April 18, 1939. G. RAYMOND 2,154,529

CHEMICAL FEEDER AND SAMPLER

Filed Dec. 19, 1936 2 Sheets-Sheet 1

Fig. 1.

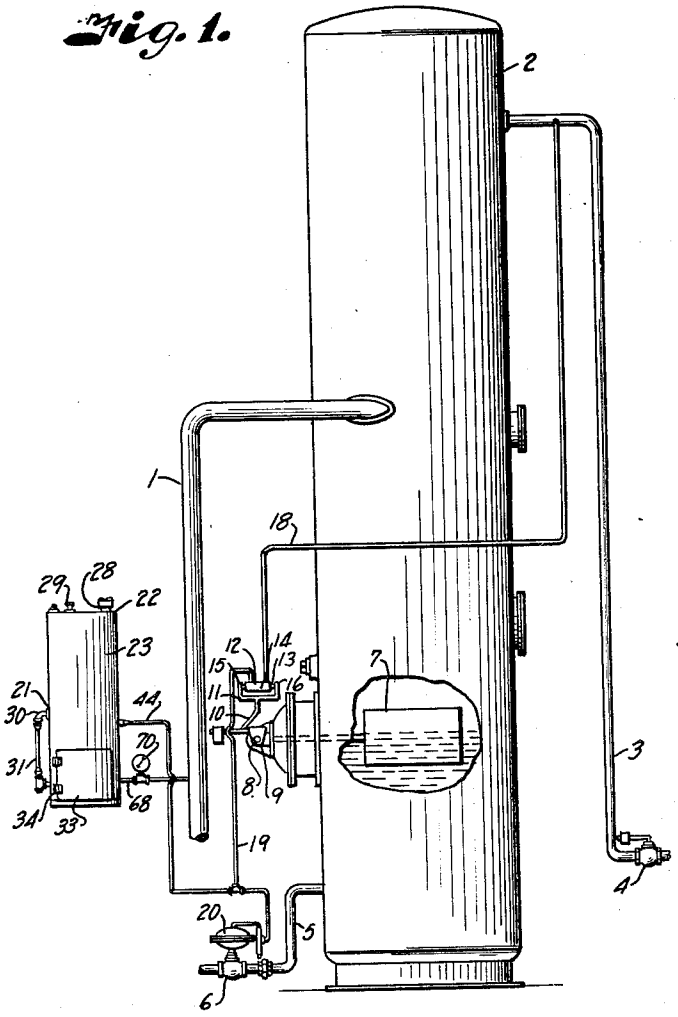

Fig. 2.

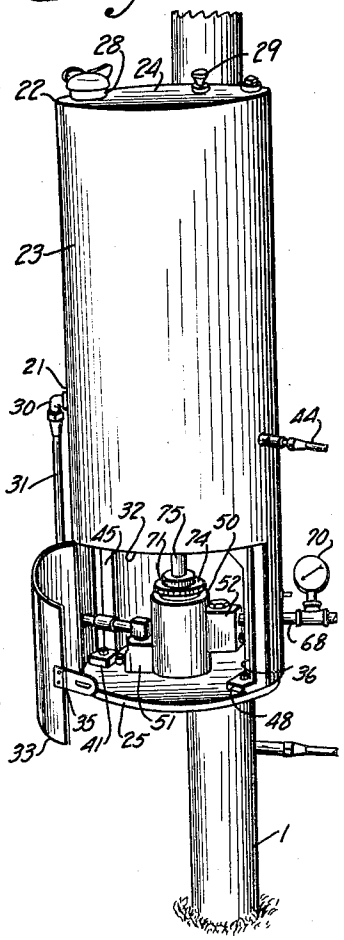

Fig. 3.

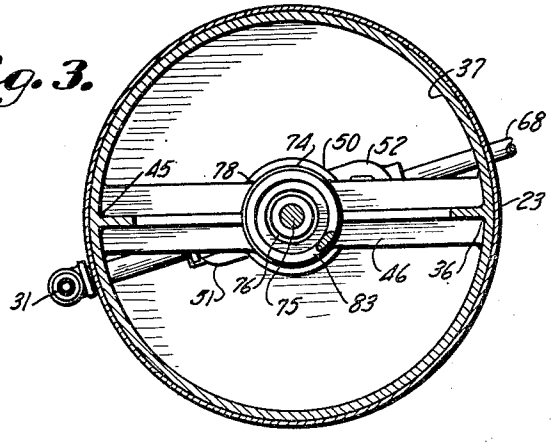

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Fig. 4.

