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O. A. SIMS

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WATER-TREATING APPARATUS

Filed Sept. 12, 1938

3 Sheets-Sheet 1

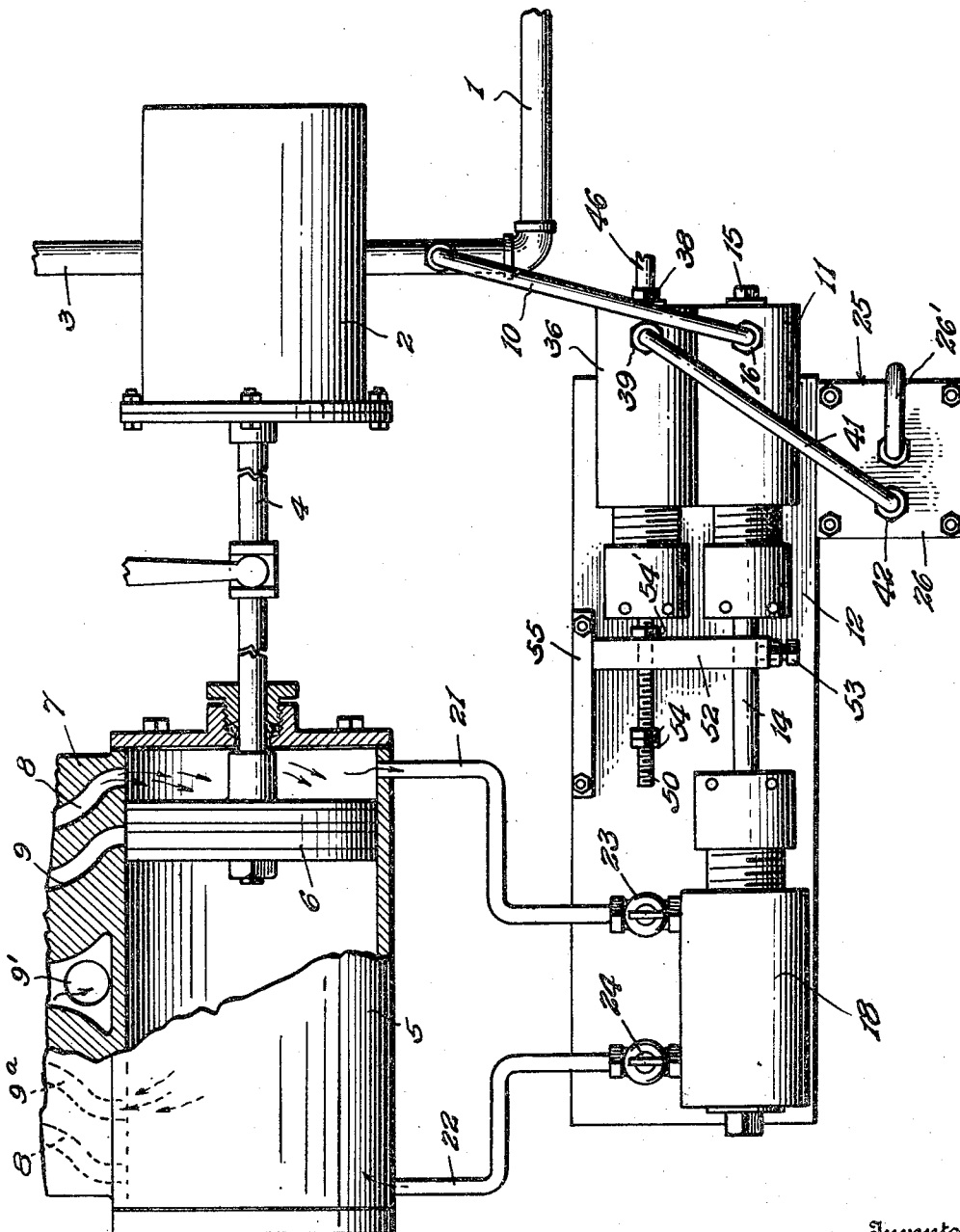


Fig. 1.

Inventor

O. A. Sims.

By

Lacey Lacey

Attorneys

Dec. 2, 1941.

