

March 28, 1944.

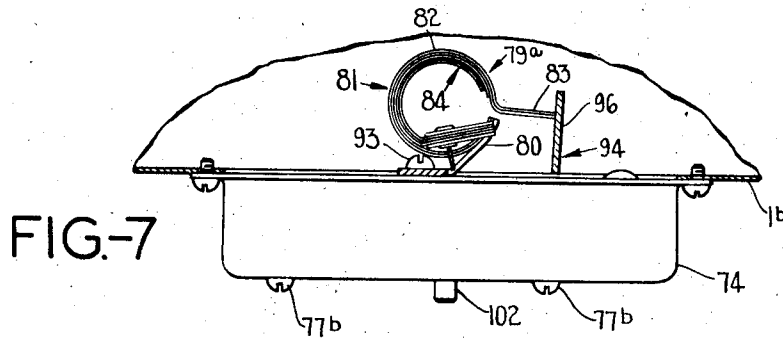
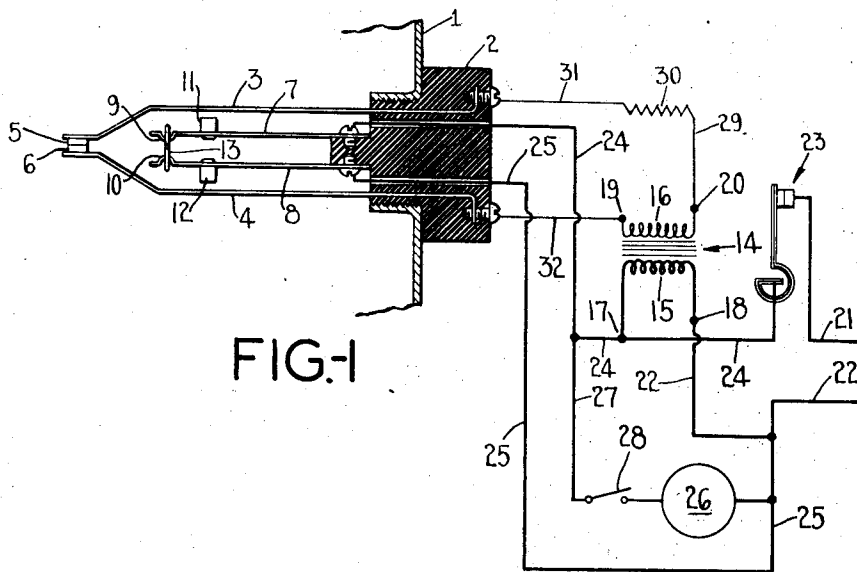
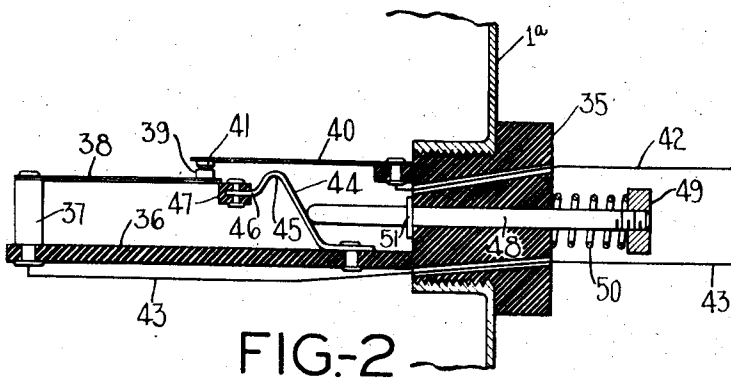
W. S. LANDON