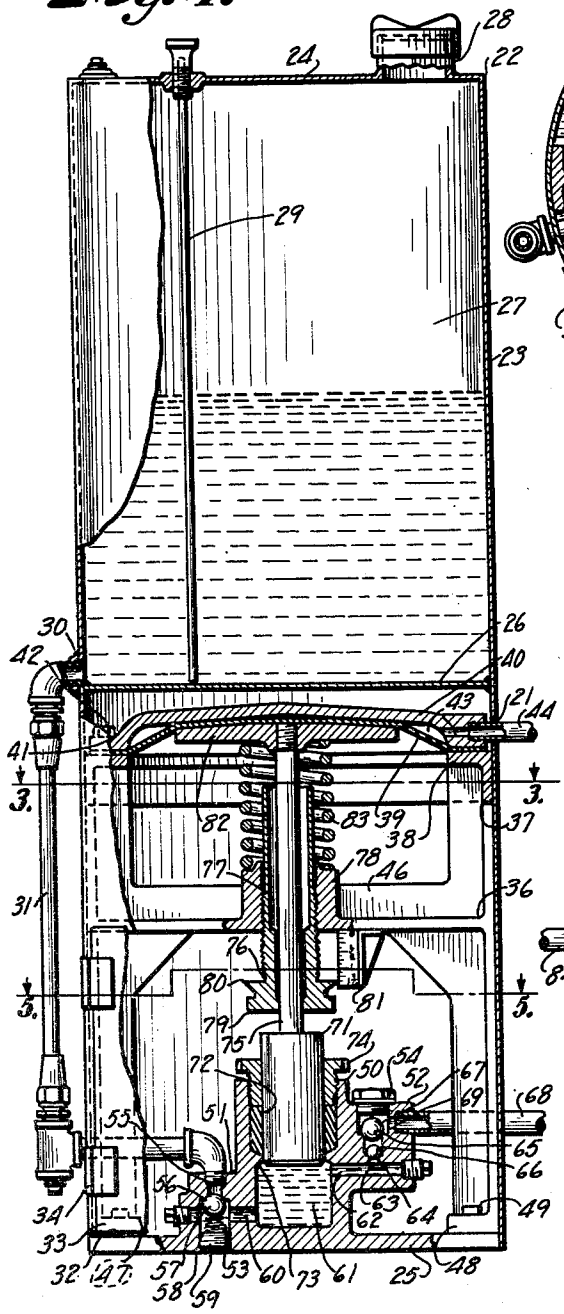


Fig. 5.

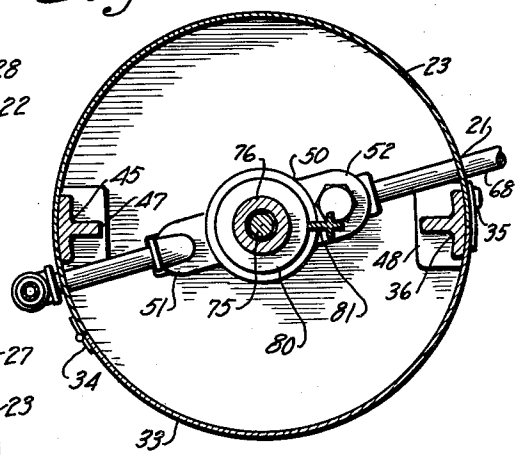
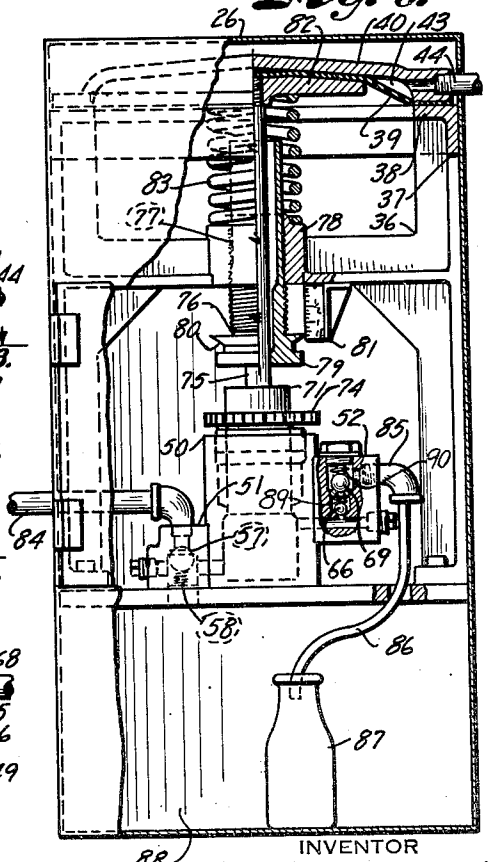


Fig. 6.



