Dec. 19, 1950 J. R. BURRESS 2,534,949

WELL ACTIVATOR

Filed April 22, 1946

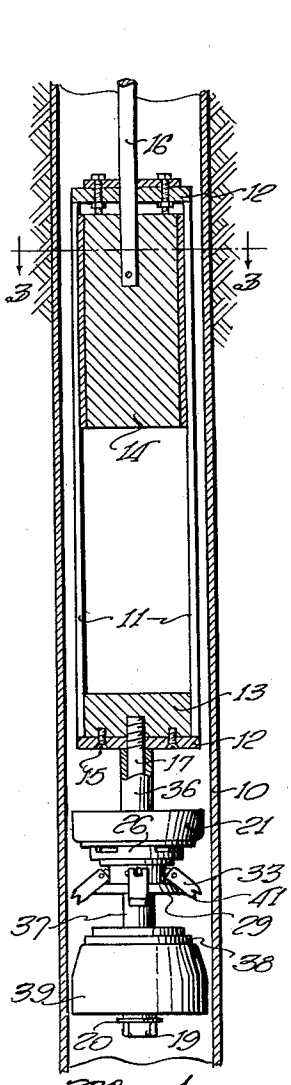


Fig. 1.

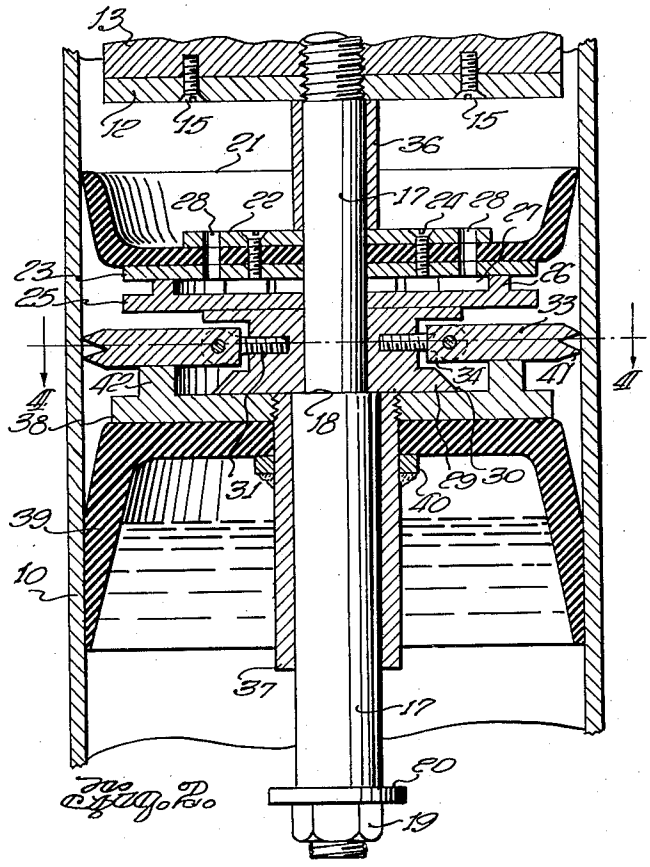


Fig. 2.

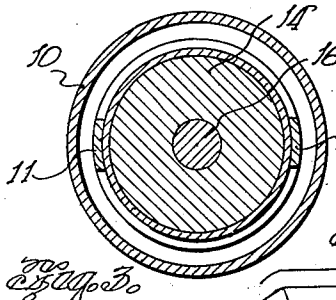


Fig. 3.

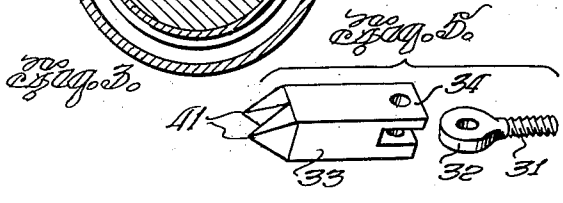


Fig. 5.

