Sept. 14, 1943. S. PERRY 2,329,292

SAFETY CONTROL FOR OIL BURNERS

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Fig. 1

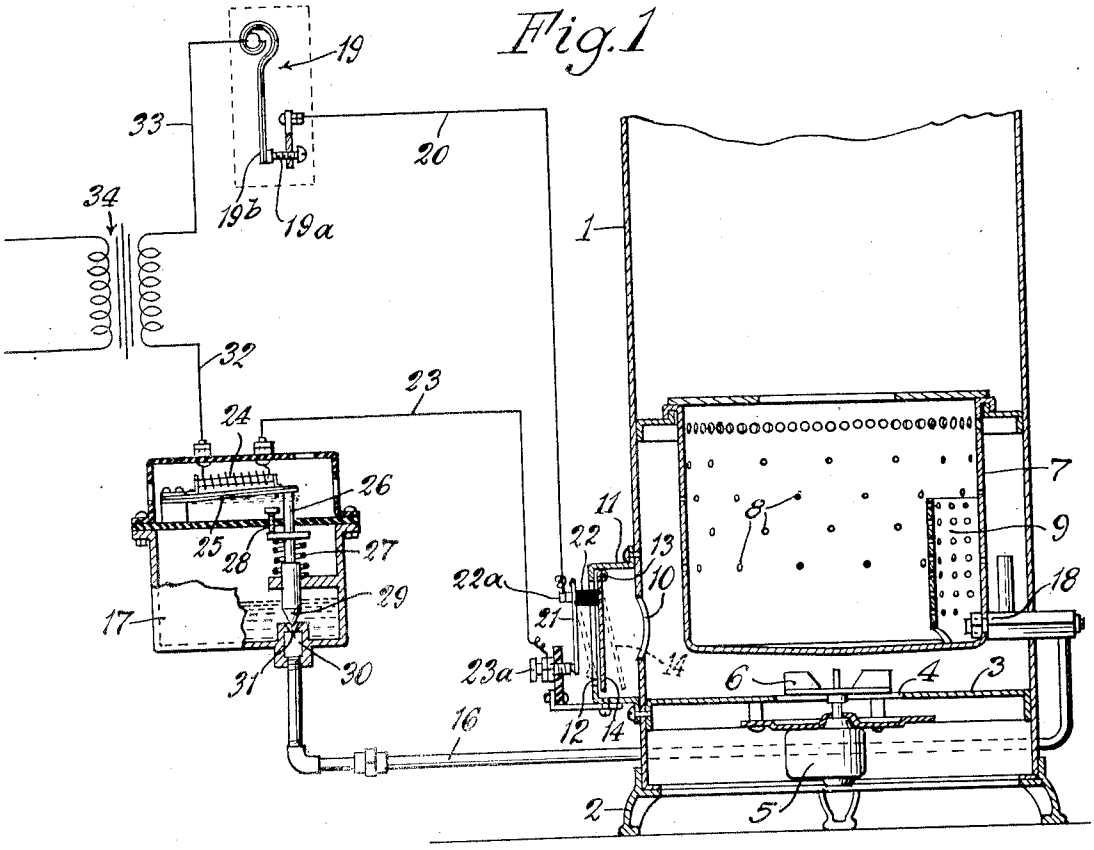
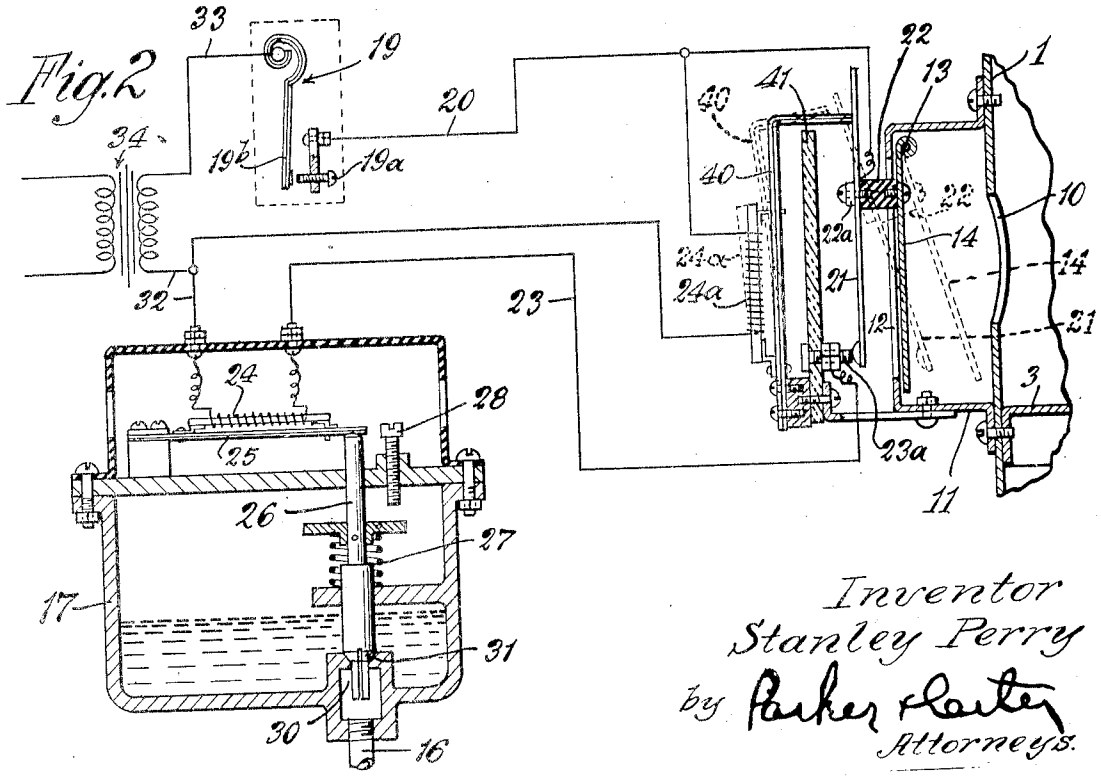