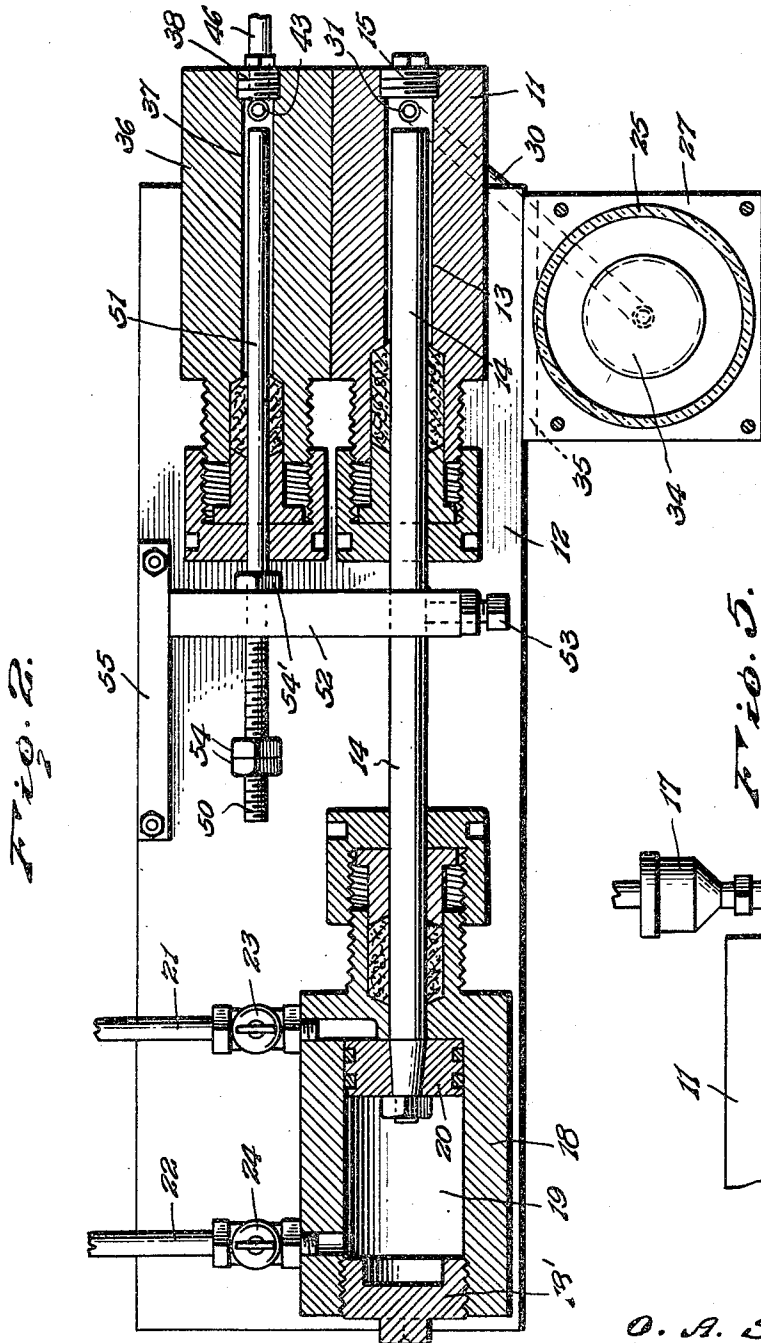
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Inventor

