Oct. 9, 1945. C. C. CARTER 2,386,593

ACTIVATOR FOR WELLS

Filed April 18, 1942

Fig. 1.

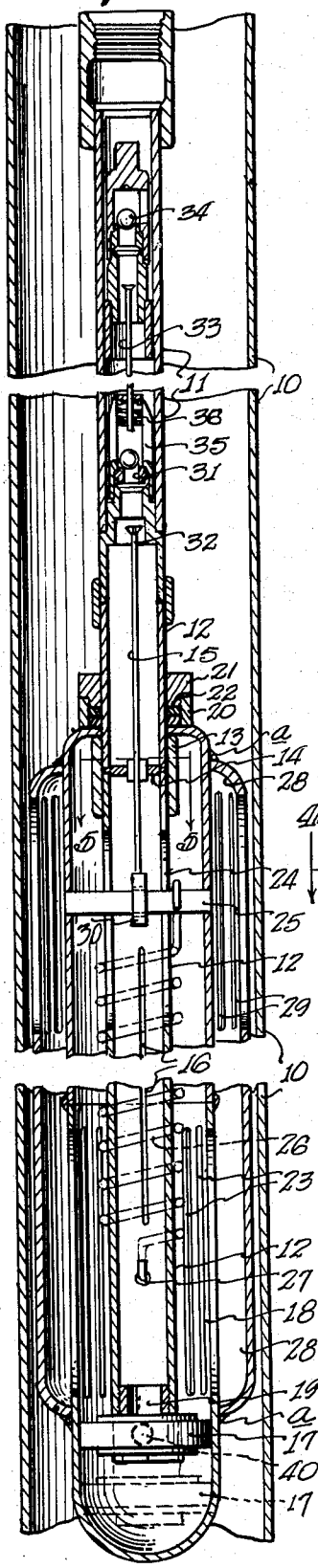


Fig. 2.

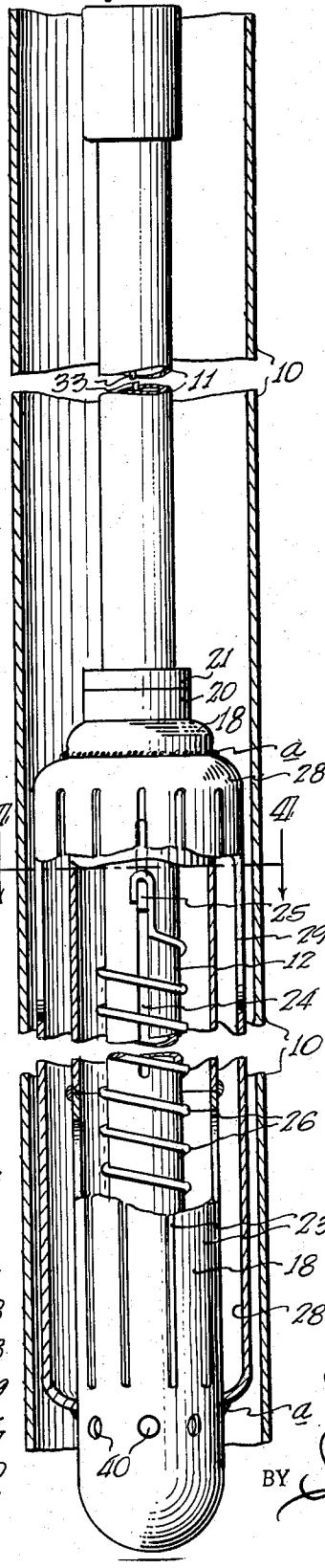


Fig. 3.

