

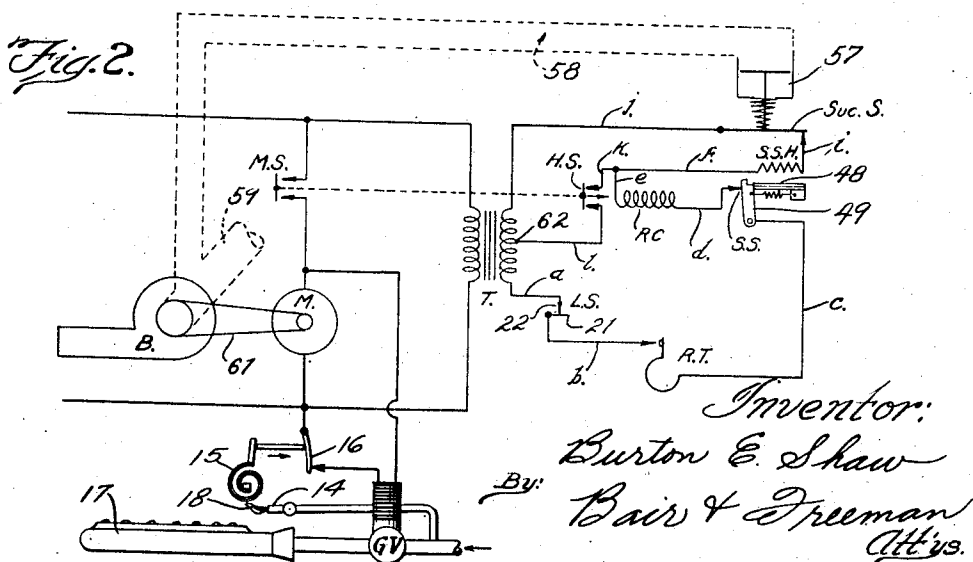
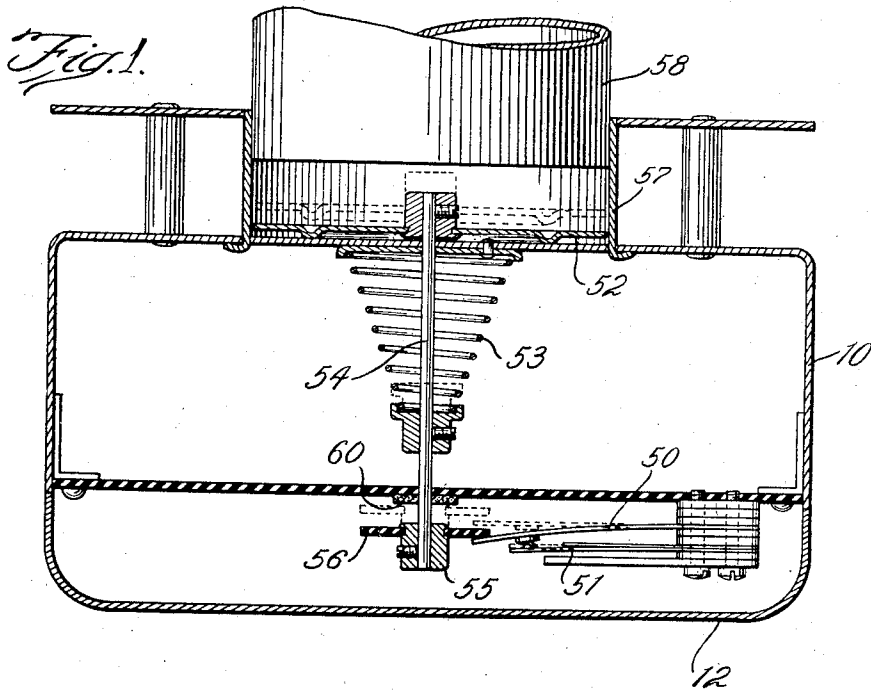
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BURNER CONTROL APPARATUS AND PROTECTION SYSTEM

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BURNER CONTROL APPARATUS AND
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5 Claims. (Cl. 158—28)

An object of my present invention is to provide a control apparatus and protection system of comparatively simple and inexpensive construction especially designed for gas burning, air conditioning furnaces where an induction fan is used for furnishing air to support combustion in the furnace. The present application is a continuation in part of my copending application, Serial No. 179,706, filed December 14, 1937.

Another object is to provide a control apparatus for burners of any type having blowers and which, therefore, if the blower operates properly, produces a vacuum, a safety switch being provided in connection with the apparatus to afford protection against explosions and the like and being controlled in response to the suction of the induction blower.

A further object is to provide control apparatus and a control circuit arrangement therefor, whereby a suction switch of the control apparatus is operable to control a safety switch thereof, so that if suction fails initially or if it fails subsequent to being established, the safety switch will operate to de-energize the control circuit and thereby stop operation of the burner and induction blower, combustion failure effecting stoppage of the flow of fuel to the burner by conventional control devices which do not form any part of my present invention.

