Sept. 6, 1932. C. F. FITTS 1,876,048

CLEANING APPARATUS

Filed Aug. 31, 1931 2 Sheets-Sheet 1

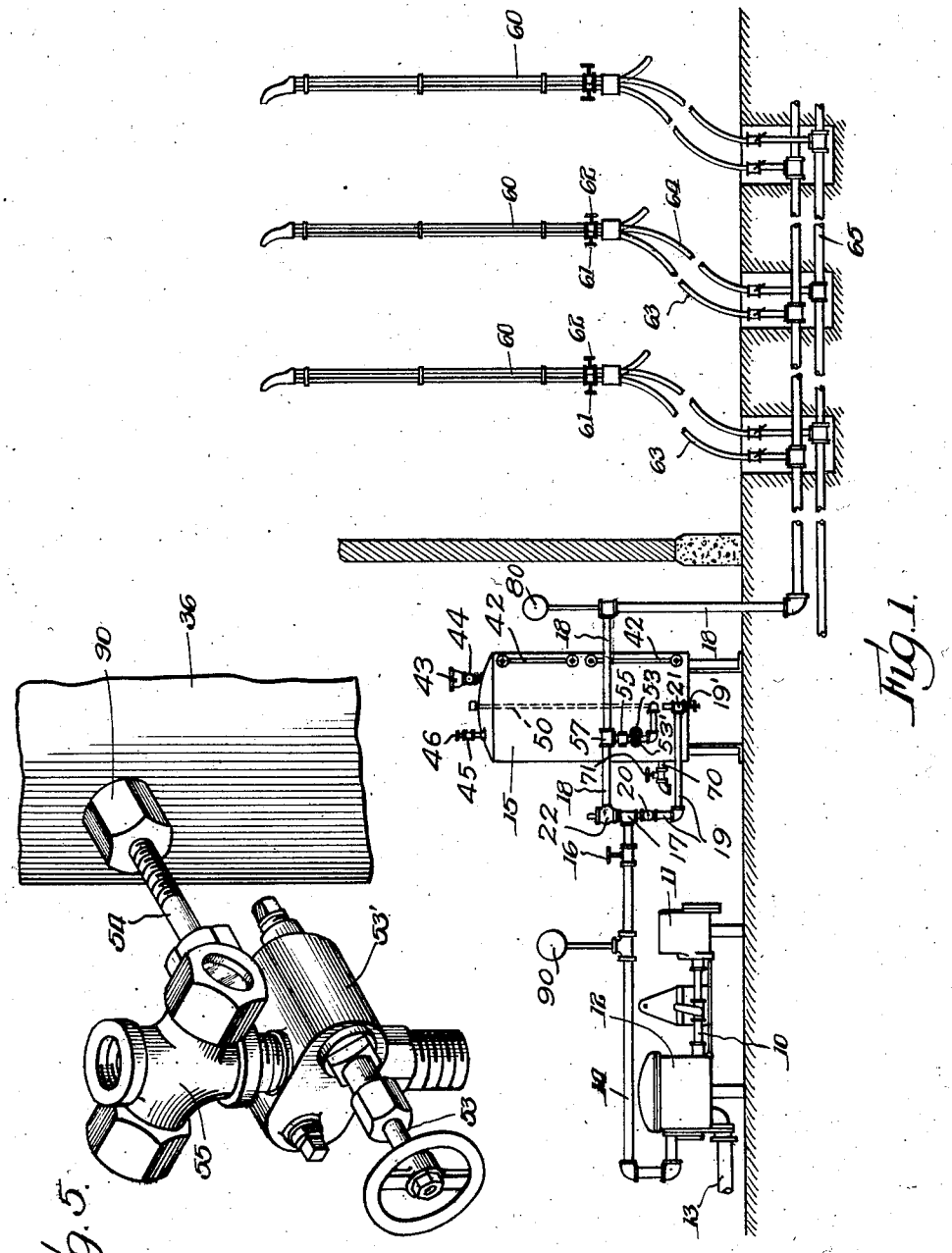

Fig. 1.

Fig. 5.

