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LIQUID CHEMICAL INJECTOR FOR USE IN WELLS

Filed Dec. 16, 1957

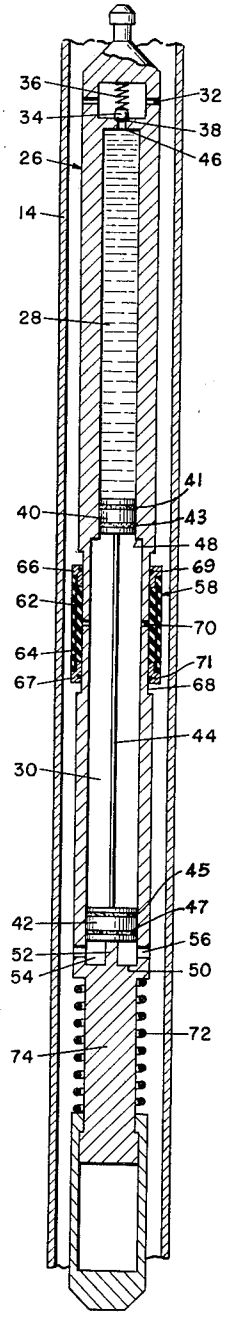

FIG. 1.

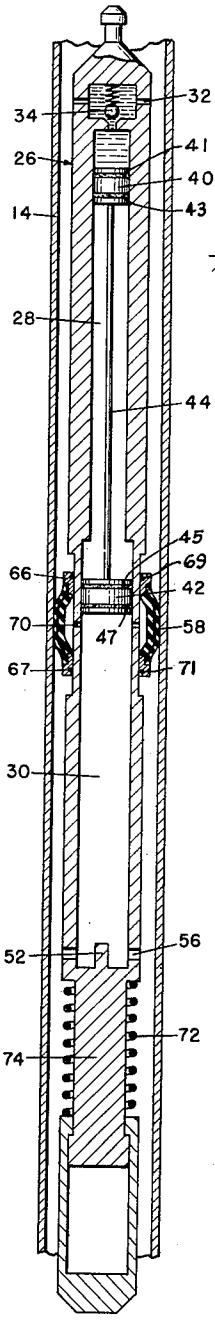

FIG. 2.

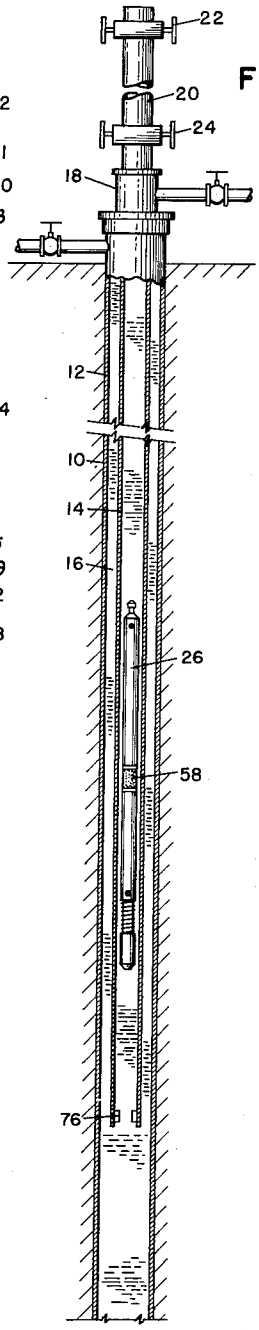

FIG. 3.

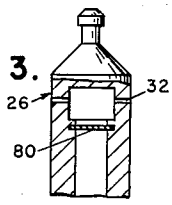

FIG. 4.

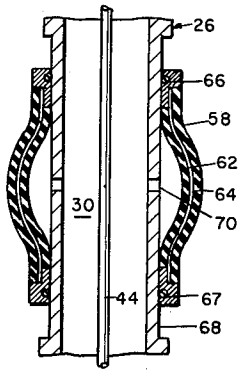

FIG. 6

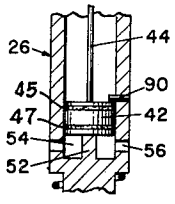

FIG. 5.

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LIQUID CHEMICAL INJECTOR FOR USE IN WELLS

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This invention relates to well treating. More particularly, this invention relates to a novel device for chemically treating the well tubing with a corrosion inhibitor.

Briefly described, the invention includes a tubular container provided with a chamber for holding the fluid for treating the tubing. At least one outlet orifice is provided in the container adapted to be placed in communication with the chamber. Means are provided for normally preventing the flow of the fluid from the chamber to the outlet orifice. Pressure responsive means, disposed within the chamber, is used for opening the normally closed means for preventing flow to the orifice from the chamber. When the pressure responsive means is actuated, the chemical is ejected from the chamber and through the orifice to be sprayed upon the inside of the well tubing.