2,344,946

CONTROLLING MEANS

Filed March 26, 1941

2 Sheets-Sheet 1



INVENTOR

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2 Sheets-Sheet 2

FIG-3

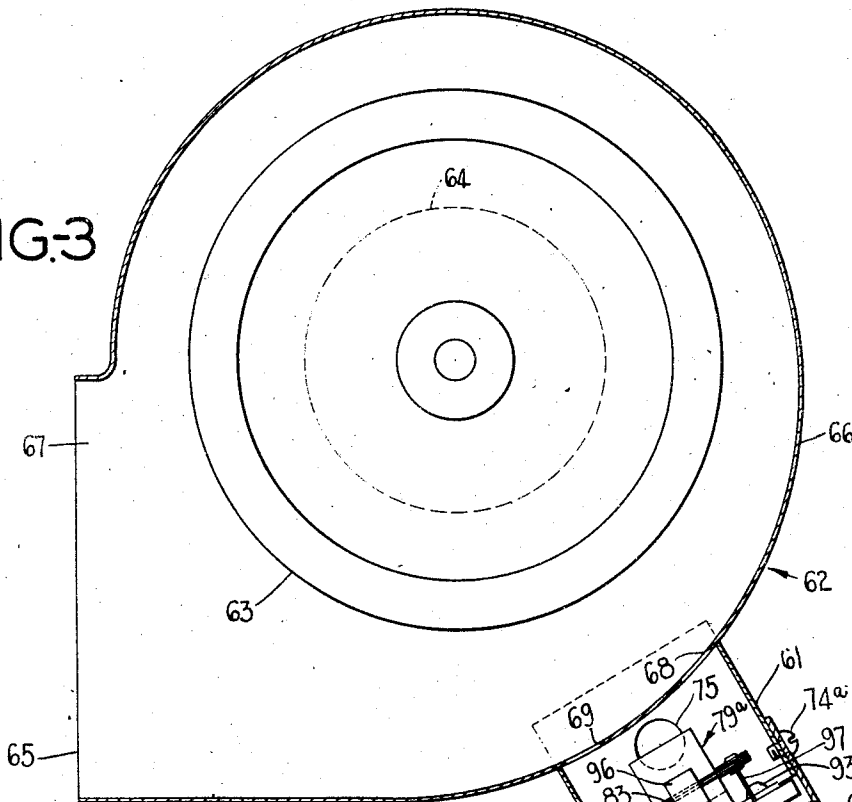
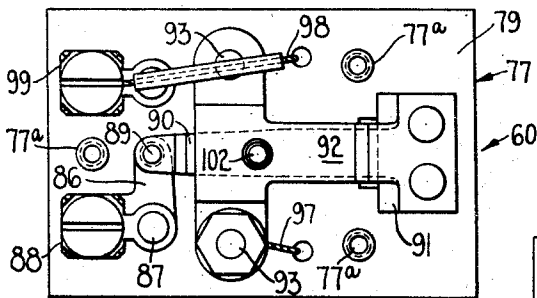


FIG-6

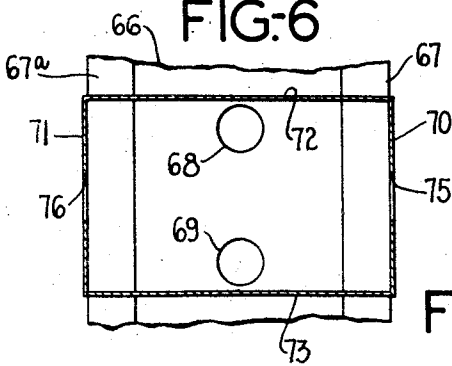


FIG-5

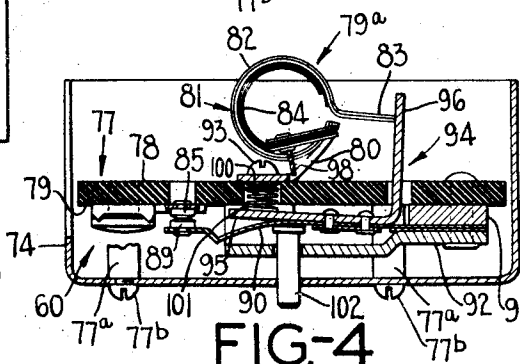


FIG-4

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2,344,946

CONTROLLING MEANS

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Application March 26, 1941, Serial No. 385,315

11 Claims. (Cl. 200—122)

This invention relates to new and useful controlling means which among other uses is particularly useful in connection with an air supplying means for a fuel burning apparatus wherein it is adapted to function as a safety means in the event of failure of the required air supply.

One object of this invention is to provide a novel controlling means responsive to failure of, or substantial change in, operation of a driven or driving means.

Another object is to provide means by which such controlling means is rendered responsive to fluid flow.

Another object is to provide a novel safety switch for fluid fuel burners.

Another object is to provide a novel safety switch for actuation upon the failure of a sufficient air supply for a fluid fuel burner.

Another object is to provide a novel control in which a heated temperature responsive element is subject to a cooling effect of a fluid to actuate a control means.

Another object is to provide a safety means which subsequent to operation indicative of an undesired condition, will maintain itself in its operated position.

Another object is to provide a simple manually operable means to reset the safety means.

These and other objects will be apparent from a reading of the specification and claims.

The invention consists in the improved construction of and combination of parts, to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings, to be taken as a part of this specification, there are fully and clearly illustrated a number of the preferred embodiments of this invention, in which drawings—

Figure 1 is a view showing a portion of air duct with a control means embodying the invention positioned therein and showing one way in which the control means may be connected into a burner control system;

Fig. 2 is a view showing a modified form of the control means;

Fig. 3 is a view of another control means embodying the invention and attached to a fan casing;

Fig. 4 is a view in section of the control means of Fig. 3;

Fig. 5 is a view in cross section of the housing which is secured to the fan casing and showing the air passageways through the housing and through the casing;

Fig. 6 is a view of the switch mechanism of the control means of Fig. 3, and

Fig. 7 is a view of the control apparatus of Fig. 3 positioned with the temperature responsive element located directly in an air duct.

