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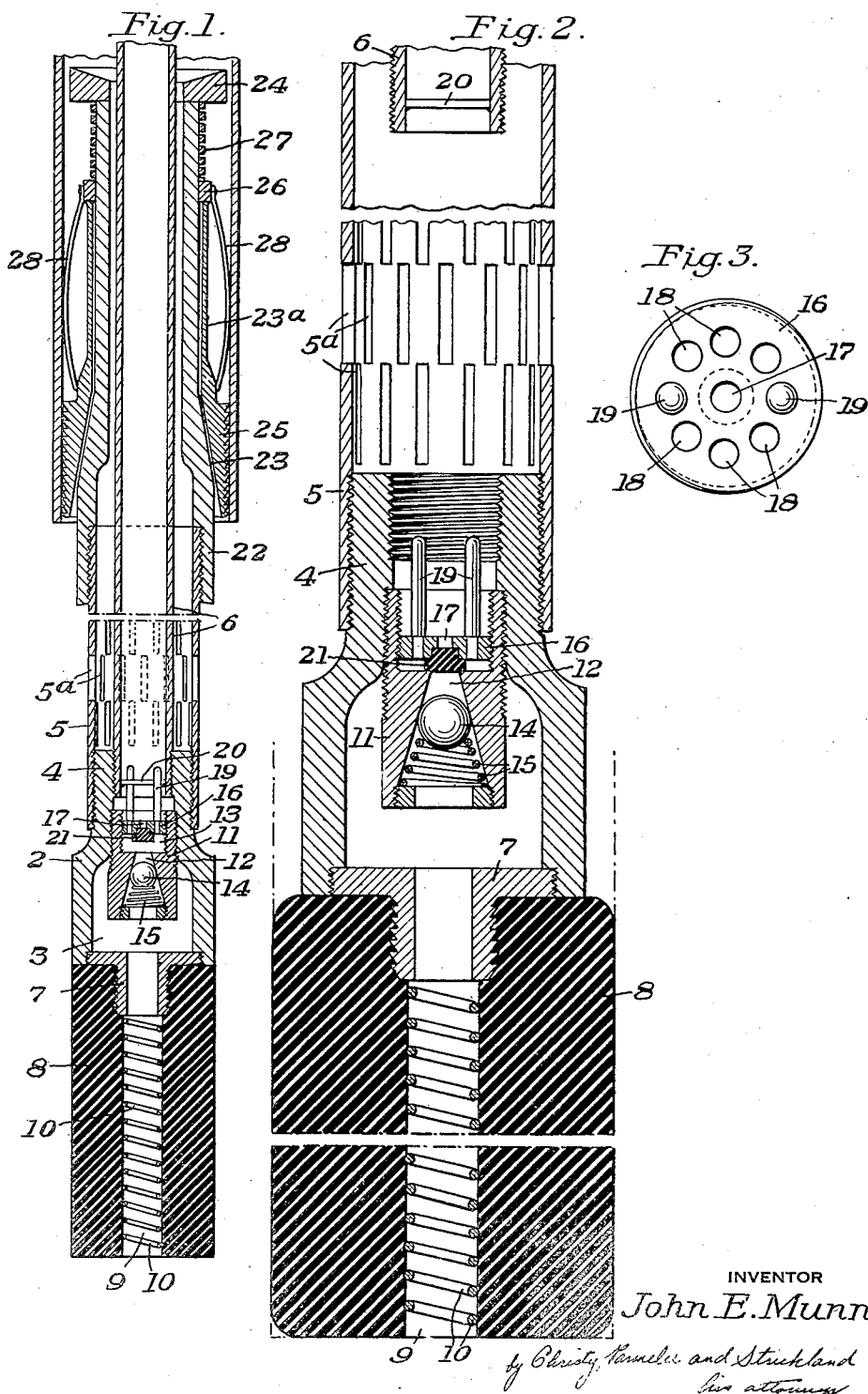
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OIL WELL PACKER