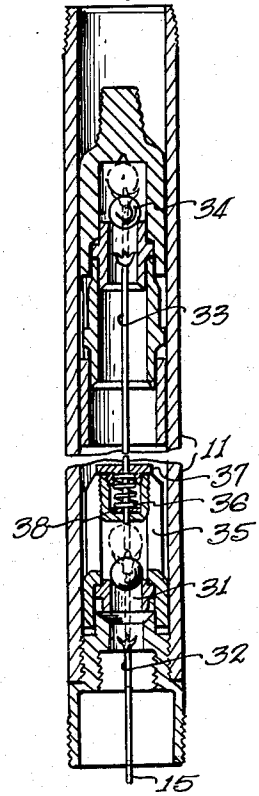


Fig. 4.

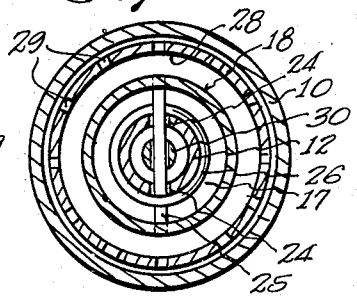
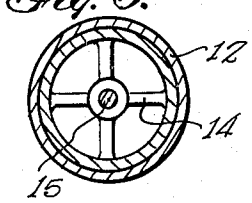


Fig. 5.



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2,386,593

ACTIVATOR FOR WELLS

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Application April 18, 1942, Serial No. 439,525

5 Claims. (Cl. 166—20)

This invention relates to oil producing equipment and it has particular reference to apparatus for maintaining optimum conditions at the bottom of the well for maximum production of oil in pumping.

The principal object of the invention is to provide means for opening the well to the source of production by a slight lowering of the pipe string in the well, which action is instrumental in raising the valves in the string off their seats and which enables the operators to introduce into the oil bearing formation live steam or other medium to effect disintegration of accumulations of silt, scale, mud, sand, lime, paraffin, or other substances tending to lower the production rate at the source or in the pipe.

Another object of the invention is to provide a simple device designed to be suspended below the working barrel on the pipe string and which requires no attention once it is operatively installed and while its function is most advantageous in increasing and maintaining maximum production from the oil bearing strata, it is not required to be frequently operated to insure continuance of production.

Still another object of the invention is to provide an apparatus whose operation can be effected without removal of the pipe string from the well and is designed to prevent or reduce to a negligible minimum the present wasteful practice in producing crude oil by eliminating erosion in the oil bearing structure which prolongs the usefulness of the valves by preventing cutting out, pitting and needless wear on these parts by such erosion and further, by keeping the fluid eduction pipes free of paraffin deposits which, if permitted to accumulate, interfere materially with the flow of oil.

Yet another object of the invention is to provide fluid inlet ports, through which fluid is constrained by the pumping equipment to pass into the pipe string from the source, and which ports are so shaped as to prevent turbulence or undue agitation exteriorly of the device likely to disturb the sand, silt, and erosive substances immediately surrounding the same during inoperative periods of the device.

With the foregoing objects as paramount, the invention has further and lesser objects as well as certain salient features of accomplishment, to become manifest as the description proceeds, taken in connection with the accompanying drawing wherein:

Figure 1 is a view showing the invention in vertical section.

Figure 2 is a side elevational view, with portions of the outer and intermediate tubes broken away to show the inner or centrally disposed tube.

Figure 3 is a detail view in vertical section showing a more or less conventional standing and traveling valve assembly and illustrating in part the manner in which the drops of these valves are elevated.

Figure 4 is a transverse sectional view on line 4—4 on Figure 2, and

Figure 5 is a detail view of the guide for one of the valve opening rods, taken on line 5—5 on Figure 1.

Continuing with a more detailed description of the drawing, reference is primarily made to Figures 1 and 2 wherein is shown the well casing 10 next adjacent the bottom of the well. The device of the invention is attached to and depends from the lower end of the pump working barrel 11 which latter, in turn, is suspended by the well tubing (not shown). The position of the device in the well is immediately below the level of the well fluid therein.

