3. I may employ any thermostatically responsive element but for convenience I illustrate a snap disc 30 associated with the conductor 28 and the fixed contact 31 associated with the conductor 27.

It will be understood that the members 30, 31 may normally be in circuit closing relation but that, in response to a predetermined increase in the temperature of or about the switch, the member 29 may snap into circuit breaking position, which breaks the circuit through the resistance 21. The circuit, of course, can be closed only when the thermostatic contacts 18a and 18b are in the circuit closing position in which they are shown in Fig. 1. The parts are so arranged that when the heat to which the switch 29 is subjected does not exceed a predetermined maximum, the circuit through the resistance 21 is closed.

40 indicates any suitable valve stem having a limit abutment disc 41, between which and the bracket 42 is compressed a spring 43. The bracket 42 may serve as a bearing for the valve stem 40, and the spring 43 normally tends to urge the valve stem upwardly as far as the limit disc 41 and the adjustable limit stop 44 will permit. The valve stem 40 may have a valve member proper 45, which may have any suitable metering slots 46. When the device is employed with an oil pilot, as shown in Fig. 1, the minimum setting of the valve 40 is such that a pilot flow of fuel is permitted to be fed to the nozzle 9, which may be consumed within the pilot baffle or shell 8. If no pilot is used, it will be understood that the valve 40 may be formed or positioned to effect a complete shutoff of fuel when it is in the low position. It will be understood, however, that, unless a circuit is closed through the resistance 21, the warping bar 22 remains in the bottom or full line position in which it is shown in Fig. 1, in which position it

is effective to hold the valve stem 40 in bottom position against the compression of the spring 43, and it is only when a circuit is closed through the resistance 21 that the resistance causes the warping bar 22 to rise to its dotted line or top position of Fig. 1.

Any suitable circuit may be used, extending from the motor 15 to the transformer 19, if constant operation is desired, or the motor circuit may be controlled by a room thermostat where its intermittent operation is desired.

In the operation of the device, when heat is called for and the thermostatic contacts 18a and 18b are as shown in the circuit closing position of Fig. 1, the circuit is closed through the resistance 21, the warping bar 22 is warped up to the dotted line or release position, and the spring 43 raises the valve stem to full flow position, and a full flow of fuel is admitted. At that time the motor 15 is in operation. The fan 14 is effective to deliver air under pressure to the space about the pot 3. This delivery of air not merely provides the air necessary for combustion but has a cooling effect on the switch or the space immediately about it.

If for any reason the fan fails, this cooling effect ceases and the switch 29 or the space about it increases in temperature sufficiently to cause the member 30 to snap into circuit breaking position. It will stay in circuit breaking position until the temperature of the pot, and thus of the space around the switch 29, becomes reduced because of the reduced flow of fuel which ensues. If before the device has any further attention the pot becomes so far cooled as to permit the member 30 again to snap into circuit closing position, the fuel supply will again be reduced as soon as the space around the switch becomes overheated because of the increased supply of fuel. In other words, the fuel supply will be intermittent, and the total heating effect will be reduced.

I may find it desirable, as shown in Fig. 3, to provide means for preventing the member 30 from snapping back into circuit closing position. I may, for example, have any suitable abutment member or plunger 50, which may be guided by any suitable guide 51, and which is urged by a spring 52 in the direction of the snap switch member 30. When the snap switch member 30 is in the circuit closing position in which it is shown in dotted line in Fig. 3, its edge engages the plunger 50 and resists the effect of the compression of the spring 52. When the member 30 snaps or flexes into the raised or circuit breaking position of Fig. 3, the spring 52 is then effective to move the plunger 50 beneath the outer edge of the member 30 to prevent it from thereafter snapping back unless and until the operator pulls on the actuating rod 53 by the exterior control handle 54 to release the member 30 again to its bottom or circuit closing position of Fig. 3. In Fig. 3 the dotted line position of the member 50 indicates its release position, and it is shown in full line as holding the member 30 also in full line position in its raised or circuit breaking position.

Fig. 3 merely indicates one type of switch, and an alternative form may be employed, as shown for example in Fig. 4. In that form I illustrate as opposed to the fixed contact 31 a warping bar 56, which is normally held in circuit closing position. The fixed contact 31 and the warping bar 56 may be mounted on any suitable base element 57, which may be applied for example to the par-

tition 12. 58 indicates a trigger which may be spring thrust as by the spring 59 and the abutment 60 into position to snap under the outer end of the warping bar 56 when the warping bar rises to circuit breaking position. Any suitable exterior handle 61, with the control rod 62, is effective to release the trigger 58 when desired and to permit the warping bar 56 to warp back into circuit closing position.

Fig. 2 illustrates a variant form of the device, which I illustrate in connection with the same switch 29, as shown in Fig. 1, but which it will be understood may inferentially include the switch of either of the forms of Figs. 3 and 4. Fig. 2 illustrates my control as applicable to a multi-stage burner. The pot 3 with the baffle housing 8 will be understood inferentially to be included in Fig. 2.