Fig. 2



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Fig. 3

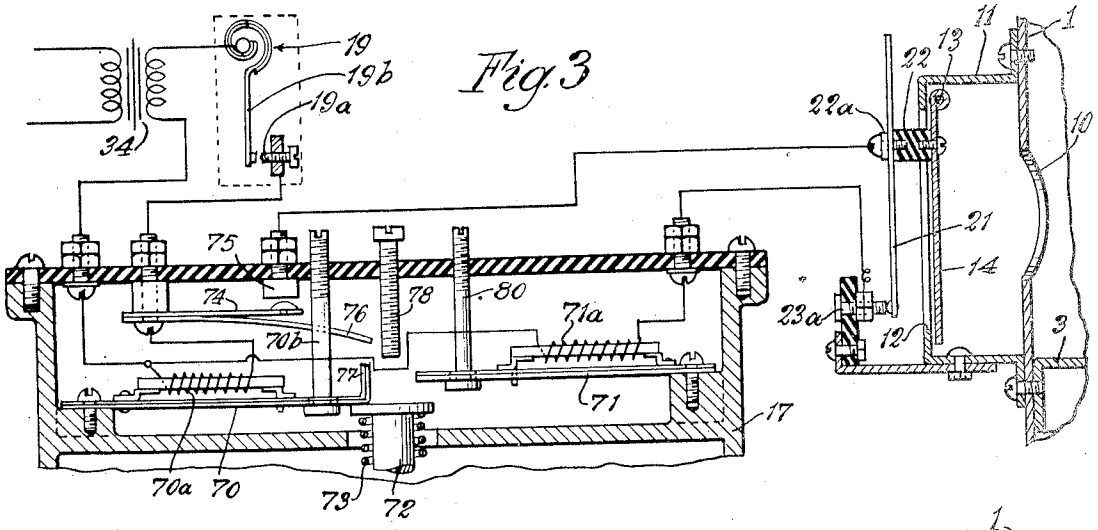


