

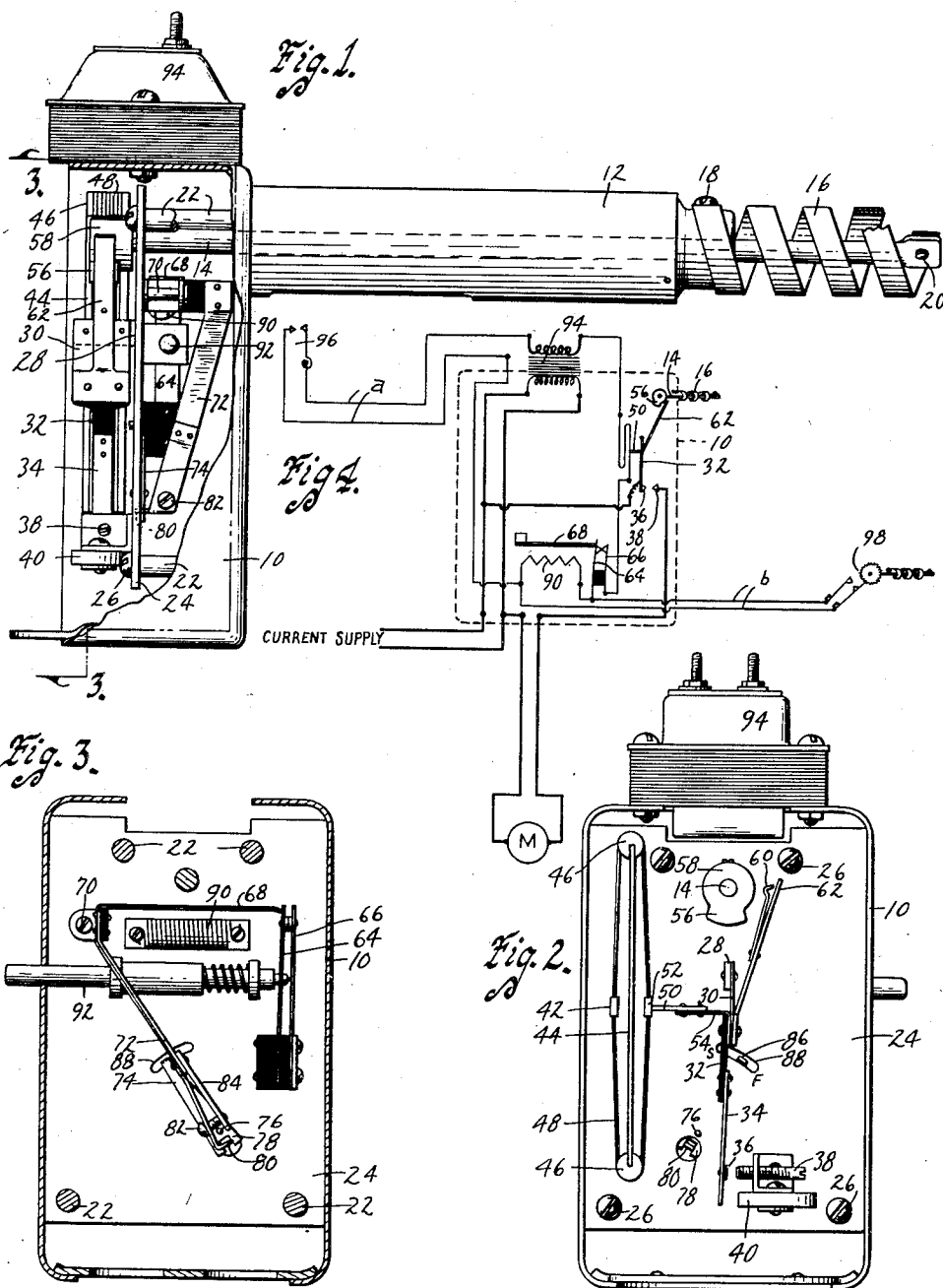
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COMBINATION LIMIT SWITCH

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COMBINATION LIMIT SWITCH

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2 Claims. (Cl. 200—113)

The object of my invention is to provide a combination limit switch having a single switch therein for opening and closing the circuit of a fuel burner or the like, with a thermostatic element responsive to the temperature of the fuel burner and operating the switch as a limit switch, other actuators also being provided for the one switch.