Filed May 19, 1941

2 Sheets-Sheet 1



INVENTOR

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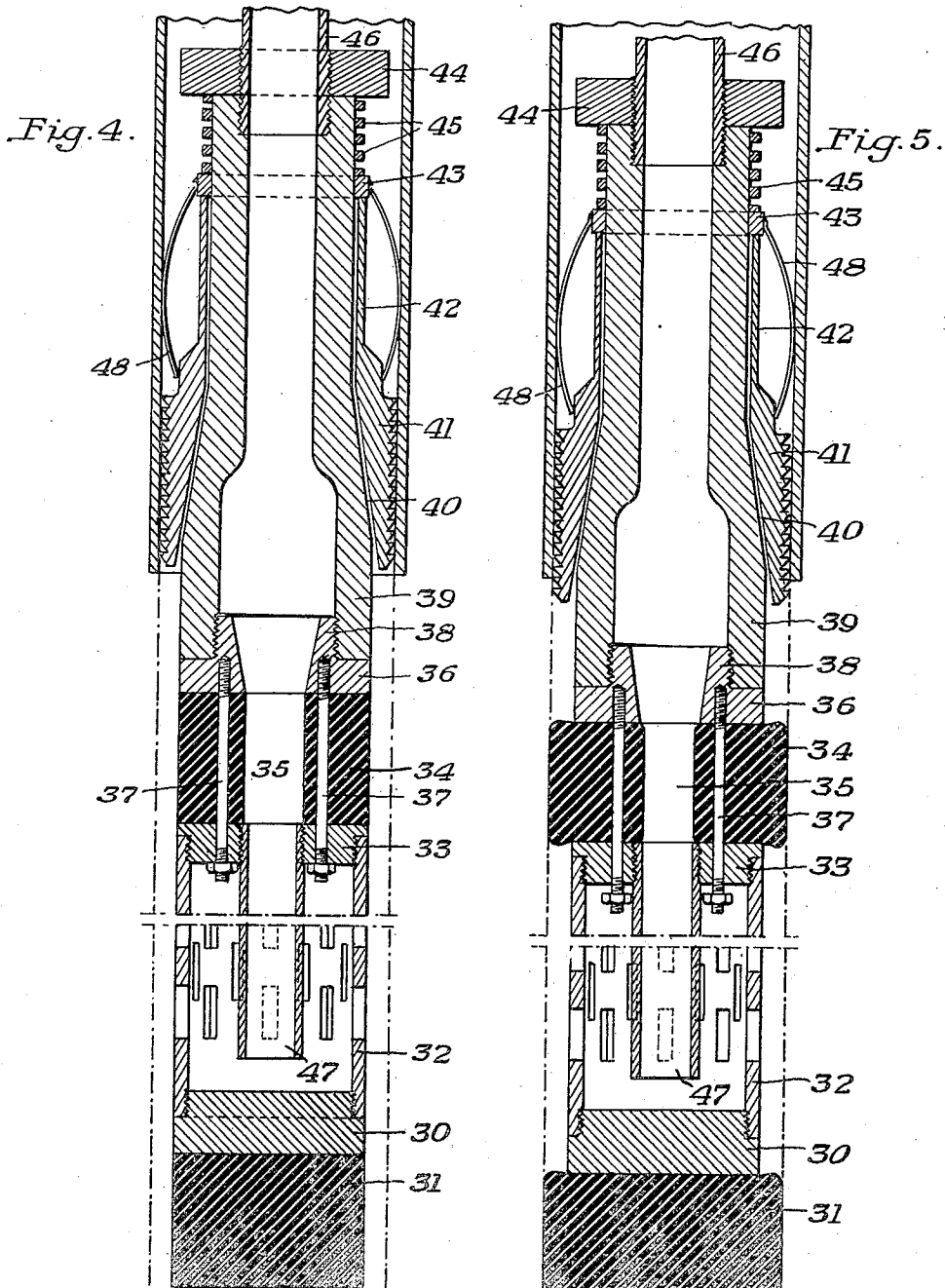
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UNITED STATES PATENT OFFICE

2,367,733

OIL WELL PACKER

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Application May 19, 1941, Serial No. 394,102

10 Claims. (Cl. 166—12)

This invention pertains to packers for use in oil wells and is for a packer especially intended for use in the bottom of an oil well where the oil well has been or is to be treated to eliminate water in accordance with the method disclosed and claimed in my copending application Serial No. 394,101, filed May 19, 1941, but it may be used otherwise or with other methods of well treating.