O. A. Sims.

Lacey, Lacey, Attorneys

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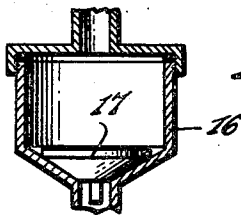
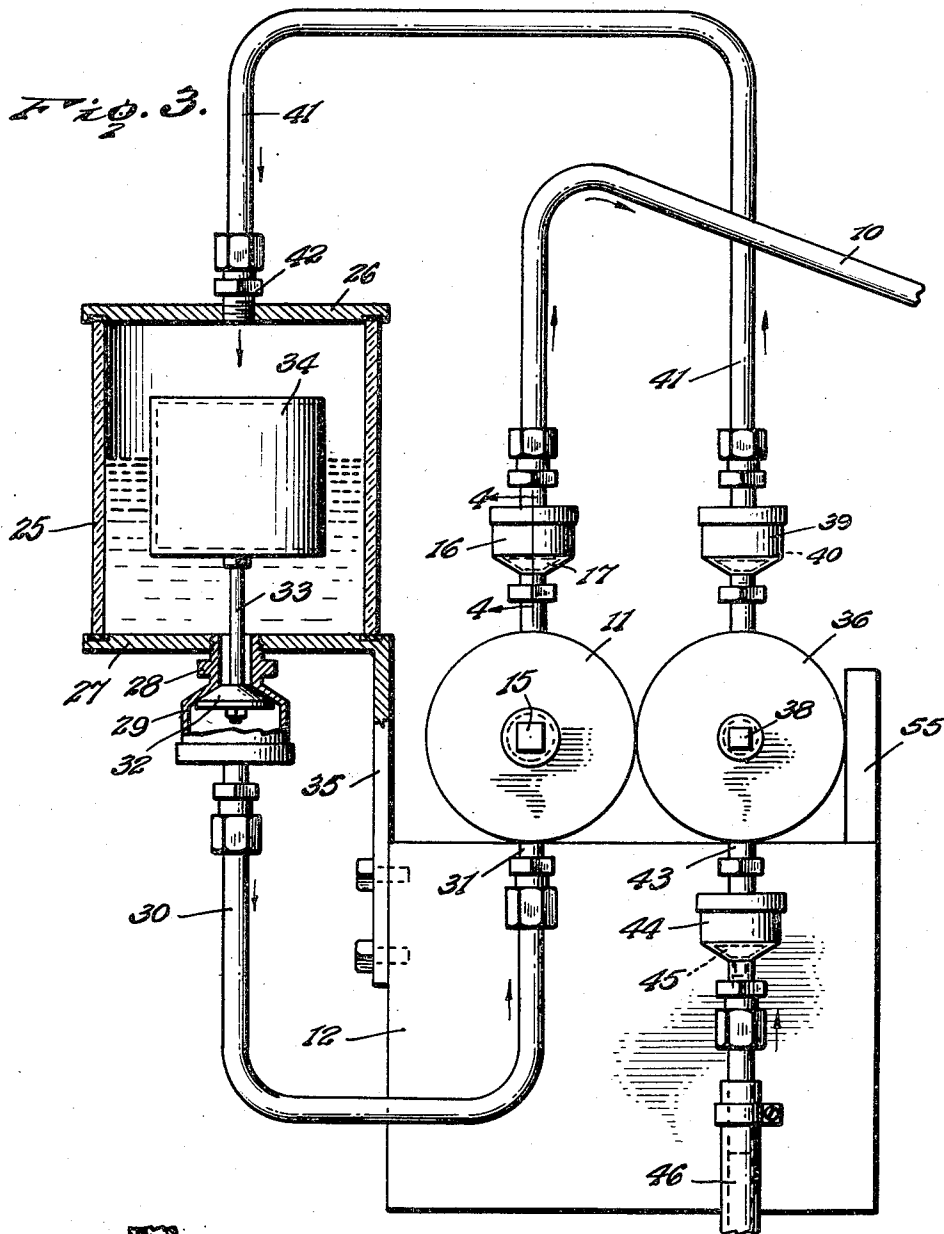
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Inventor

O. A. Sims.

By

Lacey & Lacey,

Attorneys

UNITED STATES PATENT OFFICE

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WATER-TREATING APPARATUS

Olin A. Sims, Beeville, Tex.

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6 Claims. (Cl. 210-40)

This invention relates to a water-treating apparatus and one object of the invention is to provide an apparatus by means of which a modifying liquid may be pumped into water fed to a boiler in such quantity that the proper proportions will be maintained and damage to the boiler by using water not suited prevented.

Another object of the invention is to provide an apparatus of this character wherein the modifying liquid is delivered into a pipe leading to the boiler by means of a pump which is operated in conjunction with the pump by means of which water is forced through the pipe into the boiler. It will thus be seen that the pump for delivering the modifying liquid will always be operated when the main water pump is operated and only at such time and the modifying liquid properly fed to the water.

Another object of the invention is to connect the steam cylinder of the operating unit for the modifying-liquid pump with the steam cylinder driving unit for the water pump so that part of the steam delivered into the cylinder for the operating means of the water pump may flow into the cylinder for the operating means of the modifying-liquid pump and thus assure proper operation of the modifying-liquid pump.

Another object of the invention is to provide an improved reservoir from which modifying liquid is withdrawn during operation of the apparatus, a third pump being provided for replenishing and measuring the supply of modifying liquid delivered to the reservoir and this third pump being so connected with the pump for forcing the modifying liquid into the water pipe that it will be operated during operation of the last-mentioned pump and liquid in the reservoir constantly replenished by measured quantities of liquid during operation of the apparatus.

The invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a general view of the apparatus with portions shown in section.

Figure 2 is a sectional view taken longitudinally through the pump for delivering modifying liquid to the water pipe and replenishing liquid in the reservoir,

Figure 3 is a view showing the pump of Figure 2 in end elevation and the reservoir in vertical section,

Figure 4 is a sectional view taken along the line 4-4 of Figure 3, and

Figure 5 is a fragmentary view in elevation illustrating a modified construction.

This improved apparatus is employed for delivering a modifying liquid into a pipe 1 through which water is delivered from a pump 2 to a boiler. The liquid may serve to soften the water or it may be any other liquid which it is desired to have mixed with the water. While it has been stated that the water is to flow through the pipe 1 to a boiler, it will be understood that use of the apparatus is not limited to a boiler as the water may be delivered to any apparatus or place desired, such, for instance, as a reservoir for a supply of drinking water.

The water is delivered to the pump 2 from a suitable source of supply through a pipe 3, and since the pump is of a conventional reciprocating type including a piston rod 4, the pump has not been illustrated in detail. This piston rod 4 extends into the cylinder 5 of the actuating means for the pump 2 and is connected with the piston 6. Conventional means 7 of the slide valve type is provided for delivering steam into opposite ends of the cylinder 5 through the usual passages 8 to impart reciprocating movement to the piston 6 and the piston rod 4 and this means also includes the usual exhaust passages 9 and 9^a for the steam. It will thus be seen that during operation of the steam-actuated power drive the pump 2 will be operated and water forced through the pipe 1 to the boiler.

The modifying liquid is delivered to the pipe 1 through a pipe 10 leading from a pump 11. This pump 11 is mounted upon a base or foundation block 12 and is provided with a longitudinally extending cylindrical chamber 13 into which extends a plunger 14. The outer end of the pump chamber 13 is closed by a removable plug 15 which is screwed into the end portion of the chamber, as shown in Figure 2. A valve 16 is disposed between the pipe 10 and the discharge opening of the pump 11, and referring to Figure 2, it will be seen that, when the plunger 14 is moved longitudinally of the cylinder 11 in a direction to draw a charge of liquid into the cylindrical chamber 13, suction will hold the closure disk 17 of the valve in its lowered or closed position, whereas movement of the piston during a power stroke will force the liquid up through the valve and through the pipe 10 to the pipe 1. The quantity of liquid delivered through the pipe 10 is controlled in a manner to be hereinafter set forth, and as the pumps 2 and 11 operate in unison the quantity of modifying liquid delivered into the pipe 1 will al-

ways be in proper proportion to the quantity of water delivered into the pipe 1 by the pump 2.

The pump 11 is operated through the medium of a power unit consisting of a cylinder 18 mounted upon the base 12 at the opposite end thereof from the cylinder or pump 11 and in alignment therewith. The plunger 14 extends into the cylindrical chamber 19 of the cylinder 18 and within this chamber carries a piston 20 which is adapted to be reciprocated in the chamber and move the plunger with it. The other end of the chamber 19 is closed by a plug or head 18', and in order to supply steam to the chamber 19 for operating the piston 20, there have been provided pipes 21 and 22 leading from end portions of the cylindrical chamber of the power unit 5. These pipes 21 and 22 are connected with the cylinder 18 by valves 23 and 24 which are manually adjustable in order that the quantity of steam passing through these pipes into the chamber 19 may be controlled. From an inspection of Figures 1 and 2, it will be readily seen that, when steam is admitted into the right-hand end portion of the cylinder 5 to move the piston 6 toward the left, a portion of the steam will flow through the pipe 21 into the chamber 19 and act against the piston 20 to also shift this piston towards the left, the steam exhausting from the left-hand end of the cylinder or chamber 19 back through the pipe 22 into the cylinder 5, and from there, out through the exhaust port 9'. After the two pistons have moved toward the left to the opposite ends of the cylinders 5 and 18, steam is admitted into the cylinder 5 to move the piston 6 towards the right and a portion of this steam will flow through the pipe 22 into the chamber 19 to act upon the piston 20 and shift the piston 20 towards the right, and the steam will be exhausting from the right-hand end of the cylinder or chamber 19 back through the pipe 21 into the cylinder 5, and from there, out through the exhaust port 9'. It will thus be seen that the piston 20 moves in the same direction as the piston 6 and at the same time. Therefore, the pump 11 will be operated simultaneously with the pump 2 and predetermined quantities of modifying liquid will be forced through the pipe 10 into the pipe 1 at the proper time.