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CLEANING APPARATUS

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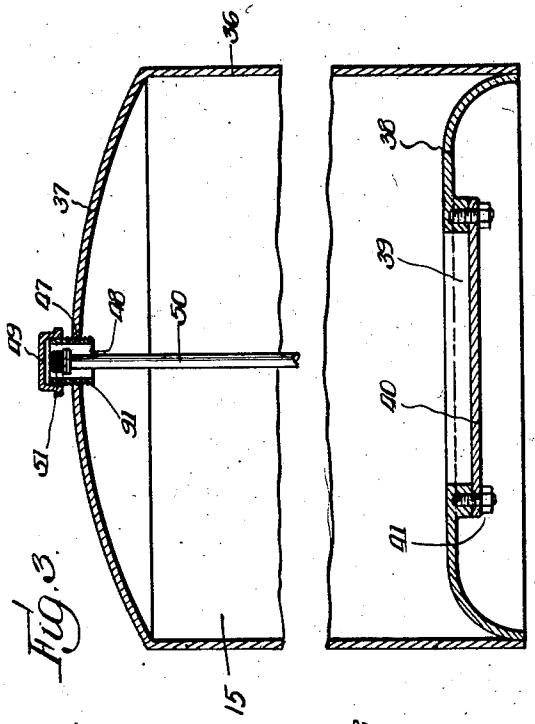

Fig. 3.

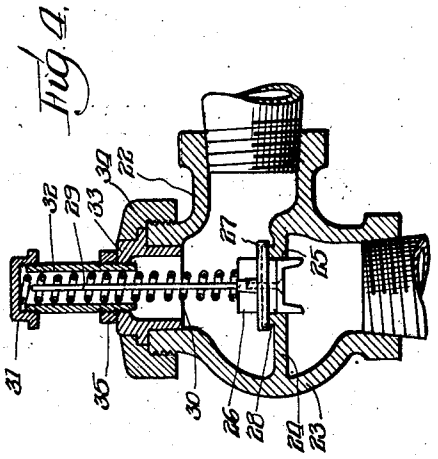

Fig. 4.

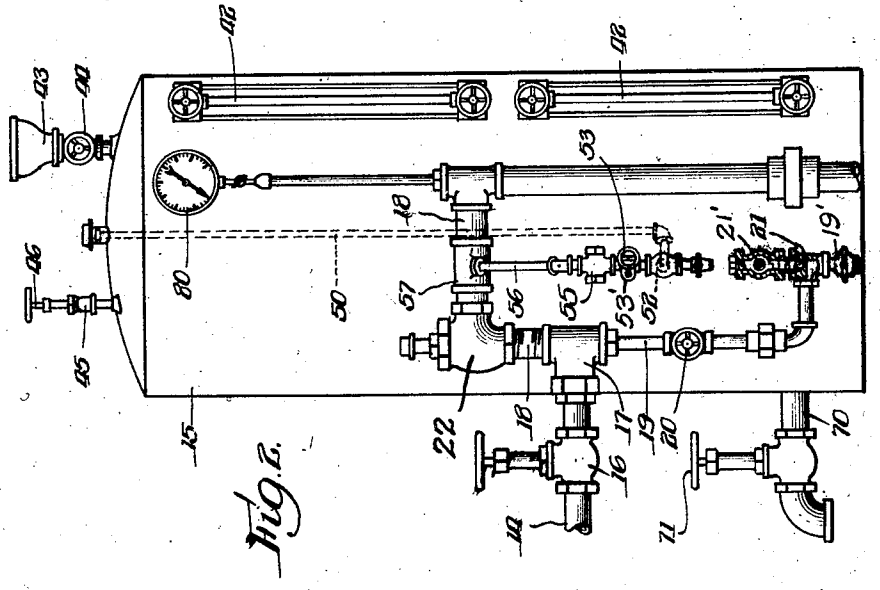

Fig. 2.

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1,876,048

UNITED STATES PATENT OFFICE

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CLEANING APPARATUS

Application filed August 31, 1931. Serial No. 560,391.

This invention relates to an improved apparatus of the type employed for cleaning surfaces by the use of a mixture of water and air under pressure and a quantity of finely divided oil suspended in the water.

