Nov. 4, 1930. L. A. M. PHELAN 1,780,313

FUSIBLE SWITCH PLUG

Original Filed July 5, 1927

Fig. 1.

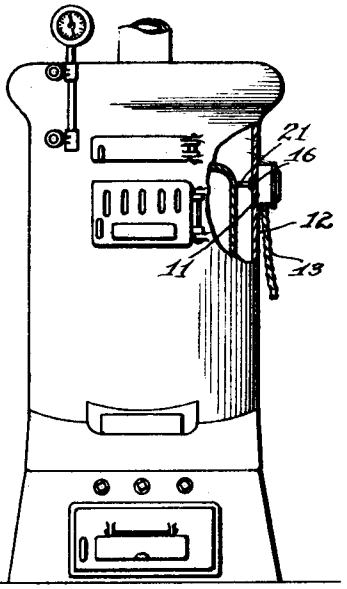


Fig. 3.

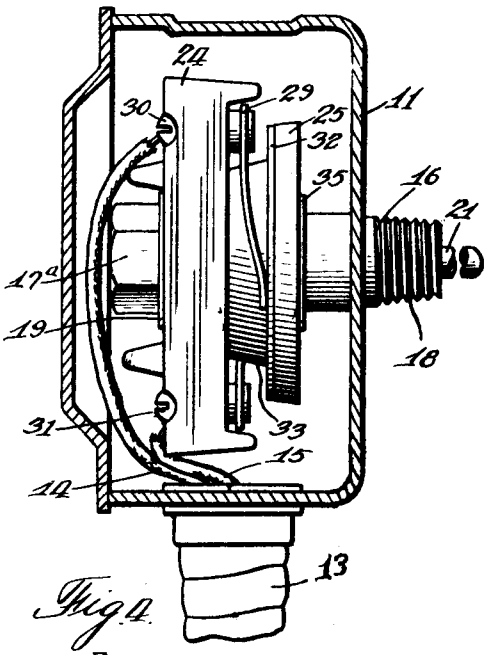


Fig. 2.

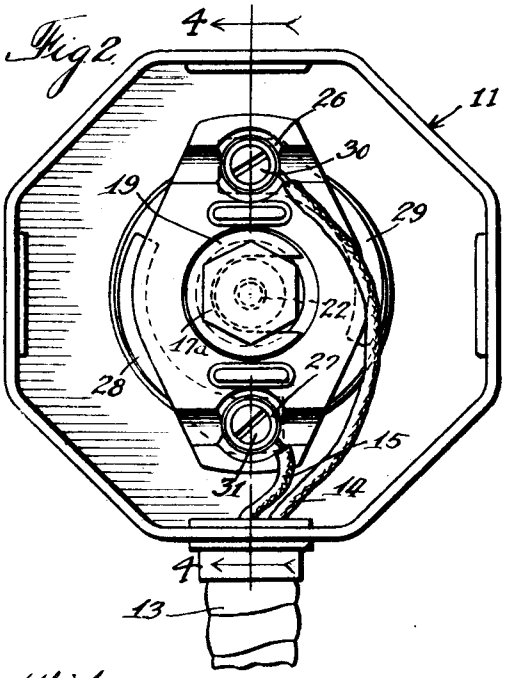
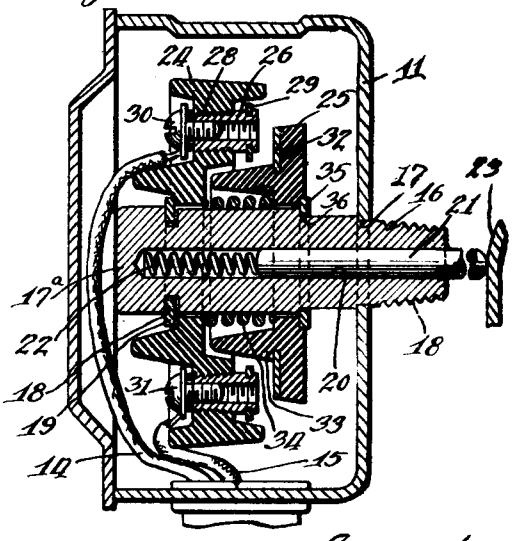


Fig. 4.



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UNITED STATES PATENT OFFICE

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FUSIBLE SWITCH PLUG

Application filed July 5, 1927, Serial No. 203,318. Renewed April 7, 1930.

This invention relates to a fusible switch plug and has special reference to a safety switch for controlling modern heating plants dependent for combustion upon oil, gas or coal under forced feed.

More particularly, this invention relates to a safety switch plug having a fusible junction which is released to open the high voltage circuit to the oil burner, to the coal burner motor or to the fuel valve of a gas burner upon obtaining a dangerously low water level in the boiler or furnace upon which latter the device is installed.

