

April 28, 1959

A. S. MARKEN

2,884,067

APPARATUS FOR TREATING WELLS

Filed Aug. 14, 1956

Fig. 1.

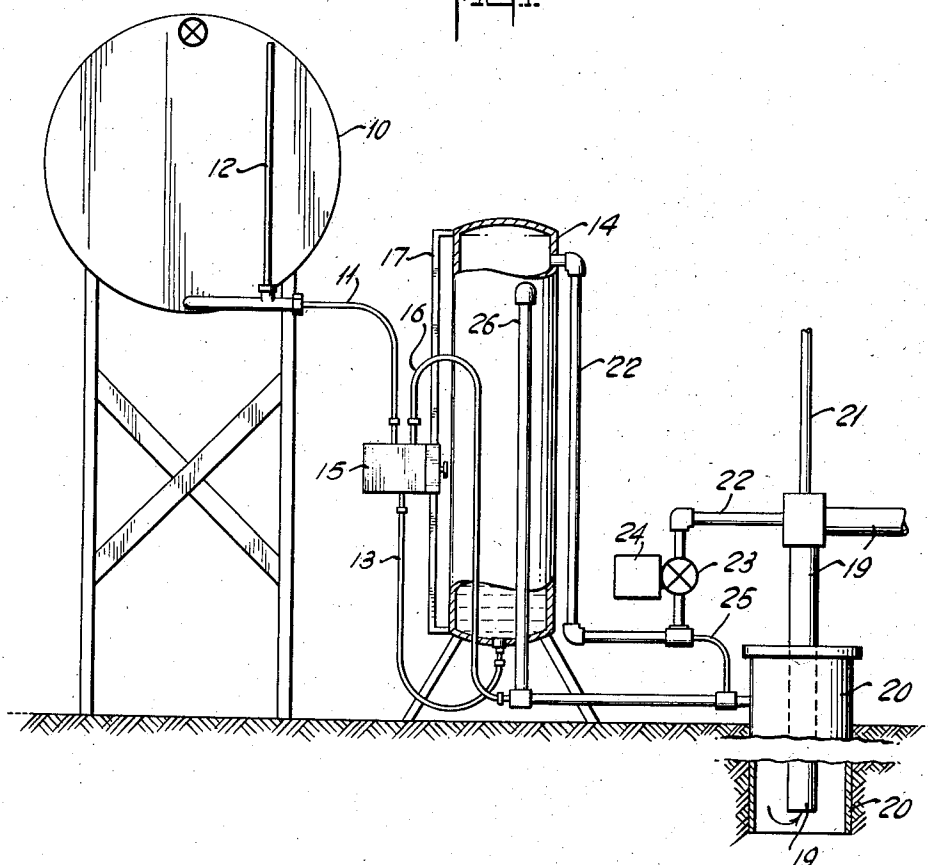
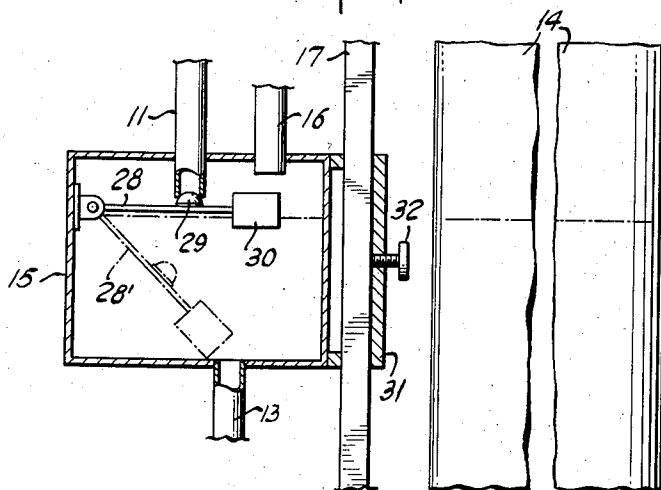


Fig. 2.



