The present invention relates to a safety device for gas burners such as used in gas stoves, furnaces and the like.

The general object of the present invention is the provision of a safety device for gas burners which will give a warning signal when a leak develops in the gas line to the burner or when the burner fails to ignite or when the burner flame is quenched by liquid or other substances accidentally dropping on the burner such as from overboiling.

Another important object of the present invention is the provision of a safety device of the character described, the electric circuit of which is made of standard electrical components thereby reducing the cost of manufacturing.

The foregoing and other important objects of the present invention will become more apparent during the following disclosure and by referring to the drawings in which:

Figure 1 is a section of the gas pressure switch as connected to a gas burner, together with a diagrammatic view of the electric circuit of the safety device shown in idle position;

Figure 2 is a view similar to that of Figure 1 showing the parts of the circuit which are energized when a leak or rupture of the gas line develops between the safety device and the burners;

Figure 3 is a view similar to that of Figure 1 showing the electric circuit in operation during the initial time period of gas admission to a burner; and

Figure 4 is a similar view of the electric circuit shown when the burners operate in a normal manner.

Referring now more particularly to the drawings in which like reference characters indicate like elements throughout, the gas pressure differential operated switch of the safety device comprises a cylinder 1 which houses a double headed piston or plunger 2 slideable within the cylinder 1 and having at one end a stem 3 surrounded by a compression coil spring 4. The stem 3 projects outwardly from the cylinder 1 and mounts a strip 5 adapted to contact the poles 6 of the electric circuit of the safety device.

The cylinder 1 is provided at the end opposite the stem 3 with a gas inlet 7 for the entrance of the gas under pressure and with two lateral ports 8 and 9 which are in communication with the interior of the cylinder 1 and with the piping 10 respectively. The piping 10 communicates with a manifold 32 for feeding gas to the gas burners 33. Each gas burner 33 is provided with a valve 34 operable by a valve handle 11. Upon opening of a valve handle 11, the gas pressure is reduced within the piping 10 and consequently a pressure differential is produced between the heads 12 and 12' of the plunger 2. Therefore said plunger is displaced to the right against the action of the spring 4 to close the main switch 5, 6.

Upon movement of the plunger 2 to the right, as shown in the drawings, the head 12 of the plunger 2 uncovers the port 8 and thereby establishes gas communication between the inlet 7 and the piping 10. When the gas is following in the piping 10, the plunger 2 remains in said named position because, due to the restricted cross-sectional area of port 8, the pressure in the space of cylinder 1 ahead of the piston head 12 is less than in the piping 10 and in the communicating port 9 and space of cylinder 1 facing cylinder head 12'.

If a leak develops in the piping 10 leading from the cylinder 1 to the burners, the pressure within said piping 10 is reduced or decreased and the plunger 2 moves to the right to close the main switch 5, 6. When the burners are all closed, the gas pressure at the two heads 12 and 12' of the plunger 2 becomes equal whereby the plunger returns to closing position, shown in Figure 1, under the action of the coil spring 4.

The electric circuit of the safety device, according to the present invention, comprises the main switch 5, 6, the battery 13 or any other suitable source of power which may supply direct or alternating current, a solenoid operated switch 14, a valve handle operated switch 15, a heat responsive bi-metal switch 16, a time switch 17, an alarm bell 18 and signal lights 19 and 20. There is one switch 15 and one switch 16 associated with each burner 33, and they are mounted in parallel in the main circuit. Each switch 15 is operable by a cam 11' mounted on the stem of the valve handle 11. Each switch 16 is disposed in the vicinity of the flame of its associated burner. Elements 11a, 11b and 15a and 16a correspond to elements 11, 11', 15 and 16, and are operatively associated with a second burner, not shown.

In the idle position of the safety device, shown in Figure 1, the main switch 5, 6 is open, the solenoid operated switch 14 has its pair of contacts 21 and 22 in a closed position under the action of spring 23, the switch 15 is open, the bi-metal switch 16 is closed and the time switch 17 is in the position in which the movable contact arm 25 engages the "running" pole 26 while the "starting" pole 27 is open.

If a gas leak develops in the piping 10 between the cylinder 1 and the gas burners, the plunger 2 will be displaced to the right to close the main switch 5, 6, and the following section of the electric circuit will be closed (see Figure 2); battery 13; main switch 5, 6; contacts 21 and 22; wire 28; alarm bell 18; wire 29 and battery 13. Thus the alarm bell will be sounded to indicate that a gas leak exists.