Heretofore, so far as applicant is aware, it is usual to operate the familiar fusible switch plug by the heat of convection or, in other words, the transference of heat from particle to particle through space. The foregoing is, of course, not a positive means of conveyance and the present invention, therefore, contemplates the operation of the improved safety switch plug or thermally controlled circuit breaker by means of the transference of heat by conduction. Further, the controlling temperature is obtained from the inner or hot wall of a boiler or the hot gas passage of the furnace.

The present invention comprises a body portion, for installation on the boiler shell at the low water line, having a pair of spaced contact carrying members and a heat conducting element mounted thereon. The conducting element contacts with a substantial portion of the body of the plug and extends within the outer shell of the boiler to contact with the inner or hot wall thereof. One of the contact carrying members is held in a fixed relation with the body portion of the plug and the other carrying member is slidable longitudinally thereof although normally held in a fixed relation therewith by means of a fusible element. In the operation of this safety switch, the transference of heat to the fusible member, by means of the conducting element and the body portion, frees the fusibly connected contact carrying element to permit the latter to open and break the motor or valve circuit of the fuel supply or the circuit of the electromagnetically operated fuel supply valve. By means of this control, it is possible to govern quickly and automatically the fuel supply or air blast in the heating unit in accordance with the water level in the boiler or the hot gas passage of the furnace.

One of the objects of this invention is to provide a fusible switch plug which is operative upon the transference of heat by conduction.

Another object of this invention is to provide a fusible switch plug which is simple in construction, easily installed and durable.

A further object of this invention is to provide a fusible switch plug which is inexpensive to manufacture, the larger parts thereof being molded of an insulating material.

Further objects and advantages of this invention will be apparent from the description and drawings forming a part of this specification to which latter reference may now be had for a more complete understanding of the characteristic features of this invention, in which drawings:

Figure 1 is an elevational view of this invention as applied to a boiler of a desired type;

Fig. 2 is a front elevational view of the thermally controlled circuit breaker embodied in this invention showing the same as mounted in a conduit box with the cover for the latter removed;

Fig. 3 is a side elevational view of Fig. 2 showing the conduit box in section; and

Fig. 4 is a central vertical sectional view taken on the line 4—4 of Fig. 2.

Referring now to the drawings, the present invention, as illustrated therein, is applied to a boiler 10 of any well known construction, the boiler being automatically operated and arranged to burn oil, gas or coal under forced feed. A conduit box 11 may be suitably secured to the wall 12 of the boiler and has a conduit 13 connected at the lower end thereof for receiving wires 14 and 15 which latter are suitably connected in the electrical control circuit of the heating system.

A bolt 16 preferably formed of brass, or other metal having a relatively high heat conductivity, is inserted through an opening 17

in the rear face of the conduit box 11, the inserted end being reduced to form a shoulder, which latter bears against the inner surface of the rear wall of the conduit box. The reduced portion of the plug or bolt 16 is threaded as indicated at 18 to engage the outer wall 12 of the boiler and acts as a mounting means for the entire circuit breaker. The opposite end of the bolt 16 is formed with a preferably hexagonal head 17ª spaced from the remaining portion of the shank of the bolt by means of a peripheral groove 18. A spring washer 19 is inserted in the groove 18 for purposes which will hereinafter be more fully described.

The bolt 16 is provided with a central aperture 20 for receiving a heat conducting element 21, preferably formed of a copper or brass bar or rod, and a coil spring 22. The outer end of the heat conducting element 21 is preferably rounded and bears against the crown sheet wall or inner wall 23 of the boiler, the element 21 being held in contact therewith by means of the coil spring 22 disposed between the other end of the element and the end of the aperture 20 in the bolt. It will thus be apparent that this heat conducting element has physical contact with the hottest portion of the boiler and that heat is transmitted to the bolt 16 by means of conduction, the bar or rod 21 having close terminal contact with the walls of the aperture 20.

In the installation of the device on a heating unit having a water jacket, it is preferable to locate a position on the outer shell of the boiler which will place the heat conducting rod 21 in contact with the inner or hot wall having the highest possible temperature. Under normal conditions, the water in the water jacket acts as a cooling agent to prevent the conduction of an intense heat to the body portion of the bolt 16. However, should the level of the water drop below a predetermined level, as determined by the location of the heat conducting rod 21, the temperature of the heat transferred to the bolt 16 will be substantially the same as the temperature of the inner or hot wall 23 allowing perhaps for a very slight heat gradient.

A pair of spaced contact carrying members 24 and 25 are disposed on the shank portion of the bolt 16, one surface of the member 24 abutting the spring washer 19. Both of these members 24 and 25 are of an insulating material and are preferably formed of a molded composition, such as hard rubber, bakelite, and the like, in order to reduce to a minimum, the cost of their manufacture. A pair of metal collars 26 and 27 are molded in the member 24, the collars having a reduced knurled portion as indicated at 28 in order that they may be fixedly held therein. A contact arm 29 is suitably fixed to each of the collar members 26 and 27 as by means of reducing the end of the projecting portion of the collar, the reduced portion being inserted in an aperture in the arm and upset. The collars 26 and 27 are internally threaded to receive screw members 30 and 31 which latter act as terminals for the wires 14 and 15.