The method of cleaning here referred to has a number of applications, such as cleaning the surfaces of locomotives, engines, or the like, and is set forth in patent to Durham, et al., No. 1,113,967, issued October 20, 1914.

This application is a continuation in part of applicant's copending application Serial No. 500,831, filed December 8, 1930, and entitled "Cleaning apparatus."

Devices by which the above cleaning process has been practiced, heretofore have employed a source of water under pressure, and prior to this invention have been provided with means for introducing a small amount of oil into the water line by hydrostatic displacement of the oil. It has been customary in such devices to locate a portion of the main water line at an elevation above the oil tank so as to assist the hydrostatic feeding of the oil. Such devices have been reasonably satisfactory, but the main objection thereto is that they are subject to a continued feeding of the oil into the water line after the apparatus is shut down. This is objectionable because upon resuming operations after the apparatus has been idled, as, for instance, standing over night, the line leading to the spraying nozzle will contain a large quantity of oil which must be displaced at the outset before the proper cleaning mixture will be ejected. This not only delays the cleaning operation, but it is extremely wasteful of oil, rendering the operation of the device unduly expensive and, in certain instances, dangerous, due to the fire hazard resulting from the wasted oil.

The objectionable feeding of oil when the apparatus is idle will naturally occur in devices relying on hydrostatic displacement unless special means is provided for preventing it, because the action of gravity on the heavier water will be effective whether the machine is in operation or not and will continue until a gravitational equilibrium is established throughout the entire system.

A further objection to this type of device results from the imperfect control over the hydrostatic oil feeding action. Although it is found in practice that the feeding of oil by hydrostatic action is in some measure proportional to the amount of water fed to the nozzles, the feeding action is nevertheless incapable of accurate control due to the constant gravitation of the heavier water.

Accordingly, the present invention aims to eliminate these difficulties and objections and to provide a highly practical apparatus which is simple in construction and by which the feeding of oil may be accurately controlled when the apparatus is in operation and by which the objectionable seeping or unintentional feeding of oil is positively prevented when the apparatus is idle.

In devising the apparatus of the present invention, applicant has made certain structural provisions, the functions and utility of which are based upon certain observations in connection with the oil feeding problem involved. First, it has been determined that complete reliance on hydrostatic displacement for the oil feeding operation is objectionable, due to the lack of control above referred to and due to its continued action when the apparatus is idle. Secondly, that more positive control and a better feeding action is produced by utilizing a positive feeding force, derived from any suitable source, such as may be obtained by developing differential pressures in the main water line. It is therefore an object of the persent invention to provide an apparatus which is free from the above stated objections and which utilizes a positive feeding force for feeding the oil under positive control during the cleaning operation, and which is free from objectionable seeping or unintentional feeding when the apparatus is idle.

It is a further object of this invention to provide an apparatus which is entirely automatic in its operation for feeding oil in accurately determined quantities proportional to the quantity of water supplied and entirely regulated by the manipulation of the nozzle valves, and for positively discontinuing the feeding action when the nozzles are shut off.

It is also an object in the above described

device, to provide an oil feeding and mixing device which includes a sight glass permitting ready inspection of the oil feeding action.

Another object of this invention is that of providing means for feeding oil into the main water pipe from a location below so that the oil passes upwardly through the adjustable oil feeding valve and into the stream of water. The upward passage of oil is not only caused by the positive feeding force, but is assisted by the hydrostatic displacement of oil in water.

Various other objects not specifically enumerated are contemplated for this invention as will readily appear to one skilled in the art as the following description proceeds.

Merely for the purpose of illustration, one preferred embodiment of this invention is hereinafter disclosed, but the invention should not be limited thereby, as the scope of the invention may be determined from an understanding of this disclosure and an appreciation of the advantages which the invention produces therein.

The following disclosure will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is an elevational view of a cleaning installation embodying the improved apparatus of the present invention, the parts being here shown somewhat diagrammatically and spread out for clarity.

Figure 2 is an enlarged elevational view of the oil tank and feeding apparatus disclosed in Figure 1.

