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APPARATUS FOR TREATING WELLS

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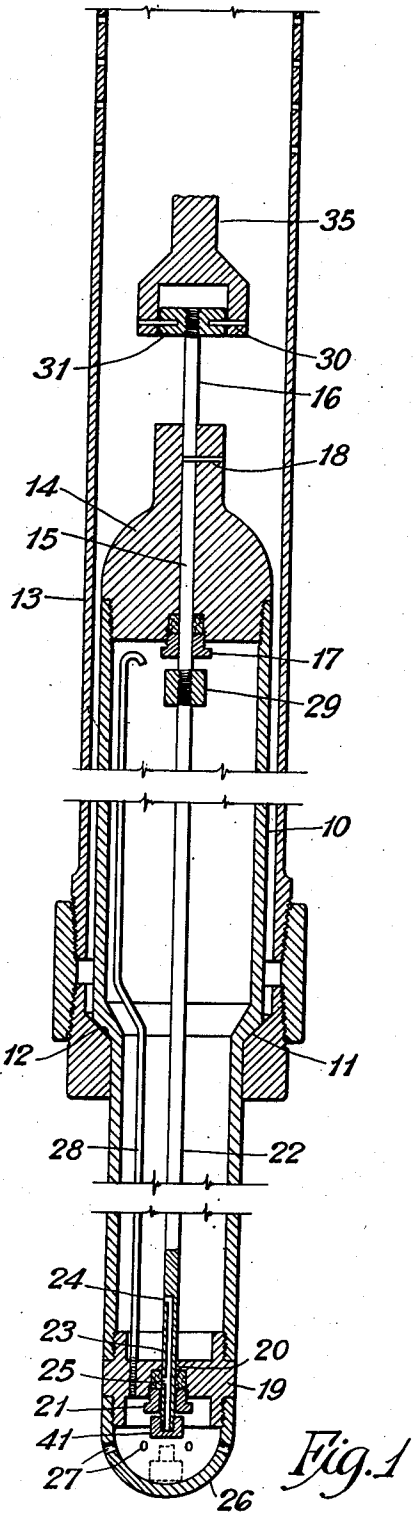

Fig. 1

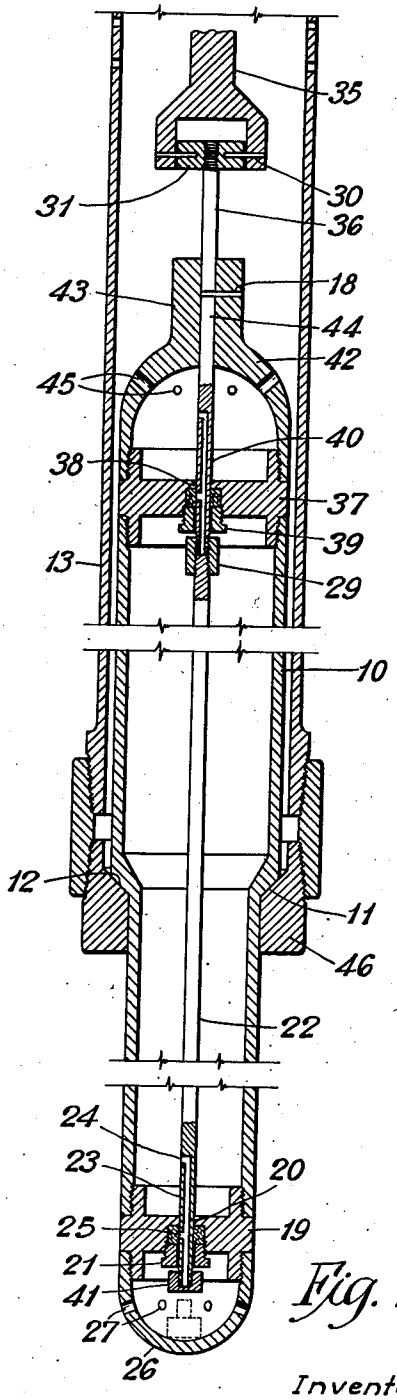

Fig. 2

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APPARATUS FOR TREATING WELLS

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1

This invention relates to apparatus for bottom hole treating of wells and more particularly for inhibiting corrosion of well tubing, pump rods, wellhead equipment and the like used in producing natural gas and oil wells, wherein the well fluid components have a tendency to attack the metal parts.

