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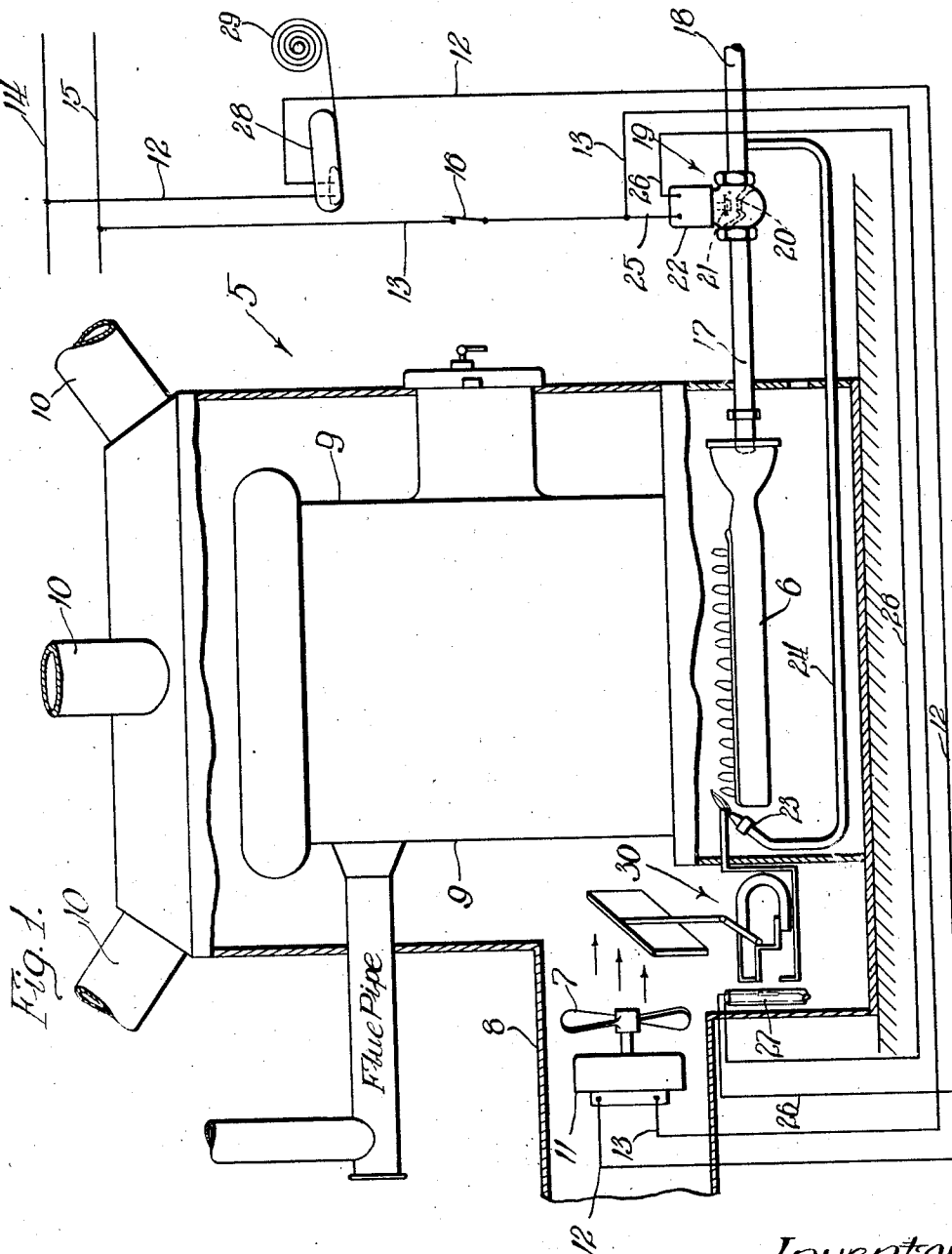
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2,185,490

ELECTRIC SWITCH.