Referring to the drawings by characters of reference, 1 designates generally an air duct through which air is caused to flow. In the embodiment as shown in Fig. 1, the duct 1 has a threaded aperture therethrough in which is threadedly secured a nut-like supporting member 2 which is preferably made of "Bakelite" fiber or other insulating material and which carries plate-like electrical conducting spring arms 3 and 4 extending into the duct 1. The arms 3 and 4 carry at their free ends contact members 5 and 6 respectively. The innate resiliency of the arms 3 and 4 act to maintain the members 5 and 6 in engagement and in good electrical contact. Positioned between and extending substantially parallel with the arms 3 and 4 are plate-like electrical conducting spring arms 7 and 8 which have one end secured to and carried by the supporting member 2. The other or free ends of the arms 7 and 8 extend toward but not to the contact members 5 and 6 and have offset or rebent portions forming hooks 9 and 10. The innate resiliency of the arms 7 and 8 acts to urge the arms 7 and 8 in a separating direction and to cause abutments 11 and 12 to move into engagement with the arms 3 and 4 respectively. The force exerted by the arms 7 and 8 in a separating direction is greater than the force exerted by the arms 3 and 4 in urging the contact members 5 and 6 together so that upon engagement of the abutments 11 and 12 with the arms 3 and 4, the arms 3 and 4 will be moved in a separating direction and the contact members 5 and 6 will part thereby to open the circuit controlled thereby.

Normally the arms 7 and 8 are held against separating movement by a fusible member 13 which may be C-shaped as shown, or any other suitable form for hooking into the hooks 9 and 10. The member 13 is preferably of high resistance and is heated by an electrical current flowing therethrough. Upon reaching a predetermined temperature, the member 13 will rupture thereby allowing the arms 7 and 8 to move apart and to open the circuit through the contact members 5 and 6. The circuit between the arms 7 and 8 will also be interrupted by the rupture of the fusible member 13.

The numeral 14 designates generally a transformer having a primary coil 15 and a second-

ary coil 16 having respectively terminals 17 and 18, and 19 and 20. Electrical energy is supplied from a suitable source of supply (not shown) through lead wires 21, 22. Lead wire 22 is connected directly to the terminal 18 of transformer 14. Lead wire 21 is connected to one terminal of a room thermostat diagrammatically shown at 23 and which is positioned within and sensitive to the temperature of the room to be heated by a heater (not shown) or may be some manually operable switch or some other form of control for an electric circuit. The other terminal of the thermostat 23 is connected by a lead wire 24 to the terminal 17 of the transformer 14 and to the arm 7. The arm 8 is connected by a lead wire 25 to the lead wire 22 so that the member 13 is connected directly across the supply. The motor diagrammatically shown at 26 and which may drive a fan for forcing air through the duct 1 has one terminal connected to the lead wire 25 intermediate the arm 8 and wire 22 and has its other terminal connected by a lead wire 27 to the lead wire 24 intermediate the arm 7 and thermostat 23. If desired, a switch 28 may be inserted in the wire 27 and automatically actuated in a manner to be hereinafter described.

A lead wire 29 connects the terminal 20 of the transformer 14 to one terminal of an actuating means 30 which is shown in the form of a resistance and a lead wire 31 connects the other terminal of the means 30 to the arm 3. The arm 4 is connected by a lead wire 32 to the transformer terminal 19 thereby completing the secondary circuit of the transformer. The means 30 is adapted to actuate a fuel supply valve (not shown) and also is operable to actuate the switch 28. One method by which the means 30 might be operable to actuate a switch and valve is shown in my copending joint application with Philip S. Russel, Serial No. 363,367, filed October 29, 1940, for Control apparatus.

In Fig. 2 there is shown a modification of the apparatus of Fig. 1 in which modification a supporting member 35 which is of a material similar to the member 2 is likewise screw-threadedly secured within an aperture through the walls of a duct 1^a. The member 35 has integral therewith a supporting portion 36 extending inwardly into the duct 1^a and has secured thereto, as by riveting, a current conducting post 37. A bimetallic strip member 38 which preferably has an appreciable resistance to current flow has one end secured to the top of the post 37 and extends therefrom toward the supporting member 35 and through about one half the distance. The free end of the member 38 has secured thereto and to its upper face a contact member 39. The supporting member 35 has secured thereto one end of a strip spring blade member 40 which has its free end overlying the contact member 39 and has secured to the free end, a contact member 41 which is operable to engage the contact member 39 to complete an electrical circuit from a lead wire 42 connected to the blade member 40 to a lead wire 43 leading from and connected to the post 37. The innate resiliency of the blade member 40 acts to urge the contact member 41 downward toward the supporting portion 36. Increase in temperature acts to cause the bimetallic member 38 to move the contact member 39 downward toward the portion 36.