The modifying liquid is delivered to the pump 11 from a reservoir or chamber 25. This reservoir is disposed vertically and has transparent annular walls, a metal top 26 provided with an air vent pipe 26' and a bottom 27 formed of metal. An outlet neck 28 is screwed into an opening formed in the bottom 27 and constitutes a portion of the housing of a valve 29 with which is connected a pipe or tube 30 connected with the inlet nipple 31 of the pump 11 so that, during movement of the plunger 14 towards the left in Figure 2 for a suction stroke, a quantity of modifying liquid may be drawn through the pipe 30 and into the chamber 13. The tube 30 is filled with liquid and the receptacle 25 partially filled, as shown in Figure 3. A closure disk 32 is mounted within the valve housing 29 and connected with the lower end of a stem 33 which extends vertically through the neck 28 into the container and at its upper end is secured to the bottom of the float 34. When the plunger 14 makes its suction stroke, it sucks the float controlled valve disk 32 open, thereby taking its full supply of liquid which lowers the float 34 in the reser-

voir and the valve 29 is left standing open as the plunger in the pump 11 completes its suction stroke. When the plunger makes its return or discharge stroke, the liquid flows back through the open float controlled valve 29 until enough liquid has returned to the reservoir to cause the float to close the float controlled valve 29. The remainder of the liquid in the pump, which equals the amount the proportionate pump 36 has just put into the reservoir during its last stroke, is discharged through the discharge valve 16 and through the tube 10 into the boiler-feed pipe line 1. The bottom 27 of the container or receptacle 25 is provided with a depending arm 35 which is secured against a side face of the base 11 and supports the container in its proper position at one side of the base.

The supply of liquid in the container or reservoir 25 must be maintained substantially constant in order that the supply of liquid may be properly delivered to the pump 11. In order to do so, there has been provided a pump 36 mounted upon the base at one side of the pump 11. This pump has a cylindrical chamber 37 corresponding to the chamber 13 and closed at one end by a plug 38. A valve 39 corresponding to the valve 16 is connected with the discharge opening in the upper portion of the pump. This valve is provided with a closure disk 40 corresponding to the closure disk 17. A pipe or tube 41 has one end connected with the housing of the valve 40 and its other end connected with a nipple 42 screwed into an opening formed in the top 26 of the container or reservoir 25 near a side edge thereof, as shown in Figure 1, so that, when the pump 36 is in operation, the liquid may be forced through the pipe or tube 41 and into the container 25 to replenish the liquid and thus maintain a proper supply of liquid in the reservoir. The inlet nipple 43 of the pump 36 has a valve 44 connected with it. This valve 44 is similar in construction to the valve 40 and within the housing of this valve is disposed a closure disk 45 which is adapted to be moved upwardly to an opened position by suction so that liquid may be drawn from a suitable source of supply through a pipe or tube 46.

In Figure 5, there has been shown another way of connecting the pipes with the pumps 11 and 36. In this embodiment of the invention, instead of drilling threaded openings through the annular walls of the cylinders, the plugs 15 and 38 are removed and the nipple 47 of a T-coupling 48 is screwed into each opening. The union 31 of the pipe 30 is engaged with the lower end of the T-coupling of the pump 11 and the discharge valve 16 connected with the upper end of this T-coupling while the T-coupling of the pump 36 has the discharge valve 39 and the suction valve 44 connected with its upper and lower ends. The pipes may, therefore, be connected with the cylinders without forming special openings for receiving them.

The pump 36 is to be operated simultaneously with the pump 11. This pump 36 includes in its construction a plunger 51 extending into the cylindrical chamber 37 of the pump. The outer end portion of the plunger 51 is threaded and loosely passes through a cross-head 52 which is bored to receive the plunger 14 and carries a set screw 53 in order that it may be firmly secured to the plunger 14. Nuts 54 and 54' are carried by the threaded outer end portion of the plunger 51, and from an inspection of Figure 2, it will be readily understood that by properly adjusting the nuts 54 to dispose them in pre-

determined spaced relation to the nut 54' the length of movement imparted to the plunger 51 by the cross-head 52 during movement of the plunger 14 may be controlled. Predetermined quantities of modifying liquid in proper proportion to the quantity of water ejected by the water pump 2 may, therefore, be drawn into the pump 36 from the source of supply and forced therefrom through the pipe 41 into the reservoir to take the place of the liquid discharged by the pump 11 through the pipe 10 into the pipe 1. The level of the liquid in the reservoir will, therefore, be maintained constant and the float valve properly closed as liquid is forced from the pump 11 during a power stroke of the plunger 14. One end of the cross-head bears against a guide secured upon the base and extending longitudinally thereof.