Filed April 20, 1938

2 Sheets-Sheet 1



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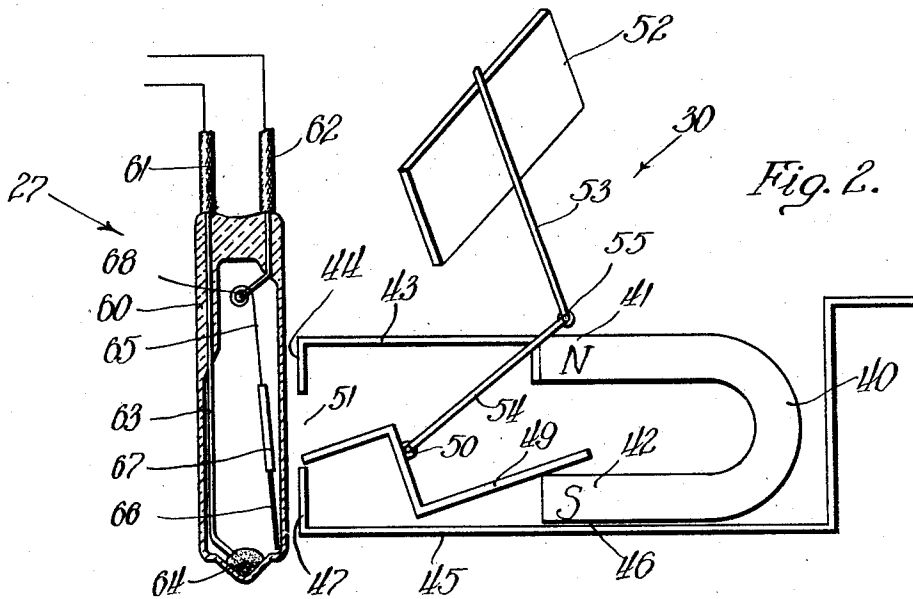
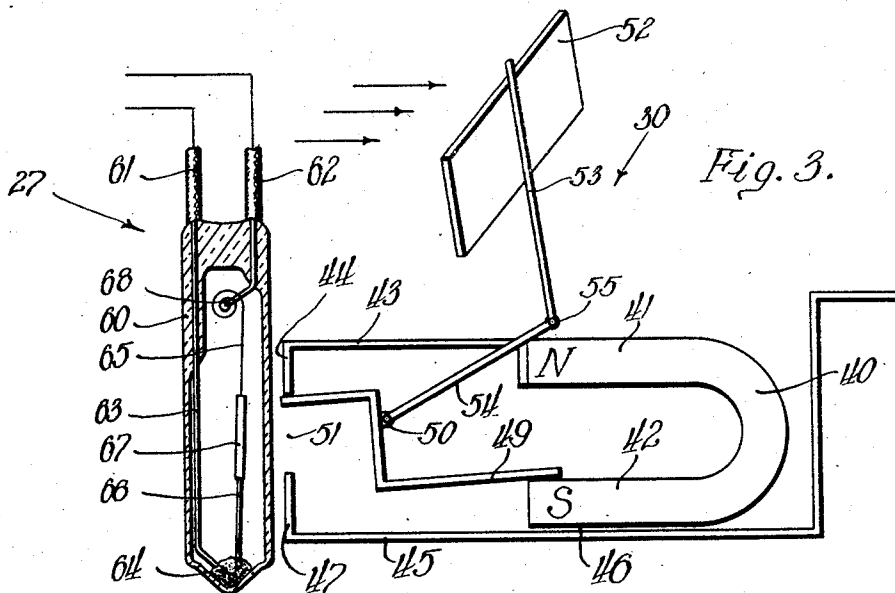
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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ELECTRIC SWITCH

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3 Claims. (Cl. 200—88)

My invention relates, generally, to safety systems for gas heaters, and it has particular relation to systems of the nature in which controls are provided that are responsive to change both in temperature and in fluid flow.

In many heating devices and furnaces it is necessary to protect certain exposed parts from overheating. This is frequently done by drawing or blowing cool air over the exposed part. For this reason it is highly desirable to have some means to insure that no fuel will be supplied to the furnace unless this cool air is flowing.

When gas is used as a fuel in heating devices and furnaces and the gas is fed automatically by means of a thermostatic control or other means, it is necessary that a pilot be burning at all times to insure the ignition of the main burner whenever gas is supplied to it.

Accordingly, an important object of my invention is to prevent the main burner of a heating system from going into operation unless air is passing over surfaces heated by it.

