June 4, 1929. G. A. SAGER 1,716,244

AUTOMATIC FUEL CUT-OFF

Filed Dec. 23, 1926 3 Sheets-Sheet 1

Fig. 1.

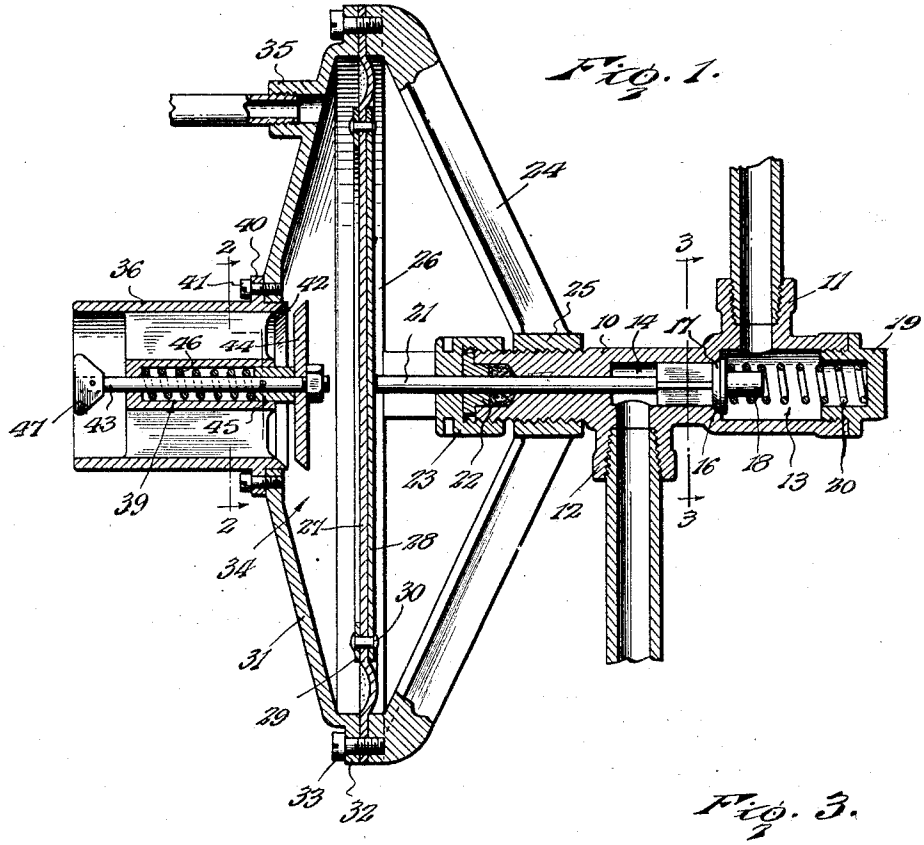


Fig. 3.

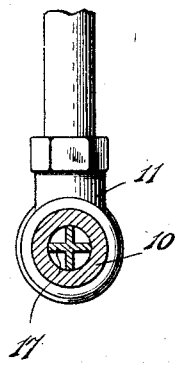
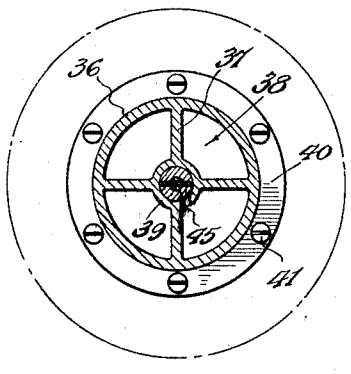


Fig. 2.