Fig. 4

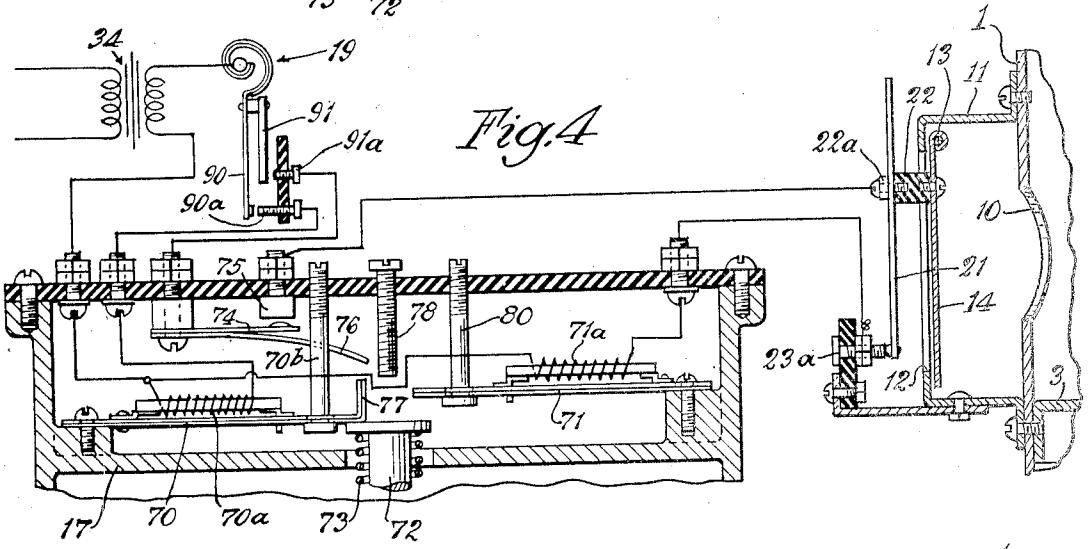
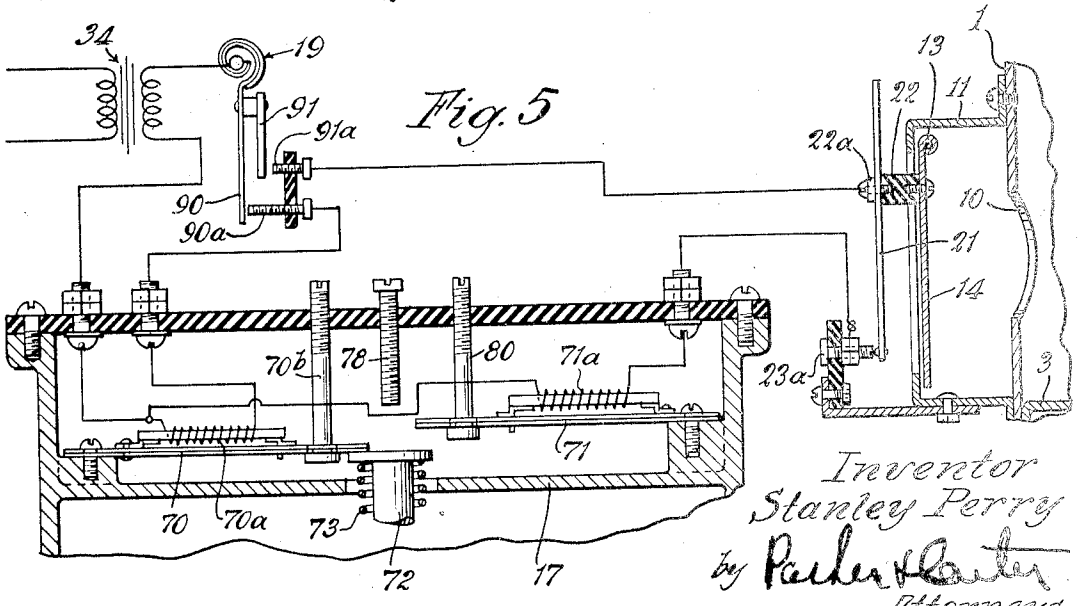