The device consists of an inner central tube 12 which may be in sections as shown, the upper section having its upper end threaded for connection to the working barrel 11. This section is joined to the lower section by means of a collar 13 and which collar, in fact, serves to support the remainder of the device on the inner tube 12. Interposed between the two sections of this tube, at the collar 13 is a guide spider 14 (Fig. 5) through a central opening in which, the valve lifting rod 15 reciprocates when the device is operated. Further reference to this rod 15 will be made presently.

The inner tube 12 is provided with elongated slots 16 in its walls which serve as fluid inlet ports during inoperative periods of the device and, mounted on the bottom of the inner tube 12 is a swab or piston 17 which snugly conforms to the inner wall surface of the intermediate tube 18 slidably surrounding the tube 12. This piston may be attached to the inner tube in any suitable manner but in the present case, it is provided with a threaded pin 19 which enters the bottom of the said tube 12. The packing of which the piston 17 is composed may be of leather, rubber, or other material on which the oil will have no deleterious effects. Further reference to the piston will be again made in the course of the description of operation.

The intermediate tube 18 concentrically embraces the lower section of the inner tube 12 and while other forms of connection between these tubes may be employed, the form shown consists of turning the upper end of tube 18 inward to snugly fit the upper section of tube 12 and the flange thus produced lies between the upper end of the collar 13 and a packing gland made up of a collar 20 into which is threaded a nut 21 to compress packing washer 22 firmly

against the walls of the inner tube 12 to provide a fluid tight connection as the latter is reciprocated. It will be observed that the intermediate tube 18 has longitudinally parallel slots 23 spaced about its lower end. It has been found that in providing slots, instead of perforations, much of the turbulent action of fluid entering the tubes is dispensed with.

The slots 23 do not extend the entire distance to the bottom of tube 18 but end above the junction of tube 18 with a surrounding shell or outer casing 28 whose upper and lower ends are welded to the tube 18 at *a*, as will be later explained. Thus the slots 23 are housed in by the surrounding shell. Below the junction of shell 28 with tube 18 outlet ports 40 are formed in the tube 18 to open outwardly of the device. Below the ports 40, the lower end of tube 18 is closed. When the intermediate tube 18 and casing 28 are suspended in the well on the inner tube 12, the upper inturned end of intermediate tube 18 rests on the upper end of collar 13 and the piston 17 on the lower end of tube 12 closes the outlet ports 40 in the tube 18. Spring 26 is arranged to normally hold the upper end of tube 18 in contact with collar 13 with piston 17 closing ports 40 so long as the device is suspended in the well out of engagement with the well bottom or any obstruction in the well which the tube 18 or casing 28 might engage while being lowered in the well.

Extending diametrically through longitudinally disposed slots 24 in the upper portion of the inner tube 12 is a cross-head 25. The ends of this cross-head extend through the walls of the intermediate tube 18 and are anchored exteriorly thereof as by bradding. In this manner, the inner tube may be moved axially downwardly in the intermediate tube to the extent permitted by the slot 24 but resisting this action is a spring 26, wound about the inner tube 12 and whose upper end is hooked over or otherwise attached to the cross-head 25, as shown. The lower end of the spring is hooked into an aperture 27 in the wall of the tube 12.

Surrounding the intermediate tube 18 is a shell or outer casing 28 which, in the present method of attachment, has both ends turned inwardly to snugly embrace the tube 18 adjacent its upper and lower ends and is welded thereto at *a*. This outer casing also has parallel slots 29 arranged in the upper portion thereof so that the liquid affluent will be constrained to traverse a tortuous route to enter the well tubing and thus be divested of much of the entrained sand which otherwise would subject the valve drops and seats, as well as the pump packing to abrasive wear.

Referring again to the rod 15, it will be observed in Figure 1 that this rod has on its lower end a stirrup 30 through which the cross-head 25 passes. After passing through the guide 14, this rod extends upward into the working barrel 11 and terminates immediately below the ball of the standing valve 31. A seat 32, carried on the upper end of the rod 15 lifts the ball when the device is actuated, as will be described presently.