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AUTOMATIC FUEL CUT-OFF

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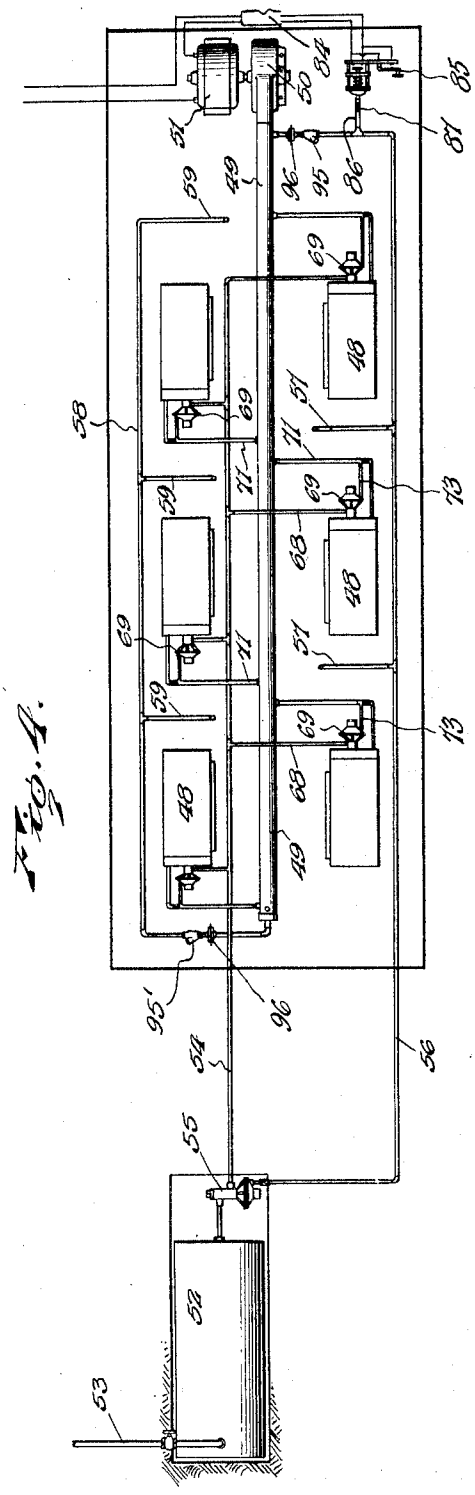


Fig. 4.

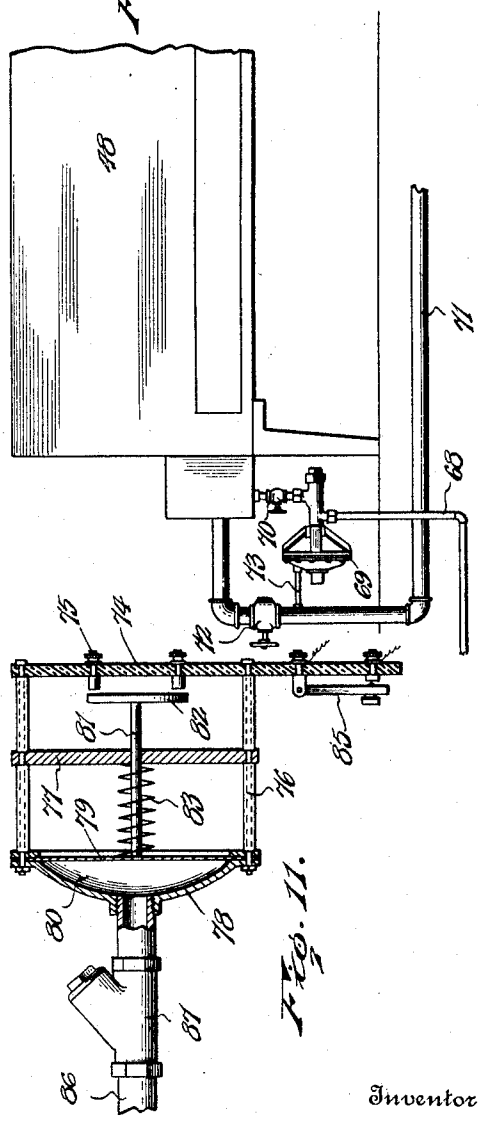


Fig. 5.

Fig. 11.

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Fig. 6.