According to the method of treating oil wells as disclosed in my said copending application, a liquid, such as carbon tetrachloride, which is heavier than water, is forced into the crevices or capillaries in the oil-producing formation in the zone extending downwardly from the bottom of the well. This fluid displaces the water in these crevices and closes the crevices against the back flow of water therethrough. In order to retain the treating fluid in the formation the invention as disclosed in my said co-pending application contemplates plugging the bottom of the well to thereby prevent the direct upflow of fluid into the bottom of the well. In addition to sealing the treating fluid in the capillaries, this plugging of the bottom of the well destroys the aspirating effect at the bottom of the well which is produced by the flow of oil into the well and up the well tubing. It is this aspirating effect that tends to draw water from an underlying plane upwardly into the bottom of the well. The present invention is for a packer which will provide an effective closure or seal at the bottom of the well. Also as disclosed in my said co-pending application, it is necessary in the correction of existing wells to provide a means whereby the treating fluid or fluids may be forced down the well only into the formation below the bottom of the well, which will seal the bottom of the well against any back-flow of fluid and which will thereafter permit oil to flow into the well laterally from a level above the bottom. One form of the present invention provides a packer through which such treatment of the well may be accomplished.

My invention may be readily understood by reference to the accompanying drawings which illustrate certain present preferred embodiments of my invention and in which

Figure 1 is a vertical section through a packer embodying my invention intended for use in the correction of existing wells;

Figure 2 is a vertical section on a larger scale showing the lower portion only of the packer after it has been set and the valve closed to prevent back-flow of the fluid, the parts being in

the position which they assume after the well is put back into production;

Figure 3 is a top plan view of the sealing disk forming a part of the packer;

Figure 4 is a view similar to Figure 1 showing a modified form of packer for use in new wells; and

Figure 5 is a section through the lower portion of the packer after the packer has been set.

Referring first to the form of the invention shown in Figures 1 to 3 of the drawings, 2 designates a metallic body member near the lower end of the packer. This body member has a hollow interior 3 and an upwardly extending neck portion 4 of reduced diameter. The neck portion 4 is exteriorly threaded and a metal tube or shell 5 is screwed onto the exterior of the neck 4. The interior of the neck 4 is also threaded, and when the packer is initially lowered into the well and set, the lower end of the well tubing 6 is screwed into the interior of the neck 4 as shown in Figure 1.

Screwed into the bottom of the body 2 is a nipple 7 and secured to the nipple is a cylindrical body of resilient elastic packing material 8. This packing material is preferably formed of an oil insoluble expansible composition or body which is also inert to the chemicals which are employed. A body of rubber coated with a plastic, such as that sold under the name "Thiocol" may be employed. The packing 8 is provided with an axial passageway 9 through it and a coil spring 10 is inserted in the passageway 9 to prevent the passageway from closing when pressure is applied to the packing 8 in a longitudinal direction to expand it.

Screwed into the interior of the body 2 is a plug 11 having a downwardly and outwardly flared opening 12 therein, and having a well 13 in the upper part thereof. In the passageway 12 there is a ball 14 which is resiliently pressed upwardly by the spring 15, the ball 14 providing a downwardly opening, upwardly closing, check valve for the passageway 12.

The interior of the well 13 is provided with a left-hand thread. Screwed into the well 13 is a disk 16, a plan view of which is shown in Figure 3 and which has a central opening 17 therein, and which has a plurality of eccentric openings 18 therethrough. The disk is also provided with two diametrically opposite upwardly extending pins or posts 19. The pins or posts 19 project upwardly into the lower end of the well tubing 6 and the well tubing 6 is provided adjacent its lower end with a transverse pin or cross-bar 20 that extends across between the two pins 19. The

disk 15 carries on its under surface a compressible plug 21 which is secured to the central opening 17.

The arrangement is such that with the parts shown in the position illustrated in Figure 1 fluid under pressure may be forced down the well tubing 6. It will pass through the openings 13 in the disk 16. It will flow through the passage 12, forcing the check valve 14 open, into the chamber 3 at the bottom of the body 2 and from the chamber 3 it will flow through the nipple 7 and down through the passage 9 into the formation at the bottom of the well. By turning the well tubing 6 in a counterclockwise direction to unscrew it from engagement with the neck 4 the cross pin 20, engaging the posts of pins 19, will turn the disk 16 in a corresponding direction but due to the threads on the interior of the well 13 being reverse to the threads on the well tubing, the disk 16 will be screwed down as the tubing is screwed up. The pins 19 are of such length that before the tubing 6 is disengaged from the neck 4 the disk 16 will have been screwed down into the well 13 to compress the plug 21 against the top of the opening 12 above the check valve, and thus form a positive seal against the upflow of fluid past the check valve.