Referring to Fig. 2, I illustrate the top of the valve stem, as at 70, normally urged into open position as by the spring 71. Its upward movement is initially resisted by the warping bar 72, the setting of which may be controlled by the adjustable stop 73. This stop may be set to give a minimum or pilot flow, or if the switch were employed with the structure without a pilot, it might be set for a complete shutoff of fuel. Associated with the warping bar 72 is a resistance 74, shown as in circuit with the fixed adjustable contact 75, which in turn is opposed to the movable contact 76 of any suitable thermostat. 77 is a transformer or other suitable power source, in circuit with the room thermostat and with the resistance 74. It will be understood that with the switch 29 normally in circuit closing position, a movement of the thermostatic contact 76 into conductive relation with the fixed contact 75 will close a circuit through the resistance 74 and will cause the warping bar 72 to warp rapidly upwardly to permit the spring 71 to raise the valve. The upward movement of the valve 70 is stopped at an intermediate flow position by a second warping bar 78, the downward position of which is limited by any suitable adjusting stop 79. The resistance 72 is in circuit with the switch 29 and with a second adjustable fixed stop 80 of the thermostat, which is adapted to be engaged in circuit closing relationship with a movable contact 81 of the room thermostat.

It will be observed that the switch 29 is not included in the circuit for the resistance 74 of the warping bar 72, but it is included in the circuit for the resistance 82 of the warping bar 78. Thus the safety provision or turndown feature is effective only at high stage.

In the operation of the device, if heat is called for, the first result is a closure of the circuit for the resistance 74 through the contacts 75 and 76. This permits the valve 70 to rise as high as the still cold warping bar 78 will permit. Unless further heat is called for, this is as far as the valve stem can rise. If still further heat is called for, the thermostat is effective to move the movable contact 81 into circuit closing relationship with the contact 80. This closes a circuit through the resistance 82 for the second warping bar 78, which circuit, however, can only be closed if the contacts of the switch 29 or its equivalent are in circuit closing position. The result then is to flex the bar 78 high enough to permit the spring 71 to move the valve stem 70 to a fully open position, controlled or limited by the adjustable stop 83 or its equivalent.

It will be understood that the motor 15 is oper-

ating at least during the high stage. If the motor 15, which is inferentially present in Fig. 2, for any reason stops operating, then the cooling effect of the fan on the switch 29 ceases, and the switch 29 shortly moves to circuit breaking position, which breaks the circuit for the resistance 82 and causes the warping bar 78 to move the valve stem back to the intermediate flow position. It is understood that the parts are so proportioned that at intermediate flow position the device may operate on natural draft and that non-operation of the motor and fan at the intermediate stage is not harmful.

It will be understood, of course, that in place of the particular switch 29, shown in Fig. 2, with the fixed contact 31 and the snap disc 30, I may substitute either of the switch structures shown in Figs. 3 and 4, which in both cases show means for holding the circuit open once it has been broken by the change in heat conditions, until the operator again releases either the plunger 50 of Fig. 3 or the trigger 58 of Fig. 4.

Referring to Fig. 5, I illustrate a switch control, which is shown as substantially identical with the switch structure of Fig. 4 except that in the place of the pivoted trigger 58, I illustrate a warping bar 90 mounted on any suitable base or bracket 91, with which is associated at resistance 92, in circuit with the thermostat and the transformer. It will thus be seen that a circuit is closed through the resistance 92 at all times that the thermostatic contacts 18a and 18b are in circuit closing position.

It will be understood that, when the resistance 92 is heated, it causes the warping bar 90 to tend to flex against the end of the switch element 56 in such fashion that whenever the switch element or warping bar 56 warps upwardly to circuit breaking position, the end of the warping

bar 90 warps in beneath it and prevents it from again returning to circuit closing position. I illustrate an exterior manual knob 93, which, through any suitable tension member 94, may be employed manually to withdraw the warping bar 90 to permit the downward movement of the warping bar 56. This manual operation may be made unnecessary by an opening of the thermostatic contacts which will break the circuit through the resistance 92 and permit the warping bar 90 to warp into inoperative position. Otherwise the control, so far as the valve is concerned, is the same.

It will be realized that, whereas I have described and illustrated a practical and operative device, nevertheless many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. I therefore wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my precise showing.

I claim:

In combination, a pot type burner, a fuel line therefor, a valve controlling the fuel line, electrically actuated means for controlling the valve, a circuit including said means and adapted when energized to open the valve, the burner including a pot, an air chamber and a fan, a thermostatically actuated switch in the air chamber exposed to the flow of air from the fan, contacts associated with said switch adapted to close the circuit when the thermostatically actuated switch is in a cold condition and to open the circuit when the switch is heated said thermostatically actuated switch being subjected directly to the heat of the pot.

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