Another aspect of this invention is the provision of a wiper member which is normally in an extended position against the well tubing. When pressure such as the well pressure is applied against the wiper member, it collapses against the side of the container, thus permitting the container to be dropped or lowered into the tubing. The inside of the collapsible wiper member is in pressure communication with a chamber in the container. Means are provided for admitting the well pressure into the chamber after the device has been lowered into the tubing to extend the wiper against the inside of the tubing. Hence, after the container has been lowered into the well and the chemical or well treating fluids ejected against the inside of the tubing, the wiper is extended against the tubing. When the container is flowed to the surface, the wiper member thus performs a wiping and distributing action on the treating fluids or chemicals.

The invention and its advantages may be further understood by reference to the following drawings and detailed description, in which:

FIG. 1 is an elevational view partially in section showing the container falling through the well tubing with the wiper member collapsed against the side of the container;

FIG. 2 is an elevational view partly in section showing the parts of the container after the treating chemicals have been sprayed against the inside of the well tubing and the wiper member extended against the sides of the tubing;

FIG. 3 is a view showing the necessary well head equipment for inserting the device of the present invention into the well tubing;

FIG. 4 is a sectional view showing a modified form of means for preventing the flow of chemicals from the chamber until a predetermined pressure within the well is reached;

FIG. 5 is still another view showing a still further means for preventing the ejectment of the chemicals or well treating fluids from the chamber until the predetermined well pressure is obtained; and

FIG. 6 is a view in vertical section showing the wiper in detail.

Referring to the figures, and particularly to FIGS. 1 and 3, a bore 10 is shown provided with a casing 12. A

tubing or pipe string 14 extends into the bore 10 and provides an annulus 16 between the casing 12 and the tubing.

Located at the surface or wellhead is the usual surface equipment, such as a "Christmas tree" 18 and a lubricator 20 provided with valve members 22 and 24.

The new device includes an elongated tubular container 26 which is adapted to be lowered or dropped through the tubing 14. The container 26 is provided with an elongated chamber which is divided into two sections with one section of smaller cross-sectional area than the other section. The smaller cylinder 28 is used to initially contain the well treating fluids, such as corrosion inhibitors. The larger chamber 30 contains a differential pressure responsive means, to be subsequently described.

At least one spray orifice 32 is provided in the upper portion of the container 26. Orifices 32 are adapted to be placed in communication with the smaller cross-sectional portion 28 of the container chamber. Means are provided for normally preventing the ejection of the chemical through the orifice, such as a ball valve 34, spring biased by a spring 36 against a valve seat 38.

The differential pressure responsive means may include a first piston 40 and a second piston 42, longitudinally separated from the first piston. Pistons 40 and 42 are interconnected by an elongated piston shaft 44. The cross-sectional area of piston 40 is substantially the same as the smaller cross-sectional portion 28 of the chamber. The cross-sectional area of the larger piston 42 is substantially the same as the larger cross-sectional portion 30 of the chamber. Piston 40 reciprocates within portion 28 and piston 42 reciprocates within chamber portion 30. The upward movements of pistons 40 and 42 are limited by shoulders 46 and 48, respectively, formed in the container. O-ring seals 41 and 43 on piston 40 and O-ring seals 45 and 47 on piston 42 provide fluid tight seals to prevent fluid from getting between pistons 40 and 42.

Extending upwardly from the bottom 50 of the chamber is a cylindrical piston support 52. Cylindrical piston support 52 limits the downward movement of pistons 40 and 42. Piston support 52 being of smaller cross-sectional area than the lower portion 30 of the chamber, provides space 54 in communication with ports 56. Hence, the well pressure is exerted against the free end of piston 42 through ports 56 and space 54.

Also mounted on the outside of the container 26 is a collapsible wiper member 58. The collapsible wiper member is normally held in its extended position. The wiper member is tubular in shape, and in construction, consists of individual bow springs 62 vulcanized to rubber 64. The rubber 64 is connected to slidable rings 66 and 67, which slide within a circular groove 68 formed on the outside of the container 26. Rings 66 and 67 slide toward one another as the wiper member is extended to engagement with the tubing and away from one another as the wiper member is collapsed. O-ring 69 in slidable ring 66 and O-ring 71 in slidable ring 67 form a fluid tight seal.

The wiper member straddles pressure equalizing ports 70, which interconnect the inside of the wiper member and the larger cross-sectional portion 30 of the chamber. Pressure equalizing ports 70 are positioned longitudinally with respect to the larger cross-sectional portion 30 of the chamber to permit the free end of piston 42 to be moved past the ports (see FIG. 2).