Fig. 5



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SAFETY CONTROL FOR OIL BURNERS

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Application December 21, 1940, Serial No. 371,175

1 Claim. (Cl. 236—1)

The invention relates to an improvement in controls for oil burners and is adaptable, for example, for use with pot type oil burners in which a booster fan is employed.

One purpose is the provision of means for reducing the flow of fuel when the fan or fan motor fails.

Another purpose is the provision of means for dropping the fuel flow from high flow to an intermediate stage when the fan fails.

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

The invention is illustrated more or less diagrammatically in the accompanying drawings wherein:

Fig. 1 is a vertical section illustrating one embodiment of the device;

Fig. 2 is a partial section of a variation on an enlarged scale;

Fig. 3 is a similar section illustrating a further variation;

Fig. 4 is a similar section illustrating a further variation; and

Fig. 5 is a similar section illustrating a further variation.

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

Referring first to the form of Fig. 1, 1 generally indicates a heater drum or housing, the details of which do not of themselves form part of the present invention. For example, means are illustrated for supporting the drum, including a plurality of legs 2. Located in a lower part of the drum is the generally horizontal partition 3, having a central aperture 4. Mounted on the partition is a booster motor 5, having a fan 6, adapted to direct air into the space about the pot 7. The pot is provided with a plurality of air inlet apertures 8 and with a foraminous pilot partition 9.

10 indicates an air aperture in the drum 1, exterior to which is an outer housing or passage member 11, having an outer aperture 12, in which is pivoted, as at 13, a shutter 14. It will be understood that, as long as the booster motor 5 is operating, a satisfactory supply of air is maintained, and pressure conditions within the drum 1 and in the space about the pot 7, which will keep the shutter 14 closed, as shown in full line in Fig. 1.

16 indicates a fuel supply line from any suitable fuel chamber 17 to the fuel inlet nozzle 18. 19 indicates a room thermostat having a normally fixed but adjustable contact 19a and a movable contact 19b. 20 indicates a conductor extending from the thermostat to the flexible leaf contact 21, which is mounted on and moves with a shutter 14 and may, for example, be mounted on an arm or insulating block 22. 23 is a conductor extending from the fixed contact 23a, through the resistance 24 associated with a warping bar 25 mounted on the chamber 17. The warping bar is opposed to the valve stem 26, which is normally held in raised position by a spring 27, against the adjustable upper limit stop 28, whereby the valve member proper 29 may be held open to permit the flow of fuel through the metering orifice 30, defined by any suitable valve seat 31 and the valve 29.

32, 33 indicate any suitable conductors completing the circuit above described with any suitable power source, for example the transformer 34. It will be understood that when the room thermostat may be closed, any suitable circuit is maintained through the motor 5, and the booster motor may be employed to maintain a circulation of air into the space about the pot 7, the air passing through the apertures 8 and maintaining combustion within the pot.

When the room thermostat is in circuit breaking position the warping bar 25 is cold and is effective to hold the valve stem 26 in minimum feed position against the compression of the spring 27. In such position a minimum flow of fuel may be provided, which may be consumed within the pilot housing 9, and at such time the booster motor is not actuated. It will be understood also that, if a burner without a pilot is employed, the parts may be so set as to cause a complete shut-off of the fuel when the booster motor fails. It is also understood that the circuit through the motor 5 may be constantly closed. In other words, while it is not shown in the drawings, it will be understood that a constant supply of current is provided for the motor 5.

