

March 15, 1960

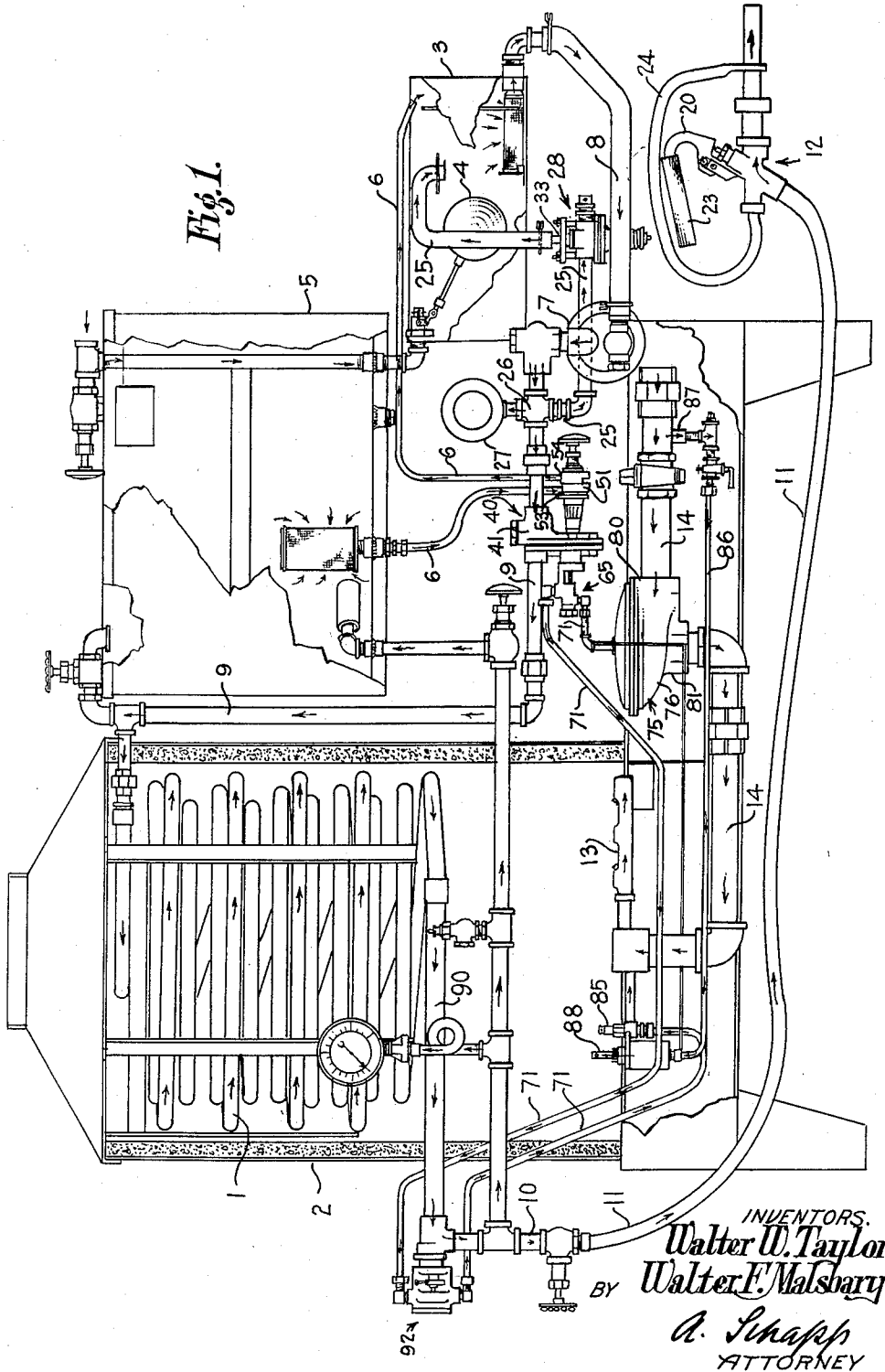
W. W. TAYLOR ET AL

2,928,613

CLEANING MACHINE

Filed Dec. 2, 1955

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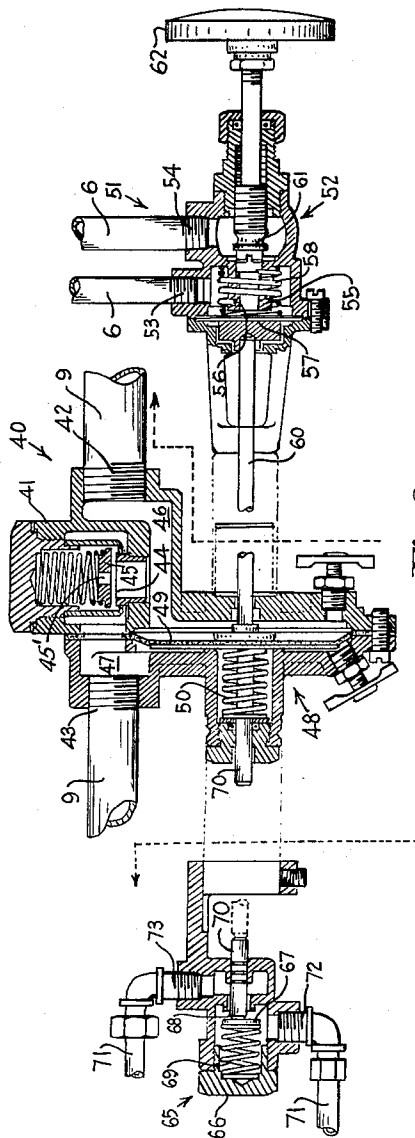