This corrosion can be caused by crude oil containing sulfide brines, which include alkali sulfides, alkaline earth metal sulfides and/or acid sulfides, such as hydrogen sulfide. Hydrogen sulfide is very soluble in water or brine, causing the brine to become very corrosive to iron and steel equipment due to the active formation of iron sulfide.

Another type of corrosion is peculiar to high pressure distillate wells and it has been discovered that organic acids are present in many highly corrosive fluids, particularly in the well water or brine withdrawn from such wells. The acids are volatile at the temperatures encountered in the wells and are highly soluble in the brine. At lower temperatures, such as are encountered near the wellheads, these acids condense on the metal parts and cause severe corrosion.

The physical nature of the fluids within the well and the velocities of the fluids being produced make it difficult to disperse within the well fluids sufficient treating agent to inhibit successfully their corrosive properties. It has been found that the addition of an aldehyde to sulfide brines effectively inhibits corrosion and that the introduction of a volatile alkali to high pressure distillate wells is effective in inhibiting corrosion due to organic acids.

One object of this invention is to provide means for inhibiting the attack of metals by corrosive well fluids. Another object of this invention is to provide an apparatus for use in treating wells. A further object is to provide means for treating produced well fluids before they enter the well tube. Still another object is to provide a means for introducing an inhibitor into the well in such a manner that it will continuously treat the produced well fluids for a substantial period of time. A further object is to provide a mechanism which is adapted to be introduced into the well via the producing string. The above and other objects of my invention will become apparent to those skilled in the art as the description thereof proceeds.

To effect the introduction of a treating agent at the base of the well where the well is produced and a packer is set between the tubing and the

2

casing, I introduce into the well hole a receptacle for the treating agent which can be positioned within the well and retrieved therefrom by a suitable running and retrieving tool. This receptacle, if the treating agent is a liquid, for example, ammonium hydroxide or formaldehyde, may comprise a metal bottle having an automatically operated valve means in one end thereof and a pressure equalizing tube to permit the well fluids' replacing the treating agent which flows from the bottle due to gravity when the valve is open. The rate of discharge from the bottle is controlled by the valve, the setting of which is determined by the desired ratio of treating material to the well fluids produced.

It is also contemplated that the treating material can be released from the container at the bottom of the well by other means. For example, a valve at the bottom of the container can be opened by the weight of the container when it is set down on a perforated bull plug on the bottom of the tubing string. Another system can be a "soft plug" which releases the well fluid in response to the temperature or pressure at the base of the well. If desired, pressuring means can be provided within the container so that the treating agent is forcibly ejected into the well fluid. This can be done by a suitable spring-loaded plunger and a timing mechanism can be associated therewith. If desired, the segregated quantity of treating material can be retained in a capsule or other disintegrable container which can be positioned within the well to discharge the treating agent progressively as the container disintegrates over a period of time on exposure to the well fluids.

The invention will be more clearly understood in view of the following description read with reference to the drawings wherein:

Figures 1 and 2 are elevations partly in section illustrating embodiments of my apparatus.

Referring to the drawings corresponding elements are designated by similar reference characters. In Figure 1, the dispensing container comprises the cylindrical body portion 10 provided with the shoulder 11 adapted to be supported by and coact with the corresponding seat 12 carried by the lower end of tubing 13. The upper end of the body portion 10 is closed by element 14 which can be threaded to the body portion 10. The closure 14 is provided with a bore 15 for the actuating valve rod 16 and a packing gland assembly 17 surrounds the actuating rod 16. A shear pin 18 is provided to retain the actuating rod 16 in its initial position.