When the room thermostat closes a circuit through the conductors 20 and 23, and the resistance 24, the warping bar 25 warps up and permits the spring 27 to raise the valve stem against the adjustable stop 28, and a maximum supply of fuel is supplied to the pot, and combustion takes place in and above the pot 7. At that time the rotation of the fan 6 maintains sufficient pressure within the space about the pot to hold the shutter 14 in closed position, and this holds the flexible leaf 21 in circuit closing position in relation to the fixed contact 23a.

If the fan fails, then the shutter 14, which may have a weight 22a on the arm 22, is moved to open position by gravity, and the flexible leaf 21 is moved into the circuit breaking position in

which it is shown in dotted line in Fig. 1. This breaks the circuit through the resistance **24**, and the warping bar **25** remains in minimum flow or shutoff position. In other words, a maximum flow of fuel can be obtained only during the operation of the motor **5** and the fan **6**. Natural draft is sufficient to maintain enough air flow to support combustion at the pilot stage. Full flow cannot be obtained unless and until the motor and fan are again put into operation.

Referring to the form of Fig. 2, a second control means is illustrated, effective for use with an intermittent operation of the motor, the form of Fig. 1 being adapted for a motor which constantly operates. A second resistance **24***a* is illustrated in parallel with the resistance **24** and associated with the warping bar **40**, which may be more or less shielded from the heat of the pot by any suitable shield or partition **41**. At the initiation of combustion, as when the pot is starting cold, the warping bar **40** is in full line position in which it is shown in Fig. 2, and it is effective to engage the upper portion of the flexible strip contact **21**, and holds it and the shutter **14** in closed position. If the motor and fan operate properly, the pressure is effective to maintain the shutter **14** in closed position, and thus to maintain the flexible contact **21** in circuit closing position. However, the effect of moving the room thermostat to circuit closing position is to heat both the resistances **24** and **24***a*, which are in parallel. The heating of the resistance **24** causes the warping bar **25** to move to full flow position, permitting the valve stem **26** to rise against the adjustable stop **28** in response to the action of the spring **27**. At the same time the warping bar **40** is warped out to the dotted line position of Fig. 2, and no longer is effective to hold the contact **21** in circuit closing position. However, if the fan motor **5** is operating, the pressure about the pot **7** will maintain the shutter **14** closed, and the contact **21** in circuit closing position.

If for any reason the motor fails to go on or stops operating, then the low pressure in the space around the pot **7** permits the shutter **14** to move to open position, and this in turn moves the flexible strip **21** to circuit breaking position and cuts out or breaks the circuit for the resistance **24**. The resistance **24***a* is still in circuit, and the warping bar **40** is maintained in the dotted line or inoperative position of Fig. 2. The resistance **24**, no longer receiving current, will warp back and will move the valve stem **26** against the compression of the spring **27** and will limit the flow of fuel to pilot supply, which can be adequately burned by natural draft through the opening left by the movement of the door to open position, and through the opening **4** in the partition **3**. Thus, unless and until the motor and fan again operate, no more than a pilot supply of fuel can be received by the pot, and there is no danger of flooding the pot with more fuel than can be burned by natural draft.

It will be understood that any suitable means may be employed for intermittently operating the motor, for example in response to the opening or closing of the thermostat contacts.