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4 Sheets-Sheet 2



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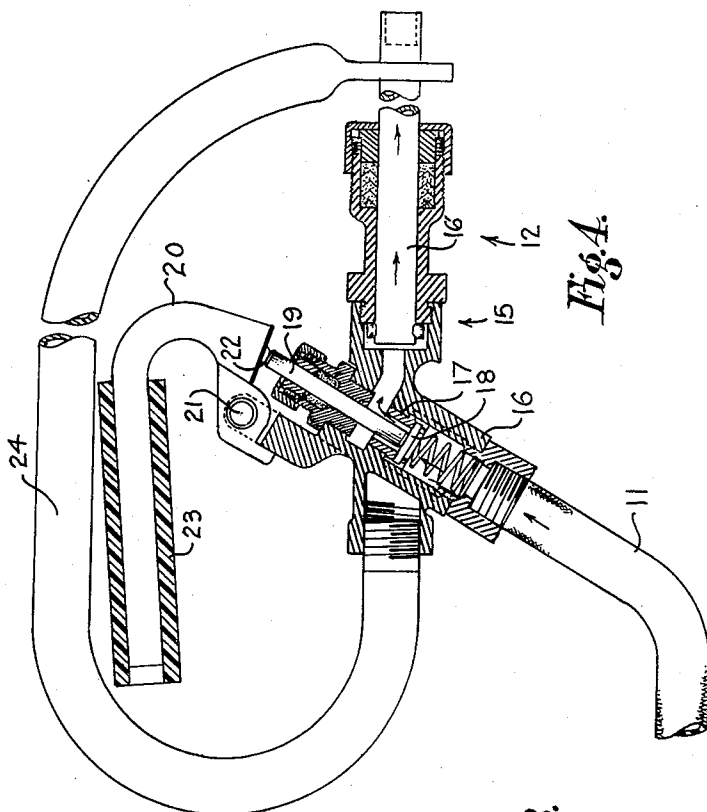


Fig. 4.