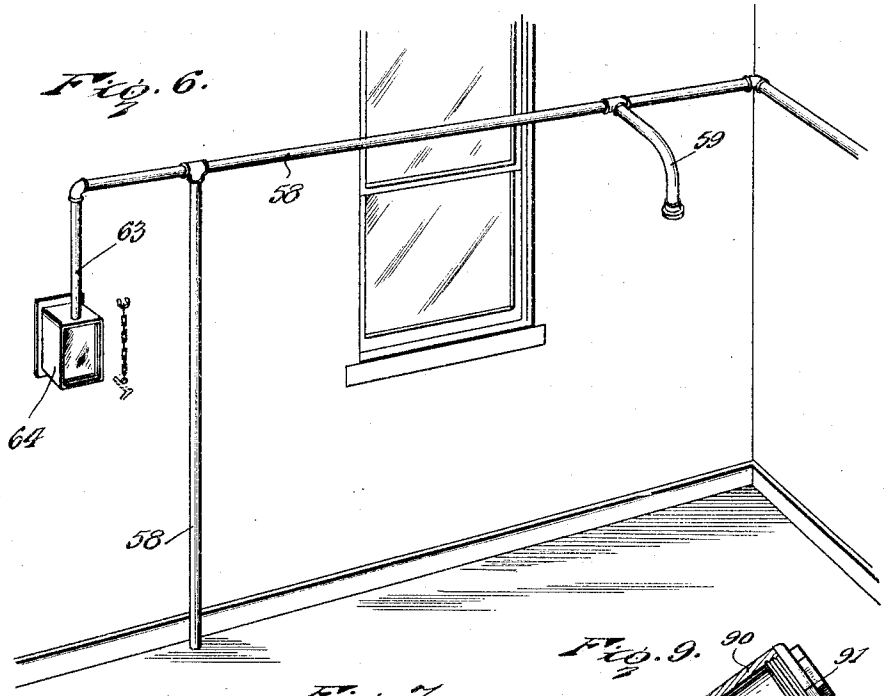


Fig. 7.

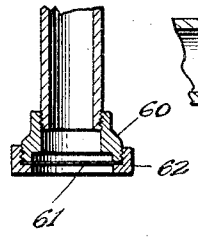


Fig. 8.

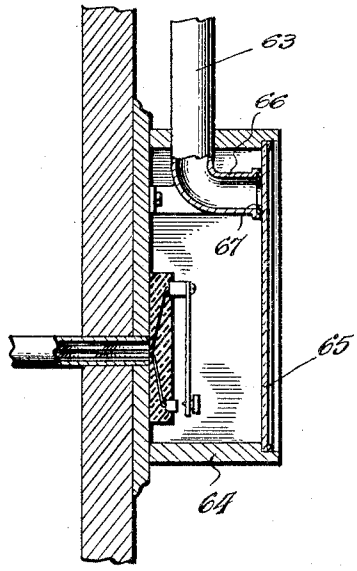


Fig. 9.

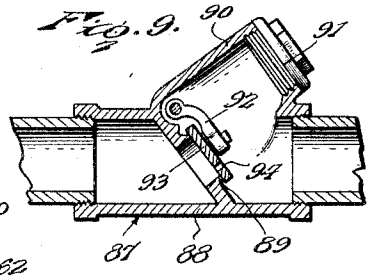
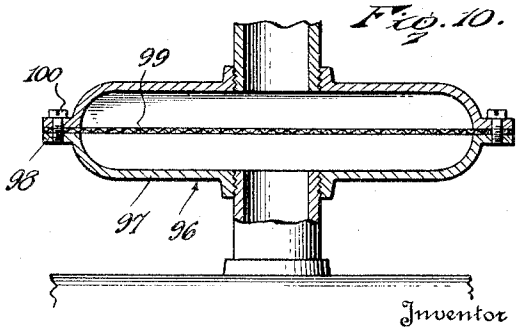


Fig. 10.



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Patented June 4, 1929. 1,716,244

UNITED STATES PATENT OFFICE.