During use of this apparatus, it is installed as shown in Figure 1 and steam or compressed air may be employed to impart reciprocating movement to the piston 6 and reciprocate the piston rod 4 so that the pump 2 will be operated to force water through the pipe 1 into a boiler or wherever it is desired to have the water delivered. The steam or air not only causes the piston 6 to be reciprocated in its cylinder but also causes the piston 20 to be reciprocated in the cylinder of the power unit 18. The piston 20 moves at the same time and in the same direction as the piston 6 and during movement of this piston 20 the plunger 14 will be reciprocated so that it will draw liquid from the receptacle or reservoir 25 through the pipe 30 into the chamber 13 and then force liquid from this cylindrical chamber through the pipe 10 into the pipe 1. Since the plunger 51 passes through the cross-head 52 carried by the plunger 14 and carries adjustable abutment nuts for engaging the cross-head, the pump 36 will be operated simultaneously with the pump 11 but with its plunger making shorter strokes and the plunger 51 will draw predetermined quantities of liquid through the pipe 46 into the chamber 37 and during a discharge stroke force the liquid through the pipe 41 and into the container or reservoir 25 to take the place of the liquid forced through the pipe 10 into the pipe 1. By adjusting the stroke of this piston rod at the cross-head with the nuts 54 on the threaded end of the piston rod 50 this pump will put the correct amount of chemical in the reservoir each stroke to treat the amount of water that the boiler-feed pump delivers into boiler-feed water line during its stroke.

The pump 11 is the pump which draws liquid from the reservoir 25 and the amount of chemical it puts into the boiler-feed line is controlled by the combination float controlled suction and discharge valve. This pump 11 has a larger plunger than the pump 36 and a longer stroke than the plunger 51. Therefore, it will discharge more liquid than the pump 36 could put into the reservoir during its stroke and that is the reason for the combination float controlled suction and discharge valve. As the plunger moves to the left, which is the suction stroke, it sucks its cylinder full of chemical from the reservoir, thereby lowering the float in the reservoir which, in turn, leaves the float controlled valve standing open and on the return or discharge stroke it circulates the liquid back through the pipe 30 and the float controlled valve 29 until enough of the liquid has returned to the reservoir to cause the float to

raise and pull the valve disk 32 closed. The remaining part of the liquid is then discharged into the boiler-feed line. Therefore, it is this combination suction and discharge valve which controls the predetermined level in the reservoir.

Having thus described the invention, what is claimed as new is:

1. In combination with a water pump having a discharge pipe, and operating means for said water pump adapted to be actuated by fluid under pressure; an apparatus for delivering modifying liquid to water discharged from the pump comprising a pump for delivering a modifying liquid into the discharge pipe of the water pump, operating means for the modifying liquid pump adapted to be operated by fluid under pressure, means for conducting fluid under pressure from the operating means for the water pump to the operating means for the modifying-liquid pump, a reservoir for a modifying liquid, said reservoir having an outlet connected with the inlet for the modifying-liquid pump, and means operated simultaneously with the modifying-liquid pump for replenishing the supply of modifying liquid in said reservoir during operation of the modifying-liquid pump.

2. In combination with a water pump having a discharge pipe, and operating means for said water pump, an apparatus for delivering modifying liquid to water discharged from the water pump comprising a reservoir for a modifying liquid, a charging pump having an inlet connected with the reservoir and an outlet pipe connected with the discharge pipe of the water pump, said charging pump having a force plunger, operating means for said charging pump, means whereby said operating means will be actuated simultaneously with the operating means for the water pump and in timed relation thereto, and a supply pump having an inlet for receiving modifying liquid from a source of supply and a discharge pipe connected with the reservoir, the supply pump having a force plunger connected with the force plunger of the charging pump and actuated therefrom whereby the supply pump will be operated simultaneously with the charging pump and in timed relation thereto.