Another object of my invention is to provide for checking as to whether or not the pilot of the main burner of a heating system is burning before fuel is supplied to the main burner.

Another object of my invention is to provide a safety system which does not require frequent adjustments, thereby eliminating the danger of the system being tampered with by unauthorized or inexperienced persons.

A further object of my invention is to provide a safety system responsive to temperature and fluid flow, which is very durable and reliable in operation because of its mechanical simplicity.

Other objects of my invention will, in part, be obvious and in part appear hereinafter. Accordingly, my invention is disclosed in the embodiment hereof shown in the accompanying drawings, and it comprises the features of construction, combination of parts, and arrangement of elements which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

For a more complete understanding of the nature and scope of my invention reference may be had to the following detailed description, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a diagram of my safety system comprising a pilot and sail switch applied to a hot air gas furnace;

Figure 2 is a diagram of the safety pilot and

sail switch control mechanism of Figure 1, there being no air flow against the sail of the sail switch; and

Figure 3 is a diagram like Figure 2, with air flowing against the sail of the sail switch.

Referring now particularly to Figure 1 of the drawings, it will be observed that the reference character 5 designates, generally, a hot air furnace such as those used in domestic heating. It is customary in changing from coal heat to gas heat to use the same furnace installation and provide a main gas burner 6 in the fire box of the furnace as shown.

A fan 7 is located in the cold air return 8 for drawing in cold air and forcing it over the heating surface 9 of the furnace 5 and out through the hot air pipes 10. The fan 7 is driven by a suitable motor 11 which may be connected by means of the conductors 12 and 13 to the energized conductors 14 and 15. For example, the conductors 14 and 15 may be connected to a source of 110 volts alternating current. A switch 16 is provided in the conductor 13 for controlling the operation of the motor 11 as desired.

The main gas burner 6 in the fire box of the furnace 5 may be connected by a pipe 17 to a gas supply main 18 through a shut-off valve, shown generally at 19. The shut-off valve 19 comprises a valve port 20 which may be closed by a valve body 21, that is operated by an electromagnet 22. For purposes of illustration, the valve body 21 is shown as being lifted off the valve port 20. It will be understood, however, that when the electromagnet 22 is deenergized, the valve body 21 will drop and close the valve port 20, thereby preventing the flow of gas to the shut-off valve 19.

With a view to lighting the main gas burner 6, a pilot burner 23 is provided which is connected by a suitable pipe 24 to the supply main 18. It will be understood that, under normal operating conditions, the pilot burner 23 is lighted continuously.

The electromagnet 22 may be energized from the energized conductors 14 and 15. One terminal of the electromagnet 22 can be connected to the conductor 13 by the conductor 25, as shown. As the switch 16 is between this terminal and the energized conductor 15, it will be impossible for the electromagnet 22 to be energized unless the switch 16 is closed. The other terminal of the electromagnet 22 is connected by the conductor 26 to the conductor 12 through a magnetically operated control switch 27. In

the conductor 12, between the junction point of conductor 26 and conductor 12 and the energized conductor 14, there is a mercury control switch 28. This mercury control switch 28 may be controlled by the thermostat 29 which is located in a room heated by the furnace 5. Thus, it will be impossible for the electromagnet 22 to be energized unless the mercury control switch 28 is in the closed position. It is seen then that it will be impossible for the electromagnet 22 to become energized, thereby allowing gas to flow to the main burner 6, unless both switch 16 and mercury control switch 28 are closed.

However, there may be times when both switches 16 and 28 are closed and it would be dangerous for the shut-off valve 19 to be open, allowing gas to flow to the main burner 6. Thus if, for some reason, the fan 7 is not running, although the switch 16 is closed, there would be no flow of air over the heating surface 9. If then the main burner 6 is on, it will overheat and damage the heating surface 9 since the heat will not be conducted away from it. Also, if the pilot burner 23 should be extinguished, it would be possible for the shut-off valve 19 to be open, allowing gas to flow through the main burner 6 unburned. In order to insure that neither of these dangerous conditions can exist, a control mechanism, shown generally at 30, is provided for operating the magnetically operated control switch 27 which is in series circuit relationship with the electromagnet 22. The operation and construction of this control mechanism will be described in detail in connection with Figures 2 and 3 of the drawings.