Figure 3 is an enlarged fragmentary view, in cross section, disclosing the interior and construction of the oil tank;

Figure 4 is an enlarged elevational view in cross section, of a one-way valve placed in the main water line and constituting an essential part of the present invention, and

Figure 5 is an enlarged perspective view of the oil feeding valve employed in this disclosure, showing the piston valve with its adjustment and the threaded valve.

By referring to Figure 1 of the drawings, it will be noted that the present invention is disclosed in connection with a cleaning apparatus which comprises a water pump 10, having a steam cylinder 11 and a pumping cylinder 12. The pumping cylinder is connected to a pipe 13, which is represented in the drawings as a source of supply of hot water. In practice, the pipe 13 is preferably connected to a water heater which is thermostatically controlled to maintain the temperature constant irrespective of the quantity of water drawn therefrom, so that one or more of a plurality of cleaning nozzles may be used in operation. The water pipe 14 is connected to the discharge of the pumping cylinder 12 and extends, as shown in Figure 1, to a location adjacent the oil tank 15 and is preferably provided with a manually operable shut-off valve 16.

The pump is preferably provided with an automatic control whereby it will pump more or less water depending upon the demand on the line and thereby maintains a constant pressure irrespective of the number of nozzles being used or the degree of opening of the nozzle valves.

As shown in Figure 2, at the location of the oil tank 15, the water line 14 is provided with a T coupling 17, for establishing branch water lines 18, extending upwardly and 19 extending downwardly. The downwardly extending line 19 is preferably smaller than the main line, and at a location adjacent the bottom of the tank it passes upwardly and thence through the wall thereof as at 21′ so as to form a water inlet adjacent the bottom. The branch line 19 is also preferably provided with a shut-off valve 20 and a check valve 21 opening upwardly at the location just ahead of the point 21′ where line 19 enters the tank. Line 19 provides a water inlet to the tank which exerts a feeding pressure on the oil equal to the pressure in the main water line as developed by the pump. A drain cock 19′ may be provided for draining line 19 when desired.

The upwardly extending branch 18 constitutes the continuation of the main water line and is therefore preferably of substantially the same size as the water line 14, or at least of sufficient diameter to accommodate the maximum load on the apparatus. The branch 18 preferably extends upwardly for a short distance and is then provided with the check valve 22, the internal construction of which is illustrated in Figure 4. It will be noted that this valve for structural convenience, is formed as an elbow and comprises an outer wall 23 having an internal partition 24 with a central opening 25 therein for accommodating the movable valve part 26. The valve part 26 has an outwardly extending flange 27, which engages the annular seat 28 surrounding the opening 25 in the partition. The valve part 26 has an upwardly extending rod 29 surrounded by a coil spring 30 having its lower end bearing on the valve part and its upper end seated against the cap 31, screw threaded on the sleeve 32. The sleeve has an adjustable threaded engagement in the cap 33 which is held tightly against the top of the upper wall by means of a collar 34, secured by screw threads as shown in the drawings. The sleeve 32 is capable of being adjusted upwardly and downwardly to vary the tension of the spring and any particular position thereof may be maintained by means of the lock nut 35. It will readily appear that this valve will be opened by the pressure of the water when the apparatus is in operation so as to permit the water to pass to the nozzle. However, depending upon

the resistance offered by the spring, the pressure in the main water line on the opposite side of the valve will be diminished to some extent to establish a reduced pressure at the location where the oil is introduced into the water line. The particular construction of the valve constitutes no part of the present invention as obviously, any valve of one-way similar construction can be employed with the same results and therefore the invention should not be limited to the present type of valve which is given merely for purposes of illustration.

The tank may be of any suitable construction but is here shown as a vertical cylinder having side walls 36, a dome top 37, and a concave bottom plate 38 provided with a central opening 39 closed by a cover plate 40 secured by bolts 41. The cover plate is adapted to be removed for permitting access to the interior of the tank for cleaning, repairing or any other purpose.

