June 22, 1943. H. F. ALFERY 2,322,410

BURNER CONTROL APPARATUS

Filed Aug. 31, 1940

Fig. 1.

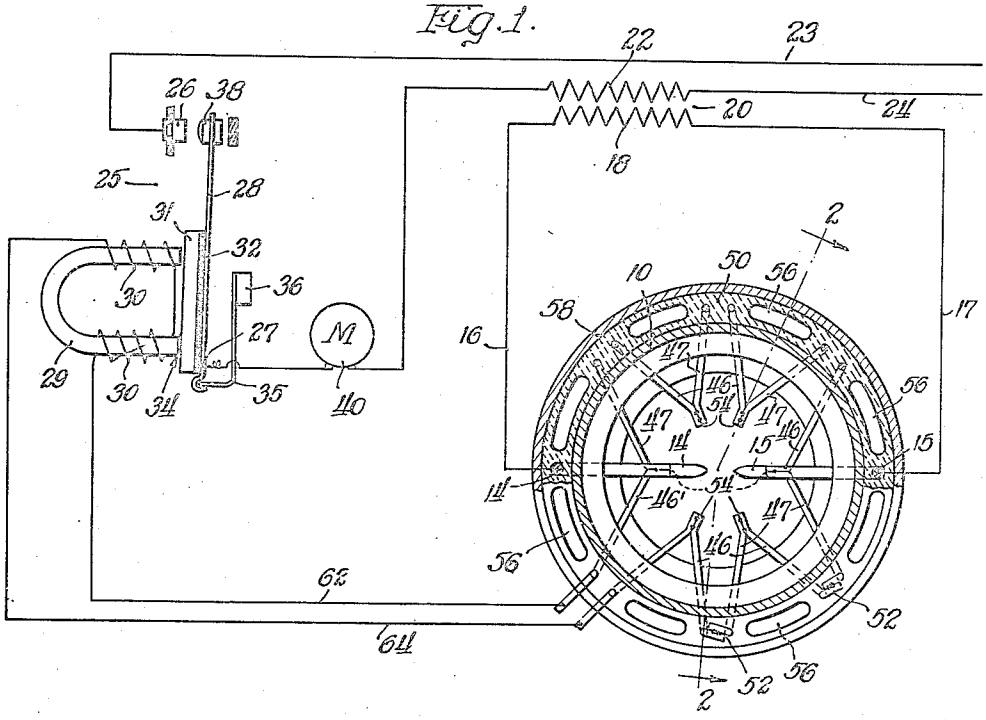
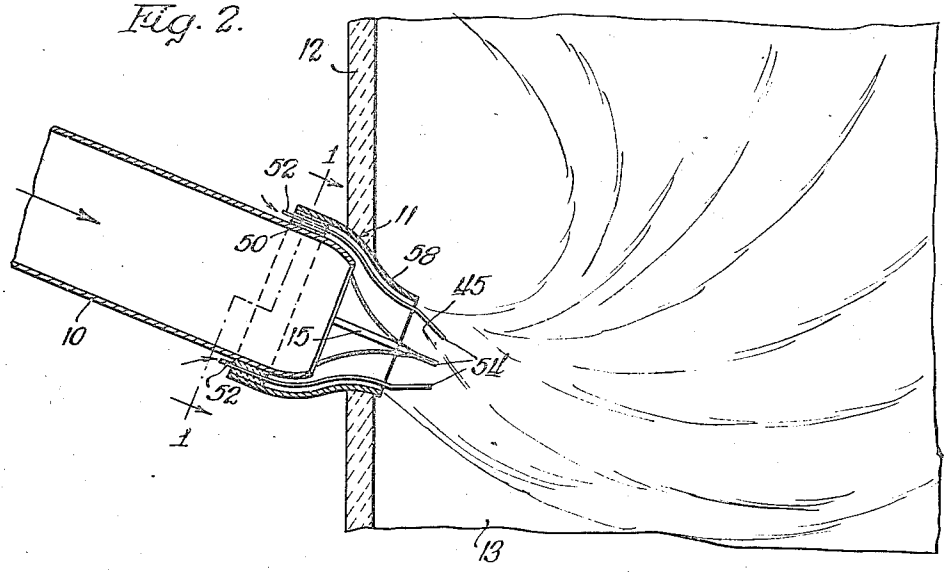


Fig. 2.