A leaf spring 44 has one end secured to the upper surface of the portion 36 adjacent the screw-threaded portion of the member 35 and extends

diagonally therefrom upward toward the member 40 to terminate in a hook portion 45 having a lip 46 which extends substantially parallel to the portion 36. An insulating member 47 is suitably secured to the lip 46 as by a rivet and has in the position of the parts as shown, a corner of the upper surface engaging the under surface of the bimetallic member 38. Normally, the upward force exerted by the spring 44 is sufficient to hold the parts against movement downward due to the force exerted by the blade member 40 and the bimetallic member 38. As the bimetallic member 38 increases in temperature, the member 38 increases its downward force flexing the lip 46 downward. This downward movement does not act to cause a parting of the contact members 39 and 41 because as the contact member 39 is moved downward the inherent resiliency of the blade member 40 moves the contact member 41 downward with sufficient force to insure a good electrical contact between the members 39 and 41.

As the temperature of the bimetallic member 38 reaches a predetermined temperature, the rotation of the bimetallic member 38 will, due to its radius arm about the post 37 and the bending of the spring 44, slip over the edge of the member 47 and being relieved of the upward force exerted by the spring 44, the member 38 will snap or move with a quick movement to part the contact members 39 and 41; the blade member 40 being limited in its downward movement by engagement with the hook portion 45 of the spring 44. Subsequent to the parting of the contact members 39, 41 the bimetallic member 38 which was heated due to the flow of current there-through will begin to cool but reengagement of the contact members 39 and 41 will be prevented because the insulating member 47 will be positioned to hold the contact members 39 and 41 apart.

A manually operable resetting means is carried by the supporting member 35 and comprises a rod-like plunger 48 which extends through an aperture in the member 35. The inner end of the plunger 48 is spherical and is adapted to engage the diagonally-extending portion of the spring 44. The outer or other end of the plunger 48 projects from and is spaced from the outer face of the supporting member 35 and has an annular head portion 49 suitably secured thereto as by screw-threading. A helically coiled compression spring 50 is positioned concentric with the plunger 48 and is under compression between the head portion 49 and supporting member 35 and acts to urge the plunger in an outward direction (toward the right as viewed in Fig. 2). Outward movement of the plunger is limited by an abutment 51 which is rigid with the plunger 48 and which engages the supporting member 35. Inward movement of the plunger 48 causes the spherical end to push against the spring 44 and flex it so that the lip 46 moves downward pushing the free end of the bimetallic member 38 downward until the free end of the member slides by the insulating member 47 and the contact members 39 and 41 then reengage. The plunger 48 is then released and spring 50 pushes the plunger 48 outward until the abutment 51 engages the supporting member 35.

Referring to Figures 3, 4, 5 and 6 there is shown another form of switch generally designated 60. In Fig. 3 the switch 60 is shown carried by a housing 61 which is in turn secured to a fan casing 62. The casing 62 is of the scroll type and in which is positioned a pressure type fan 63 which is held in place therein and rotated therein by a

suitable means such as an electric motor 64. The casing 62 has an inlet (not shown) which opens axially into the central portion of the fan 63 and has an outlet 65 for connection to a duct for flow of air to the supplied means such as a fluid fuel burner. The casing 62 has a spiral side wall 66 and substantially parallel end walls 67 and 67^a. The wall 67 carries the motor 64 and the other wall 67^a has the inlet. The wall 66 has two apertures 68, 69 extending therethrough positioned midway between the end walls 67, 67^a and spaced one from the other. The apertures 68 and 69 connect the housing 61 and casing 62 and form passageways for the flow of air therebetween.

The housing 61 is rectangular and has side walls 70, 71, 72 and 73 with the side wall 66 of the casing 62 forming one end wall. The other end of the housing 61 is closed by the switch 60 and its cover 74. The cover 74 is secured to the housing 61 by a suitable means such as a screw 74^a. The side walls 70, 71 have passageways or apertures extending therethrough for the flow of air.

The switch 60 comprises a substantially rectangular plate 77 preferably of "Bakelite" or other electrically insulating material having opposite substantially parallel surfaces 78, 79. A plurality of spacing members 77^a are carried by the plate 77 and extend from the surface 79 and have threaded apertures in their extended end portion for receiving screws 77^b which act to rigidly secure together the cover 74 and plate 77. Secured to the surface 78 is a bimetallic temperature sensitive means 79^a comprising a supporting member 80 and to which is secured one end of a bimetallic strip 81. The strip 81 is formed into a substantially circular portion 82 and has a lip portion 83 projecting substantially radially therefrom at the opposite end of the strip 82 from that which is secured to the member 80. An electric resistance heater unit 84 is positioned within and electrically insulated from the circular portion 82 and closely fits the inside surface of the circular portion 82 so that there is a good thermal path therebetween. The particular bimetallic shape and heater herein shown and described forms the subject matter of my co-pending application Serial No. 339,427, filed June 8, 1940, for Heat actuated devices.