1

2,884,067

APPARATUS FOR TREATING WELLS

Alden S. Marken, Great Bend, Kans., assignor to The Texas Company, New York, N.Y., a corporation of Delaware

Application August 14, 1956, Serial No. 604,014

12 Claims. (Cl. 166—75)

This invention relates to apparatus for automatically feeding an accurately measured quantity of liquid periodically to a consumer thereof. More particularly it concerns apparatus for treating a well, such as a producing oil well, and is specifically directed to a liquid handling device for introducing predetermined amounts of a liquid corrosion inhibitor, solvent or the like into a producing well.

Oil well producing equipment is subjected to a wide range of corrosion conditions which cause serious deterioration of equipment. Particularly severe corrosion conditions are encountered within the casing of oil wells, which conditions have markedly adverse effects on the steel producing lines. One method of relieving this condition is to introduce liquid corrosion inhibiting agents into the annulus formed between the flow tube and the well casing, the agents then flowing to the bottom of the well and being carried up the flow tube with the well fluid.

The corrosion inhibiting agents employed for treating wells are often toxic materials and represent a health hazard to the persons who come in contact with them. It is highly desirable, therefore, that means be developed for introducing the treating agent into the well while reducing or eliminating contact between the agent and the personnel handling same.

The volume of corrosion inhibitor normally used to treat a well is small. Amounts in the range of one or two quarts up to about two gallons are generally employed. Since the quantity of the corrosion inhibiting liquid is small, it is frequently necessary that auxiliary fluids be employed to flush the corrosion inhibitor into the well and to insure adequate distribution and circulation of the inhibitor over the surfaces to be protected.

In treating a well, a predetermined volume of the inhibitor is introduced into the well at regulated intervals of time. Depending on the severity of the conditions to be alleviated, the inhibitor may be introduced into the well on a weekly, semi-weekly or on a more frequent schedule. The actual treating period during which the inhibitor is introduced and circulated in the well may be of short duration, for example 15 minutes, or it may be of relatively long duration, say four hours or more. It will be seen that the treatment of wells with corrosion inhibitors can be an expensive and time consuming operation. The device of this invention, which meters the treating liquid and which introduces it into the well with the aid of an auxiliary flushing and circulating agent and which may perform these operations automatically or semi-automatically, very substantially reduces the problems and time required for properly treating a producing well.

The device of this invention operates, in combination, with a well having a well tubing through which a well fluid is being produced, and a casing surrounding the well tubing. In accordance with the invention, a liquid reservoir and a dispensing tank are inter-connected by a supply line through a liquid level control means. The

2

dispensing tank is also connected to the annulus in the well casing by a siphon connected from the liquid level control means. Under static conditions, the tank will contain a metered amount of liquid as determined by the liquid level control means. The level of this liquid, as determined by the control means, will be below the point at which the siphon can be primed. A valved line connects the well tubing with the dispensing tank. The device is set into operation by opening the valve in this latter line. Back pressure from the well tubing forces oil or other well liquids into the dispensing tank where they mix with the inhibitor thereby raising the level of the liquid therein above the top of the siphon. Raising the liquid level in this tank primes the siphon and causes the tank liquid to be discharged into the annulus of the well casing.

The discharge of liquids is stopped by closing the valve on the line between the well tubing and the dispensing tank. The liquid remaining in the dispensing tank then is almost completely removed by siphon action to end the discharge cycle. At this point, the liquid level control means on the tank opens a valve on the supply line and meters a new charge of liquid from the reservoir into the dispensing tank.

The device of this invention is illustrated by the accompanying drawing in which,

Figure 1 is a side elevational view, partly cut away and in section, of the complete device connected to a well, and

Figure 2 is a sectional view of one form of the liquid level control means.

In Figure 1, reference numeral 10 represents a reservoir which may be any kind of vessel, such as an oil drum or the like. Usually reservoir 10 is positioned above tank 14 to permit gravity flow of liquid into the tank, but the liquid also may be pumped if desired. Supply line 11 runs from reservoir 10 to the top of liquid level control means 15 which is connected to the bottom of dispensing tank 14 by a line 13. Glass tube 12, mounted on supply line 11 indicates the volume of liquid contained in the reservoir.

Liquid level control means 15 may be any suitable mechanism for controlling the amount of liquid entering tank 14. Desirably, control means 15 is an automatic float control means which is actuated by the height of the liquid therein corresponding to the level in the dispensing tank 14. Thus, when the liquid in the tank reaches the level of the control means 15, the float mechanism in control means 15 is caused to close supply line 11 thereby preventing any additional liquid from entering the tank.