GEORGE A. SAGER, OF ALBANY, NEW YORK.

AUTOMATIC FUEL CUT-OFF.

Application filed December 23, 1926. Serial No. 156,691.

This invention relates to an improved automatic safety liquid fuel cut off especially designed for use in connection with furnaces or the like employing an air blast to maintain combustion of the fuel, and seeks, among other objects, to provide a device which will serve not only to greatly reduce fire and accident hazards but will also, by preventing waste, as for instance when a burner is unintentionally extinguished, effect a marked conservation of the fuel.

The invention seeks, as a further object, to provide a device which will dependably function to cut off the supply of fuel to the furnace upon failure of the air blast or an appreciable drop in the pressure thereof.

A further object of the invention is to provide a device which, after having functioned to cut off the fuel supply, will maintain said supply cut off until the device is manually reset, even though the blast pressure of the air supply should, in the meantime, be resumed.

And the invention seeks, as a still further object, to provide a device adapted for installation in shops or the like in connection with the fuel supply lines of the shop furnaces for reducing fire hazards.

Other objects of the invention not specifically mentioned in the foregoing will appear during the course of the following description.

In the accompanying drawings:

Figure 1 is a vertical longitudinal sectional view through my improved cut off.

Figure 2 is a transverse sectional view on the line 2—2 of Figure 1, looking in the direction indicated by the arrows, and particularly showing the air escape passages of the pressure chamber.

Figure 3 is a transverse sectional view on the line 3—3 of Figure 1, looking in the direction indicated by the arrows, and particularly showing the fuel valve.

Figure 4 is a schematic view showing the use of the cut off in conjunction with the fuel supply lines and furnaces of a shop.

Figure 5 is a detail elevation showing a typical installation of one of the cut offs at one of the furnaces.

Figure 6 is a fragmentary perspective view showing a portion of one of the pilot lines as embodied in a fire preventative system using my improved cut off, a fire alarm box being also illustrated.

Figure 7 is a detail sectional view particularly showing the mounting of the fusible or inflammable closure employed at the mouth of each of the bleeders.

Figure 8 is a detail vertical sectional view through the fire alarm box shown in Figure 6.

Figure 9 is a detail sectional view showing a typical check valve employed.

Figure 10 is a detail sectional view showing a typical strainer employed, and

Figure 11 is a detail sectional view showing the automatic cut off for the blower motor employed.

In carrying the invention into effect, I employ a valve casing 10 having an inlet 11 and an outlet 12, and formed in the casing at its outer end is a valve chamber 13 from the inner end of which leads a passage 14 connecting the inlet with the outlet. At the junction of the chamber 13 with the passage 14 is a valve seat 16, and slidable in said passage to cooperate with said seat is a fuel valve 17 which may be of the single seat or of the double seat balanced type depending on the size of the unit in which it is employed. At its outer end the valve is provided with an axial stud 18. Closing the chamber 13 at its outer end is a plug 19 screwed into said chamber, and fitting at one end in said plug is a spring 20, the opposite end of which engages over the stud 18 of the fuel valve for normally holding the valve closed. As will be appreciated, the inlet 11 may, if desired, be suitably closed, and an inlet pipe connected in the outer end of the valve chamber 13 in lieu of the plug 19. Slidable through the inner end portion of the casing 10 axially thereof is a push rod 21 which projects into the passage 14 to abut the inner end of the valve 17, and I preferably provide, at the inner end of the casing, a packing gland 22 for the rod, although, in some instances, said gland may be eliminated. Adjustable upon the inner end of the casing is a gland cap 23.