The side walls of the tank are preferably provided with sight gauges 42 by which the quantity of oil in the tank may be determined. A funnel 43 is provided on top of the tank leading to the interior thereof, the communicating opening of which may be opened and closed by the manual valve 44. This funnel provides a means by which the oil may be introduced into the tank. Also a pet cock 45, controlled by the manual valve 46 is preferably provided on top of the tank for establishing an outlet for air during the filling operation. An opening 47 is preferably provided in the dome of the tank for accommodating the sleeve 48 having its upper end closed by a cap 49, forming a small fluid pocket 91 into which the upper end of the oil outlet pipe 50, extends. The upper end of this pipe, is preferably provided with a filtering screen 51 so as to prevent the feeding of any foreign matter which may get into the oil tank, or to the oil feeding valve. The pipe 50 extends downwardly as shown in Figure 2 and thence horizontally passing through the wall of the tank for connection as at 52, with the oil regulating valve 53′ mounted outside of the tank. Mechanically, the pipe 50 is supported by the tank itself and provides a protected communication from the upper portion of the tank to the oil control valve which in the present instant, is located at a relatively low level.

By referring to Figure 2, it will be noted that the air pocket 91 above referred to provided by means of the sleeve 48 and cap 49 will always contain a limited quantity of air which will be trapped during the operation of filling the tank with oil. Thereafter, when the machine is put in operation and the oil tank is put under the pressure of the main water line, the pocketed air is compressed to an extent to permit the level of the oil to rise above the upper edge of the outlet pipe. This provides a free passage for the feeding of oil in the manner above described. However, after the machine is shut down and the pressure on the tank reduced, the pocketed air is allowed to expand an extent permitted by the reduced pressure which is sufficient according to the construction of the apparatus to lower the oil level below the upper end of the outlet pipe so as to break the outlet passage. This action in operation supplements the action of the check valve for possibly preventing the seeping of oil into the water line when the machine is idle.

In its essential aspect, the oil mixing valve may be of any usual construction which is capable of manual adjustment to determine the degree of opening constituting the oil passage but in the present disclosure, it is shown in Figure 5, as comprising a dual chamber valve 53′ having an opening for one chamber regulated by the hand operated screw threaded valve 53 and the opening of the other chamber regulated by the piston type of valve 54. Valve 53′ may be of any conventional or suitable construction providing accurate control and the feeding of oil in regulated quantity upwardly through the sight feed 55, and therefore, the details of its construction are not here shown or claimed.

Above the oil regulating valve, a sight feed device 55, is preferably provided having glass windows on opposite sides of the fluid passage so as to permit the passage of light therethrough and a ready inspection of the oil feeding action. Just above the sight feed 55, the oil feeding pipe 56 is provided, the upper end of which is connected by means of the coupling 57 to the horizontal portion of the main water line 18. In operation, the oil feeding pipe 56 and the sight feed 55 are filled with water through which the oil travels upwardly in bubbles or a thin stream according to the valve regulation and demand on the apparatus, by a hydrostatic feeding action. The hydrostatic feeding action, however, is confined to this local portion of the apparatus as the feeding of the oil from the tank of the regulating valve is caused entirely by the positive feeding pressure of the water line in the tank and the reduced pressure at the oil inlet established by the resistance of the check valve 22.

The hydrostatic feed at the location of the sight feed 55 provides a very efficient and satisfactory means for accurately determining the oil feeding action, as the oil can be clearly seen in the form of bubbles or a thin stream passing upwardly by hydrostatic displacement through the column of water in the sight feed device 55 and connecting pipe 56.

As shown in Figures 1 and 2, the main water line 18 then passes downwardly and thence horizontally to any suitable location

adjacent the places where the cleaning operations will be performed. As shown in Figure 1, a plurality of cleaning nozzles 60 are provided with control valves 61 and 62 for regulating the mixture of water, oil and air. The nozzles are connected by means of flexible pipes or hose 63 to the main water line 18 and by flexible pipes or hose 64, to the air line 65. The pipe 65 is connected to a suitable source of air under pressure, for establishing the desired cleaning mixture in accordance with the principles of the Durham patent above referred to.

Although the invention is not to be so limited, it may be mentioned that in many instances, it is desirable to utilize the air pressure as a means for regulating the operation of the pump so that the quantity of oil and water mixture supplied by the apparatus may be automatically regulated to maintain a predetermined relationship between the pressures of the mixture of oil and water and the air. This form of the apparatus is based upon the discovery that the best cleaning results are produced when the pressure of the oil and water is substantially equal to that of the air so by regulating the pressure of the water by the pressure of the air, the latter of which may vary slightly, on different occasions, substantially equal pressures may be assured.