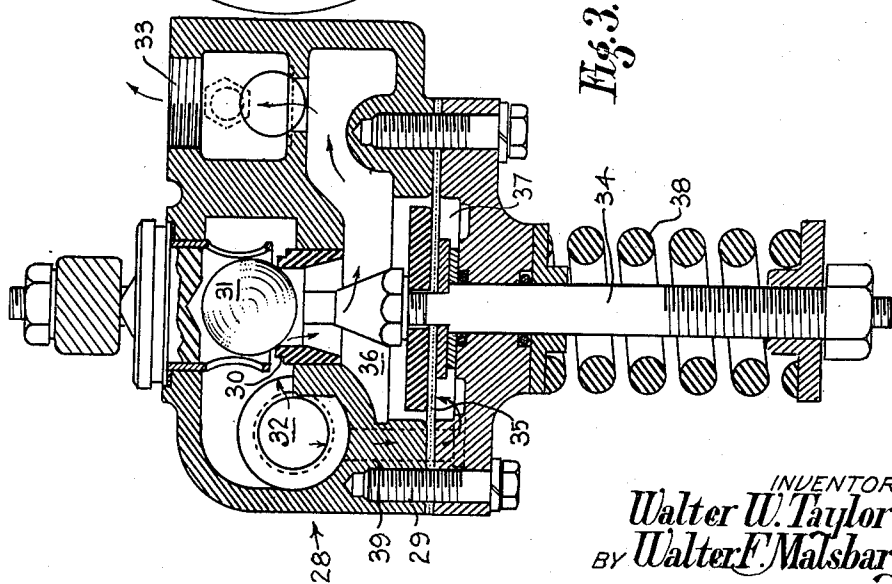


Fig. 3.

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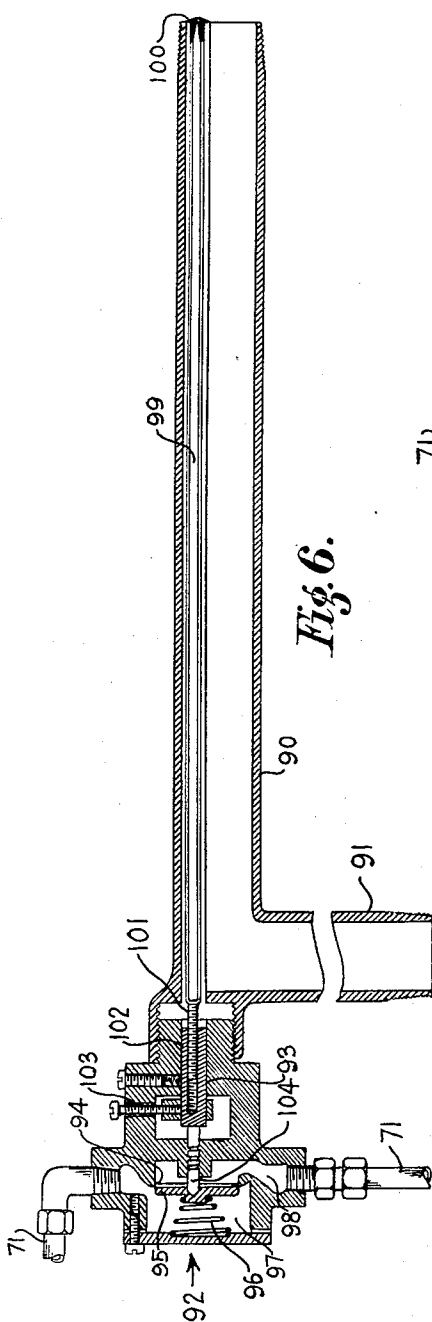


Fig. 6.

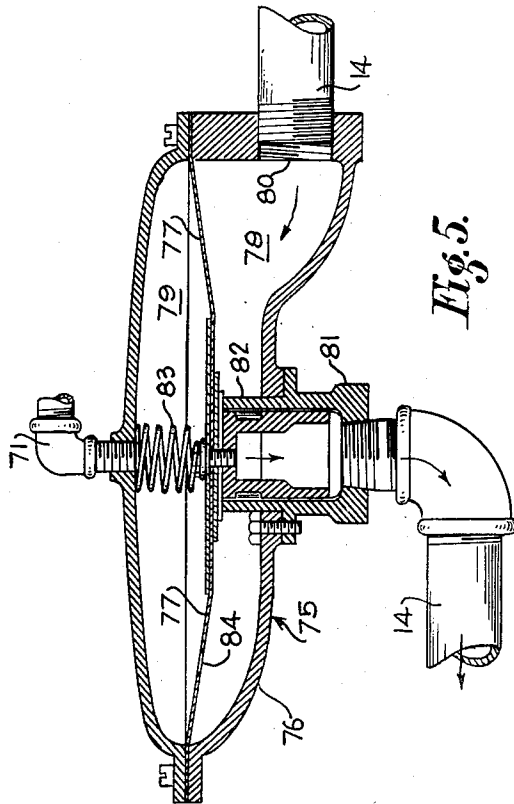


Fig. 5.