Mounted upon the inner end of the casing is a spider 24, the arms of which are connected at their inner ends by a sleeve 25 screwed over the inner end of the casing, and connecting said arms at their outer ends is a ring 26. Seating at its periphery against said ring is a diaphragm 27, preferably of leather or other suitable flexible ma-

terial, and fixed to the outer side of said diaphragm is a preferably galvanized sheet metal circular back plate 28 reinforcing the diaphragm throughout the greater portion of its area. The plate 28 is of less diameter than the diaphragm and overlying the diaphragm at its inner side is a burr ring 29 registering with said plate. Extending through the peripheral margin of the back plate and through said ring are circumferentially spaced rivets 30 rigidly connecting the plate with the diaphragm. Mating with the ring 26 of the spider 24 is a frusto conical cap 31 having a base flange 32 overlying the peripheral margin of the diaphragm, and extending through said flange are cap bolts 33 screwed into said ring for tightly binding the diaphragm between said flange and ring. A pressure chamber 34 is thus defined at the inner side of the diaphragm and attention is now directed to the fact that the construction of the diaphragm is such that the force exerted on the push rod 21 by the diaphragm will be dependent on the pressure in the chamber 34 and, within certain limits, not dependent on the position of the diaphragm. As will later appear, the effective area of the diaphragm must bear a relation to the tension of the spring 20 and to the area of the valve 17 which will depend both on the blast pressure normally employed and upon the fuel pressure.

Formed on the cap 31 near its periphery is an air inlet 35, and snugly fitting through said cap axially thereof is a cylindrical valve casing 36 in which is provided, as seen in Figure 2, a spider 37 defining a plurality of air escape passages or ports 38, the spider being formed with an axial socket 39 open at its inner end. Encircling the valve casing 36 near the inner end thereof is a flange 40 seating against the cap, and extending through said flange are cap bolts 41 rigidly securing the valve casing in position. However, if desired, the valve casing may be formed integrally with the cap 31. Formed on the valve casing at its inner end is a valve seat 42, and slidable through a suitable bore at the outer end of the socket 39 is a valve stem 43, to the inner end of which is fixed an air escape valve 44 to cooperate with said seat. Pinned to the inner end of the valve stem is a bushing 45 slidable in the inner end of the socket 39, and housed in said socket to act against such bushing is a spring 46 normally holding the valve open. However, should the device be mounted so that the valve was disposed in a vertical position, the valve may be opened by gravity. Detachably fixed to the outer end of the valve stem is a preferably conical knob 47 and, as will be observed, the length of the valve casing 36 is such that, when the valve 44 is open, the knob lies within the lines of the casing so as to be housed and protected by the casing. The valve 44 must be of such size that the minimum blast pressure employed in any particular installation will be sufficient to retain the valve closed against the action of the spring 46 so that the exact dimensions of this valve will, therefore, be dictated by conditions of use. Furthermore, the ports or passages 38 must be of sufficient size to prevent appreciable air pressure being established in the chamber 34 when the valve is open and, as will be seen, by employing the tapered knob 47, it will be rendered difficult to engage an object or instrument with said knob and prop the valve 44 closed.

In use, the inlet 35 is connected to the supply line conducting air under pressure to the burner of the furnace or the like so that the blast pressure in said supply line will, when the valve 44 is closed, also exist in the chamber 34. The fuel inlet 11 is suitably connected with the source of fuel supply while provision is made for conducting the fuel from the outlet 12 to the burner so that, as will be perceived, the fuel valve 17 is interposed in the fuel supply line of the burner. To set the device, the knob 47 is grasped and the valve 44 manually closed. The valve is then held closed until the air pressure in the chamber 34 builds up sufficiently to overcome the tension of the spring 46 and maintain the valve closed. As the air pressure in the chamber 34 then reaches the pressure existing in the air supply line, the diaphragm 27 is distended against the push rod 21, with the result that said rod is shifted longitudinally for opening the valve 17 against the tension of the spring 20 as well as the pressure of the fuel in the chamber 13. The fuel is then, of course, permitted to flow past the valve 17 to the burner as long as the valve 44 remains closed. However, should the pressure in the air supply line fail or drop to an appreciable extent, the air pressure in the chamber 34 will, of course, be correspondingly diminished, with the result that the spring 46 will immediately function to open the valve 44. Thus, the air pressure against the diaphragm 27 will be relieved, and the spring 20 will instantly function to shift the valve 17 to closed position so that the supply of fuel to the burner will be automatically cut off. As will be observed, the combined area of the ports or passages 38 is much greater than the area of the inlet 35 of the chamber 34 so that even should the air pressure in the air supply line be resumed, or should said pressure, after having dropped, be again built up to normal, a pressure cannot be created in said chamber sufficient to distend the diaphragm against the tension of the fuel valve spring 20. Accordingly, the fuel valve will remain closed until the device is manually reset.