3. In combination with a water pump having a discharge pipe and including a piston rod; apparatus for delivering modifying liquid to water comprising a delivery pump having an outlet pipe connected with the discharge pipe of the water pump and including in its construction a reciprocating force plunger, a second pump, a reservoir for a modifying liquid having an outlet pipe connected with the inlet of the second pump, a float valve for controlling flow of liquid back through the outlet pipe, operating means for the water pump adapted to be actuated by fluid under pressure and including a cylinder receiving the piston rod of the water pump and having fluid inlets at its end, a piston in the cylinder carried by the piston rod of the water pump, operating means for the delivery pump including a cylinder receiving the force plunger of the delivery pump and having fluid inlets at its end, pipes extending from end portions of the cylinder of the operating means for the water pump to the inlets of the cylinder of the operating means for the delivery pump, a piston in the cylinder of the operating means for the delivery pump carried by the piston rod extending therein, a replenishing pump having an inlet for receiving modifying

liquid from a source of supply and having a discharge pipe leading to the reservoir, a force plunger for the replenishing pump, and a cross-head extending from the piston of the delivery pump and slidably surrounding the plunger of the replenishing pump, adjustable abutments carried by the plunger of the replenishing pump for engaging the cross-head whereby the replenishing pump will be actuated from the piston rod of the delivery pump, and a predetermined quantity of modifying liquid pumped into the reservoir to compensate for liquid withdrawn from the reservoir by the delivery pump.

4. In an apparatus of the character described, a water pump having a discharge pipe, fluid actuated operating means for said water pump, a reservoir for a modifying liquid, a delivery pump having an inlet connected with said reservoir and a discharge pipe leading to the discharge pipe of the water pump, the delivery pump including a piston rod, operating means for the delivery pump operatively associated with the piston rod thereof and adapted to be actuated by pressure received from the operating means of the water pump, means for leading pressure from the operating means of the water pump to said operating means for the delivery pump, a replenishing pump including a piston rod and having an inlet to receive modifying liquid from a source of supply and a discharge pipe leading to said reservoir, a cross-head carried by the piston rod of the delivery pump and extending laterally therefrom and formed with an opening through which the piston rod of the replenishing pump extends, abutments adjustably carried by the piston rod of the replenishing pump for engaging said cross-head, and means for securing the cross-head in a set position upon the piston rod of the delivery pump.

5. In combination with a water pump having a discharge pipe, and actuating means for the water pump operated by fluid under pressure; apparatus for delivering modifying liquid comprising a reservoir for a modifying liquid, a delivery pump, a pipe for conducting liquid from the reservoir to the inlet of the delivery pump, a valve in said last mentioned pipe, said reservoir including a housing and a closure disk in the housing, a float in said reservoir having a stem ex-

tending downwardly therefrom and connected with the closure disk of said valve, a discharge pipe for delivering liquid from the delivery pump to the discharge pipe of the water pump, a check valve for said second mentioned discharge pipe opening in the direction of the water pump, actuating means for the delivery pump operated by fluid under pressure from the actuating means for the water pump, means for leading fluid under pressure to the actuating means for the water pump, means for leading fluid under pressure to the actuating means for the delivery pump, and a replenishing pump operated by the means for operating the delivery pump and having an inlet for receiving modifying liquid from a source of supply and a discharge pipe leading to the upper portion of the reservoir and having a check valve opening toward the reservoir.

6. In combination with a water pump having a discharge pipe and including a piston rod, operating means for the pump including a cylinder slidably receiving said piston rod through one end and having inlet and exhaust ports for fluid under pressure, and a piston in said cylinder carried by said piston rod; apparatus for delivering modifying liquid to water discharged by said water pump comprising a delivery pump having a discharge pipe leading to the discharge pipe of the water pump and including in its construction a reciprocating force plunger, a reservoir for a modifying liquid having an outlet pipe leading to the inlet of the delivery pump, a float valve for controlling flow of liquid back through the outlet pipe, operating means for the delivery pump including a cylinder slidably receiving the said force plunger, a piston in the last mentioned cylinder carried by the force plunger, pipes connecting ends of the said last mentioned cylinder with ends of the cylinder of the operating means for the water pump, a replenishing pump having a discharge pipe leading to said reservoir and an inlet for receiving modifying liquid from a source of supply, a suction valve connected with the inlet of the replenishing pump, a force plunger for the replenishing pump, and actuating means for the force plunger of the replenishing pump carried by the force plunger of the delivery pump.

OLIN A. SIMS.