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2,928,613

CLEANING MACHINE

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4 Claims. (Cl. 239—533)

The present invention relates to improvements in a cleaning machine intended particularly for the cleaning of heavy industrial machinery, motor driven trucks and the like, by means of a stream of hot water, steam, or a mixture of hot water and steam discharged at the object to be cleaned under high pressure.

A machine of this type has been described in the Malsbary Patent No. 2,295,228, and the machine comprises in its principal features, a coil through which water is pumped under high pressure, a tank from which the water is pumped, a solution tank connected for delivering a desired amount of solution to the first tank, a gas burner for heating the coil, a discharge hose connected to the coil and terminating in a nozzle having a small discharge orifice.

It is proposed in the present invention to provide the nozzle with a control valve which is opened by the grip of the operator and which is closed automatically when the grip is released.

The release of the grip works up a back pressure in the system, and it is the object of the invention to utilize the back pressure for actuating various control elements, which allow the pump to continue operation without damage to the system, which automatically stop the solution feed into the water tank, and also automatically stop the flow of gas to the burner.

In carrying out these objects, we propose to provide a by-pass on the discharge side of the pump adapted to feed back into the water tank, and equipped with a pressure-operated relief valve which opens automatically when the nozzle is closed.

It is further proposed to provide a control for the solution feed conduit including a metering valve for adjusting the solution feed and a back-pressure responsive shut-off valve for discontinuing the solution feed altogether when the nozzle valve is closed.

It is additionally proposed to provide a control valve for the gas conduit with back-pressure responsive means for shutting off the gas supply when the nozzle valve is closed, this control being integrated into a thermostat control for the gas which is operative to arrest the flow of gas to the heater in response to excessive temperatures developed in the coil.

And finally, it is proposed to provide a unitary structure for the back-pressure responsive control for the two shut-off valves for the solution and gas feeds.

Further objects and advantages of our cleaning machine will appear as the specification proceeds, and the new and useful features of the invention will be fully defined in the claims attached hereto.

The preferred form of our invention is illustrated in the accompanying drawings forming part of this application, in which:

Figure 1 shows a general assembly view of our cleaning machine in side elevation, with parts shown in section;

Figure 2, a detail view, in longitudinal section, of the common, back-pressure responsive control for the valves of the solution feed and of the gas feed.

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Figure 3, a detail view, in vertical section, of the pump by-pass control valve;

Figure 4, a detail view, in axial section, of the nozzle control valve;

Figure 5, a detail view, in section, of a gas control valve; and

Figure 6, a detail view, in section, of a control thermostat.

While we have shown only the preferred form of our invention, it should be understood that various changes or modifications may be made within the scope of the claims hereto attached, without departing from the spirit of the invention.

Referring to the drawing in detail, and particularly to the assembly view of Figure 1, our cleaning machine comprises in its general features, a coil 1 mounted in a cylindrical housing 2, suitably insulated, a water tank 3 having a float control 4, a solution tank 5, a conduit 6 feeding from the solution tank to the water tank by gravity, a pump 7, an intake conduit 8 connecting the pump to the water tank, a discharge conduit 9 connecting the pump outlet to the upper end of the coil, a coil outlet conduit 10 having a hose 11 connected thereto, a nozzle or gun 12 at the end of the hose, a heater 13 mounted underneath the coil, and a gas conduit 14 leading to the heater.

In the ordinary working of the system, the pump 7 draws on the water tank 3 and discharges through the coil 1 into and through the nozzle valve 12, while the solution feeds into the water tank through conduit 6, and the water, with its solution, is heated in the coil to any desired temperature by the gas burner 13 fed through the pipe 14.

The nozzle valve 12, as shown in detail in Figure 4, is the self-closing type, and comprises a housing 15 having an angularly disposed intake 16 adapted for securing upon the discharge hose, and an outlet pipe 16 adapted for connection to the orifice, with a valve seat 17 interposed.

The valve seat 17 is normally closed by a spring-pressed valve head 18 having a stem 19 projecting in the opposite direction. A curved valve handle 20 is pivoted in the housing, as at 21, and has an end face 22 adapted to bear on the valve stem for opening the valve when the free end 23 of the handle is swung upward.