Adjacent one end of the plate 77 and on the surface 79 is a contact member 85 which is carried by one arm of an L-shaped current conducting plate member 86 which is secured to the surface 79 as by a rivet 87. Held under the rivet 87 and overlying the other arm of the member 86 is a terminal member 88 having a screw for a lead wire connection. A movable contact member 89 is secured to one end of a leaf spring 90 which extends toward the opposite end of the plate 77 and along the surface 79. The end of the spring 90 opposite to the end having the contact member 89 is rigidly clamped between a rectangular spacing block 91 which is positioned against the surface 79 and the long arm of a T-shaped protecting member 92 which overlies the spring 90 and has its cross arms offset toward the surface 79. Screws 93 extend through apertures in the plate 77 and clamp the offset cross arms to the surface 79 and the supporting member 80 of the sensitive means 79^a to the surface 78.

A bell crank 94 has one leg 95 secured to the spring 90 adjacent to but spaced from the block 91 and has its second leg 96 extending through an aperture in the plate 77 and adjacent the bimetallic strip lip portion 83. The heater unit 84 has its lead wires 97, 98, extending through aper-

tures in the plate 77 and along the surface 79. The lead wire 97 is connected to the screw 93 which is adjacent the aperture through which it extends and is clamped thereto as by a nut. The lead wire 98 is secured to a terminal member 99 which is similar to the terminal member 88 and which has a screw for attaching a lead wire thereto. The plate 77 has an aperture 100 there-through intermediate the screws 93 and positioned within the aperture 100 is a helical compression spring 101 which has one end engaging the supporting member 80 and has its other end engaging the leg 95. The spring 101 normally acts to urge the leg 96 against the end surface of the lip portion 83.

As the temperature of the strip 81 increases, the lip portion 83 moves away from the surface 78 and at a predetermined temperature the lip portion 83 will move beyond the end of the leg 96 so that the spring 101 can act to rotate the bell crank 94 and to part the contact members 85 and 89 with a quick movement, thereby de-energizing the heater unit 84. Subsequent cooling of the strip 81 acts to cause the lip portion 83 to move toward the surface 78 but due to the movement of the bell crank 94 by the spring 101 the arm 96 will be in the path of movement of the lip portion 83 and the portion 83 will be held from returning to the shown position. A resetting plunger 102 extends through an aperture in the T-shaped member 92 and is reciprocally guided therein, and has a head portion to prevent removal thereof outward through the aperture in member 92. The plunger 102 may be pushed to move the arm 95 against the force of the spring 101 and to move the arm 96 beyond the end surface of the lip portion 83 so that the portion 83 can move to the position shown and the contact members 85 and 89 can move into engagement. Subsequent release of the plunger 102 will allow the spring 101 to move the arm 96 against the end surface of the portion 83. Engagement of the arm 96 and end surface of the portion 83 will hold the contact members 85 and 89 in engagement.

In Fig. 7 the housing 61 has been omitted and the switch has been secured directly to a fluid flow duct 1^b with the strip 81 positioned directly in the path of fluid flow therethrough. In all other respects the switch 60 is identical with the showing of the switch 60 in Figs. 3, 4 and 6.

The operation of the apparatus as illustrated in Fig. 1 is as follows: Upon closure of the circuit through the thermostat 23, current flows through the lead wire 21, lead wire 24, arm 7, fusible member 13, arm 8, lead wire 25 and lead wire 22. Closure of the circuit through the thermostat also acts to establish a circuit through lead wire 21, lead wire 24 and lead wire 27 to the switch 28 which when closed completes the circuit to the motor 26 and to the lead wire 25 which is connected to lead wire 22. At the time the thermostat 23 closes the circuits above mentioned, it also acts to energize the primary coil 15 of the transformer 14 which causes a current to flow through the secondary coil 16, lead wire 29, actuating means 30, lead wire 31, arm 3, contact members 5 and 6, arm 4 and lead wire 32 to the coil 16. Energization of the means 30 actuates a means such as a fuel valve and also actuates the switch 28 to energize the motor 26. Fuel is now allowed to flow to the burner or heater (not shown) and air is caused to flow through the duct 1. Air flowing through the duct 1 flows over the fusible member 13 and acts to cause a rapid

transfer of heat therefrom to the air stream. At the time the thermostat 23 established the current flow through the fusible member 13, member 13 began to heat up, due to its resistance to current flow, with the result that its temperature was caused to increase. The rate of increase in temperature of the member 13 is so related to the actuation of the switch 28 by the means 30 that the temperature of the member 13 is not raised to a point which will cause the member 13 to rupture and part the contacts 5 and 6 before the means 30 actuates the motor 26 to start air flow through the duct 1. If the fan driven by the motor 26 acts to supply the desired air flow through the duct 1, the rate of heat transfer from the member 13 to the air flowing through the duct 1 will be sufficiently great to prevent the heating effect of the current flow through the member 13 to raise the temperature thereof to the point at which the member ruptures, irrespective of the length of time the current flows through the fusible member 13. The apparatus will then continue to function as described. Should, however, the air flow through the duct 1 fall below a predetermined rate, the rate of heat transfer from the member 13 to the air within the duct 1 will diminish so that the temperature of the member 13 will increase, causing the member to rupture. Rupture of the member 13 allows the arms 7 and 8 to fly apart and the abutments 11 and 12 to engage and move the arms 3 and 4 respectively, in a parting direction to open the secondary circuit of the transformer 14, thereby deenergizing the means 30. Deenergization of the means 30 acts to reduce the fuel flow to the heating apparatus (not shown) and to open the switch 28 deenergizing the motor 26. The apparatus is then in a safety position and the thermostat 23 will be rendered ineffective to control the motor 26 or means 30. To again place the apparatus into operation, it is necessary to replace the member 13 by a new one.