Still a further object is to provide a combination limit switch having a single set of switch contacts for controlling the motor of a fuel burner, so that only one set of contacts need be examined when the motor circuit does not properly flow through the switch, this set of contacts being operated by a limit control whereby, by installing the combination switch, a safe installation is insured because the switch is primarily a limit switch and installed as such, whereas in the type of installation where a limit switch is to be installed independent of a motor or relay switch, the dealer in order to cut down expense sometimes eliminates the limit switch and that is not possible with my arrangement.

A further object is to provide the switch contacts actuated also by a "wire motor", which in turn is controlled by a room thermostat, whereby the motor switch is not immediately responsive to the room thermostat, thus preventing undesired making and breaking of the motor circuit when the contacts of the room thermostat are jiggled from any cause such as vibration of the wall and even vibrations of the atmosphere caused by trucks or the like passing the house.

A still further object is to provide a limit switch having a protruding temperature responsive element for mounting in the bonnet of a furnace, and so arranged that wiring is simplified, it merely being necessary to run current wires to the switch and from the switch to the motor, all operating parts for the switch being included within a casing therefor, the switch necessitating but two controls, a room thermostat and a stack switch which can be operated on a low voltage circuit, thus reducing wiring expense.

A still further object is to provide the wire motor with a compensation feature so that under all conditions it operates in the same period of time, the present application being a continuation in part of my co-pending application Serial Number 638,114, filed October 17, 1932.

With these and other objects in view my invention consists in the construction, arrangement and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter more fully set forth,

pointed out in my claims, and illustrated in the accompanying drawing, in which:

Figure 1 is a side elevation partly in section of a combination limit switch embodying my invention.

Figure 2 is a front elevation of the same looking from the left end of Figure 1.

Figure 3 is a sectional view on the line 3—3 of Figure 1; and

Figure 4 is an electro diagrammatical view showing the wiring connections with the motor to be controlled and with the controlling devices for the switch.

In the accompanying drawing I have used the reference numeral 10 to indicate a switch housing. The housing 10 has a hub 12 extending therefrom in which is rotatably mounted a shaft 14. A bimetal coil 16 has one end secured as at 18 to the hub 12, and its other end secured as at 20 to the shaft 14. The elements 12 and 16 are adapted for insertion in the bonnet of a furnace or the rod 14 can be associated in a well known manner with a temperature responsive device, responsive to the temperature of water or steam pressure in a hot water or steam heating system.

Within the switch housing 10 and mounted on posts 22 is a base 24, preferably of insulating material. The base 24 is held in position on the post by screws 26. Upstanding from the base 24 is a bracket 28 to which is secured a leaf spring 30. A strip of insulation 32 is secured to the leaf spring, and an armature 34 is secured to the strip of insulation.

The armature 34 carries a contact 36 for co-action with a stationary contact 38. At 40 is shown a permanent magnet for the purpose of imparting snap action to the armature 34. The spring 30 tends to maintain the contact 36 engaged with the contact 38.

For closing the contacts 36 and 38 I provide a wire motor comprising a stationary projection 42 from the base 24, a floating plate 44 having end members 46 of insulating material, and a resistance wire 48 wound around the end elements, as more fully disclosed in my co-pending application Serial Number 638,114, filed October 17, 1932.

A link 50 is provided with a head 52 through which the resistance wire 48 extends. The link 50 is connected by a leaf spring 54 with the armature 34 for operating it in accordance with the energization of the wire motor element 48.

After the contacts 36 and 38 are closed, they may be opened either by de-energization of the wire 48 or by a lobe 56 on a cam 58 engaging a leaf spring 60 of an extension 62 of the arma-

ture 34. The spring 60 prevents undue strain on the parts of the switch, but is stiff enough to overcome the tension of the spring 30 for opening the contacts 34 and 36 even though the wire 48 by energization has permitted them to close.

On the back of the base 24 I provide a safety cutout switch comprising contact springs 64 and 66 normally held engaged by a bimetal element 68. The element 68 is pivoted at 70 and is compensated for ambient temperature by a bimetal element 72 connected therewith. The element 72 is adjustable by means of a lever 74 pivoted at 76, and having a notch 78 engaging an extension 80 on the element 72. The extension 80 is adjustable at the factory relative to the element 72, by means of a screw 82 threaded in a relatively stiff extension 84 of the element 72. The adjusting lever 74 has an extension 86 which extends through a slot 88 in the base 24, so that it can be adjusted from the front side of the base. This adjustment permits the safety switch to be adjusted for either fast or slow operation as desired.

A heating element 90 is mounted adjacent the bimetal element 68 for warping it upwardly when heated for a predetermined period of time. This permits the spring 64 to swing toward the left for separating the contacts carried by the springs 64 and 66, so that the circuit is locked out of operation. It can be manually reset after the trouble is remedied, however, by pushing inwardly on a pin 92 which permits the bimetal element 68, after it has cooled down, to spring again to the position shown in Figure 3.