The housing has a loop 24 secured thereon in the plane of the handle and passing around the same, so that an operator may grip the loop and the handle at the same time for opening the valve at the same time he picks up the nozzle. On the other hand, as soon as the operator lays down the nozzle, the valve closes automatically.

As soon as the nozzle valve is closed, with the pump still going, a back-pressure develops, and this back-pressure is made to perform several functions.

In the first place, the back-pressure is made to by-pass the water discharged by the pump back into the tank 3. The by-pass 25 connects with the pump discharge conduit through a fitting 26, which is also made for attachment to a cushion dome 27, and has a free end delivering into the tank 3.

The by-pass has a pressure relief valve 28 which may assume the form illustrated in detail in Figure 3. The valve comprises a housing 29 having a valve seat 30, a ball valve 31 adapted for closing the seat, an intake 32 and an outlet 33.

The valve ball 31 is operated, for opening the seat, by a vertical valve stem 34, which, in turn, is operated by a diaphragm 35 mounted to provide an upper chamber 36 and a lower chamber 37.

A spring 38 normally tends to pull down on the valve stem and the diaphragm, so as to cause the valve stem

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to retract from the ball and to allow the latter to seat.

The incoming water connects with the chamber 37 through a conduit 39.

In operation, when the nozzle valve is open, and the water is free to flow through the coil, the pressure in the chamber 37 is relatively light and is not sufficient to overcome the pressure of the spring 38, with the result that the valve stem allows the ball 31 to seat, and that no water passes through the relief valve.

But, when the nozzle valve is closed, and the full pump pressure is made to operate on the diaphragm in the lower chamber 37, the water pressure overcomes the spring pressure and lifts the diaphragm and the valve stem, and the latter lifts the ball, so as to allow the water to freely pass from the intake through the chamber 36 and the outlet 33 to the water tank 3.

In the second place, the shutting off of the nozzle valve and the back pressure created thereby is made to stop the solution feed through pipe 6. For this purpose we provide the valve arrangement generally indicated at 40 and illustrated in detail in Figure 2.

A valve housing 41 is connected into the water conduit 9 and has an intake 42 and an outlet 43 with a horizontal valve seat 44 interposed between intake and outlet and adapted to be closed by a spring-pressed valve 45, which yields to the pressure of the normal flow of water. The valve housing presents an intake chamber 46 on the intake side of the valve and an outlet chamber 47 on the other side of the valve.

When the nozzle valve is closed, the spring-pressed valve 45 closes due to the increased back pressure, and the valve 45 is formed with a bleeder hole 45' which allows the pressures to equalize on opposite sides of the valve after the latter is closed.

The housing thus far described has a diaphragm housing 48 depending therefrom, with a diaphragm 49 mounted in the latter housing in such a manner that the inside face of the diaphragm is subject to the pressure prevailing in chamber 46, while the outside face is subjected to the pressure prevailing in the chamber 47. A spring 50 normally urges the diaphragm inwardly.

As long as the outward pressure on the inner face of the diaphragm exceeds the combined pressures on the opposite face, the diaphragm will be pressed outward, as shown in Figure 2. But, when the back pressure, caused by the closing of the nozzle valve, combined with the spring pressure, exceed the outward pressure, the diaphragm will be forced inwardly, that is, to the right in Figure 2.

The diaphragm 49 is used to operate a valve generally indicated at 51 and forming part of the solution conduit 6. This valve comprises a housing 52 arranged coaxially with the diaphragm and having a lateral intake 53 communicating with the intake side of the conduit 6, and a lateral outlet 54 communicating with the discharge side of conduit 6.

The housing 52 has a central tube 55, the end of which forms a valve seat 56 in opposing relation to a diaphragm 57 which is normally pressed away from the seat by a spring 58.

As long as the diaphragm 57 is pressed away from the seat, solution is free to flow from tank 5 through pipe 6, valve intake 53, past the open end of tube 55, through the latter and out the outlet 54, to continue through the continuation of conduit 6 to the water tank 3.

Thus, the solution flow is maintained normally, as long as the system is in operation, but, when the nozzle valve is closed to stop the flow of the water, the back pressure bearing on the rear face of the diaphragm 49, aided by the spring 50, pushes the diaphragm forward, that is, to the right, as viewed in Figure 2, and this forward movement is communicated to the diaphragm 57 by means of an axial connecting rod 60.