To operate a gas burner 33, the time switch 17 is first turned in "starting" position, shown in Figure 3, in which the arm 25 is in contact with the "starting" pole 27. Then the valve handle 11 is turned to open the gas valve 34. The switch 15 is thus closed and the plunger 2 is again displaced to the right closing the main switch 5, 6. Current flows through the starting circuit indicated in thick lines in Figure 3, namely: battery 13; main switch 5, 6; solenoid 24 of switch 14 (which opens the contacts 21 and 22 whereby the alarm bell 18 is prevented from ringing); switches 15 and 16; arm 25 and pole 27 of the time switch 17; green light 19 and back to the battery 13 through line 29. Simultaneously current flows from switch 15 through line 30, green light 20 and back to the battery 13. Therefore, upon opening of a valve 34 for a burner 33, both green lights will operate to indicate the initial period of burner operation but the alarm bell 18 is not energized.

After the initial time period has elapsed, which is preferably of the order of one minute, the arm 25 of the time switch 17 springs back into its "running" position in contact with the "running" pole 26. If the burner fails to ignite during the initial time period, the heat responsive switch 16 remains closed and the alarm bell 18 starts ringing upon closing of the circuit signal: switch 16; wire 31; arm 25; pole 26; bell 18; wire 29 and battery 13.

3 Claims. (Cl. 158-122)
If the burner is ignited during the initial time period, the heat responsive switch 16 opens, while the time switch 17 is still in "starting" position and when the arm 25 switches back to its "running" position in contact with the pole 26, the electric circuit for the alarm bell 18 and the green light 19 is cut off. Therefore, only the green light 20 is lit indicating normal run. The normal operation of the electric circuit is shown in Figure 4 which shows the following running circuit in thick lines: battery 13; main switch 5, 6; solenoid 24; switches 15 and 16; line 30 and to battery 13 through green light 20. If an ignited burner 33 is snuffed out, the bi-metal switch 16 cools down and closes the following signal circuit: switch 16; wire 31; arm 25; pole 26; bell 18; wire 29 and battery 13. Thus an alarm is given.

While a preferred embodiment according to the present invention has been illustrated and described, it is understood that various modifications may be resorted to without departing from the spirit and scope of the appended claims.

I claim:

1. In combination with a gas burner having a valve and a gas supply pipe leading to said valve, a safety device comprising a main switch, flow responsive means in said gas supply pipe upstream of said gas burner valve, operatively connected to said main switch to close said main switch upon opening of said gas burner valve, said main switch being operable to closing position upon opening of said gas burner valve, a first switch, transmission means connecting said first switch to said gas burner valve and adapted to close said first switch when said valve is opened, a second normally closed switch, heat responsive means positioned to be heated by said burner and adapted to open said second switch when said heat responsive means are heated by said burner, a third switch having "starting" and "running" fixed contacts and a movable contact and manually set timing means for engaging said movable contact with said starting contact and after a predetermined time for disengaging said movable contact from said starting contact with said running contact, a source of power supply, a circuit connecting in series said power supply, said main switch, said first switch, said second switch and the movable and starting contact of said third switch, and an electrically operable alarm device connected in series with said running contact of said third switch and with said power supply, a line by-passing said alarm device and connecting said starting contact with said power supply, whereby upon opening of said gas burner valve said main switch and said first switch will be closed, and upon actuation of said third switch to starting position current will by-pass said alarm device for said initial time period, and when said third switch assumes its running position at the end of said initial time period, said alarm device will be actuated if the gas burner has failed to ignite and said second switch is closed, but will be prevented from operating if the gas burner has ignited during said initial time period and said second switch has opened.

2. The combination as claimed in claim 1, further including a solenoid device connected in series in said circuit, a fourth manually closed switch operated by said solenoid device, and connected in series with said main switch between said power supply and said alarm device and by-passing said first, second and third switches, whereby said alarm device is actuated upon closing of said main switch even if said first switch remains open, to thereby give a positive indication of a gas leakage in the piping to said gas burner.

3. The combination as claimed in claim 2, further including a first signal light connected in said by-passing line between said starting contact and said power supply and a second signal light connected to said power supply and to said first switch whereby said first signal light will be lighted only during said initial time period and said second signal light will be lighted when said first switch is closed.

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