The member 25 is preferably annular in shape and carries a metal contact ring 32 on its inner surface, the inner portion of the contact ring 32 being molded in the member 25 and the latter having an annular flange portion 33 extending from the inner surface thereof toward the member 24. This flange is spaced from the shank of the bolt 16 in order to envelope a coil spring 34 which is compressed between the inner surface of the members 24 and 25.

As has been hereinbefore pointed out, the spring washer 19 fixes the position of the member 24. The member 25 is slidable longitudinally of although normally held in a fixed relation with the shank portion of the bolt 16 by means of a disc 35 which is fusibly connected at 36 to a reduced portion of the bolt 16. The coil spring 34 tends to move the member 25 away from the member 24 in order to separate the contact arms 28 and 29 from the metal ring 32 upon which the former contact. This movement, however, is restrained by the disc 36 which, as stated, is fusibly connected to the bolt 16, the fusible connection being sufficiently strong to overcome the tension of the spring during the normal operation of the heating system. When the water level lowers beyond the point at which the bolt enters the wall 12, the temperature of the inner wall 23 is transferred by conduction through the rod or bar 21 to the bolt 16 and therethrough to the fusible connection. The lowering of the water level, of course, withdraws the cooling medium from contact with the rod 21 and therefore a sufficient heat is obtained at the fusible element which latter melts to release the member 25. Member 25, which has heretofore been held in a position such that the contact arms 29 bear against the metal ring 32 to close a circuit therethrough, is then forced away by the coil spring 34 to open the circuit therethrough, whereby the motor circuit is immediately broken and the operation of the coal burner motor, or the fuel supply of the oil burner, or the fuel valve of the gas burner is discontinued.

It will be noted that the copper or brass bar or tube 21 has a physical contact with the inner hot surface of the boiler. As briefly recited hereinbefore, the location for this rod or bar should be such that the latter is in contact with the inner or hot wall having the hottest possible temperature should the water drop below the low water line. In no event should the mounting position of the device be higher than the low water line or should the mounting position be so low that the inner shell 23 will be seriously exposed by

lowering the water too far before operating the fusible junction at point 36. Again it may be readily apparent that the rod can come into direct contact with a hot gas passage of a furnace as well as in contact with the crown wall of a water passage in a boiler.

It will be observed that a very compactly arranged and inexpensive thermally operated circuit breaker has been disclosed herein. The larger portions of the device may be molded of a composition in order to produce a unitary device which minimizes the cost of assembly as well as the cost of the materials. Further the fusible disc 35 is in a direct contact with the hottest portion of the boiler, in order that the circuit may be broken to stop the operation of the heating system almost instantaneously.

While but a single embodiment of this invention is herein shown and described, it is to be understood that many modifications therein may occur to those skilled in the art without departing from the spirit and scope of this invention and it is desired that the same shall be limited by the scope of the appended claims and the showing of the prior art.

I claim:

1. A thermally controlled circuit breaker comprising an apertured plug, a stationary insulating member and a relatively movable insulating member mounted on said plug, coacting contact making members mounted on each of said insulating members, means between said insulating members to disengage said contact members, thermally controlled means normally restraining said disengaging movement, and a heat conducting element disposed in said plug aperture in thermal contact with said restraining means.

2. A thermally controlled circuit breaker comprising an apertured plug, a stationary insulating member and a relatively movable insulating member mounted on said plug, a pair of collars molded in one of said insulating members for receiving terminal screws, a pair of contact arms fixed to said collars, a contact plate mounted on the other of said insulating members for engaging said contact arms, means between said insulating members for disengaging said contact arms and said plate, and a fusible member connected to said plug for normally restraining said disengaging movement.

3. A thermally controlled circuit breaker comprising an apertured plug, a stationary insulating member and a relatively movable insulating member mounted on said plug, coacting contact making members mounted on each of said insulating members, means between said insulating members to disengage said contact members, thermally controlled means normally restraining said disengaging movement, and a spring pressed heat conducting rod disposed in said plug aperture in thermal contact with said restraining means.

4. A thermally controlled circuit breaker comprising coacting contact members, fusible means for disengaging said contact members, and a spring-pressed member of high heat conductivity adapted to be placed in close thermal contact with a heated member and serving to conduct the heat to said fusible element.

5. A thermally controlled circuit breaker comprising an apertured plug, coacting contact members mounted on said plug, fusible means for disengaging said contact members, and spring pressed means disposed in the aperture of said plug adapted to be held in contact with a heated member and serving to conduct heat therefrom to said fusible means.

6. A thermally controlled circuit breaker comprising a metal body portion for engaging the outer wall of a heating unit, coacting contact members mounted on said body portion, fusible means for disengaging said contact members, and a spring pressed member of high heat conductivity adapted to pass through said outer wall of said heating unit to engage an inner hot wall thereof for conducting heat to said fusible means.

In witness whereof, I have hereunto subscribed my name.

LOUIS A. M. PHELAN.