Thus, the back pressure caused by the closing of the

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nozzle valve closes the valve 51 and stops the solution flow.

The valve housing 52 is also equipped with a metering valve 61 which may be operated independently by means of a handle 62.

In the third place, the diaphragm 49 is used for controlling the gas feed in such a manner that it shuts off the feed when the nozzle is closed.

This control is effected by means of the valve 65 (see Figure 2 for details). This control valve is mounted coaxially with the diaphragm 49 and in opposite relation to the valve assembly 51. It comprises a housing 66 having a valve seat 67 and a valve head 68 cooperating therewith, a spring 69 tending to seat the valve head.

The valve head 68 is connected to the diaphragm 49 by means of a rod 70, and as long as the diaphragm is in the position shown in Figure 2, which is the normal position when the water is running freely through the system, the diaphragm pushes the valve head 68 off its seat, against the opposition of the spring 69. When the diaphragm moves inward, that is to the right, in response to the stopping of the flow of water, the spring 69 closes the valve.

The valve 65 does not act directly on the main gas supply, but on a by-pass 71, which in turn, is used to control the main gas line 14. The valve is connected into the bypass by means of its intake 72 and outlet 73.

To effect the control of the by-pass over the main gas line, we provide a diaphragm valve 75 in the main gas line, which is illustrated in detail in Figure 5. This valve comprises a housing 76 divided centrally by a diaphragm 77 to provide a lower chamber 78 and an upper chamber 79.

The lower chamber is connected into the main gas line 14 by a lateral intake 80 and a central bottom outlet 81, so that the main gas supply flows through the lower chamber. The flow is controlled by the diaphragm 77 which cooperates with an annular valve seat 82 formed about the outlet 81 in opening and closing the valve. A spring 83 in the upper chamber exerts downward pressure on the diaphragm.

The upper chamber 79 is connected directly to the by-pass 71, and a small leak-hole 84 is provided in the diaphragm between the two chambers.

As has been previously described, the by-pass 71 is controlled by the valve 65, which is normally open, but which is closed automatically when the flow of water through the system is stopped by the closing of the nozzle valve.

In operation, as long as the valve 65 is open, the gas, flowing through the lower chamber, bears on the bottom face of the diaphragm 77 and lifts the latter off its seat, so as to allow of a free flow of gas through the chamber.

While the gas is flowing through the lower chamber, a small portion thereof is by-passed through the leak-hole 84 in the diaphragm and enters the upper chamber and the by-pass 71 which eventually leads to the gas burner and discharges into the main flame through a pilot 85.

When the by-pass 71 is closed, due to the stoppage of the water flow, the free flow of the gas through the by-pass ceases and the gas escaping through the leak-hole 84 builds up counter pressure in the upper chamber 79, and when the combined pressures of the gas in the upper chamber and the spring 83 exceed the pressure in the lower chamber, the diaphragm is forced downward upon the seat and stops the flow of gas through the lower chamber, thereby extinguishing the burner.

A second conventional by-pass 86 is connected into the main gas line ahead of the diaphragm valve 75, as at 87, and terminates in the usual pilot 88, which is unaffected by the diaphragm valve and is always ready to re-light the gas at the burner.

The gas by-pass 71 is also used as a part of the thermo-

stat control of the gas flame, independently of the valve 65.

For the purpose of the thermostat control (see Figure 6), we provide a straight tube 90 of expansible material connected to the bottom end of the coil and extending diametrically across the coil, substantially in the hottest region of the coil housing.

The tube 90 has an end extending outside the housing, with a downwardly extending outlet 91 adapted for the hose connection.

Upon the end of the tube is mounted a valve housing 92, including in its principal features, a horizontal passage 93 aligned with the upper portion of the tube, a vertically presented, tubular valve seat 94, a valve 95 adapted for engagement upon the valve seat, and a spring 96 urging the valve upon its seat.

The valve forms an outer chamber 97 and an inner chamber 98 connected into the by-pass 71.

The tube 90 has a rod 99 of smaller diameter and constructed of non-expansible material mounted inside thereof and secured to the tube at its inner end, as at 100.