The lower end of the body portion 10 is provided with a removable closure 19 which is provided with a bore 20 and a packing gland 21. The valve rod 22 is provided with a slide valve 23, the openings 24 and 25 being spaced a sufficient distance to span the closure 19 when in the open position. A protective cap or buffer 26 is carried by the lower end of the apparatus and is provided with perforations or openings 27 which permit the flow of fluids therethrough. A vent tube 28 extends through the closure 19 to a high point within the body 10 of the dispensing device. The valve actuating rod 16 and the valve rod 22 are provided with a suitable stop means, for example, the threaded element 29. The connector stop means 29 abuts the closure 14 when the container is being passed within the well.

The upper end of the valve actuating rod 16 can be fixed to the running tool by means of shear pins 30. The ejection valve 23 is opened by shearing pin 18 and forcing the valve actuating rod 16 downwardly until the lower end of the valve rod 22 rests on the cap 26. The pins 30 can then be sheared to permit the withdrawal of the running tool and the dispensing container remains at the bottom of the tubing. A suitable fishing tool can then be used to retrieve the container by latching over the element 31.

Figure 2 comprises another modification of a well treating apparatus adapted to be lowered within the well by means of a running tool 35. The running tool is fixed to the dispensing container by shear pins 30 carried on the upper end of a valve actuating rod 36. The ends of the body 10 are provided with closures 19 and 37. In the embodiment illustrated by Figure 2, these closures are threaded to the body portion 10 and are provided with passage ways or bores 20 and 38 and packing glands 21 and 39. Slide valves 23 and 40 are integral with the valve rod 22 and the valve actuating rod 36. The openings in each of the slide valves are spaced so as to span the respective closure and the associated packing gland. A stop means 29 performs the additional function of joining the two rods 22 and 36. The slide valves can be constructed by drilling holes in the rods longitudinally thereof and providing ducts into the drilled holes. The lower end of the valve rod 36 is provided with a combination closure and travel stop 41. Each end of the dispensing device is provided with a perforated cap or shield 26 or 42. The perforated cap 42 on the upper end of the dispensing container includes an elongated portion 43 and a bore 44 through which the valve actuating rod 36 passes. Shear pin 18 is adapted to retain the rod 36 in its initial position. In operating this embodiment, the valves 23 and 40 are opened by shearing pin 18 and forcing the rods downwardly through the closures 19 and 37 until the stop means 41 rests on the cap 26. The container can be run into the well, discharged at the bottom of the well and retrieved in the manner taught in connection with Figure 1.

The apparatus of Figure 2 is adapted for use with either liquid or gaseous treating agents and depending upon the relative density of the treating fluid and the well fluids, the upper and lower valves may function either as ejection or vent valves. Thus, if a water solution of an aldehyde is employed as the treating agent and hydrocarbons are being treated in the well, the treating agent will enter the well by means of the lower valve and well fluids by means of the upper valve. If the treating agent is a volatile or gaseous material, the embodiment shown in Figure 2 permits the dispensing of the treating agent from the top of the container and the well fluids may enter at the bottom of the container.

In view of the above, it is apparent that a system for attaining the objects of this invention has been provided wherein a container or segregated quantity of treating agent is introduced into the tubing by means of a running tool without "killing" the well.

The preferred embodiments of my invention described herein are for the purpose of illustration only and are not intended to limit the scope of invention defined by the appended claims inasmuch as it is apparent that the principles of my invention may be modified by those skilled in the art in view of the foregoing description without departing from the invention.

I claim:

1. Apparatus adapted to be lowered within a well tubing and to dispense a treating agent within the well which comprises a vertically elongated dispensing chamber, a fluid passageway communicating with an upper portion of said chamber, a valve means in a lower portion of said chamber, rigid valve actuating means extending between said valve means and the exterior of said chamber, a shear pin adapted to prevent movement of said rigid means within the chamber during the travel of the chamber within the well, and stop means carried by said rigid means to limit its longitudinal movement within said chamber.

2. Apparatus adapted to be lowered within a well tubing and to dispense a treating agent within the well which comprises a vertically elongated chamber, a removable closure at the lower end of said chamber, a fluid conduit extending within said chamber between said closure and an upper portion of said chamber, a slide valve in said closure, rod means extending between said slide valve and through the top of said chamber, and a shear pin engaging said rod to hold the valve in an initial closed position.