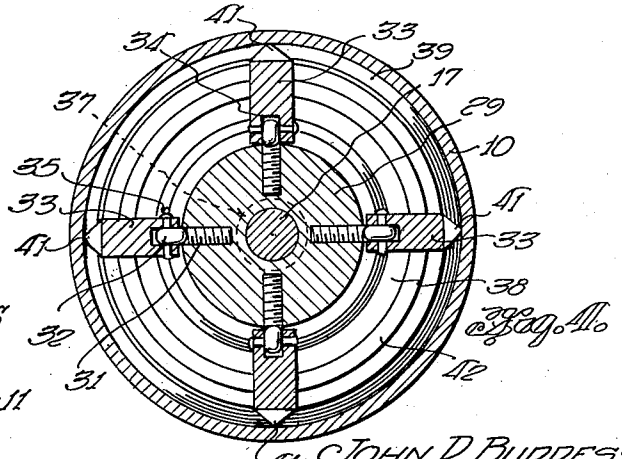


Fig. 4.

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WELL ACTIVATOR

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7 Claims. (Cl. 166—20)

1

This invention relates to apparatus for restoring production in static oil wells and more particularly to impact apparatus for activating such wells.

The principal object of the invention is to provide a well activator consisting of a packer, an anvil and hammer for expanding the packer against fluid in the casing to generate pressure in a downwardly direction to dislodge stubborn paraffin deposits in the formation. Moreover, the invention includes a stabilizing device by which the imposed pressure may be sustained on the fluid, as well as means effective upon raising the device, to create a partial vacuum therebelow, causing a surging action, further minimizing the flow deterring characteristics of paraffin and other matter, thus causing the well to resume normal or above normal production.

With the foregoing and other object in view, the invention has particular reference to certain features of accomplishment which will become apparent as the description proceeds taken in connection with the accompanying drawings wherein:

Figure 1 is an elevational view of the invention partly in longitudinal section as it appears while being lowered into a well casing.

Figure 2 is a fragmentary view in vertical section, showing only the packer, suction element and stabilizer.

Figure 3 is a view in transverse section taken on line 3—3 on Figure 1.

Figure 4 is a view in transverse section taken on line 4—4 on Figure 2, and

Figure 5 is a detail perspective view of one of the arms of the stabilizer and its mounting eye.

Continuing with a more detailed description of the drawing, reference is primarily made to Figure 1 wherein the apparatus embodying the invention is shown as being lowered into a well casing 10. Inasmuch as problems presented by accumulations of paraffin in a well are well known to those versed in the art of oil production, it is considered unnecessary to enter into detail concerning these problems, hence the following description will deal only with the invention and its effect to encounter and overcome conditions in a well which diminish or, in some cases, cut off entirely the production of oil from a well.

The invention consists primarily of a frame comprised of parallel straps 11, joined together at each end by plates 12, the lower plate supporting an anvil or striking plate 13 for a hammer 14. Screws 15 secure the anvil 14 onto the lower plate 12.

2

The frame in which the hammer 14 reciprocates is suspended by a rod assembly or wire line 16. While being run into the casing, as shown in Figure 1, the entire assembly is supported by the hammer. However, it will become apparent presently that when the fluid in the casing is encountered, downward movement of the apparatus is suspended, yet the hammer 14 may continue downwardly, striking the anvil 13 with great force to accomplish the results to be described. Obviously, the hammer may be raised and lowered repeatedly, striking the anvil as many times as the conditions of the well may require, to loosen the formation thus relieving the clogged condition of the well so that flow may be resumed or increased.

Threaded into the lower plate 12 and the anvil 13 is a rod 17, having a shoulder 18 intermediate its ends. Threaded onto the lower end of the rod is a nut 19, retaining a washer 20. Spaced below the anvil 13 is a suction cup 21 of rubber or equivalent material, in which is disposed a reinforcing plate 22, the latter being secured to an underlying plate 23 by means of screws 24 passing through the cup 21.

Below the suction cup 21 and its underlying plate 23 is a retaining flange 25 having segmental protuberances 26 on its upper surface which engage the underside of the flange 25 and maintain spaced relationship of the said flange and plate 23. Being thus spaced apart, an open area 27 is defined between these elements, communicating with which is a series of apertures 28 extending through the reinforcing plate 22, cup 21 and underlying plate 23. Fluid entrapped above the cup 21, for the purpose to be presently explained, is enabled to flow slowly back into the well through these apertures and between the projections 26 on the flange 25.