The tube or shell 5 is perforated for a distance above its lower end, the perforations preferably being in the form of vertically elongated slits around the shell, this perforated area being indicated at 5a. The purpose of the slits is to permit oil to flow laterally to the packer above the bottom packing after the packer has been set. The length of the shell or tubing 5 is determined by the well in which the packer is to be used, but in most instances it will have a length of approximately 50 feet. Above the oil-bearing stratum the shell is not perforated. The upper end of the shell is screwed into an upper body member 22, which body member has a conical surface 23 and which is provided at its top with an annular abutment 24. Surrounding the conical portion 23 of the body are a plurality of slip jaws 25 of a character commonly used in oil well equipment, these jaws having serrated outer surfaces. They are provided with extensions 23a hingedly attached to a ring 26. An actuating spring 27 is interposed between the ring 26 and the annular abutment 24. Leaf springs 28 serve to press the jaws inwardly against the conical surface 23. The general construction of the slip jaws and the actuating mechanism therefor is quite common in oil well packers and it forms no part of the present invention per se, except insofar as some means is necessary for holding the packer set after it has been lowered to the bottom of the well.

In operation the packer is lowered into the well by means of the well tubing 6 with the parts in the position shown in Figure 1. When the packer reaches the bottom of the well, the weight of the tubing may be used to expand the mass of compressible material. Then, by lifting the tubing slightly and relieving some of the pressure the mass of compressible material 8 tends to spring back and the conical surface 23 engaging the slip jaws 25 forces the slip jaws 25 into locking engagement with the interior of the well casing and the packer is thus set and held in its operative position. After the packer has been set the treating fluids are forced down the well tubing under a pressure greater than the operating pressure within the well to force the treating fluids through the bottom of the packer into the oil

stratum immediately below the bottom of the well in the manner hereinbefore described, the fluids preferably being fluids as described in my copending application above referred to. After the fluids have been forced into the zone below the bottom of the well the well tubing 6 is disconnected from the neck portion 4 of the body 2 in the manner hereinbefore described. The operation of disconnecting the tubing screws the disk 16 down to set the plug 21 over the valve passage 12 as previously explained. After the tubing is disconnected it is raised so that the oil which flows into the perforated area 5a can flow or be pumped up the well tubing 6. This is shown in Figure 2 where the end of the well tubing 6 is elevated a considerable distance above the top of the neck 4.

The modification shown in Figures 4 and 5 is intended primarily for use in a new well where the fluids for excluding water have been forced into the capillaries extended downwardly from the bottom of the well during the process of drilling and where it is unnecessary, therefore, to force liquids through the packer into the bottom of the well. According to the modification shown in Figures 4 and 5, the packer comprises a metal body portion 30 having a cylinder or plug 31 secured to the bottom thereof as, for example, by vulcanizing the plug to the body 31, the plug preferably being formed of synthetic rubber such, example, as Neoprene. The upper part of the body 30 is of reduced diameter and is exteriorly threaded and is screwed into the lower end of a shell or tubing 32. The shell or tubing 32, which corresponds generally to the shell or tubing 5 of the construction shown in Figures 1 and 2, is perforated in the zone adjacent its lower end, but the portion of the tubing which extends above the oil-producing stratum is not perforated. The length of the tubing 32 is made to suit the requirements of a particular well, but normally the length of the tubing will be somewhere in the neighborhood of fifty feet. The upper end of the tubing 32 is screwed onto an upper body or disk member 33. Above the disk member 33 is a second cylindrical body of packing material 34 which has a central hole 35 therethrough and at the top of the compressible packing 34 is a third body or annulus 36. Bolts 37 screwed into the annulus 36 pass through the packing material 34 and are slidably passed through the annulus or disk 33. These bolts are provided at their lower ends with nuts to hold the assembly against longitudinal separation, the arrangement being such that in the setting of the packer the member 33 may move toward the member 36 to compress the packing 34, the bolts 37 permitting such relative movement while they tie the structure together against longitudinal separation in the opposite direction. The annulus 36 is provided with a nipple portion 38 that screws into an upper body member 39 having a conical surface 40. Slip jaws 41 are positioned around the conical surface 40 and they have serrated outer surfaces thereon. The jaws 41 have upwardly projecting extensions 42 that are hingedly connected to a ring 43. The upper portion of the body 39 is provided with an annular abutment 44. There is an actuating spring 45 between the abutment 44 and the ring 43. A main well tubing 46 is screwed into the upper end of the body 39 and the body 39 has a hollow interior. Screwed into the intermediate ring 33 is a downwardly extending tubing 47. Attached to the ring 43 are leaf

springs 48 for holding the slip jaws in contact with the conical surface 40.