3. An apparatus for treating wells comprising a vertically elongated chamber adapted to be passed within a well, an upper and a lower closure for said chamber, a longitudinally slidable valve means associated with at least one of said closures, rigid means extending between said valve means and through one of said closures, a shear pin associated with said rigid means for retaining said valve means in an initial closed position, means for running the apparatus into the well and means for shearing the said pin and urging said rigid means longitudinally within said chamber.

4. An apparatus for treating wells comprising a vertically elongated chamber adapted to be passed within a well, a valved closure for said chamber, a longitudinally slidable valve means associated with said closure, an actuating rod extending between said valve means and exterior of the chamber, a shear pin associated with said rod for retaining said valve means in an initial closed position, means associated with the upper end of said rod extending exterior of said chamber for running the apparatus into the well and means for shearing the said pin and forcing said rod longitudinally within said chamber thereupon opening said valve means.

5. An apparatus for treating wells comprising a vertically elongated chamber adapted to be passed within a well, an upper and a lower closure for said chamber, aligned bores in said clo-

sures, a longitudinally slidable valve means associated with each of said bores, each of said valve means comprising a hollow tube having longitudinally spaced perforations to permit bypassing of said closures, a rigid actuating means extending between said valve means, a shear pin associated with said rigid means for retaining said valve means in an initial closed position, means associated with said rigid means exterior of said chamber for running the apparatus into the well, and means for shearing the said pin whereby said slide valves are opened.

6. An apparatus for treating wells comprising a vertically elongated chamber adapted to be passed within a well, a shoulder on said chamber adapted to seat upon a tubing plug, an upper and a lower closure for said chamber, a valve actuating rod extending between said closures and exterior of said chamber, a shear pin engaging said rod for retaining said rod in an initially fixed position, and means associated with the exterior end of said rod for engaging a running tool.

7. In an apparatus adapted for inhibiting corrosion in a dually completed well where production is through the tubing, the improved apparatus comprising in combination a vertically elongated chamber adapted to be passed within the tubing, said chamber consisting essentially of a tubular member, a closure for the upper end of said tubular member, a closure for the lower end of said tubular member, an aligned bore through each of said closures, a longitudinally slidable rigid means extending through said aligned bores in said closures, a valve means carried by said rigid means within the bore in said lower closure, a shear pin in said upper closure adapted to retain said rigid means with said valve means in an initially closed position, a tubular vent means extending from said lower closure to a point in the upper part of said tubular chamber immediately subjacent said upper closure, means for running the apparatus into the tubing, an exterior inclined shoulder on said tubular member and an inclined seat carried by the bottom of the tubing for supporting said chamber with its inlet and outlet below the bottom of the tubing.

8. An apparatus for progressively dispensing a corrosion inhibitor into well fluids being produced in a dually completed well, said apparatus comprising a tubular member adapted to pass within

a tubing string, said tubular member being generally cylindrical with an upper portion of larger diameter than the lower portion whereby an exterior shoulder is provided about the tubular member, a threaded closure means for the upper end of said tubular member, a second threaded closure means for the lower end of said tubular member, a pair of aligned bores through said closure members, a longitudinally slidable valve-actuating means extending through said bores, a first stop means carried by said valve-actuating means to limit the upward withdrawal of said valve-actuating means from the tubular member, a shear pin normally holding said valve-actuating means in a valve closing position, a second stop means at the lower end of said valve-actuating means adapted to restrict the downward movement of said valve-actuating means when the shear pin has been severed, a longitudinally slidable valve means carried by the lower end of said valve-actuating means within the second closure means, a vent conduit extending through said second closure means and longitudinally within said tubular member to a point subjacent the first closure means, an apparatus supporting seat fixed to the end of the tubing string for supporting the apparatus in a substantially vertical position with the discharge port of the apparatus below the lower end of the tubing string, and port means in said tubing string above the upper end of said dispensing apparatus adapted to admit the well fluids and corrosion inhibitor passing to the surface in the tubing string.

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