The nozzles above referred to may be provided in any suitable number and the location of each selected for convenient use at the location where the cleaning operation is to be performed.

It will readily appear that when it is desired to fill the tank with oil, any water which may be contained therein can be drained through the discharge pipe 70, controlled by the manual valve 71. Thereafter, the tank may be filled through the funnel 43 during which operation the pet cock 45 will be opened to permit the escapement of air. Upon completing the filling operation, the pet cock and funnel are closed. The apparatus is then ready for operation and by opening valve 16 and one or more of the cleaning nozzles, the water is caused to flow through the main water line 14—18 by the action of the pump and delivered at a constant temperature and pressure, irrespective of the demand on the line. Immediately upon starting the apparatus, water is fed through the branch pipe 19, past the check valve 21 and into the bottom of the tank to establish a feeding pressure therein equal to the pump pressure in the main water line. The main volume of water however, passes into pipe 18 and through the check valve 22 where it acts to lift the valve and pass on to the nozzles. The spring of the check valve is adjusted to establish the desired differential in pressure at the location of the oil inlet so that there is provided a feeding pressure on the oil of one intensity tending to force the oil into a water line against a resisting pressure adjusted to a predetermined lesser intensity.

This differential in pressure provides the positive feeding force by which the oil is introduced to the oil regulating valve 53′, and thence to the water line. The valve as shown in Figure 5 may preferably have the valve stem 54 positioned with its end adjacent the side of the tank with the threaded knob 90 on the end thereof in abutting engagement against the tank. The piston valve 54 is forced outwardly to provide an oil passage by the pressure in the feeding line and therefore in operation, it will assume the maximum outward position permitted by the particular adjustment of the threaded knob. Accordingly, by adjusting the threaded knob, a very accurate permanent adjustment may be made at the oil feeding valve. By having two valves as described, the threaded valve may be entirely shut off or open to its maximum position if such is desired, while maintaining the more accurate permanent adjustment by means of the piston valve.

The pressure differential effected by the check valve may be readily determined by providing a pressure gauge 80 for the main water line as shown in Figure 2, which may be compared with a similar gauge 90, connected on the opposite side of the check valve, for indicating the pump pressure.

The apparatus of this invention has been put into commercial practice and found to be highly efficient and satisfactory in performance. The check valve 22 has a dual function in this apparatus, first, to establish the differential pressure providing the positive feeding force for the oil which, as above pointed out, is essential in constructions like the present where the hydrostatic displacement of oil is eliminated, and secondly, that of preventing any back flow of liquid in the main water line, between the oil inlet to the water line and the inlet of water into the tank.

The value of this last function can be appreciated by observing that the objectionable seepage and unintentional feeding is of course attributable to the displacement of oil by water during the process of establishing a gravitational equilibrium in the system as when the apparatus is shut down. This displacement involves a flow of water and necessarily involves the travel of water from the location of the oil inlet back through the line into the bottom of the tank, as the feeding of oil into water line must displace water and this water must ultimately find its way into the tank to take the place of the displaced oil. As such reverse flow is prevented by the check valve, it will be obvious that the objectionable seeping and unintentional feeding is effectively prevented.

The seepage is further eliminated by the cut off action at the top of the oil feeding pipe 50, as it will be appreciated from the above description that upon lowering the tank pressure as when the apparatus is shut down, the trapped air in the top of pocket 91 will expand and the oil level will be lowered to a point below the upper end of the pipe 50 so as to break the oil feeding communication to the oil feeding valve.

It is intended that this invention cover various modifications and alterations which embody the principle herein described and illustrated and as will fall within the scope of the appended claims.