Mounted on the switch housing 10 is a transformer 94. It is provided for supplying low voltage current for operating the resistance wires 48 and 90. The electrical hook-up is shown in Figure 4 wherein a room thermostat is designated at 96, a motor at M, and a stack switch at 98. The circuit arrangement is specifically claimed in my co-pending application Serial Number 18,745 filed April 29, 1935.

Practical operation

In the operation of my device after proper installation, closure of the room thermostat 96 because of a low room temperature energizes the heating elements 48 and 90. Energizing of the heating element 48 causes it to expand thereby permitting the spring 30 to close the contacts 36 and 38 for starting the burner motor. Thereafter if combustion occurs, the combustion switch contacts of the switch 98 are closed for shunting the heater 90 out of circuit, so that the lock-out switch will not operate to open the circuit, which, however, it will do after a time period if combustion does not occur, or which it will do if after combustion establishment, combustion fails and thereby causes the switch 98 to open.

Upon the bonnet of the furnace attaining a predetermined high degree of heat, the cam 58 will open the contacts 36 and 38, so that the furnace does not get too hot when the room thermostat calls for heat over an extended period of time. When the room thermostat is satisfied, the low voltage circuit is broken through its contacts so that the heating element 48 is de-energized and will contract to the position shown in Figure 2 for opening the contacts 36 and 38.

By mounting all of the operating parts for the switch contacts 36 and 38 in a single casing and using this casing then as a limit switch so it can be installed in the usual position of a limit switch, I insure that the dealer in making the

installation, makes it properly, whereas I have often experienced that dealers sometimes omit limit switches when they are independent of the other controlling apparatus to cheapen the installation and thus make an installation which is not altogether safe. Such an arrangement also simplifies wiring, since it is merely necessary to extend current supply wires to and from the housing 10, and then to the motor M, the only additional wires needed being the low tension wires *a* and *b*, extending to the room thermostat and combustion switch respectively. These, of course, need not be installed in conduit.

The plate 44 is preferably made of the same material as the heating element 48, so that its coefficient of expansion at various temperatures is the same. This compensates for any ambient temperature change, since expansion of the element 48 is equaled by expansion of the element 44. This also provides for the same time period of operation when the current is cut off, regardless of whether the wire motor is relatively cool because of energization and deenergization soon thereafter, or whether it has been well heated by a prolonged period of energization.

One advantage of using a wire motor instead of a relay for closing the contacts 36 and 38 is that it takes the wire motor some ten seconds or so to respond sufficiently to open the contacts, this lag in operation preventing undesired starts and stops of the burner mechanism caused by vibration of the room thermostat contacts. Also when energized the wire motor does not vibrate as when alternating current is used on an electro-magnet.

A warp switch can be used instead of a wire motor, but it is too slow in operation as the heat generated must first be transferred to a bimetal element or the like before it can respond to energization. With a wire motor, however, since the electric current goes direct through the wire, it will expand immediately, thus giving much quicker operation, which is satisfactory for relay purposes, whereas a warp switch would not be satisfactory.

By arranging the switch so that the spring 30 tends to close it, and the resistance wire 48 when cold opens it against such tendency whenever the low voltage circuit is broken from any cause, the wire 48 will contract to its cool position, causing the contacts 36 and 38 to be opened. On the other hand, if the wire motor is so damaged that it permits the spring 30 to close the switch, it will again be opened by the limit control 16, thus avoiding any dangerous long period of operation of the fuel burner.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. In a combination limit switch, a switch casing, a normally open burner switch therein, electro-responsive means therein for closing said burner switch and a temperature responsive element extending from said casing and adapted for mounting in a furnace bonnet or the like, said temperature responsive element being operatively associated with said switch to open the same while closed by said electro-responsive means upon a predetermined limit of temperature being attained in said furnace bonnet.

2. In a combination limit switch, a switch casing, a burner switch therein, means for biasing said burner switch to closed position, a resistance wire normally preventing closure of said burner switch against the action of said biasing means for permitting closing of said burner switch by said biasing means upon said resistance wire being stretched by energization thereof and a temperature responsive element extending from said casing and adapted for mounting in a furnace bonnet or the like, said temperature responsive element being operatively associated with said switch to open the same while permitted to assume a closed position by energization of said resistance wire upon a predetermined limit of temperature being attained in said furnace bonnet. 5

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