The rod has a threaded extension 101 extending into the passage 93 and the extension has a sleeve 102 threaded thereon, the sleeve being turnable by means of a handle 103 to adjust the overall length of the rod assembly. The sleeve has a projecting plunger 104 bearing on the valve and adapted to push the same off its seat for opening the by-pass.

When the tube 90 is cool, it shrinks and causes the rod and the plunger 104 to bear on the valve for opening the same, so as to allow of the free passage of gas through the by-pass 71. As the tube 90 expands due to the heat, the rod 99, which does not substantially expand, is pulled backward to allow the valve 95 to move toward closing position and to close altogether when the heat becomes excessive.

The closing of the valve again works up back-pressure in the chamber 79 of the diaphragm valve 75, and stops the flow of gas in the main line.

The operation of our cleaning machine may be described as follows:

When the machine is in operation, with the nozzle valve 12 open:

(1) Water is pumped from tank 3, through pipe 8, pump 7, valve 40, pipe 9, coil 1, thermostat tube 90, outlet pipe 10, hose 11, and nozzle 12.

At this time:

(2) Valve 28 is closed, so as to bar the by-pass 25;
(3) Valve 51 is open to allow solution to feed from tank 5 into tank 3;

(4) Gas by-pass valve 65 is open to allow gas leaking through the leak-hole 84 in the diaphragm 77 to escape into pilot 85;

(5) Thermostat valve 92 is normally open, but responsive to excessive heat to close and stop the flow of gas to the burner.

When the nozzle valve 12 is closed, the following changes take place automatically:

(1) Valve 28.—The increased pressure caused by the closing of the nozzle valve lifts the diaphragm 35 (Figure 3), and the plunger 34, which latter lifts the ball 31 and opens the valve to allow the pumped water to escape and be by-passed into the tank 3.

(2) Valve 51.—Back pressure active on the rear face of diaphragm 49 (Figure 2), aided by the spring 50, causes the diaphragm to flex forward and the plunger 60 to close valve 51, which in turn closes the solution feed 6 from tank 5 to tank 3.

(3) Valve 65.—Diaphragm 49 (Figure 2), on its forward swing, pulls plunger 70 away from valve head 68, and allows the spring 69 to close valve 65, and the gas by-pass 71.

(4) Valve 75.—The closing of the gas by-pass valve 65 tends to equalize pressures on opposite sides of the diaphragm 77 (Figure 5) and allows the spring 83 to force the diaphragm upon its seat, thereby closing the main gas line 14.

(5) Thermostat valve 92.—This valve also forms part of the gas by-pass 71 and is adapted to close the same in case of excessive heat, with the same effect, namely the equalizing of pressures on opposite sides of the diaphragm 77 and the closing of the main gas valve 75.

We claim:

1. In a machine of the character described, a conduit having a discharge nozzle, a pump connected into said conduit and operative for pumping a liquid through the conduit under pressure, a valve housing mounted in said conduit longitudinally thereof and having a spring-pressed valve adapted for opening by the outward pressure of the liquid when the nozzle is open and for closing under combined spring pressure and back pressure when the nozzle is closed, a diaphragm housing projecting laterally from the first housing and having a diaphragm mounted therein transversely to the conduit and free to flex in a direction parallel to the conduit, the diaphragm housing having connection with the conduit to subject the front face of the diaphragm directly to the pump pressure of the liquid and to subject the rear face of the diaphragm to the delivery pressure of the liquid, a spring bearing on the rear face of the diaphragm and tending to move the diaphragm forward, the pump pressure being operative to move the diaphragm rearward when the pump pressure greatly exceeds the delivery pressure, and the combined spring pressure and delivery pressure being operative to move the diaphragm forward when the delivery pressure and the pump pressure are substantially equalized, and the first-named valve having a bleeder hole therein for equalizing the pressures on opposite sides thereof when the said valve is closed.

2. A combination as defined in claim 1, in which the diaphragm has control elements mounted on opposite sides thereof to operate other instrumentalities.

3. A combination as defined in claim 1, including a second conduit having a valve mounted in axial alignment with the diaphragm and spaced from one side thereof, and a rod projecting centrally from the diaphragm and operable by the diaphragm for operating the valve of the second conduit.

4. A combination as defined in claim 3 in which the second valve has means for metering the flow of liquid therethrough.

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