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UNITED STATES PATENT OFFICE

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CHEMICAL FEEDER AND SAMPLER

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13 Claims. (Cl. 137—165)

This invention relates to a pumping apparatus operable incidental to movement of liquid in flow line systems; for example, the discharge of liquid from a liquid and gas separating system, the principal object of the present invention being to provide a pumping apparatus of this character adapted for actuation responsive to intermittent or periodic flow of liquid in or from the system.

Other important objects of the invention are to provide a pumping apparatus that is readily connected to a flow system, to provide for automatic operation of the apparatus responsive to control of mechanism establishing intermittent or periodic flow, and to provide means for regulating a pumping apparatus for moving a predetermined quantity of material at each flow period.

Other important objects of the invention are to provide an apparatus of this character for effecting automatic feed of a chemical into the liquid treated in a separator, and to provide an apparatus which may be used for removing samples of liquid discharged from a separator or similar vessel.

In accomplishing these and other objects of the invention I have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is an elevational view of a liquid and gas separator equipped with a pumping apparatus embodying the features of the present invention and arranged for feeding a chemical into the flow line leading to the separator.

Fig. 2 is an enlarged perspective view of the chemical tank and housing enclosing the pumping apparatus and showing the door of the pumping compartment in open position.

Fig. 3 is a horizontal cross section of the pump housing on the line 3—3, Fig. 4.

Fig. 4 is a vertical section through the chemical compartment, the pump compartment, and the pumping apparatus enclosed therein.

Fig. 5 is a horizontal section on the line 5—5, Fig. 4.

Fig. 6 is an elevational view of a modified form of the invention, a part of which is shown in vertical section.

Referring more in detail to the drawings:

In the form of the invention illustrated in Figs. 1 to 5, inclusive, 1 designates a flow line for conducting a stream of liquid, for example, oil and gas, to a separator 2, wherein the gas is separated from the oil and discharged through a flow line 3 under control of a pressure regulating valve 4. The separated oil and liquid collect in the bottom of the separator for discharge through a flow line 5 upon actuation of a master valve 6, the actuation of which is controlled by a float 7 operable on the level of liquid collecting in the separator. The float 7 includes an actuating shaft 8 extending through a suitable stuffing box 9 in the side of the separator, and which carries a lever 10 having a yoke-shaped head 11 thereon to operate a pilot valve 12. The pilot valve 12 is of standard construction and is actuated by a rod 13 having its end projecting from the valve housing 14 to be respectively engaged by the terminals 15 and 16 of the head 11. The inlet of the pilot valve is connected with a source of pressure medium, such as the gas discharged through the flow line 3 by means of a conduit 18, as clearly shown in Fig. 1.

The outlet of the pilot valve is connected by a conduit 19 with a pressure chamber 20 having mechanism for effecting opening of the master valve 6 when the float has reached a predetermined height in the separator. Upon opening of the master valve the liquid flows from the separator until the float has reached a point to effect closure of the pilot valve, thereby cutting off supply of pressure medium to the master valve and effecting its closure until a sufficient body of liquid has again collected in the separator, whereupon another charge of liquid will be delivered from the separator.

It is thus obvious that the flow of liquid from the separator is intermittent and timed in accordance with the rate at which the liquid collects in the separator.

The construction thus far described is conventional of an oil and gas separator and specifically forms no part of the present invention which has to do with the association therewith of a pumping apparatus generally designated 21, and which is operated simultaneously with operation of the master valve, and responsive to opening of the float controlled pilot valve.

The pumping apparatus includes a shell 22 illustrated as comprising a cylindrical wall 23, heads 24 and 25, and an intermediate partition 26, the partition 26 cooperating with the side wall and head 24 to form a compartment 27 adapted to contain a chemical material for delivery to the liquid being admitted through the flow line 1 upon actuation of pumping apparatus that is contained in the portion of the housing between the partition 26 and the head 25. The head 24 carries a filler neck 28 wherethrough chemical is inserted into the compartment, and a gauge rod 29 wherewith the amount of chemical in the

compartment may be ascertained. The lower end of the compartment 27 is provided with an outlet 30 to which is connected a conduit 31 leading into the pump compartment of the shell.