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Patented June 22, 1943

2,322,410

UNITED STATES PATENT OFFICE

2,322,410

BURNER CONTROL APPARATUS

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Application August 31, 1940, Serial No. 354,964

5 Claims. (Cl. 136—4)

This invention relates to burner control apparatus and has to do with a safety shutoff mechanism particularly adapted for use with oil burners, although it may be used with other burners as suitable or desired.

One of the main objects of the invention is to provide an improved safety shutoff mechanism for shutting off the burner upon failure of ignition or combustion so that the oil or the fuel mixture will not pass into the furnace unignited where it may become a fire hazard or flood the place where the furnace is located and result in an explosion.

Another object of the invention is to provide an improved thermopile safety shutoff for use particularly with oil burners and other equivalent burners.

Another object of the invention is to provide an automatic safety shutoff of relatively simple and inexpensive construction, and which may be installed conveniently and will operate effectively; also a thermopile safety shutoff having a highly effective arrangement of its thermojunctions and mounted or supported in a highly effective manner.

Further features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawing, in which:

Figure 1 is a diagrammatic illustration of one embodiment of the invention; and

Figure 2 is a fragmentary section through the fuel nozzle shown in Figure 1 and through the adjacent portion of the furnace, taken substantially on the line 2—2 of Figure 1.

Referring to the drawing, I have shown more or less diagrammatically in Figure 2 the nozzle 10 of an oil burner or other equivalent burner which nozzle 10 directs the fuel mixture, for example, of oil and air through an opening 11 in the wall 12 of the furnace and into a zone of ignition in the combustion chamber 13.

The oil burner has a motor and blower (not shown) of any suitable or preferred form for projecting the fuel mixture through the nozzle 10 and into the combustion chamber 13.

The fuel mixture is ignited as it leaves the inner end of the nozzle 10 by ignition means shown in the form of a spark gap comprising spark gap electrodes 14, 15 connected by conductors 16, 17 to the secondary 18 of a transformer 20 which transformer is adapted for supplying a high tension spark across the spark gap between the electrodes 14, 15 as well understood in the art. A spark plug or other suitable ignition means may be employed within the scope of the broader aspects of the present invention.

The primary 22 of the transformer 20 is connected to the usual or any suitable line or supply circuit shown generally as comprising line wires 23, 24. This line circuit has therein a thermoelectric switch designated in its entirety at 25 and preferably of the type more fully shown and described in the copending application of Theodore A. Wetzel, Serial No. 148,495, filed June 16, 1937, now Patent No. 2,267,775 dated Dec. 30, 1941, or of any other suitable or preferred form.

In the illustrated embodiment of the invention, the line wire 23 is connected to a stationary contact 26 at the thermoelectric switch and the other line wire 24 is connected at 27 to the switch arm 28. The thermoelectric switch has an electromagnet comprising a magnet frame 29 and a coil or coil means 30 wound or wrapped thereon. The thermoelectric switch is shown as also having an armature 31 shown for purposes of illustration as being carried by and insulated at 32 from the switch arm 28.

The armature 31 is mounted for swinging movement preferably on the lower edge of the lower leg of the magnet frame 29 at 34 as more fully disclosed in the above-mentioned patent of Theodore A. Wetzel.

The switch arm 28 is preferably held yieldingly, for example, by a leaf spring 35, fixedly mounted at one end at 36, in position with the contact 38 at the outer end of the arm 28 separated from the contact 27 to open the line circuit 23, 24. Upon energization of the electromagnet, the armature 31 is swung to attracted position about the pivot at 34 and the movable contact 38 engages the stationary contact 26 to close the line circuit 23, 24.

The motor, shown more or less diagrammatically at 40, is connected in any suitable or preferred manner with the blower or fan (not shown) for projecting the fuel mixture through the nozzle 10 and into the combustion chamber 13.