The operation of the apparatus of Fig. 2 is quite similar to that of the apparatus of Fig. 1 but instead of using a fusible member 13 this form utilizes a bimetallic member 38 which is heated by the current flow therethrough. With the apparatus utilizing the member 38 it is not necessary to replace any parts to place the system into operation after the contact members 39 and 41 have opened the circuit; it is necessary only to manually press inward on the head portion 49 to reclose the contact members 39 and 41. In the event the rate of air or fluid flow through the duct 1 falls below a minimum rate, the heating effect of the current flowing through the member 38 will increase the temperature thereof and cause the end carrying the contact member 39 to move downwardly against the spring 44 until the corner of the movable end of the member 38 slips over the corner of the insulating member 47, at which time the contact members 39 and 41 will part with a quick movement as hereinbefore described. It will be noted that the spring blade member 40 will move the contact member 41 downwardly as the contact member 39 is moved downwardly until limited by engagement of the member 40 with the hook portion 45, which occurs substantially at the time the blade member 40 slides off of the insulating member 47. The member 47 is now in a position to prevent engagement of the contact members 39 and 41 and cooling of the member 38 will not cause the contact members 39 and 41 to reengage. To reset the contact members 39

and 41 in their engaging positions, it is necessary to push in on the plunger 48 so that the insulating member 47 is moved downwardly toward the portion 36 enough to allow the contact member end of the member 38 to again slide by the member 47 and bring the member 39 into engagement with the member 41. Release of the inward force manually exerted on the plunger 48 allows the spring 50 to move the plunger 48 to the position shown.

In the modification as shown in Figs. 3-6, the circular portion of the bimetallic strip 81 is heated by the heater unit 84 which has its circuit controlled by the contact members 85 and 89. Current is supplied by a lead wire (not shown) to the terminal member 88, and then flows through the plate member 86, contact members 85 and 89, spring 90, member 92 to one lead wire 97 of the unit 84, through the unit 84, and through the other lead wire 98 of the unit 84 to the terminal member 89 which is connected by a lead wire (not shown) to complete the circuit. Air flow through the fan casing 62 causes air to flow through the passageways 68, 69, 75 and 76 and over the strip 81, thereby increasing the rate of heat flow therefrom sufficiently to prevent the temperature thereof to raise sufficiently to cause the lip portion 83 to be moved beyond the end of the leg 96 so that the spring 101 is not effective to part the contact members 85 and 89. Should the fan 63 fail to provide the desired air flow through the casing 62 the air flow over the strip 82 will be reduced sufficiently so that the temperature of the strip 82 will increase and move the lip portion beyond the end of the leg 96, allowing the spring 101 to act to move the contact member 89 away from the contact member 85. Parting of the contact members 85 and 89 deenergizes the heater unit 84 and allows the strip 82 to cool. Movement of the lip portion toward the position shown in Fig. 4 is limited, however, by engagement with the end surface of the leg 96 which will have been moved by the spring 101 into the path of movement of the lip portion 83. To reset the contact members 85 and 89 in circuit making position, it is necessary to push in on the outer end surface of the plunger 102 which moves the leg 96 of the bell crank 84 toward the surface 79 compressing the spring 101 and moving the leg 96 out of the path of movement of the lip portion 83. By the time the operator gets around to pushing the plunger 102, the strip 81 will have cooled sufficiently so that the lip portion will move substantially to the position shown and upon release of the plunger 102 the lip portion 83 will hold the arm 96 as shown and the contact member 89 in engagement with the contact member 85.

The direction of flow of air through the passageways 68, 69, 75 and 76 will depend upon the restriction of air flow through the outlet 85. At high restrictions to flow through the outlet 85, the air will flow from the casing 62; and at low restrictions, the air flow will be into the casing 62. The apertures 75 and 76 may be omitted entirely and, in this event, the air flow through the housing seems to be in through the passageway 68 over the strip 81 and out through the passageway 69. In each instance of operation, however, it has been ascertained that sufficient air flow is obtained to actuate the switch 80 as desired.

In the showing of Fig. 7, the housing 81 has been eliminated and the strip 81 placed directly in the air stream flowing through the duct 1 to

which the switch 60 is secured. The operation of the switch 60 under these circumstances is substantially as previously described and will be readily apparent to those skilled in the art.

It may now be seen that there is provided by this invention a simple means which is responsive not directly to the temperature of the fluid in which the temperature sensitive element is placed but rather to the rate of fluid flow through a fluid conducting member. The means provided also acts to prevent further operation of the apparatus until the control has again been manually replaced in operation. This apparatus, it will be apparent, is particularly adaptable for use when an abnormally low air or fluid flow would be highly objectionable or, as in a fluid fuel burner, dangerous.