The side wall of the housing is provided with a door opening 32 wherethrough access is had to the interior of the pump compartment and which is normally closed by a door 33, the door being hinged at one edge of the opening, as indicated at 34, and secured at the opposite side by a suitable hasp and staple, as indicated at 35.

Inset within the pump compartment is a frame 36, including an annular ring 37 having an inwardly extending lateral flange 38 forming a seat for the periphery of a flexible diaphragm 39. Extending over the diaphragm is a plate 40 having an offset annular flange 41 which is clamped against the diaphragm by fastening devices, such as bolts 42, extending through the flange 41, through the diaphragm and into the flange 38. The plate 40 thus cooperates with the diaphragm to form a pressure chamber 43 to which a pressure medium is supplied through a conduit 44 having connection with the conduit 19 previously described. Therefore when pressure medium is admitted to the actuated master valve 6 pressure medium is also admitted through the conduit 44 into the pressure chamber 43 to effect movement of the diaphragm downwardly from the plate 40, for a purpose later described.

The frame 36 includes vertical leg portions 45 depending from the ring 37 and connected above the door opening 32 by a cross bar 46. The lower ends of the leg portions terminate in inwardly extending feet 47 and 48 to which the lower head 25 is secured by fastening devices, such as bolts 49, as best shown in Fig. 4. Supported on the head 25 is a pump cylinder 50 having laterally extending bosses 51 and 52, in which are provided inlet and outlet chambers 53 and 54, respectively. The inlet chamber 53 is connected with the conduit 31 through a port 55 encircled by a seat 56 seating a ball valve 57 that is normally retained against the seat by a coil spring 58 bearing against the valve and against a threaded plug 59 closing the lower end of the valve chamber. The inlet chamber connects with the pump cylinder through a port 60 so that chemical from the compartment 27 may flow through the conduit 31 and past the valve 57 into the valve chamber and through the port 60 into the cylinder chamber 61.

The outlet chamber 54 connects with the cylinder chamber 61 through channels 62 and 63, the latter channel being provided with spaced differentially sized valve seats 64 and 65 for seating ball valves 66 and 67 adapted to prevent back flow of chemical from the outlet valve to the cylinder chamber. The outlet chamber is also connected with a discharge pipe 68 through a port 69. In the illustrated instance the pipe 68 is connected with the inlet line 1 leading to the separator, the pipe 68 being provided with a pressure gauge 70.

Reciprocable in the cylinder chamber 61 is a piston 71, slidable through a packing ring 72 having its lower end seated against an internally extending flange 73 formed just above the cylinder chamber, the packing being compressed in sealing engagement with the piston by a packing nut 74 threaded in the cylinder and bearing against the opposite end of the packing ring, as clearly shown in Fig. 4.

The piston is connected with an actuating rod 75 extending upwardly through an adjusting sleeve 76 that is threaded within the opening 77 of a boss 78 on the cross bar 46. The lower end of the sleeve is of suitable diameter to provide guiding support for the piston rod, and carries a head 79 provided with an annular tapered flange forming a marker 80, movable relatively to a scale 81 dependingly supported from the bar 46. The upper end of the rod carries a disk-shaped plate 82 arranged to bear directly against the diaphragm responsive to a coil spring 83 having one end bearing against the plate and its opposite end against the boss 78, so that the diaphragm and piston 71 are normally retained in retractive position. The sleeve 76 extends above the boss 78 and is arranged to provide a stop for the disk-shaped plate 82 to thereby limit the stroke of the piston 71 when it is operated by the diaphragm.

It is thus obvious that the stroke of the piston may be adjusted so as to regulate the displacement thereof by manipulating the sleeve 77 with the marker 80 according to the scale 81 to effect displacement of specified amounts of chemical from the cylinder chamber upon each stroke of the piston.

The operation of the apparatus constructed and assembled as described is as follows:

Oil and gas to be separated may be discharged directly from the well through the flow line 1 into the separator where the gas is separated and discharged through pipe 3 under control of the pressure regulator 4 so that a predetermined gas pressure is maintained in the separator to effect expulsion of the liquid collected in the bottom of the separator. As the liquid collects in the separator the float rises until the arm 11 is in position to open the pilot valve 14, whereupon gas is admitted through the pipes 18 and 19 to the master valve, and through the pipe 44 to the diaphragm chamber 43. When pressure is admitted to the master valve 20 the master valve is opened to allow discharge of liquid from the separator until the float drops an amount sufficient to effect closing of the pilot valve, whereupon pressure supplied to the master valve and diaphragm chambers 20 and 43 is suspended and the chambers are vented to atmosphere through the pilot valve.