Now, referring to Figures 2 and 3, there is shown a permanent magnet 40 with upper and lower poles 41 and 42 respectively, pole 41 being designated as the north pole and pole 42 as the south pole. The permanent magnet 40 may be replaced by an electromagnet, and the polarity of the poles 41 and 42 interchanged with no resultant change in operation. To the upper pole 41 a pole extension member 43, of ferro-magnetic metal, is attached as shown. At the end of the pole extension member 43 and adjacent to the control switch 27 there is formed the end portion 44 which is substantially parallel to the switch 27. The lower pole 42 has disposed adjacent and parallel thereto a pole extension member 45 of Curie point metal and separated therefrom by the air gap 51. Also at the end of the pole extension member 45, and adjacent to the control switch 27, there is formed the end portion 47 similar to the end portion 44. The pole extension member 45 extends out from the permanent magnet 40 over the pilot burner 23 as shown in Figure 1, thus becoming thermally responsive to the flame of the pilot burner 23.

When the pilot burner 23 is lighted, the pole extension member 45 will be heated sufficiently to cause the portion between the lower pole 42 and the control switch 27 to be raised above its Curie point and to act as a non-magnetic material. In this condition it will not serve as a conductive path for the flux from the lower pole 42. However, if the pilot burner 23 is extinguished, the pole extension member 45 will cool and regain its magnetic properties and once more will constitute a controlled path for the flux from the lower pole 42.

With a view to forming another controlled path for the flux from the lower pole 42, an intermediate bridge member 49 of ferro-magnetic metal is provided. The bridge member 49 is hinged at

50 with one end resting on the top of the pole 42 and capable of rotatable movement thereon. Its other end is suspended for movement between the end portions 44 and 47 in the air gap 51. A sail member 52 is so interconnected with the bridge member 49 by means of the members 53 and 54 joined at the pivot 55 that, when air is not flowing against it, its weight will be sufficient to cause the bridge member 49 to take the position shown in Figure 2. However, when air is flowing against the sail member 52, its weight will be counteracted and it will rotate upwardly around the pivot 55, thereby carrying the bridge member 49 into the position shown in Figure 3.

It will be seen that the flux density in the air gap 51 is subject to change due both to the pole extension member 45 being heated above its Curie point and the different positions of the bridge member 49. There are four different conditions of operation with corresponding flux densities in the air gap 51. These four conditions are, namely: (1) when the bridge member 49 is in the position shown in Figure 2 and the pole extension member 45 is below its Curie point, (2) when the bridge member 49 is in the position shown in Figure 2 and the pole extension member 45 is above its Curie point, (3) when the bridge member 49 is in the position shown in Figure 3 and the pole extension member 45 is below its Curie point, and (4) when the bridge member 49 is in the position shown in Figure 3 and the pole extension member 45 is above its Curie point.

With a view to taking advantage of the fact that the air gap 51 will have different flux densities corresponding to each of the four different operating conditions, the magnetically operated control switch 27 is disposed adjacent to the air gap 51, as shown. The control switch 27, which is in series circuit relationship with the thermostatically controlled control switch 28, comprises a glass container 60 with a pair of sealed leads 61 and 62, lead 61 continuing as the conductor 63 to the bottom of the glass container 60 where, in a suitably formed depression, there is deposited a pool of mercury 64 in which the conductor 63 is at all times immersed. Lead 62 is connected to a coiled spring conductor 65 which normally holds a lower contact end 66 immersed in the pool of mercury 64. The coiled spring conductor 65 also carries a magnetic armature 67 which is directly opposite the air gap 51, and when sufficiently attracted by the magnetic flux of the air gap 51, it will cause the lower contact end 66 to leave the mercury pole 64 and thereby break electrical contact with it and open the circuit between leads 61 and 62.

The coil spring 68 is designed with such strength that the magnetic armature 67 will be attracted sufficiently to cause the lower contact end 66 to leave the mercury pole 64 when the flux density in the air gap 51 corresponds to (1), (2) or (3) above-mentioned conditions. However, when the flux density of the air gap 51 corresponds to the above-mentioned condition (4), the magnetic armature 67 will not be attracted sufficiently to cause the lower contact end 66 to leave the mercury pole 64, and, as a result, electrical contact will be established between the leads 61 and 62.