What is claimed and is desired to be secured by Letters Patent of the United States is:

1. In a switch means of the character described, a plate-like insulating supporting member having substantially parallel opposite surfaces, a bimetallic temperature responsive member secured to one of said surfaces and having a movable lip portion spaced from said one surface, a contact member carried adjacent the other of said surfaces, a longitudinally extending flexible arm carried by and extending along said other surface, said flexible arm having one end portion held rigid with said supporting member and having its other end portion overlying said contact member, a second contact member carried by said arm other end portion and being cooperable with said first-named contact member to control an electric circuit, said supporting member having an aperture therethrough and opening through said one surface and through said other surface adjacent said arm, means carried by said arm and having a portion overlying said other surface and having a portion extending through said aperture and engageable with the end surface of said lip portion, and means urging said arm in a direction to move said second contact member away from said first-named contact member, said lip portion acting through said extending portion to hold said contact members in engagement against the force of said urging means, said responsive member acting upon a predetermined temperature thereof to move said lip portion out of engagement with said extending portion thereby to allow said urging means to move said second contact member out of engagement with said first-named contact member.

2. In a switch means of the character described, a plate-like insulating supporting member having substantially parallel opposite surfaces, a bimetallic temperature responsive member secured to one of said surfaces and having a movable lip portion spaced from said one surface, electrical heater means positioned in heat exchange relation with and operable to heat said responsive member, said responsive member being operable to be cooled by fluid flow thereby to maintain the temperature thereof below a predetermined temperature at fluid flows above a predetermined rate of flow, a contact member carried adjacent the other of said surfaces, a longitudinally extending flexible arm carried by and extending along said other surface, said flexible arm having one end portion held rigid with said supporting member and having its other end portion overlying said contact member, a second contact member carried by said arm other end portion and being cooperable with said first-

named contact member to control an electric circuit, said supporting member having an aperture therethrough and opening through said one surface and through said other surface adjacent said arm, means carried by said arm and having a portion overlying said other surface and having a portion extending through said aperture and engageable with the end surface of said lip portion, and means urging said arm in a direction to move said second contact member away from said first-named contact member, said lip portion acting through said extending portion to hold said contact members in engagement against the force of said urging means, said responsive member acting upon attainment of said predetermined temperature thereof to move said lip portion out of engagement with said extending portion thereby to allow said urging means to move said second contact member out of engagement with said first-named contact member.

3. In a switch means of the character described, a supporting member having opposite surfaces, a bimetallic temperature responsive member secured to one of said surfaces and having a movable lip portion spaced from said one surface, a contact member carried adjacent the other of said surfaces, an arm carried by said other surface, said arm having one end portion held to said supporting member and having its other end portion overlying said contact member, a second contact member carried by said arm other end portion and being cooperable with said first-named contact member to control an electric circuit, said supporting member having an aperture therethrough and opening through said one surface and through said other surface adjacent said arm, means carried by said arm and having a portion extending through said aperture and engageable with the end surface of said lip portion, and means urging said arm in a direction to move said second contact member away from said first-named contact member, said lip portion acting through said extending portion to hold said contact members in engagement against the force of said urging means, said responsive member acting upon a predetermined temperature thereof to move said lip portion out of engagement with said extending portion thereby to allow said urging means to move said second contact member out of engagement with said first-named contact member.

4. In a switch means of the character described, a supporting member having opposite surfaces and having spaced apertures extending therethrough and opening through said surfaces, a bimetallic temperature responsive member having a movable lip portion, means securing said responsive member to one of said surfaces and spacing said lip portion from said one surface, said securing means having spaced apertures extending therethrough and aligned with said supporting member spaced apertures, a contact member carried adjacent the other of said surfaces, an arm carried by said other surface, said arm having one end portion held to said supporting member and having its other end portion overlying said contact member, a second contact member carried by said arm other end portion and being cooperable with said first-named contact member to control an electric circuit, said supporting member having a third aperture therethrough and opening through said one surface and through said other surface adjacent said arm, means carried by said arm and having

a portion extending through said aperture and engageable with the end surface of said lip portion, a protecting member overlying at least a portion of said arm and having side flange portions, said flange portions having apertures therethrough aligned with said supporting member spaced apertures, means extending through all of said spaced apertures and acting to clamp together said securing means and said supporting member and said protecting member, said supporting member having a fourth aperture therethrough and registering with said securing means, and spring means positioned in said fourth aperture and seating against said securing means and said arm and urging said arm in a direction to move said second contact member away from said first-named contact member, said lip portion acting through said extending portion to hold said contact members in engagement against the force of said spring, said responsive member acting upon a predetermined temperature thereof to move said lip portion out of engagement with said extending portion thereby to allow said spring to move said second contact member out of engagement with said first-named contact member.