With the foregoing and other objects in view, which will become apparent as the description proceeds, my invention consists in the construction, arrangement and combination of the various parts thereof, whereby the objects as above contemplated are attained, as hereinafter more fully set forth, pointed out in the appended claims and illustrated in the accompanying drawing, in which

Figure 1 is a sectional view showing details of a suction switch used in my burner control apparatus and protection system; and

Figure 2 is a circuit diagram for my control apparatus and protection system.

On the accompanying drawing I have used the reference numeral 10 to indicate generally a housing formed of sheet metal or the like. The housing 10 is preferably closed against the entrance of dust or tampering of the mechanism therein by a cover 12.

The suction switch of my control apparatus is indicated generally in Figure 2 as Suc. S. It comprises a pair of switch arms 50 and 51 (see Figure 1) and a disc 52 for operating them. Normally, the switch arms are retained in contact with each

other by a spring 53 urging a rod 54 outwardly. The rod 54 has a hub 55 secured thereto which carries a disc 56. The disc 56 engages the switch arm 50. The disc 52 is mounted in and substantially spans a section of conduit 57.

The conduit 57 is connected by a conduit 58 to the intake 59 of an induction blower B (see Figure 2). Accordingly whenever the blower B operates, a vacuum will be created in the conduit 57 which will suck the disc 52 inwardly against the bias of the spring 53 to the dotted position shown in Figure 1. In this position the hub 55 engages a felt washer 60 which prevents shock to the parts and also prevents vibration of the disc 52 while subject to the suction of the blower. In the dotted position, the disc 56 permits the switch arm 50 to separate from the switch arm 51, thus opening the circuit through the suction switch Suc. S. In Figure 2, I show diagrammatically a relay coil RC operatively connected with a motor switch MS. The parts RC and MS comprise a relay, which relay also includes a holding switch HS. The holding switch and the motor switch are normally open but close when the relay coil RC is energized.

A safety switch SS is more or less conventional and comprises a safety switch heater SSH, a bimetal latch 48 and a switch arm 49. The latch 48 normally holds the arm 49 in closed circuit position while a predetermined period of energization of the safety switch heater SSH results in warping of the bimetal latch 48 to a position permitting the safety switch SS to open.

The various control devices thus far described are included in a control circuit energized by the secondary of a transformer T. This circuit includes a limit switch LS and a room thermostat RT while the motor switch MS is included in the power circuit of the blower motor M. The motor M is illustrated as being belted as by a power transmission belt 61 to the induction blower B. The blower furnishes air to the burner of the furnace.

My control system as thus far described does not include means for taking care of combustion failure either initially or subsequent to combustion establishment. My system is included in a conventional burner control installation that already has such protection, and such conventional installation may include ignition mechanism consisting of a gas valve GV, a pilot light 14, a thermostat 15 and a gas valve switch 16. The gas valve GV when open supplies gas to a burner 17. The heat from the burner 17 and/or from the pilot flame 18 normally keeps the thermostat 15

in the position illustrated with the switch 16 closed. The switch 16 is in series with the gas valve GV and in series with the motor switch, thus permitting gas to flow to the burner 17 only when the motor M is operating.

Practical operation

In the operation of my burner control apparatus and protection system, the parts are normally in the position of Figure 2. When the room thermostat RT calls for heat, its contacts close. This establishes an initial room thermostat circuit through the following wires and elements of the circuit, the wires being indicated by lower case letters. From the lower end of the transformer secondary coil through *a*, LS, *b*, RT, *c*, SS, *d*, RC, *e*, *f*, SSH, *i*, Suc. S. and *j*, to the upper end of the secondary coil.

This initial room thermostat circuit causes energization of the relay coil which closes the holding switch HS and the motor switch MS. Closure of the holding switch alters the character of the initial room thermostat circuit so that instead of a single circuit there is then a pair of circuits which I will designate as "second" and "third" circuits. The second circuit is from the lower end of the secondary coil through the following wires and elements: *a*, LS, *b*, RT, *c*, SS, *d*, RC, *e*, *k*, HS and *l*, to a center tap 62 of the transformer secondary.

The third circuit is from the center tap 62 through the following wires and elements: *l*, HS, *k*, *f*, SSH, *i*, Suc. S. and *j* to the upper end of the transformer secondary. The second and third circuits thus established provide for low voltage protection of the control system in a manner fully set forth in my Patent No. 2,080,580, of May 18, 1937, and accordingly will not be gone into in more detail in the present application. It should be mentioned, however, that the second circuit thus established provides a holding circuit for the relay coil RC while the third circuit is provided for the safety switch heater SSH and can be opened without de-energizing the relay coil.