The motor and blower are set into operation when the line circuit 23, 24 is closed by engagement of the contact 38 with the contact 26 as well understood in the art.

The electromagnet is adapted to be energized, as long as combustion and ignition are functioning properly within the combustion chamber 13, by thermocouple means indicated in its entirety at 45. The thermocouple means 45 is shown in the form of a thermopile comprising a plurality of pairs of thermocouple elements 46,

47 connected in series as well understood in the art. The two elements 46, 47 of each thermocouple forming the thermopile 45 are of different thermoelectric characteristics.

One suitable form of mounting for the thermopile 45 is shown as comprising an insulating sleeve 50 mounted and suitably held in place upon the exterior of the nozzle 10 near the inner end thereof. The thermopile elements 46, 47 are shown as carried by and extending through the sleeve 50. The outer ends of the thermopile elements are joined together to form the "cold" thermojunctions 52 of the thermopile. The inner ends of the thermopile elements 46, 47 which are shown as converging inwardly extend into the combustion chamber 13 and are joined to form the "hot" thermojunctions 54. These "hot" thermojunctions 54 are arranged in circumferentially spaced relation about an extension of the axis of the nozzle 10 and in position to be heated by the combustion of the fuel in the zone of ignition within the combustion chamber 13 as long as combustion and ignition are functioning properly. The insulating sleeve 50 is shown as having circumferentially spaced openings 56 for the passage of adequate air therethrough in the direction indicated by the arrows in Figure 2.

An outer nozzle part 58 may be mounted and held in place upon the exterior of the sleeve 50. This outer nozzle part encloses and protects the thermopile or thermocouple elements 46, 47 and extends through the opening 11 in the furnace wall and into the combustion chamber 13. The wall of the nozzle part 58 is shown as sloping or converging to a reduced diameter at its inner end and this inner end of the nozzle part 58 is shown as terminating short of the "hot" junctions of the thermopile. The spark gap electrodes 14, 15 are also shown as carried by the insulating sleeve 50 and extending through the space between the nozzle 10 and the nozzle part 58 to dispose the inner spark gap ends in suitable position.

The outer end or terminal of the thermopile or thermocouple element 46' is connected by a conductor 62 to one terminal of the coil or coil means 30 of the electromagnet. The other terminal of the coil or coil means 30 is connected by a conductor 64 to the outer end or terminal of the thermocouple or thermopile element 47'.

The operation of the apparatus is as follows:

Assuming that ignition and combustion of the fuel mixture are functioning properly within the combustion chamber 13, the combustion of the fuel heats the "hot" junctions 54 of the thermopile 45 to set up the thermoelectric current which energizes the electromagnet and actuates the armature 32 to and holds same in attracted position engaging the contact 38 with the contact 26 and maintaining this engagement as long as proper ignition and combustion is taking place. When the line circuit 23, 24 is thus closed and as long as it remains closed, the motor 40 and blower or fan operate to project the fuel mixture into the combustion chamber. The spark gap means 14, 15 functions through the secondary circuit 16, 17 to produce the spark for ignition of the fuel.

If, for any reason, ignition fails or the proper combustion of the fuel for heating the thermojunctions 54 does not take place, the discontinuance or reduction of the thermoelectric current results in deenergization of the electromagnet and the armature 32 is swung to retracted position in a clockwise direction (Figure 1) about its pivot 34 and in the illustrated embodiment of the invention under the action of the spring 35. This separates the contact 38 from the contact 26 opening the line circuit 23, 24 and stopping the operation of the motor 40 and its blower or fan and thereby the injection of further fuel into the combustion chamber 13.

Manual or other means may be provided for closing the line circuit 23, 24 for example at the thermoelectric switch or elsewhere as desired when the ignition or other means is again rendered operative and this means may be adapted to be released when the combustion of the fuel again heats the thermojunctions 54 to energize the electromagnet and maintain the armature 32 in attracted position and the switch closed. Of course, the thermoelectric switch may be closed merely by the application of heat to the thermojunctions 54 to energize the electromagnet sufficiently to actuate the armature 32 to attracted position.