5. In a switch means of the character described, a plate-like supporting member having opposite surfaces, a securing means having a surface seating against one of said surfaces, a temperature responsive member carried by said means and having a movable portion spaced from said one surface, a first contact member carried adjacent the other of said opposite surfaces, said supporting member having an aperture therethrough, a switch arm fulcrumed to said supporting member and extending along and spaced from said other surface and having a portion extending through said aperture for engagement with said responsive member movable portion, a second contact member carried by said switch arm and cooperable with said first contact member to control an electric circuit upon movement of said arm, a protecting member overlying at least a portion of said switch arm, means clamping together said protecting member and said supporting member and said securing means, said supporting member having an aperture therethrough registering with said securing means, and means positioned in said aperture and held under stress intermediate said securing means and said switch arm, said last-named means acting to urge said second contact member away from said first contact member and urging said switch arm portion into engagement with said movable portion.

6. In a switch means of the character described, a supporting member having an aperture therethrough, a mounting bracket secured to one face of said member and overlying said aperture, a switch arm secured to said supporting member and overlying the other end of said aperture, a helical spring positioned in said aperture between said bracket and said arm and operable to actuate said arm, a bimetallic member carried by said bracket, a lever arm extending from said switch arm and into abutting relation to said bimetallic member to hold said spring under compression, and an electric heating means for said bimetallic member to warp said bimetallic member out of abutting relation to said lever arm so that said spring can actuate said switch arm.

7. In a safety switch to be cooled by heat transfer to a fluid medium, a plate-like supporting

member of electric insulating material, a temperature responsive locking element laterally movable upon temperature increase and mounted on one side of said supporting member, an electric heating coil directly carried by and bodily removable from said element and operable to heat said element, a switch member mounted on the other side of said supporting member, an operating arm for said switch member and extending into abutting relation to said element, said arm being locked by said element against switch member operating movement, and means tending to move said arm for switch member operation and holding said arm against said element, said element moving out of locking relation to said arm upon predetermined heating so that said tending means can move said arm.

8. In an apparatus of the character described, a conduit for conveying air under pressure and having a side wall with an opening therethrough, a supporting plate member of electric insulating material substantially closing said opening and forming a continuation of the conduit side wall, a bracket on said plate member and extending into said conduit, a bimetal latch member carried by said bracket and positioned in said conduit for cooling by air flow through said conduit, an electric heating element for heating said bimetal member and supported in said conduit by said bimetal member, said plate member having an aperture therethrough, an electric switch mounted on said plate member external of said conduit member and having a movable switch arm extending through said plate member aperture and into cooperable abutting latched engagement with said bimetal member, and means stressing said arm toward switch opening position and urging said arm into engagement with said bimetal member.

9. In an apparatus of the character described, a conduit for conveying air under pressure and having a side wall with an opening therethrough, a pan-like housing secured to said wall and closing said opening and having its open side facing said opening, a supporting plate member of electric insulating material secured to and removable with said housing, said plate member substantially closing said opening and separating the interior of said housing from said conduit and forming a continuation of said side wall, a bracket on said plate member and extending into said conduit, a bimetal latch member carried by said bracket and positioned in said conduit for cooling by air flow through said conduit, an electric heating element for heating said bimetal member and supported in said conduit by said bimetal member, said plate member having an aperture therethrough, an electric switch mounted on said plate member external of said conduit member and having a movable switch arm extending through said plate member aperture and into cooperable abutting latched engagement with said bimetal member, and means stressing said arm toward switch opening position and urging said arm into engagement with said bimetal member.

10. A safety switch comprising a housing having a bottom wall and surrounding side walls, a supporting plate member of electric insulating material positioned in and extending across said housing parallel to said bottom wall to provide a switch compartment, a bimetal latch member supported on said plate member external of said compartment, an electric switch carried by said plate member and positioned in said com-

partment, said plate member having an aperture therethrough, a switch arm extending through said aperture and into cooperable abutting engagement with said latch member, a spring stressing said switch arm against said bimetal latch member, and an electric heating element carried by said bimetal latch member and operable to heat said latch member thereby to flex said latch member out of holding engagement with said switch arm so that said spring can actuate said switch.

11. A safety switch comprising a supporting plate member of electric insulating material, a supporting pad on said member, a resilient switch blade having one end fixed to said pad and extending substantially parallel to said plate member, a fixed switch contact on said plate member adjacent the free end of said blade, a contact carried by said blade and cooperable with said

fixed contact, said plate member having an aperture therethrough, an angle lever having one arm fixed to said blade intermediate said second-named contact and said pad and having its other arm extending through said aperture, a bimetal latch member mounted on said plate member on the opposite side from said switch blade and having one end in abutting engagement with said angle lever other arm, an electric heating element carried by and operable to heat said bimetal member thereby to flex said bimetal member out of abutting engagement with said lever other arm, and a spring acting on said lever one arm and operable to actuate said switch blade upon flexing of said bimetal member out of said abutting engagement.

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