With a view to describing the operation of my safety system responsive to temperature and fluid flow, assume that the pilot burner 23 is lighted, the main burner 6 is out, the switch 16 is closed, the control switch 28 is open, and that the fan 7 is stopped. Under this set of condi-

tions, the control mechanism 30 will have assumed the above-mentioned condition (2). That is to say, the bridge member 49 will be in the position shown in Figure 2 and the pole extension member 45 will be heated above its Curie point, and therefore will act as a non-magnetic material. As stated above, the control switch 27 will be opened under this condition (2) and the shut-off valve 19 will be closed. Now if the room heated by the furnace 5, in which the thermostat 29 is located, cools below a predetermined temperature, it will close the control switch 28 and thereby complete the energizing circuit to the motor 11 which drives the fan 7. The draft of air shut off by the fan 7 will cause the sail member 52 to rise to the position shown in Figures 1 and 3, and the above mentioned condition (4) will be established. As stated above, the control switch 27 will close under this condition (4), and the circuit connecting the electromagnet 22 to the energized conductors 14 and 15 will be completed, thereby energizing the electromagnet 22. When the electromagnet 22 is energized, it will open the shut-off valve 19 and gas will flow to the main burner 6 and be ignited by the flame of the pilot burner 23. It follows that the heating surface 9 will receive heat from the main burner 6 and the gas flowing over it will be heated, thereby warming the room in which the thermostat 29 is located. When this becomes heated sufficiently, the thermostat 29 will open the control switch 28, thereby turning off the fan 7. The sail member 52 will no longer be held up and the bridge member 49 will fall to the position shown in Figure 2, thereby opening the control switch 27 and closing the shut-off valve 19.

It will be seen that if the pilot burner 23 should become extinguished at any time, it will be impossible for the above-mentioned condition (4) to be instituted, and the shut-off valve 19 will not be opened. Thus, the flow of unignited gas to the main burner 6 will not be possible. Also, it is seen that if the furnace 5 is in operation and for some reason the fan 7 should stop forcing air over the heating surface 9, the bridge member 49 will fall to the position shown in Figure 2, thereby opening control switch 27 and closing the shut-off valve 19. Thus, it will be impossible for the main burner 6 to operate unless air is passing over the heating surface 9 and protecting it from overheating.

If it is desired, the bridge member 49 can be adapted for manual operation, and thereby can be used for starting and stopping the operation of the main burner 6 when the pilot burner 23 is on.

Since certain changes may be made in the foregoing construction and different embodiments of the invention made without departing from the scope thereof, it is intended that all matter shown in the accompanying drawings or described hereinbefore shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. A fluid flow and temperature actuated control mechanism comprising, in combination, a magnetic electric switch having a spring conductor carrying a magnetic armature, the spring holding the lower contact end of the spring conductor in contact with a pool of mercury when the magnetic armature is not sufficiently attracted to break the contact, a permanent magnet constituting a source of flux for attracting the magnetic armature, a pole extension member of Curie point metal disposed adjacent to one of the poles of the permanent magnet and spaced therefrom by an air gap constituting a controlled path for the flux from said adjacent pole, a flux conducting member movably resting on said adjacent pole constituting another controlled path for the flux from said adjacent pole, and a sail member for moving said flux conducting member.

2. A fluid flow and temperature actuated control mechanism comprising, in combination, a magnetic electric switch having a spring conductor carrying a magnetic armature, the spring holding the lower contact end of the spring conductor in contact with a pool of mercury when the magnetic armature is not sufficiently attracted to break the contact, a permanent magnet constituting a source of flux for attracting the magnetic armature, a flux conducting member movably resting on a pole of said permanent magnet constituting a controlled path for the flux from said pole, and a sail member for moving said flux conducting member.

3. A fluid flow and temperature actuated control mechanism comprising, in combination, a magnetic electric switch including a magnetic armature, a magnet constituting a source of flux for attracting said magnetic armature, a member of Curie point metal constituting a controlled path for the flux between one pole of said magnet and said magnetic armature, a flux conducting member movably mounted constituting a second controlled path for the flux from said pole whereby it can be diverted from said member of Curie point metal, and a sail member responsive to fluid flow for moving said flux conducting member.

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