The embodiment of the invention shown in the drawing is for illustrative purposes only and it is to be expressly understood that said drawing and the accompanying specification are not to be construed as a definition of the limits or scope of the invention, reference being had to the appended claims for that purpose.

I claim:

1. In combination, a fuel supply nozzle, an insulating sleeve surrounding and carried on the external surface of said nozzle, a thermopile comprising a plurality of pairs of thermocouple elements extending through and carried by said sleeve with their outer ends joined together, the inner ends of said thermocouple elements extending from the inner end of said nozzle and joined to form "hot" thermojunctions in circumferentially spaced relation beyond the inner end of said nozzle, an outer nozzle part surrounding and held in place on the external surface of said insulating sleeve, said outer nozzle part enclosing and protecting the thermocouple elements and terminating short of said "hot" thermojunctions and a pair of spark gap electrodes carried by said insulating sleeve and extending between the fuel supply nozzle and the outer nozzle part with the ends thereof disposed inwardly beyond the fuel supply nozzle and forming a spark gap for igniting the fuel.

2. In combination, a fuel supply nozzle, an insulating sleeve surrounding and carried on the external surface of said nozzle, a thermopile comprising a plurality of pairs of thermocouple elements extending through and carried by said sleeve with their outer ends joined together, the inner ends of said thermocouple elements extending from the inner end of said nozzle and joined to form "hot" thermojunctions in circumferentially spaced relation beyond the inner end of said nozzle, an outer nozzle part surrounding and held in place on the external surface of said insulating sleeve, said outer nozzle part enclosing and protecting the thermocouple elements and terminating short of said "hot" thermojunctions and a pair of spark gap electrodes carried by said insulating sleeve and extending between the fuel supply nozzle and the outer nozzle part with the ends thereof disposed inwardly beyond the fuel supply nozzle and forming a spark gap for igniting the fuel, said insulating sleeve having circumferentially spaced openings for the passage of air therethrough.

3. In combination, a fuel supply nozzle, an

insulating sleeve surrounding and carried on the external surface of said nozzle, and a thermopile comprising a plurality of pairs of thermocouple elements extending through and carried by said sleeve with their outer ends joined together, the inner ends of said thermocouple elements extending from the inner end of said nozzle and joined to form "hot" thermojunctions in circumferentially spaced relation beyond the inner end of said nozzle, the outer ends of said thermocouple elements being joined together to form "cold" thermojunctions adjacent the outer end of said insulating sleeve, said insulating sleeve having circumferentially spaced openings extending through the sleeve between said thermocouple elements for the passage of air therethrough and adjacent said "cold" thermojunctions.

4. In combination, a fuel supply nozzle, an insulating sleeve surrounding and carried on the external surface of said nozzle, a thermopile comprising a plurality of pairs of thermocouple elements extending through and carried by said sleeve with their outer ends joined together, the inner ends of said thermocouple elements extending from the inner end of said nozzle and joined to form "hot" thermojunctions in circumferentially spaced relation beyond the inner end of said nozzle, the outer ends of said thermocouple elements being joined together to form "cold" thermojunctions adjacent the outer end of said insulating sleeve, said insulating sleeve having circumferentially spaced openings extending through the sleeve between said thermocouple elements for the passage of air therethrough and adjacent said "cold" thermojunctions, and an outer nozzle part surrounding and held in place on the external surface of said insulating sleeve, said outer nozzle part enclosing and protecting the thermocouple elements and terminating short of said "hot" thermojunctions.

5. In combination, a fuel supply nozzle, an insulating sleeve surrounding and carried on the external surface of said nozzle, a thermopile comprising a plurality of pairs of thermocouple elements extending through and carried by said insulating sleeve with their outer ends joined together, the inner ends of said thermocouple elements extending from the inner end of said nozzle and joined to form "hot" thermojunctions in circumferentially spaced relation beyond the inner end of said nozzle, and a pair of spark gap electrodes carried by said insulating sleeve and extending to position with the ends thereof disposed inwardly beyond the fuel supply nozzle and forming a spark gap for igniting the fuel.

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