I claim:

1. A cleaning apparatus of the character described comprising in combination a water pipe adapted for connection at one end to a source of hot water under pressure and at its other end to a supply nozzle; a tank containing oil; a water feed pipe extending from said water pipe to the lower portion of said oil tank; means for feeding oil from said tank to said water pipe including a vertical oil feed pipe connected to said water pipe from below and having an oil feeding valve therein, said last named pipe being connected to the top portion of said oil tank; and a valve in said water pipe located between the connections of said water feed pipe and said oil feed pipe and constructed to permit the flow of liquid in said water pipe in the direction of from said source of hot water under pressure to said spray nozzle, while preventing flow in the reverse direction.

2. A cleaning apparatus of the character described comprising in combination, a water pipe adapted for connection at one end to a source of hot water under pressure and at its other end to a spray nozzle; a tank containing oil; a water feed pipe extending from said water pipe to the lower portion of said oil tank; means for feeding oil from said tank to said water pipe including a vertical oil feed pipe connected to said water pipe from below and having an oil feeding valve therein, said last named pipe being connected to the top portion of said oil tank; and an adjustable check valve in said water pipe located between the connections of said water feed pipe and said oil feed pipe and constructed to permit the flow of liquid in said water pipe in the direction of from said source of hot water under pressure to said spray nozzle, while preventing flow in the reverse direction.

3. A cleaning apparatus of the character described comprising in combination, a water pipe adapted for connection at one end to a source of hot water under pressure and at its other end to a spray nozzle; a tank containing oil; a water feed pipe extending from said water pipe to the lower portion of said oil tank; means for feeding oil from said tank to said water pipe including a vertical oil feed pipe connected to said water pipe from below and having an oil feeding valve therein, said last named pipe being connected to the top portion of said oil tank; and means in said water pipe located between the connections of said water feed pipe and said oil feed pipe, for decreasing the water pressure in said water pipe whereby the pressure at the point of connection of said oil feed pipe with said water pipe is less than the pressure in said tank.

4. A cleaning apparatus of the character described comprising in combination, a water pipe adapted for connection at one end to a source of hot water under pressure and at its other end to a spray nozzle; a tank containing oil; a water feed pipe extending from said water pipe to the lower portion of said oil tank; means for feeding oil from said tank to said water pipe including a vertical oil feed pipe connected to said water pipe from below and having an oil feeding valve therein, said last named pipe being connected to the top portion of said oil tank; and a check valve located between the connections of said water feed pipe and said oil feed pipe for decreasing the water pressure in said water pipe whereby the pressure at the point of connection of said oil feed pipe with said water feed pipe is less than the pressure in said tank.

5. A cleaning apparatus of the character described comprising in combination, a water pipe adapted for connection at one end to a source of hot water under pressure and at its other end to a spray nozzle; a tank containing oil; a water feed pipe extending from said water pipe to the lower portion of said oil tank; means for feeding oil from said tank to said water pipe including a vertical oil feed pipe connected to said water pipe from below and having an oil feeding valve therein, said last named pipe being connected to the top portion of said oil tank; and a check valve located between the connections of said water feed pipe and said oil feed pipe and constructed to permit the flow of liquid in the direction of toward said nozzle only, and to decrease the water pressure in said water pipe whereby the pressure at the point of connection of said oil feed pipe with said water pipe is less than the pressure in said tank.

6. A cleaning apparatus of the character described comprising a water pipe adapted to be connected at one end to a source of hot water under pressure and at its other end to a spray nozzle, a tank of oil, said water pipe being connected to said oil tank from a point above the bottom of said oil tank, and means for feeding oil from the top of said tank to said water pipe, said last named means comprising a pipe and a trapped air pocket at the top of said tank, the end of said last

named pipe being open and positioned in said trapped air pocket.

7. A cleaning apparatus of the character described comprising a water pipe adapted to be connected at one end to a source of hot water under pressure and at its other end to a spray nozzle, a tank of oil, said water pipe being connected to said oil tank from a point above the bottom of said oil tank, and means for feeding oil from the top of said tank to said water pipe, said last named means comprising a pipe and a trapped air pocket at the top of said tank; the end of said last named pipe being open and positioned in said trapped air pocket, said last named pipe thence extending downwardly, outwardly, and upwardly for connection with said water pipe.

Signed at Chicago, Illinois, this 27th day of August, 1931.

CHARLES F. FITTS.