Tank 14 is connected with the well annulus within well casing 20 by lines 13 and 16 through liquid level control means 15. Line 16 is the upper part of the siphon and line 13 forms a part of the siphon during the discharge cycle.

Line 22 connects well tubing 19 with tank 14 through valve 23. Valve 23 may be an automatically controlled or manually operated valve. Desirably, an automatic actuating and timing mechanism 24 is associated with valve 23 in order to regulate the initiation, timing, and completion of the flushing cycle and also the duration of time between subsequent flushing cycles. Drain line 25 serves to drain line 22 when valve 23 is closed. Line 26 which connects the upper portion of tank 14 with a lower portion of line 16 is merely an overflow line to discharge any excess well fluids entering tank 14. Reference numeral 21 refers to a pumping rod (sucker rod).

A vertical bracket 17, located on the side of tank 14, supports the liquid level control means 15. This bracket may be graduated to indicate the capacity of the tank at various levels. In a preferable form of the device, con-

trol means 15 is adapted to be moved up or down bracket 17 at will and to be set at a height which will determine the volume of liquid entering tank 14.

One suitable way to adjust the height of the control means 15 is by resetting thumbscrew 32, shown in Figure 2, which passes through a bracket 31 and frictionally engages bracket 17. To permit such adjustment, lines 11, 13, and 16 should comprise flexible tubing.

Figure 2 is a vertical section of one form of liquid level control means 15. Supply line 11, connecting line 13, and siphon line 16 are shown connected to this control means. A preferred form of the control means is an automatic float control. In the illustration, arm 28 is a part of the float mechanism carrying float 30. Valve 29 is mounted on arm 28 and serves to open and close the outlet of supply line 11.

In a typical operation of the invention when tank 14 is empty, the chamber in the float control means 15 is also empty. Under these conditions, arm 28 falls to the position indicated at 28'. This opens the supply line orifice and permits liquid from the reservoir to enter into the tank. As the liquid rises in the tank to the level of the float control chamber 15, float 30 causes arm 28 to rise with the result that valve 29 shuts off the outlet of supply line 11. Tank 14 is now ready to dispense the liquid inhibitor into the well annulus within well casing 20. The dispensing of the inhibitor liquid is accomplished by the automatic opening of valve 23 by actuating and timing mechanism 24. Well fluid then flows through line 22 into tank 14, thereby mixing the well fluid with the liquid inhibitor and raising the level of the liquid therein above the top of the siphon formed by lines 13, 16 and float control chamber 15. The raising of the liquid level above line 16 actuates the siphon and the liquid in tank 14 discharges through line 13, chamber 15 and line 16, into the well annulus. Well fluid continues to be introduced into tank 14 through line 22 as long as valve 23 remains open. After a predetermined time, valve 23 is automatically closed by actuator and timer 24 thereby preventing additional well fluid from entering tank 14. Upon the emptying of tank 14 thereafter, the siphonic action in lines 13, 16, chamber 15 is broken. At this point arm 28 falls into position indicated at 28'. This opens the orifice of line 11 and permits the inhibitor liquid from reservoir 10 again to enter tank 14. As the liquid rises in tank 14 to the level of float control chamber 15, float 30 causes arm 28 to rise with the results that valve 29 shuts off the outlet of supply line 11. Tank 14 is now ready to dispense another batch of inhibitor upon the opening of valve 23.

When using the apparatus described above, a well attendant sets the valve timing and actuating mechanism 24 for the desired cycle and then proceeds to the other wells under his jurisdiction. As long as the supply of inhibitor liquid in reservoir 10 lasts, the cycle of feeding inhibitor from tank 14 followed by refilling tank 14 from reservoir 10, will be repeated at the desired regular intervals. For example, valve timer 24 may be set to open valve 23 daily or weekly and to keep it open for several hours. Different time cycles may be used for different wells, depending upon the extent of the corrosion problem. Without the present invention, the well attendant would be obliged to attend the well very frequently to regulate treatment with the corrosion inhibitors.

While the foregoing device has been described in connection with a particular embodiment, namely the treating of wells with corrosion inhibiting liquids it is not intended to be limited thereto. The device is also suitable for treating wells with various treating agents and for various purposes. Thus, it may be employed to introduce solvents into a well for the purpose of removing wax accumulations from the producing zone.