In Fig. 3 is illustrated a form of the invention effective to reduce the oil supply from high to an intermediate rate of flow if the air pressure fails because of motor failure. This result is obtained by the employment of two warping bars **70** and **71** opposed to the valve stem top portion **72** and the spring **73**, which tends normally to raise the valve stem to maximum fuel flow position. When the circuit is broken by the room thermostat, as when in the position in which it is shown in Fig. 3, the resistances **70***a* and **71***a* are both cold, and the warping bars are in the position in which they are illustrated in Fig. 3, and the lower warping bar **70** is effective to hold the valve stem **72** in a minimum feed or pilot position, which may be adjusted by the adjustable stop **70***b*. When the room thermostat moves to close the circuit, then initially the resistance **70***a* is heated, and the strip **70** is upwardly warped and permits the valve stem **72** to rise under the influence of the spring **73** until the top of the valve stem strikes the still cold intermediate warping bar **71**, the position of which is controlled by the adjustable stop **80**. Up to that time no circuit has been closed through the resistance **71***a*, and the warping bar **71** is still cold.

Any suitable means may be provided for closing a circuit through the resistance **71***a* after a predetermined or controlled time lag, in response to or following the heating of the resistance **70***a* and the consequent flexure of the warping bar **70**. For example, the flexible spring contact **74** may be employed, which normally remains out of contact with an opposed fixed contact **75**. As the warping bar **70** rises its upward movement may be employed to move the contacts **74** and **75** into position to close a circuit through the resistance **71***a*. As an example of means for doing this there is illustrated a spring **76**, which may be contacted by a projection **77** of the warping bar **70**, to move the flexible contact **74** against the fixed contact **75**, to close the circuit through the resistance **71***a*. Thereafter the upward movement of the warping bar **71** in response to the heating of the resistance **71***a* is effective to permit the spring **73** to raise the valve stem **72** to maximum flow position, limited by any suitable adjusting screw or member **78**. If desired, the upward warping of the bar **71** may be controlled or delayed by the initial spring tension of the warping bar **71**, by its mass and by the metals of which it is formed.

In the normal operation of the device the closure of the room thermostat contacts **19***a* and **19***b* closes a circuit through the quick warping bar **70**, which is preferably so formed as to warp rapidly upwardly to give a quick initial upward movement of the valve **72** and a quick increase of the fuel supply to intermediate flow, controlled by the position of the still cold warping bar **71**. After a predetermined lag, controlled as above mentioned by the initial spring tension of the warping bar **71** or by its mass and by the metals of which it is formed, the slow warping bar **71** rises and permits full fuel flow to ensue.

In the event that the fan motor fails, then pressure conditions about the pot will permit the shutter **14** to swing by gravity into open position, which in turn swings the flexible contact **21** to circuit breaking position and breaks the circuit for the resistance **71***a*, without affecting the circuit for the resistance **70***a*. The result is that the warping bar **71** warps back to its bottom position, permitted by the adjustable stop **80**, and holds the valve stem **72** against the spring **73**, at any suitable intermediate fuel flow controlling position. The parts are so designed that a sufficient supply of air is provided by natural draft through the fan opening **4** and past the shutter **14** to maintain a proper combustion of such fuel as is permitted to flow when the valve stem **72** is in contact with the warping bar **71**. In this form of the device an inter-

mediate flow of fuel is permitted when the fan fails, but not a maximum flow.

The form of Fig. 4 illustrates another three-stage control with a time delay between the second and third stage, and a booster safety control in the third stage circuit. In the form of Fig. 4 the room thermostat is provided with two contacts or leaves. When the first contact **90** moves to circuit closing position against the fixed contact **90***a*, a circuit is initially closed through the resistance **70***a*, which causes a flexure of the warping bar **70**, to permit the valve stem **72** to rise under the influence of the spring **73** to intermediate position, defined by the warping bar **71** in its cold position. If this increase in the fuel supply is sufficient, then the room thermostat does not operate further for the time being, and the burner burns at intermediate stage of fuel supply. Under these conditions, while it may be desirable to have the booster fan motor running, there is still sufficient air available under natural draft to burn the fuel supply satisfactorily if the fan fails.