Owing to the hydrostatic head of the chemical in the compartment 27 and to the suction produced by the upstroke of the piston 71, the cylinder chamber 61 is kept full of chemical so that when pressure is admitted to the diaphragm chamber 43 the diaphragm is moved downwardly against action of the spring 83 to force the piston against the chemical collecting in the cylinder chamber to displace it through the outlet valves and pipe 68 to into the oil and gas stream being admitted to the separator through the line 1.

It is obvious that the amount of chemical admitted at each operation of the piston may be regulated by adjusting the position of the sleeve 76 so that a definite amount of chemical is injected into the line 1 whenever the master valve is actuated to discharge liquid from the separator. When the liquid has been discharged from the separator and the pilot valve moved to closed position for venting the diaphragm chambers, the spring 83 becomes effective to move the piston 71 to retractive position, thereby drawing in another charge of chemical to the cylinder ready to be replaced whenever another slug of liquid is discharged from the separator.

In Fig. 6 I have illustrated a modified form of a pumping apparatus wherein the chemical tank is omitted and the supply pipe 84 for the pump is adapted for connection with the liquid discharge line of a separator and the outlet 85 for

the pump is connected with a line 86 leading to a receptacle 87 carried in a compartment 88 provided at the bottom of the pump compartment. The remainder of the apparatus illustrated in Fig. 6 is similar to the form of pumping apparatus illustrated in Fig. 4 and the same numerals designating the corresponding parts are applicable thereto.

With this construction the pump operates upon each actuation of the master valve to discharge into the receptacle 87 a predetermined quantity or sample of the liquid in the separator. As the pressure in the separator may be considerably above atmosphere, the pump when acting as a sampler is working "down hill", i. e. the pressure of the intake is higher than that of the discharge. To prevent the liquids "blowing through", springs are used back of the balls 66 and 67 of sufficient tension to make the discharge pressure higher than the intake pressure.

From the foregoing it is obvious that I have provided a pumping apparatus that is operated incidental to intermittent flow of liquid and which may be used for injecting a chemical into the liquid, or for taking measured samples of the liquid simultaneously with each intermittent flow.

It is also apparent that the amount of fluid moved by the pump is proportional to the amount delivered from the separator under control of the float so that an accurate amount of chemical may be injected in the instance of the invention illustrated in Figs. 1 to 5 inclusive, or proportionate amounts of liquid may be withdrawn from the line for sampling purposes.

What I claim and desire to secure by Letters Patent is:

1. In combination with a vessel, float actuated means for effecting intermittent discharge of predetermined quantities of liquid from the vessel responsive to rise and fall of liquid in the vessel, a pumping apparatus for effecting flow of a fluid, operating means connecting said float actuated means with the pumping apparatus, and means for regulating fluid displacement of the pumping apparatus for effecting flow of said fluid proportionately to the volumetric discharge of said liquid.

2. In combination with a vessel, float actuated means for effecting intermittent discharge of predetermined quantities of liquid from the vessel, a pumping apparatus for effecting flow of a fluid, operating means connecting said float actuated means with the pumping apparatus, means for regulating fluid displacement of the pumping apparatus for effecting flow of said fluid in proportion to the volumetric discharge of said liquid, and means for injecting the fluid into said liquid.

3. In combination with a vessel, float actuated means for effecting intermittent discharge of predetermined quantities of liquid from the vessel, a pumping apparatus including a cylinder having inlet and outlet connections, a piston in the cylinder for drawing fluid into the cylinder through the inlet connection and discharging said fluid through the outlet connection, a pressure actuated disphragm, means connecting said diaphragm with the piston, and means for admitting an actuating fluid to act on said diaphragm responsive to actuation of said float actuated means.

4. In combination with a liquid and gas separator including, means for conducting flow of liquid to the separator, means for effecting intermittent flow of liquid from the separator, a pumping apparatus for effecting flow of a fluid, operating means connecting said intermittent flow effecting means with the pumping apparatus, gas supply means connecting the separator with the operating means for actuating the pumping apparatus, means for regulating displacement of the pumping apparatus for effecting flow of said fluid intermittently with flow of said liquid from the separator, and means for introducing said fluid into the liquid.