Obviously, many modifications of the invention may be made without departing from the spirit and scope there-

of, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. A device for introducing a liquid into a producing well, said well having a well tubing surrounded by a casing, which comprises, in combination, a liquid reservoir, a dispensing tank, automatic valve means associated with said tank adapted to govern the volume of liquid introduced into said tank from said reservoir, a siphon associated with said automatic valve means communicating with said casing, and a valved line communicating with said well tubing and said tank adapted to prime said siphon by raising the level of the liquid in said tank.

2. A device for flushing a liquid into a producing well, said well having a well tubing surrounded by a casing, which comprises, in combination, a liquid reservoir, a dispensing tank, automatic float level means associated with said tank adapted to govern the volume of liquid introduced into said tank from said reservoir, a siphon associated with said automatic float level means communicating with said casing, and a valved line communicating with said well tubing and said tank adapted to prime said siphon by raising the level of the liquid in said tank.

3. A device for flushing a liquid into a producing well, said well having a well tubing surrounded by a casing, which comprises, in combination, a liquid reservoir, a dispensing tank, a liquid level control means having an automatic float level associated with said tank and adapted to govern the volume of liquid introduced into said tank from said reservoir, a siphon associated with said liquid level control means and communicating with said casing, and a valved line communicating with said well tubing and said tank adapted to prime said siphon by raising the level of the liquid in said tank.

4. Apparatus for periodically discharging a measured quantity of liquid from a liquid reservoir comprising, in combination, a liquid reservoir; a dispensing tank; means providing a chamber located at a level above the bottom of said tank; a first conduit connecting said reservoir to said chamber for supplying liquid thereto; a first valve controlling said first conduit; a second conduit leading from said chamber to the bottom of said tank for conducting liquid between said chamber and said tank; mechanism responsive to the level of liquid in said chamber for actuating said valve to close said valve at a predetermined level; a third conduit leading from said chamber to a first position above said predetermined level and thence down to a second position below the bottom of said tank for siphoning off liquid from said tank through said second conduit, said chamber, and said third conduit; a fourth conduit connected to said tank for supplying liquid thereto to raise the level in said tank above said first position to start siphon action in said third conduit; and a second valve controlling said fourth conduit.

5. An apparatus according to claim 4 wherein said second valve is associated with a timing mechanism for automatically opening and closing said valve.

6. An apparatus according to claim 4 in which said chamber is adjustable and said first, second and third conduits are flexible.

7. An apparatus according to claim 4 in which said dispensing tank has an overflow line running from the top of said tank into the lower portion of said third conduit.

8. A device in accordance with claim 3 which also comprises a conduit leading from the bottom portion of said tank to the bottom portion of said liquid level control means.

9. A device in accordance with claim 3 wherein the valve in said valved line is associated with a timing mechanism for automatically opening and closing said valve.

10. Apparatus according to claim 4 also comprising a fifth conduit connecting said third conduit to said fourth conduit in a manner to drain the liquid contained in said

5

fourth conduit into said third conduit when said second valve is closed.

11. Apparatus for discharging a measured quantity of liquid comprising, in combination, a dispensing tank; means providing a chamber located at a level above the bottom of said tank; a first conduit for supplying liquid to said chamber; a valve controlling said first conduit; a second conduit leading from said chamber to the bottom of said tank for conducting liquid between said chamber and said tank; mechanism responsive to the level of liquid in said chamber for actuating said valve to close said valve at a pre-determined level; a third conduit leading from said chamber to a first position above said pre-determined level and thence down to a second position below the bottom of said tank for siphoning off liquid from said

5

10

15

6

tank through said second conduit, said chamber, and said third conduit; and means for supplying liquid to said tank to raise the level in said tank above said first position to start siphon action in said third conduit.

12. Apparatus in accordance with claim 11 wherein said means providing a chamber is located externally of said tank and is movable up and down at will to vary the volume of said liquid admitted to said tank.

References Cited in the file of this patent

UNITED STATES PATENTS

1,150,673	Greth et al. _____	Aug. 17, 1915
2,773,551	Warden et al. _____	Dec. 11, 1956