If, however, further heat is called for, then the second blade **91** of the room thermostat warps into engagement with the fixed contact **91***a* and closes a circuit through the resistance **71***a*, which circuit has been initially prepared by the movement of the contact **74** against the fixed contact **75** by the upward warping of the bar **70** into engagement with the spring **76**. Thus the result of the movement of the leaf **91** to circuit closing position is to heat the resistance **71***a* and thereby cause the warping bar **71** to rise after its above described time lag, and to permit the valve stem **72** to reach its highest or fully open position under the influence of the spring **73** and against the adjustable limit stop **78**. When a maximum fuel flow supply is thus provided, a safety device is desirable in the event that the motor fails, and such safety device is provided by the above described shutter **14** and the flexible contact **21** controlled thereby. If for any reason the booster motor fails, the change in pressure conditions permits the gate **14** to move by gravity to open position and to move the flexible contact **21** to circuit breaking position. The circuit through the resistance **71***a* is opened, and the warping bar **71** then moves to its lowest position on and in relation to the stop **80**, thus permitting the burner to receive only an intermediate supply of fuel, a supply which can be handled by natural draft, as above described.

Fig. 5 also illustrates a three-stage control with a booster safety arrangement at the third or high volume stage. The result of the closure of the room thermostat contacts **90** and **90***a* is is to close a circuit through the resistance **70***a*, which moves the warping bar **70** to releasing position and permits the spring **73** to raise the valve stem **72** as far up as the cold warping bar **71** will permit. At this stage, while as above pointed out it may be advantageous to have the booster operate, still sufficient air may be provided by natural draft to burn all of the fuel supplied at the intermediate stage. It will be understood, of course, that if desired the booster motor may be made to operate only at high stage, an arrangement which is also possible in the forms of Figs. 3 and 4. In the form of Fig. 5, if more heat is called for and the blade **91** moves to circuit closing position with the stop **91***a*, then the resistance **71***a* is heated, and the warping bar **71** moves to full fuel supply position, as above described. As in the form of Fig. 4, a motor failure will cause a movement of the contact **21** to circuit breaking position and will break the circuit for the resistance **71***a* and cause the warping bar **71** to move down to its lowest position on the stop **80**.

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 the invention. It is therefore wished that the description and drawings be taken as in a broad sense illustrative or diagrammatic, rather than as limiting to the precise showing.

Whereas the pot and booster fan are illustrated only in Fig. 1, it will be understood that they are inferentially included in all five figures.

The use and operation of the invention are as follows:

Basically, what is provided is a fuel control or safety feature which may be employed, for example, in connection with a booster motor and fan for a pot type burner, and which responds to a failure of the motor.

If a two-stage control is employed, as shown in the form of Fig. 1, the result of motor failure is to cause the movement of the valve stem to minimum flow position. If a pilot means is employed, the minimum flow position of the valve is set to permit a pilot flow of fuel to continue when the motor fails. If no pilot is employed, the valve stem **29** may be so set as to cut fuel off entirely in the event of motor failure.

The form of Fig. 2 is available for use where the motor is intermittently employed. The forms of Figs. 3, 4 and 5 is effective for use with three-stage controls, where there is a cutoff or minimum fuel flow stage, a maximum fuel flow stage, and an intermediate fuel flow stage. In these forms the failure of the booster fan results in causing the fuel flow to drop from high to intermediate.

I claim:

A control device for pot type liquid fuel burners and the like including a burner pot, a fuel supply, and a fuel control valve, an apertured pressure chamber adapted to supply air under pressure to the pot, a damper adapted to close the aperture in the pot in response to pressure in the chamber, a damper switch adapted to be closed by the damper only when the damper is closed, a room thermostat and a thermostat switch controlled thereby, means responsive to the closure of the thermostat switch for positioning the valve in intermediate position, means operative only when the damper and thermostat switches are closed and subsequent to the operation of the means for positioning the valve in intermediate position, for positioning the valve in high heat position, and means effective when the damper switch is open and the thermostat is closed for positioning the valve in intermediate position.

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