5. In combination with a liquid and gas separator, a flow line connected with the separator for conducting the fluid to be treated in the separator, means for effecting intermittent flow of liquid from the separator, a pumping apparatus for effecting discharge of a chemical material, operating means connecting said intermittent flow effecting means with the pumping apparatus, and means connecting the pumping apparatus with said flow line for injecting said material into the fluid delivered to the separator.

6. In combination with an oil and gas sparator, a flow line connected with the separator for conducting the flow of fluid to be treated in the separator, means for effecting intermittent flow of liquid from the separator, a pumping apparatus for effecting discharge of a chemical material, operating means connecting said intermittent flow effecting means with the pumping apparatus, means connecting the pumping apparatus with said flow line for injecting said material into the fluid delivered to the separator, and means for controlling the pumping apparatus for regulating the amount of material injected.

7. In combination with a liquid and gas separator, a flow line connected with the separator for conducting the fluid to be treated in the separator, means for effecting intermittent flow of liquid from the separator, a pumping apparatus for effecting discharge of a chemical material, operating means connecting said intermittent flow effecting means with the pumping apparatus, means connecting the pumping apparatus with said flow line for injecting said material into the fluid delivered to the separator, and means for regulating displacement of the pumping apparatus for effecting discharge of said chemical material in proportion to the volumetric discharge of said liquid from the separator.

8. In combination with a liquid and gas separator, a flow line for delivering a fluid to be treated in the separator, means for effecting intermittent flow of separated liquid from the separator, means for introducing a chemical material into the fluid delivered to the separator, and means responsive to intermittent flow of liquid from the separator for rendering said chemical material introducing means effective.

9. In combination with a liquid and gas separator, means for delivering a liquid to be treated to the separator, a valve connected with the separator for controlling flow of liquid from the separator, means for actuating said valve responsive to predetermined volume of liquid on the separator side of said valve, a pumping apparatus for delivering a definite amount of chemical material to the liquid, and means connecting said valve actuating means with the pumping apparatus to render the pumping apparatus effective simultaneous with actuation of said valve.

10. In combination with a liquid and gas separator, means for delivering a liquid to be treated to the separator, a valve connected with the separator for controlling flow of liquid from the separator, pressure actuated means for operating

the valve, means for supplying pressure medium to said pressure actuated means responsive to predetermined volume of liquid on the separator side of said valve, a pump for delivering a definite amount of chemical to the liquid, a pressure actuated diaphragm for operating the pump, and means for delivering a part of said pressure medium to operate said diaphragm.

11. In combination with a liquid and gas separator, means for delivering a liquid to be treated to the separator, a valve connected with the separator for controlling flow of liquid from the separator, pressure actuated means for operating the valve, means for supplying pressure medium to said pressure actuated means responsive to predetermined volume of liquid on the separator side of said valve, a pump for delivering a definite amount of chemical to the liquid, a pressure actuated diaphragm for operating the pump, means for delivering a part of said pressure medium to operate said diaphragm, and means for regulating the pump to vary the amount of chemical delivered to the liquid.

12. In combination with means for conducting flow of a liquid, means for effecting discharge of predetermined quantities of the liquid, a pump apparatus for introducing a fluid into said liquid, a pressure medium supply for the pumping apparatus separate from said liquid, a pilot valve for controlling flow of pressure medium to the pumping apparatus, and means connecting the pilot valve with said discharge means whereby said pumping apparatus is actuated responsive to actuation of said discharge means.

13. In combination with means for conducting flow of a liquid, a chemical pumping apparatus having a chemical inlet connected with a chemical supply and an outlet connected with said flow conducting means for drawing chemical from the inlet connection and discharging said chemical through the outlet connection to said flow conducting means, a diaphragm actuator, means operatively connecting the diaphragm actuator with the pumping apparatus, a normally closed valve in said flow conducting means, means in said flow conducting means movable responsive to a predetermined accumulation of flow in said conducting means by said valve, a diaphragm actuator operatively connected with the valve to open said valve and effect discharge of said accumulation, a pilot valve having a pressure fluid inlet and a pressure fluid outlet controlled by said movable means, and a fluid conducting line connecting the outlet of the pilot valve with said diaphragm actuators to effect actuation of said pump and said pilot valve.

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