In Figures 4 and 5 of the drawings, I have shown the use of the cut off in conjunction with the fuel and air supply lines of the furnaces of a shop or the like. A number of conventional furnaces are indicated at 48 and the air blast supply line of said furnaces at 49, air being forced under pressure through the supply line 49 by a suitable blower 50 operated by an appropriate motor 51. A main fuel supply tank is indicated at 52. This tank, as is usual, is buried below the ground level, and connected to one end of the tank is a pipe 53 through which air, under pressure, is introduced into the tank for forcing the liquid fuel to the furnaces. Leading from the opposite end of the tank to the furnaces is a fuel supply line 54, and interposed in said supply line near the tank is one of the cut offs, indicated as a whole at 55. Connected with the air blast supply line 49 is a pilot pipe 56 which extends within the shop and leads to the cut off 55 for conducting air under pressure to the air pressure chamber of said cut off. Thus, after said cut off has been manually set in the manner previously described, the fuel valve thereof will, as long as the operating pressure in the supply line 49 is maintained, be held open to permit a flow of fuel through the fuel supply line 54 and, as will be perceived, the cut off 55 provides a master or primary cut off controlling the supply of fuel to all of the furnaces. Extending from the pipe 56, at suitably spaced points within the shop, are any appropriate number of branch pipes or bleeders 57, these bleeders being located adjacent the furnaces at one side of the shop. Leading from the blast supply line 49 is another pilot pipe 58 from which extends an appropriate number of bleeders 59 like the bleeders 57, the bleeders 59 being located adjacent the furnaces at the other side of the shop. Screwed on the lower end of each of the bleeders, as shown in detail in Figure 7, is a head 60 seating a fusible or inflammable closure 61, which may be a celluloid disc, and tightly securing said closure in position is a clamping ring 62 screwed on the head. As many of the pilot pipes and bleeders may, of course, be employed as desired, and as shown in Figure 6, the pilot pipes may be arranged to extend along the walls of the building while the bleeders may be disposed to project within the shop from said walls. In Figures 6 and 8 of the drawings I have also shown a bleeder 63 in connection with a fire alarm box 64. The fire alarm box and the alarm mechanism may be of any conventional construction but for the purposes of the present invention, said box is provided at the front thereof with a frangible closure pane 65. In the instance shown, the bleeder 63 extends into the box at the top thereof and is provided at its lower end with an elbow 66 in the mouth of which is fitted a yieldable gasket 67 forming an air tight joint with the closure pane 65.

Leading to the burners of the furnaces 48, from the fuel supply line 54, as shown in Figure 4, are fuel supply pipes 68 and, as typically shown in Figure 5, one of the cut offs, indicated as a whole at 69, is interposed in each of these pipes to provide a secondary cut off for each furnace, a manually adjustable fuel regulating valve 70 being employed between said cut off and the furnace burner. Leading from the air supply line 49 to each of the furnaces is a blast supply pipe 71 in which is interposed a manually adjustable blast regulating gate 72, and leading from each of the pipes 71 to the air pressure chamber of the associated cut off 69 is a pipe 73 supplying air, at supply line pressure, to said chamber. Thus, after the cut offs 69 have been set, the fuel valves thereof will be held open to permit a flow of fuel to the furnace burners. However, should the air pressure in the supply line 49 drop or disappear, the cut offs 69 will, as will be well understood in view of the foregoing description, immediately function to automatically cut off the supply of fuel to the furnaces.