A shock spring 72 is provided about a lower portion 74 of the container 26 to cushion the impact of the container if it is allowed to fall against a mechanical tubing stop 76 placed within the tubing 14.

In operation, the smaller cross-sectional area of the chamber 28 is filled with the well treating fluid, such as a corrosion inhibitor chemical. The weight of the fluid rests on the top free end portion of piston 40, thus moving piston 42 on the piston rest 52, as shown in FIG. 1. The container is then placed in the lubricator 20 at the surface of the well. The rubber wiper 58 will flatten to the outside wall of the container when the lubricator is brought to wellhead pressure due to the fact that the chamber within the container will be at atmospheric pressure. With the wiper collapsed, valve 24 is opened and the device will fall freely in the tubing until such time as piston 42 moves upward past the equalizing orifices 70 under the rubber element, thus again equalizing the pressure on each side of the rubber and allowing it to return to its normal expanded position and occupy the full inside area of the tubing 14.

The area of piston 42 is larger than that of piston 40. Then, assuming that the wellhead pressure is, say 2000 p.s.i., the pressure inside the smaller cylinder will be 2000 times the ratio of the area of piston 42 to the area of piston 40 and the differential pressure attempting to unseat the check valve 34 will be this liquid pressure minus 2000 p.s.i. If we should want the chemical ejection to start at a hole pressure of 4000 p.s.i., then the pressure inside the smaller cylinder would be 4000 times the ratio of the piston areas and the differential pressure tending to unseat the check valve 34 would be this pressure minus 4000 p.s.i.; therefore, we would use a check valve that would unseat at this predetermined differential pressure. When the check valve 34 moves off its seat, the pistons will move upward due to the difference in their areas and the liquid will be displaced out of the cylinder. As piston 42 moves past the equalizing orifices 70, the wiper member 58 will return to its normal position as the pressure is equalized across it, and when the well is flowed the tool will return to the surface where it can be caught in the lubricator and removed for refilling.

The flowing out of the tool is accomplished by flowing fluid down the well through the annulus 16 between the tubing 14 and casing 12, and then from the bottom of the well up the inside of the tubing 14 to carry the container 26 up to the surface.

The container 26 may be dropped to the lower portion of the tubing and against the mechanical stop 76, where the corrosion inhibitor is ejected through orifices 32 against the inside of the lower part of the tubing. However, it is possible by using my new tool to place the corrosion inhibitor at any desired location within the tubing and even to spray a protective covering on the inside of the tubing as the container is lowered through the tubing. For this purpose the container 26 may be lowered into the tubing at any desired rate by a wire line, for example. The check valve 34 is adjusted so that chemical injection will start at some predetermined point. The rate of movement of piston 40 is predetermined by the size of the holes 32 in the head of the container so that the chemical will be sprayed on the tubing walls as the tool falls. At some desired point in the tubing above the tubing stop, piston 42 will pass the equalizing orifice 70, thus allowing expansion of the wiper 58, thereby stopping the tool at this point. By flowing the well the tool is returned to the lubricator.

An objective of preventing corrosion on tubing is to provide a uniform film of inhibitor on the walls of the tubing. The wiping and smearing action of the wiper 58 as the tool flows to the surface aids in distributing the protective chemical over all the inside surface of the tubing. This wiping action will also remove deposited condensed acid salts on the tubing walls and collar recessions in the upper portion of the tubing string.

In place of the check valve shown in FIG. 1, a rupture disc 80, such as shown in FIG. 4, may be used as a means for preventing the ejection of the chemical until the predetermined well pressure is reached. Also, instead of a check valve, as shown in FIG. 1, or a rupture disc, as shown in FIG. 4, a shear pin 90 may be mounted in the chamber in a position to prevent the movement of piston 42 until the predetermined well pressure is reached.

It is to be understood that the schematic drawings shown are merely illustrative of my new invention, and that various modifications and changes may be made without departing from the scope of the appended claims.

I claim:

1. A device for depositing a chemical in a well comprising: a normally vertical elongated tubular container provided with an elongated chamber defined by the inside of the tubular container and having one elongated portion of larger cross-section than another elongated portion, and an outlet orifice in fluid communication with the smaller cross-sectional portion; a chemical contained within the smaller cross-sectional portion; means normally preventing the ejection of the chemical through the orifice and responsive to a predetermined well pressure to permit the ejection of the chemical through the orifice; a smaller piston having a cross-sectional area substantially the same as the smaller cross-sectional portion of the chamber and a larger piston having a cross-sectional area substantially the same as the larger cross-sectional portion of the chamber; a piston shaft interconnecting said pistons and having a length sufficiently long to restrain movement of the smaller piston to within the smaller cross-sectional portion regardless of the position of the larger piston; said pistons being disposed within the chamber so that the chemical in the smaller cross-section of the chamber normaly rests against the free end of the smaller piston; and means permitting the well pressure to be exerted against the free end of the larger piston causing at a predetermined well presure the overcoming of the means normally preventing the ejection of the chemical through the orifice.