Below and supporting the cup 21 and the described elements associated therewith is a circular hub 29 having upper and lower annular flanges, the lower flange being beveled, as shown at 30. The hub is radially tapped and threaded to receive pins 31 (Fig. 5) having eyes 32 formed thereon. A series of radially extending arms 33 are disposed to receive in their bifurcated ends the eyes 32 of the threaded pins 31 in such manner that the arms may move in a vertical plane on their pivots 35. Further reference to these arms will be made presently.

The hub 29, flange 25, cup 21 and the reinforcing plate 22 are all held in fixed relationship and

in spaced relation to the anvil 13 by virtue of the fact that the hub 29 bears against the shoulder 18 of the depending rod 17 and further, that a sleeve 36 embraces the rod 17, with one end bearing against the plate 12 supporting anvil 13 while its lower end bears against the reinforcing plate 22 lying in the cup 21. Thus, all of the described parts are held immovably on the rod 17.

Movably mounted on the rod 17, below the shoulder 18 thereof is a sleeve 37 whose upper end is exteriorly threaded to enter a threaded central opening in a plate 38 which latter is interposed between the hub 29 and a casing packer 39. It is obvious from an examination of Figure 2 that there is nothing to prohibit free vertical movement of the packer 39 and overlying plate 38 by virtue of the sliding engagement with rod 17 of the sleeve 37 on which these elements are mounted. Relative displacement of the packer 39 and plate 38 is obviated by a washer 40, welded or otherwise secured to the sleeve 37 to bear against the underside of the packer 39, as shown in Figure 2. Downward displacement of the sleeve 37 and consequently the packer 39 is limited by the washer 20, held in place on the end of rod 17 by nut 19.

While the tool is being lowered into the casing, as shown in Figure 1, the packing element 39 is unexpanded and its normal diameter is less than the inner diameter of the casing 10. Moreover, the combined weight of the packer, sleeve 37 and plate 38 cause these elements to move downwardly to be supported by the washer 20. When the described elements are in lowered position, the radial arms 33, which serve in the capacity of well known slips, lie in the angular plane shown in Figure 1 and are supported on the beveled lower flange 30 of the hub 29.

The outer ends of each of the arms 33 have hardened, dual points 41 and the distance between axially aligned arms 33, when extended is slightly greater than the inner diameter of the casing 10. This provision is made so that when pressure is encountered by the packer 39 and the anvil 13 is struck a blow by the hammer 14, the points 41 of the arms 33 will bite into the casing walls and will remain stationary while their pivot points will be thrust by the impact of the hammer to a point approximately 1° below dead center, thereby stabilizing the tool between the mechanical lock supplied by the arms 33 and the pressure of well fluid below the packer 39. Obviously continued blows applied by the hammer will impose further pressure on the head of fluid in the casing, yet the extended arms 33 will not yield to the increasing pressure of the fluid as it is forced downwardly in the casing and outwardly into the formation therebelow.

In operation, the tool is lowered in the casing as described and when fluid is encountered in the casing, the packer 39 will expand against the walls thereof, and at the same time will move upwardly, causing the plate 38 to advance upon the now inclined arms 33, bringing its annular lifting rib 42 against these arms, raising the same collectively to a position where their points 41 bite into the casing walls. As pressure on the fluid increases, upward pressure on the arms 33 increases and the hammer 14 is raised and permitted to drop repeatedly on the anvil 13 which not only imposes greater pressure on the fluid but reverses the inclined positions of the arms 33, as described, to hold the tool, other than the hammer, against upward displacement.

Pressure on the well fluid is thus held and increased until it is determined that the pressure is adequate. Following this operation, the tool is pulled upwardly, overcoming the radial pressure of the arms 33, whereupon the latter drop downwardly onto the beveled flange 30 of the hub 29, as exemplified in Figure 1. It will be understood that when the tool is initially introduced into the well, a certain amount of fluid will bypass the packer 39 and will rise above the cup 21. This is expected and is important in further carrying out the function of the apparatus in that the fluid trapped above the cup 21 serves as a liquid seal, closing for a short period of time the apertures 28 of the cup and is effective to expand the walls of the cup against the well casing as the tool is further moved towards the surface.

By rapidly pulling the apparatus upwardly, a suction is created in the casing therebelow which, combined with the pressurizing effects previously described, causes a surging in the casing well calculated to dislodge even the most obstinate deposits of paraffin and other matter which tends to close the interstices in the formation restraining natural flow of fluid. Continued or repeated operation of the tool to alternately provide pressure and suction in the casing depends upon the condition of the well but actual experiments have disclosed that the most difficult wells require but a minimum number of the described operational cycles to effect resumption of production.