In conjunction with the motor 51 I employ an automatic cut-out, best shown in Figure 11 of the drawings. This cut-out includes an insulating panel 74 on which are mounted terminals 75, and fixed to the panel are spaced rods 76 carrying an insulating cross bar 77. Mounted upon said rods is a head 78 closed at its open side by a diaphragm 79 which defines a pressure chamber 80 within the head. Slidable through the cross bar 77 is a switch rod 81 carrying a switch member 82 to cooperate with the terminals 75, and normally holding the switch open is a spring 83. As shown in Figure 4, the terminals 75 are electrically connected with a motor starting compensator 84, which may be of any conventional design so that upon the breaking of the circuit by the movement of the switch member 82 to open position, the compensator will be tripped for stopping the motor. Mounted upon the panel 74 is a manually operable switch 85 and, as also shown in Figure 4, this switch is connected across the circuit of the switch terminals 75. As will be later explained this switch is utilized in starting the motor. Leading from the pilot line 56 is a pipe 86 which is connected to the head 78, and interposed in said pipe is a check valve indicated as a whole at 87. As shown in Figure 9, this check valve includes a casing 88 in which is provided a valve seat 89, and extending from the casing is a side outlet 90 closed by a plug 91. Pivoted within the casing is an arm 92, and carried by said arm is a valve disc 93 gravi-

tating to engage the seat 89 in closed position. Formed through the valve disc is a small opening 94. The function of the check valve will be later explained.

Interposed in the pilot line 56, preferably near the source thereof, is a check valve 95 like the valve 87 and interposed in the pipe 58, preferably near its source, is a like check valve 95′. Arranged in advance of the valves 95 and 95′ are strainers 96. As shown in detail in Figure 10, each of these strainers includes a pair of mating side plates 97 having peripheral flanges 98, and clamped between said flanges is a screen or other straining medium 99 secured by bolts 100 connecting the side plates to the strainer. The strainer is, of course, provided for filtering dirt from the air entering the pilot lines so as to prevent the pilot lines from becoming clogged.

As will now be seen, in case of fire in the shop, the air pressure in the pressure chamber of the cut off 55 will, upon the rupture of any one of the bleeder closures 61, be immediately relieved, with the result that said cut off will immediately function to stop the flow of fuel from the fuel tank through the main supply line into the shop. Accordingly, the fire hazard will be greatly reduced since the main fuel tank is, as is usual, located some distance from the shop. Coincidently, the cut offs 69 will, due to the drop in air pressure in the supply line 49, be caused to function so that the flow of fuel will be cut off at each of the furnaces. Furthermore, as will be perceived, the cut off 55 will function to stop the flow of fuel to the shop when the blower 50 is shut off and the shop is shut down and, of course, the flow of fuel will also be cut off at each of the cut offs 69.

To start the blower motor 51, the switch 85 is manually closed. As a result, the motor circuit will be closed for energizing the motor and the switch 85 is held closed until the motor has been in operation a sufficient length of time to build up the air pressure normally carried in the blast line 49. Accordingly, the pilot line 56 will be filled with air under pressure as will also the chamber 80 of the motor cut-out, with the result that the diaphragm 79 of said cut-out will be distended to act against the switch rod 81 and close the switch member 82. The switch 85 may then be released, when the motor circuit will be maintained closed by the pressure of air in the chamber 80 of the cut-out. However, upon failure of the motor or upon failure of the blower, with a consequent drop in air pressure in the blast line and accordingly in the pilot line and chamber 80 of the cut-out, the spring 83 will function to open the switch member 82 and stop the motor. A like result would, of course, follow in case of fire in the shop since upon the rupture of any one of the bleeder closures 61, the pressure in the pilot line, and accordingly in the chamber 80 of the cut-out, would be reduced so that the cut-out would automatically function to stop the motor.