2. A device in accordance with claim 1 wherein the means normally preventing the ejection of the chemical through the orifice is a shear pin mounted in the chamber and against the shaft side of the larger piston so as to hold the larger piston against motion until the predetermined pressure is applied against the larger piston.

3. A device in accordance with claim 1 wherein the means normally preventing the ejection of the chemical through the orifice is a valve member in the fluid flow path from the smaller cross-sectional portion to the orifice.

4. A device in accordance with claim 1 wherein the means normally preventing the ejection of the chemical through the orifice is a rupture disc in the fluid flow path from the smaller cross-sectional portion to the orifice.

5. In a device for depositing treating fluids in well tubing: a container having a chamber, at least one passageway extending outwardly from the chamber and at least one port longitudinaly spaced from the passageway; a normally extended collapsible tubular member sealingly mounted on said container with its inside in pressure communication with said chamber through the passageway, said tubular member being initially collapsed by the well pressure; a longitudinally movable member transversely mounted within the chamber and sealing with the interior of the chamber adapted for the application of a force against the side thereof facing the passageway to locate said member at a point in the chamber between said passageway and said port; and a support member mounted on the container and extending into said chamber and adapted to position said longitudinally movable member so that the pressure in the well tubing is applied through the port and against the other side of the longitudinally movable member so that as the device is lowered down the well and a force is applied against the longitudinally movable member greater than the force against the side of the longitudinally movable member facing the passageway, the longitudinally movable mem-

ber is moved to a point in the chamber to permit the pressure in the well tubing to be applied through the passageway to extend the tubular member against the inside of the tubing.

6. A device in accordance with claim 5 wherein said tubular member is a rubber tubular member and has bow springs therein for normally biasing the tubular member to an extended position.

7. A device for depositing a chemical in a well comprising: a container provided with a chamber defined by the inside of the container and having one elongated portion of larger cross-section than another elongated portion, and an outlet orifice in fluid communication with the smaller cross-sectional portion and at least one port in fluid communication with the larger cross-sectional portion; a differential piston arrangement including one portion of smaller cross-sectional area than another portion, the smaller cross-sectional end being movable within the smaller cross-sectional portion of the chamber and the larger cross-sectional portion being movable within the larger cross-sectional portion of the chamber, said larger cross-sectional portion being subjected to the well pressure applied through said port; a chemical contained within the smaller cross-sectional portion of the chamber and in contact with the smaller cross-sectional end of the differential piston arrangement; means for normally preventing movement of the piston arrangement, said means being responsive to a predetermined well pressure applied through the port to permit the movement of the piston arrangement to flow the chemical from the smaller cross-sectional portion of the chamber and out through the orifice.

8. A device for depositing a corrosion inhibiting chemical in the inside of well tubing comprising: a normally vertical elongated tubular container provided with an elongated chamber defined by the inside of the tubular container and having one elongated portion of larger cross section than another elongated portion, and an outlet orifice in fluid communication with the smaller cross-sectional portion; a chemical contained within the smaller cross-sectional portion; means normally preventing the ejection of the chemical through the orifice and responsive to a predetermined well pressure to permit the ejection of the chemical through the orifice; a smaller piston having a cross-sectional area substantially the same as the smaller cross-sectional portion of the chamber and a larger piston having a cross-sectional area substantially the same as the larger cross-sectional portion of the chamber; a piston shaft interconnecting said pistons and having a length sufficiently long to restrain movement of the smaller piston to within the smaller cross-sectional portion regardless of the position of the larger piston; said pistons being disposed within the chamber so that the chemical in the smaller cross section of the chamber normally rests against the free end of the smaller piston; a naturally extended collapsible means; means for connecting said collapsible means to said tubular container so as to hold said collapsible means over pressure-equalizing ports formed in the container to interconnect the larger cross-sectional portion of the chamber and the inside of the collapsible means, said pressure-equalizing ports being positioned longitudinally with respect to the larger cross-sectional portion of the chamber to permit the free end of the larger piston to be moved past the ports; and means permitting the well pressure to be exerted against the free end of the larger piston causing at a predetermined well pressure the overcoming of the means normally preventing the ejection of the chemical through the orifice so that the chemical is ejected and the free end of the larger piston moved beyond the equalizing ports causing the well pressure to be exerted against the inside of the collapsible means to equalize the pressure on the inside and outside of the collapsible means to allow said collapsible member to extend against the tubing whereby the naturally extended collapsible member performs a wiping and distributing action on the chemicals as the device is flowed to the surface.

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