In order that the invention will be complete in its structure and function, it includes the attendant valve lift rod 33 which has the function of raising the ball of the traveling valve 34 simultaneously with the action of the lift rod 15 in raising the drop of the standing valve 31. When both rods operate, as will be explained, the well is opened from top to bottom to admit steam or other agent thereinto when introduced at the surface as a cleaning agent or regurgitant.

The rod 33 is mounted in the manner best illustrated in Figure 3. The cage 35 of the standing valve is of special construction to provide a recess in its top for a small coiled spring 36. The stem or rod 33 extends downwardly through a threaded cap 37, which retains the spring in its recess and into the operative range of the standing valve ball. A washer 38, forming a shoulder on the rod 33 below the spring is urged upwardly to compress the spring when the rod is elevated by the ball drop of the standing valve immediately below the lower end of the rod 33.

In operation, the device is mounted on the lower end of the working barrel 11 with piston 17 closing ports 40 and lowered into the well to a point therein where it will be completely submerged in well fluid. The device immediately fills with fluid, the latter entering through slots 29 of the casing, slots 23 of the intermediate tube and slots 16 of the inner tube 12 to be in readiness for elevation by reciprocation of the pump in the working barrel, in the conventional manner. The device remains in this position until production falls below normal by reason of accumulations of silt, sand, or the like about the fluid inlets, deposits of paraffin in the formation or tubing or for other reasons.

The device is operated by lowering the entire tubing string in the well until the lower end of the intermediate tube 18 engages the bottom of the hole or until the outer casing 28 engages the shoulder on which the well casing 10 rests. Downward movement of the outer shell or casing 28 and intermediate tube 18 is thereby suspended but the inner tube 12 continues downward a short distance sufficient to move the piston 17 from a position covering the outlet ports 40 to a position in the lowermost portion of the tube 18, as illustrated in dotted lines in Figure 1, thereby opening these ports to the well. Simultaneously with and due to the lowering action of the tubing, the ball of the standing valve 31 is raised by the rod 15 since the latter is stationary with the intermediate tube 18 and has ceased movement. As the standing valve ball is raised, it engages the rod 33 thereabove which rises and engages the ball 34 of the traveling valve. Thus, the entire tubing string is open from top to bottom.

After live steam, chemicals, or other agent has been introduced into the well, usually under pressure, to pass into the oil bearing formation at the bottom, through ports 40, the tubing is raised to its original position and the displaced parts of the device will be returned also to their original positions by the spring 26 whose sole function is to close the outlet ports 40 and insure reinstatement of the valve drops for continued pumping operation which, due to the cleansing action of the steam or other agent, will result in increased production, attended by smoother pump operation and longer serviceability.

Manifestly, the construction as shown and described is capable of some modification and such modification as may be construed to fall within the scope and meaning of the appended claims is also considered to be within the spirit and intent of the invention.

What is claimed is:

1. An activating device for wells including in combination with a working barrel attached to the well tubing, traveling and standing valves associated with said working barrel, a central tube

connected to and suspended below said tubing string, having longitudinal slots circumferentially spaced about its upper end portion, a piston carried by the lower end portion of said tube, a second tube closed at its lower end and slidably surrounding said central tube and having longitudinal slots circumferentially spaced about its lower end, terminating at their lower ends a substantial distance above the lower end of said second tube and in which said piston is received, said second tube enclosing the slots of said central tube and having fluid outlet ports below the longitudinal slots in said second tube adapted to be covered by said piston, when the latter is in its upper position, spring means normally urging said central and second tubes into relative positions where the piston covers the outlet ports and for resisting relative longitudinal displacement of said tubes to uncover said ports, a shell fixed to and closed at both ends about said second tube above the outlet ports thereof and having slots longitudinally disposed and circumferentially spaced about its upper end to enclose the slots of said second tube and cooperating means in fixed relation to said second tube for opening the traveling and standing valves of said tubing string upon downward movement of the latter to effect longitudinal displacement of said central tube and said piston with respect to said second tube and shell to uncover said outlet ports.