Attention is now directed to the fact that the check valve 87 will swing open to permit a free flow of air to the chamber 80 of the motor cut-out but, upon a drop in the air pressure in the pilot line, will automatically swing to closed position to permit only a restricted flow of air out of said chamber through the passage 94 of the valve disc. The functioning of the cut-out will thus be delayed, in the event of rupture of any one of the bleeder closures 61, until the cut off 55 and cut offs 69 have functioned to stop the flow of fuel to the furnaces, when the blower motor will be stopped. Otherwise, should the blower be shut down previous to the shutting off of the oil supply, oil will flow into the furnaces and cause a great deal of unnecessary smoke. The check valve 95 is arranged so as to permit a restricted flow of air into the pilot line through the passage 94 of the valve, but a free flow of air out of the pilot line, the valve disc swinging to open position under the latter condition. This arrangement of the valve is chosen so that should the source of power operating the blower motor fail, with resultant rapid stoppage of the blower, the air pressure in the pilot line will be reduced as rapidly as possible in order to actuate the mechanism for shutting off the fuel supply. The restriction of flow into the pilot line is for the purpose of preventing the blower from maintaining pressure in the pilot line after the rupture of any one of the bleeder closures 61. The check valve 95′ is arranged like the check valve 95 and performs like functions. In the instance of an extensive pilot line some time would be required for the pressure to be reduced through the valve 95 alone. The bleeder 63 is provided in connection with the fire alarm box 64 so that when the closure pane 65 of said box is broken for turning in an alarm, the bleeder will be opened at its mouth for liberating the air in the pilot line and consequently effecting the actuation of the mechanism for shutting off the fuel supply and stopping the blower motor. The bleeder 63 is, of course, resealed by replacing the closure pane. If, however, delay in replacing the closure pane interferes with the operation of the shop, the bleeder may be temporarily sealed with a cork, to permit the resumption of operation.

Having thus described the invention, what I claim is:

1. The combination with a furnace, a fuel supply line leading to the furnace, an air blast supply line for the furnace, a motor,

and a blower operated by said motor for normally maintaining a predetermined air pressure in said blast line, of a pressure controlled cut off interposed in said fuel supply line, means conducting air under pressure from said blast line to said cut off, said cut off being automatically operable upon a reduction in air pressure thereto for stopping the flow of fuel through said fuel supply line, means including an element adapted to be fused for venting said blast line and reducing the pressure therein, a switch controlling the motor and normally held open, and means connected with said blast line and operable by said predetermined air pressure for holding the switch closed.

2. The combination with a furnace, a fuel supply line leading to the furnace, an air blast supply line for the furnace, a motor, and a blower operated by said motor for normally maintaining a predetermined air pressure in said blast line, of a pressure controlled cut off interposed in said fuel supply line, means conducting air under pressure from said blast line to said cut off, said cut off being automatically operable upon a reduction in air pressure thereto for stopping the flow of fuel through said fuel supply line, a pilot line connected with said blast line and including an element adapted to be fused for venting said blast line and reducing the pressure therein, a switch controlling the motor and normally held open, switch operating means connected with said pilot line and operable by said predetermined pressure in the blast line for holding the switch closed, and means for retarding a reduction in the air pressure acting on said switch operating means.

3. The combination with a furnace, a fuel supply line leading thereto, an air blast supply line for the furnace, a motor, and a blower operated by said motor for normally maintaining a predetermined air pressure in said blast line, of a pressure controlled cut off interposed in said fuel supply line, means conducting air under pressure from said blast line to said cut off, said cut off being automatically operable upon a reduction in air pressure thereto for stopping the flow of fuel through said fuel supply line, a pilot line including an element adapted to be fused for venting said blast line and reducing the pressure therein, a switch controlling the motor and normally held open, means connected with said pilot line and operable by said predetermined pressure in the blast line for holding the switch closed, and means interposed in the pilot line for restricting the flow of air into the plot line but operable to permit a free flow of air from the pilot line into the blast line.

In testimony whereof I affix my signature.

GEORGE A. SAGER. [L. S.]