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. A well activator including a frame arranged to enter the casing of a well and having an anvil in its lower end, a rod connected to and depending from said anvil, a suction cup mounted on said rod in sealing engagement with said well casing, a sleeve slidable on said rod below and in spaced relation to said suction cup, a well packer disposed on said sleeve in sealing engagement with said well casing, a hub fixed on said rod between said suction cup and packer, a series of radially disposed casing engaging arms pivoted to said hub for movement into and out of gripping engagement with the walls of said casing and adapted upon downward movement of said frame relative to said packer to be engaged and extended into gripping engagement with the walls of said casing by said packer under pressure of fluid therebelow, to hold said packer against upward displacement, and means reciprocable in said frame to impinge said anvil for driving said packer downwardly against said fluid pressure.

2. A well activating device including a frame and anvil for suspension in the casing of a well, a rod connected to and depending from said anvil, a sleeve slidably disposed on said rod, a well packer mounted on said sleeve to be moved in relation to said frame and expanded into sealing engagement with said casing by fluid in said casing, radial arms pivotally mounted on and spaced circumferentially about said rod above said packer for movement into and out of gripping relationship with said casing and engageable and extendible by said packer into engagement with the walls of said casing to hold said packer against upward displacement by pressure of said casing fluid, means reciprocable in said

frame for imposing repeated blows on said anvil to drive said packer downwardly in said casing and suction means mounted on said rod for sealing engagement with said casing above said packer for creating a partial vacuum below said packer upon upward movement of said device.

3. Apparatus for restoring the flow of wells including a frame for suspension in the casing of a well, a rod connected to and depending from said frame, a sleeve slidable on said rod, a packer mounted on said sleeve for sealing engagement with said casing and capable of limited vertical displacement on said rod below said frame, means also on said rod above said sleeve pivoted for movement into and out of gripping engagement with said casing, said pivoted means being engaged and actuated by said packer under pressure of fluid therebelow for engaging said casing and securing said packer against other than downward movement in said casing, means reciprocable in said frame for exerting a downward force on said packer, suction means mounted on said rod and in sealing engagement with said casing above said packer and pivoted means for creating a partial vacuum in said casing upon upward movement of said frame lifting said pivoted means out of engagement with said packer thereby disengaging said pivoted means from said casing.

4. Apparatus for restoring the flow of fluid in cased static wells including a frame, a rod affixed to and depending from said frame, a packer slidably mounted on said rod in sealing engagement with the well casing and movable vertically in relation to said frame, means expandable into and out of gripping engagement with said well casing and mounted on said rod above said packer and engaged and actuated by said packer upon encounter with fluid in the casing of a well for securing said packer against other than downward displacement in said casing, means reciprocable in said frame for repeatedly imposing a downward force on said packer against pressure of fluid in said casing and means also in sealing engagement with said casing above said packer and expansible casing gripping means for creating suction in said casing upon upward movement of said apparatus to disengage said casing gripping means from said packer.

5. Apparatus for restoring flow of fluid in a cased static well including a frame, a rod attached to and depending from said frame, a resilient expansion cup slidably supported by said rod for limited longitudinal movement thereon below said frame in sealing engagement with the well casing, and expandable upon downward movement of said frame by encounter with fluid in the casing of a well, a plurality of radial arms pivotally mounted on and spaced circumferentially about said rod for movement into and out of gripping engagement with said casing above said expansion cup and engaged and actuated by the expansion cup into casing gripping engagement for securing the expansion cup against upward displacement by fluid in said casing, means on said frame for imposing a downward force on said expansion cup, and suction means on said rod above said radial arms in sealing engagement with said casing adapted to create a suction in the well casing below said apparatus upon upward movement thereof to disengage said radial arms from said expansion cup and surrounding said well casing.

6. Apparatus of the character set forth in claim 5, further defined in that the suction means is apertured to by-pass well fluid above and below the same.

7. Apparatus as set forth in claim 5, further defined in that arms are pivoted at their inner ends to a mounting surrounding said rod and whose outer ends are pointed to bite into the walls of a casing when extended.

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