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DRAFT-RESPONSIVE CONTROL FOR LIQUID FUEL BURNERS

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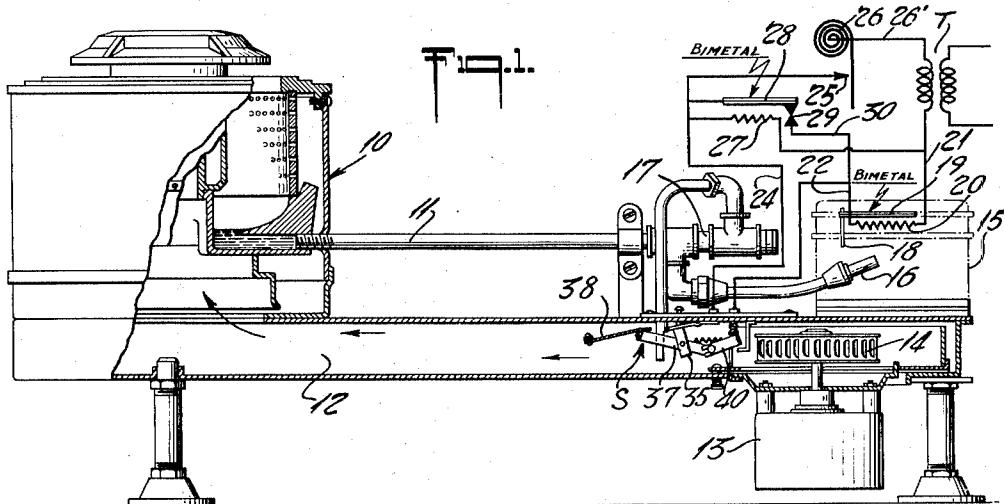


FIG. 2.

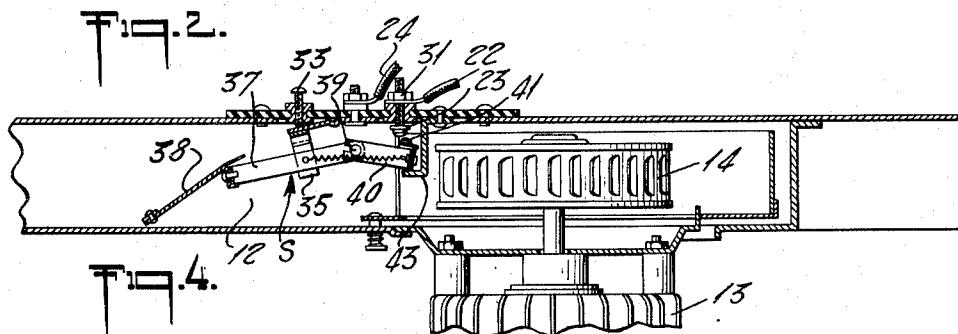
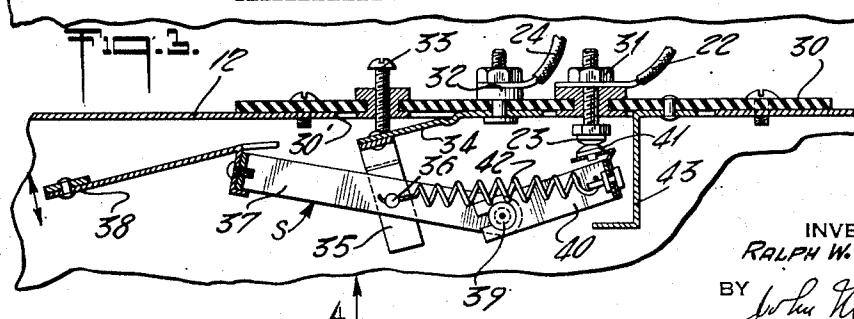
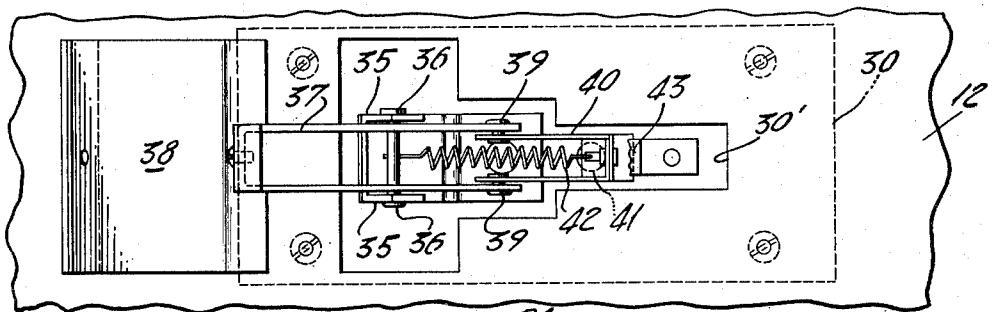


FIG. 4.