2. An activating device for wells comprising in combination with a working barrel attached to a tubing string, traveling and standing valves associated with said working barrel, a series of concentrically related tubular members, the central one of said tubular members being slotted above its midsection and connected to and suspended below said tubing string and longitudinally slidable with an intermediate one of said tubular members, said intermediate tubular member having a closed lower end and slidably embracing said central member and having slots therein below its midsection, whose lower ends terminate well above the lower end of said tube, a fluid outlet port in said intermediate tubular member below said slots, a piston carried by said central tubular member and covering said fluid outlet port, in its upper position the outer of said tubular members constituting a shell closed about said intermediate member above said port and embracing the slots of said intermediate member and itself having slots above its midsection, spring mean normally urging said central and intermediate tubular members into rotative positions where said piston covers said outlet port and for resisting displacement of said central tubular member to actuate said piston to open said port and means actuated upon said displacement, effective to open said tubing valves to downward passage of fluid through said tubing string and outlet port.

3. A well activating device comprising in combination with a working barrel attached to the well tubing, traveling and standing valves associated with said barrel, a series of concentrically related and spaced tubular members suspended by the central one of said members below said tubing string, slots arranged in said central member above its midsection, enclosed by the intermediate member also having slots below its midsection, terminating a substantial distance above its lower end, the outer of said members constituting a shell and having slots above its midsection, an outlet port at the bottom of said intermediate member below the longitudinal slots therein and said shell, all but the central one of said members being closed at both ends, the central member being slidable longitudinally in the intermediate member when said tubing string is lowered, a piston carried by said central member adapted to cover the outlet port of said intermediate member in raised position of said control member, spring means normally urging said central and intermediate members into position to dispose said piston over said outlet port and for yieldably resisting sliding movement of said central member and means in fixed relation to the companion members to actuate said valves to open said tubing string to downward passage of fluid when said tubing string is lowered to open said outlet port.

4. A well activator including a tubular body suspended by a working barrel attached to the well tubing, traveling and standing valves associated with said working barrel, said tubular body having slots above its midsection, a tubular member in concentric and spaced relation to said tubular body, enclosing the slots of said body and itself having slots below its midsection but terminating a substantial distance above its lower end, said tubular member further having closed ends and capable of limited displacement on said body, and provided with a fluid outlet port adjacent its lower end below the slots therein, a piston carried by said tubular body adapted to cover said outlet port in raised position of said activator, a shell surrounding said tubular member above its outlet port, embracing the slots in said member and closed except for slots above its midsection, spring means connecting said tubular body and said member, normally urging the body and member into relative position to dispose said piston over said outlet port and yieldably resisting displacement of said tubular member relative to said body and means rendered operative by the displacement of said tubular member to lift the valves in said tubing to open the latter to the downward passage of fluid through said activator and outwardly through said port.

5. A well activator comprising in combination with a working barrel attached to the well tubing, valves associated with said working barrel, concentrically related tubular members, all except the central one being closed at their ends about companion members, the central one of which is suspended from the bottom of said tubing string and arranged for limited sliding movement in the intermediate one of the companion tubular members when said tubing string is lowered to the bottom of a well, fluid inlet and outlet ports in the lower end of said intermediate tubular member, slots in the upper portion of said central member, slots also in the lower portion of said intermediate member but terminating above said ports, the outer of said tubular members constituting a shell, whose lower closed end is above the ports in said intermediate member and itself having slots therein above its midsection, a piston covering the outlet ports of said intermediate member when said piston is in raised position, means carried by said central member for actuating said piston to open the outlet ports of said intermediate member upon downward movement of said well tubing and means simultaneously actuated for opening the valves in said well tubing to open the latter to the downward passage of fluid into said well through said outlet ports.

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