Closure of the motor switch MS causes the motor M to operate and likewise the blower B to operate. Operation of the blower will by the time the motor gets up to speed, have produced enough vacuum in the conduits 57 and 58 to cause the disc 52 to open the suction switch Suc. S., thus breaking the circuit for the safety switch heater SSH. Accordingly the bimetal latch 48 will not unlatch and the safety switch will remain closed. If there is an initial failure of suction, however, caused by a broken belt, improper operation of the motor, jamming of the blower or the like, then the suction switch will remain closed and the safety switch heater, after being energized for a period of time, for instance, thirty seconds, will warp the bimetal latch 48 to an unlatched position thereby permitting the safety switch SS to open and accordingly stop operation of the burner system because of de-energization of the relay coil RC. The trouble must then be remedied and the safety switch reset in closed position. If suction fails after being established, due to failure of the motor or blower or breakage of the belt 61 or the like, then the suction switch will close resulting in a re-energization of the safety switch heater so that after a time period the safety switch will open and shut down the system.

Thus I provide a protection system for the burner which operates to shut down the system after a time period in response to either initial

or subsequent suction failure from any cause resulting in reversion of the air in the conduit 57 to atmospheric pressure. The time delay period permits starting of the burner while the proper suction is being built up in the conduit 58. Otherwise, immediate opening of the safety switch SS because of the suction switch being normally closed, would prevent starting.

The limit switch serves as a means to open the room thermostat circuit and therefore shut down operation of the burner whenever the room thermostat calls for heat beyond a safe temperature of the furnace. After the limit switch opens, if the furnace temperature falls to a position permitting the limit switch to again close while the room thermostat is still closed, there will be another burner operation which will be discontinued either by the room thermostat in response to sufficient rise in temperature in the room or in response to excessive temperature of the furnace again opening the limit switch. Thus the limit switch guards against excessive furnace temperature while the suction switch guards against either initial failure of suction or failure thereof after suction has been established.

As long as the pilot light 14 is burning, the gas valve GV will be opened whenever the motor M is energized. In the event of combustion failure of the burner 17 and extinguishment of the pilot flame 18, however, then the thermostat 15 will open the switch 16 so that gas will cease flowing to the burner. In this way provision is made in a conventional manner for preventing continued flow of fuel to the burner when ignition fails due to the pilot flame 18 becoming extinguished or due to the pilot burner becoming soot-laden or otherwise inoperative.

Various modifications can be made in the construction and arrangement of the parts of my burner control apparatus and protection system without departing, however, from the real spirit and purpose of my invention. Therefore, I intend 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 burner control apparatus and protection system for a burner having an induction blower, a room thermostat, a relay operable upon energization to cause operation of the burner and the induction blower, a control circuit for said relay controlled by said room thermostat, said room thermostat establishing said control circuit upon closure of the room thermostat, said control circuit including a safety switch, means to open said safety switch after a time period, a switch responsive to suction of said induction blower and operable to render said means to open said safety switch inoperative upon a substantial vacuum being produced by said induction blower and another control circuit to stop flow of fuel to the burner upon combustion failure either initially or subsequent to establishment.

2. In a burner apparatus and protection system for a burner having an induction blower, a transformer, a room thermostat, a relay operable upon energization to cause operation of the burner and induction blower, a circuit including the secondary of said transformer and said relay and controlled by said room thermostat, said room thermostat establishing said circuit when it closes, means thereafter operable to maintain said relay energized from a portion only of said secondary, an actuator for said means, a suction

switch responsive to the suction of said induction blower, said suction switch being in circuit with the remaining portion of said secondary and being normally closed, said suction switch opening and thereby rendering said actuator inoperative upon a substantial vacuum being produced by said induction blower and means to stop the flow of fuel to the burner upon combustion failure.

3. In a burner control apparatus and protection system for a burner having an induction blower and means to stop the flow of fuel as a result of combustion failure, a control circuit for the burner and blower to cause operation thereof when the control circuit is closed, a room thermostat, a safety switch and a safety switch actuator in said control circuit and a suction switch responsive to the suction of said induction blower, said suction switch being also in said circuit and operable to de-energize said safety switch actuator when said suction switch responds to a vacuum produced by said induction blower.

4. In combination with a burner having means to stop the flow of fuel upon combustion failure and an induction blower, a safety switch, means for opening said safety switch after a time period and means for retaining said last means inopera-

tive upon suction being established by said induction blower comprising a switch in the operating circuit of said safety switch, said last switch being responsive to such suction.

5. A burner control apparatus for a burner having means to stop the flow of fuel thereto upon combustion failure, said burner having an induction blower, said apparatus including a safety switch and a suction switch for rendering said safety switch inoperative, said switches being included in a control circuit and means for operating said suction switch comprising a conduit connected with said induction blower, a disc mounted in said conduit and substantially spanning the diameter thereof, said disc being supported for movement relative to said conduit, means biasing said disc to remain in a predetermined position relative to said conduit at which position said safety switch is in operation and whereby a change in pressure in said conduit on opposite sides of said disc causes the disc to move to another position against its bias and thereupon change the position of the suction switch, said changed position of said suction switch causing it to render said safety switch inoperative.

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