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DRAFT-RESPONSIVE CONTROLS FOR LIQUID FUEL BURNERS

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6 Claims. (Cl. 158—28)

1

The present invention relates to burner controls for liquid fuel burners and is more particularly directed toward controls for intermittently operated gravity-fed, liquid fuel burners under the control of a remote switch, such as a room thermostat or an immersion thermostat, with a fuel valve adapted to be opened and closed by such thermostat, and employing forced draft produced by a motor driven blower which operates continuously over long periods where pilot ignition is employed, or which operates intermittently where electric or gas ignition is employed.

In such burners there is a possibility that fuel supply may continue to the burner even though the forced draft producing apparatus has not been brought into operation or for some reason has failed to function.

The present invention contemplates a system including a normally open safety switch closeable by the moving stream of air employed for forced draft, this switch being in series with the fuel valve controls. According to the present invention, it is also contemplated that the safety switch may be shunted by a normally closed switch under the control of a time responsive element which opens the shunting switch at the proper time.

The employment of the present invention assures the presence of forced draft whenever fuel is being fed to the burner, except possibly during the starting period when forced draft is not desired.

Other and further objects will appear as the description proceeds.

The accompanying drawings show, for purposes of illustrating the present invention, an embodiment in which the invention may take form, it being understood that the drawings are illustrative of the invention rather than limiting the same.

In the accompanying drawings:

Figure 1 is a side elevational view illustrating an oil burner installation with controls;

Figure 2 is an enlarged vertical sectional view through the safety switch showing it open;

Figure 3 is a still further enlarged sectional view showing the switch closed; and

Figure 4 is an inverted plan view of the safety switch.

In the drawings, a pot type burner is illustrated generally at 10, fuel supply pipe at 11, and the forced draft duct at 12. Forced draft is secured by blower motor 13 operating a fan 14.

A combined constant level valve and metering valve of usual construction is indicated at 15. Through a pipe 16 and fittings 17 it supplies fuel to the supply pipe 11. The valve structure 15 also includes a metering valve indicated at 18. This is under the control of a bi-metal element 19 with electric heater 20.

2

Low voltage control current is obtained through a transformer T connected by a wire 21. The other side of the heater 20 is connected by a wire 22 with a fixed contact 23 of the safety switch S. The other side of the safety switch is connected by a wire 24 with the normally open contact 25 of the control thermostat 26. This thermostat is connected with the transformer by wire 26'. A thermal heater 27 is connected between wire 21 and wire 24. It is normally cold, but is heated whenever the thermostat 26 calls for burner operation. The bi-metal element 28 is connected with wire 24 and through a switch 29 and wire 30 with the wire 22, thereby providing circuit in shunt with the safety switch S.

The safety switch S is a unitary structure having an insulating mounting plate 30 adapted to be placed over an opening 39' in the top wall of the duct 12 so that it is readily available for inspection and adjustment. It carries a binding post 31 connected with wire 22, a binding post 32 connected with wire 24, and an adjusting screw 33. The post 32 carries a conducting spring 34 which extends under the adjusting screw 33. This spring carries a U-shaped yoke 35 to which is pivoted at 36 a rocker arm 37 carrying a vane 38. The other end of the arm 37 carries pins 39 in which is pivoted movable contact carrying arm 40. The movable contact is indicated at 41 in the form of a rounded button opposite the fixed contact 23. The arm 40 is connected with pivot 36 by coiled spring 42. The adjustment of the screw 33 determines the position of the vane at which the switch opens and closes.

The motor 13 operating the blower 14 may be a continuously operated motor where pilot ignition is employed or may be an intermittently operated motor where electric ignition is employed. When the motor 13 is not operating, the safety switch shifts to the open position, indicated in Figure 2, on account of the weight of the vane, which biases the lever 37 in a counter-clockwise direction. This moves the pivot 36 high enough for the over-the-center spring 42 to snap the movable contact arm 40 down against a stop 43. The circuit of the safety switch is open in the absence of forced draft.

Should the thermostat 26 call for heat, a circuit will be established through the wire 21, heater 20, wire 30, switch 29, bi-metal 28, to the thermostat 26 and wire 26'. This will start heating the bi-metal 19 which thereafter opens the metering valve 18. Current will also flow through the heater 27 and start heating the bi-metal 28. The fan motor 13 is then started either manually or through suitable timing controls set into operation by the thermostat 26 so that a blast of air passes into the burner. This blast of air reacts against the vane 38, lifts it from the position of Figure 2 to the position of Figure 3. This car-

ries the pivot 39 below the spring 42 and causes the switch to snap closed. The closing of the safety switch S completes a second circuit for the heater 20 of the metering valve, so that the metering valve continues to be held open even though the bi-metal 28 has opened the contact 29. Such opening takes place after a predetermined time which normally is sufficient for the blower to have been brought into operation. If for any reason the blower has not been brought into operation, the fuel valve heater 20 will in due time have been disconnected by the switch 29 and the flow of fuel stopped.

If for any reason the forced draft is not available because of power failure, motor failure or fan failure, the switch S will remain open so that it is impossible to flood the burner or supply fuel when there is inadequate draft.

During the time that the blower is in operation, the vane 32 will move back and forth slightly as indicated by the arrows at the left of Figure 3, and this will cause a back and forth horizontal movement of the contact 41 over the contact 23 as indicated by the short arrows near these elements. This serves to dislodge dirt particles which might collect and impair the low voltage circuit and to keep the contacts clean.

Since it is obvious that the invention may be embodied in other forms and constructions within the scope of the claims, I wish it to be understood that the particular form shown is but one of these forms, and various modifications and changes being possible, I do not otherwise limit myself in any way with respect thereto.

What is claimed is:

1. In combination, a gravity fed, forced draft, liquid fuel burner, a metering valve for controlling flow of fuel to the burner and biased toward closed position, a fuel flow control circuit including a low voltage transformer, a condition responsive switch, an operator for the metering valve and a draft responsive switch all in series, a forced draft blower, a duct connecting the blower to the burner, a lever extending lengthwise of the duct and pivotally mounted intermediate its ends, a vane carried by the end of the lever remote from the blower, the vane being biased by gravity toward a position to obstruct air flow and movable upwardly by the air stream to a variable, less obstructing position, a duct-carried, downwardly facing, fixed contact forming one part of the draft responsive switch, a movable contact interconnected with the lever on the end opposite the vane and cooperable with the fixed contact to form the other part of the draft responsive switch, the interconnections between the lever and movable contact including a horizontal pivot which moves down and up as the vane moves up and down and an over-the-center spring connecting the free end of the movable contact and the pivot for the lever and acting, when above said pivot, to urge the movable contact upwardly, the movable contact moving across the face of the fixed contact when the vane shifts position in its upper range of movement so as to wipe dirt off the contacts and maintain the low voltage circuit.

2. The combination of claim 1, wherein the vane, the switch contacts and the snap spring are supported on an insulating member which covers an opening in the duct.

3. The combination of claim 1, having a normally closed switch in shunt with the vane con-

trolled switch, and a thermally responsive means for opening the normally closed switch after a predetermined time whereby the metering valve may be initially opened irrespective of blower operation.

4. The combination of claim 1, having means for vertically shifting the lever pivot to adjust the sensitivity of the switch.

5. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

10 6. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

15 7. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

20 8. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

25 9. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

30 10. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

35 11. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

40 12. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

45 13. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

50 14. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

55 15. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

60 16. In combination, a gravity fed liquid fuel burner, a fuel line leading to the burner, an air duct for supplying air for combustion, a blower connected to the air duct to provide forced draft through the same to the burner, a metering valve for supplying fuel to the fuel line, a bimetallic operator for the metering valve, a heater for the bimetallic operator, a low voltage source for the heater and two switches in series with the heater, one being a condition responsive, thermally operated switch, the other a forced draft responsive switch mounted in the air duct and including a lever pivoted on a horizontal axis in the duct and carrying at one end a vane which swings down under the influence of gravity and is lifted by the air stream from the blower, and at the other end a pivoted movable contact, an over-the-center spring interconnecting the lever and movable contact, and a fixed contact against which the spring holds the movable contact when the vane is raised and over the surface of which it moves the movable contact with movement of the vane so long as it is high enough to keep the spring axis above the pivot of the movable contact, so that contact surfaces of the second switch are kept clean over long periods of blower operation.

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