In using the packer it is lowered into the well when the well is ready to be put into production. Pressure is applied to the packer by the weight of the column of tubing above it to expand the compressible packing 31 at the bottom of the packing and to also expand the intermediate packing 34. Then by slightly lifting the well tubing the packer may be set as described in connection with Figures 1 and 2 and the slip jaws 41 will engage the interior of the well casing to hold the packer in the set position.

After the packing has been set in the bottom of the well, the bottom of the well is effectually closed against any upflow of fluid therethrough and all of the liquid that enters the same must flow laterally into the well from the zone above the bottom of the well and through the perforations in the shell or tubing 32.

Both embodiments of the invention as herein described provide an effective method for sealing the bottom of a well which has been previously treated with fluid to prevent water from flowing upwardly through the bottom of the well and for causing all liquid which enters the well to enter in a lateral direction from a zone above the bottom of the well. Both form of packers prevent the aspirating effect at the bottom of the well due to the flow of fluids into the well from points above the bottom. While the packer is primarily designed to be used in wells that have been previously processed with chemicals, it may be used in any location where the backflow of fluid through the bottom of the well is desirable.

While I have illustrated and described certain particular embodiments of my invention, it will be understood that this is by way of illustration and that various changes and modifications are contemplated within the scope of the following claims.

I claim:

1. An oil well packer for use in water exclusion treatment of oil wells, adapted to close the bottom of the well against upflow of liquid therethrough, comprising a body having a packing plug element at the lower end thereof for closing the bottom of the well, a perforate tubing extending upwardly from said body and forming a well screen and means at the upper end of said tubing for anchoring the packer.

2. An oil well packer for use in water exclusion treatment of oil wells, adapted to close the bottom of the well against upflow of liquid therethrough, comprising a body having a packing plug element at the lower end thereof for closing the bottom of the well against the upflow of liquid, a perforate tubing extending upwardly from said body and forming a well screen, means at the upper end of said tubing for anchoring the packer, and a well tubing through which oil may be withdrawn from the interior of said first tubing.

3. An oil well packer for use in water exclusion treatment of oil wells adapted to close the bottom of the well against upflow of liquid therethrough, comprising a body having a compressible mass of oil-resistant packing at the lower end thereof, a shell member extending upwardly from the body and having the lower portion thereof perforated to provide a well screen, means at the top of said shell for anchoring the packer in a well, and a well tubing opening into the interior of said shell and through which liquid may be withdrawn from the interior of the shell.

4. An oil well packer for use in water exclusion treatment adapted to close the bottom of the well against upflow of liquid therethrough but constructed to permit of the downflow of liquid through the packer into the earth formation at the bottom of the well, comprising a body member, a compressible mass of oil-resistant packing material at the bottom of said body member, said body member and said mass of oil-resistant packing having a passageway therethrough, means forming a well screen extending upwardly from the body, a well tubing extending down into the well screen and detachably connected with said body, and valve means in the body to prevent the back-flow of liquid through the body.

5. An oil well packer for use in water exclusion treatment adapted to close the bottom of the well against upflow of liquid therethrough but constructed to permit of the down flow of liquid through the packer into the earth formation at the bottom of the well, comprising a body member, a compressible mass of oil-resistant packing material at the bottom of said body member, said body member and said mass of oil-resistant packing having a passageway therethrough, means forming a well screen extending upwardly from the body, a well tubing extending down into the well screen and detachably connected with said body, valve means in the body to prevent the back-flow of liquid through the body, said valve means and well tubing being operatively connected in such manner that the disconnecting of the well tubing from the body closes said valve.

6. An oil well packer for use in water exclusion treatment adapted to close the bottom of the well against upflow of liquid therethrough but constructed to permit the down flow of liquid through the packer into the zone below the bottom of the well, comprising a body member, a compressible mass of oil-resistant packing material at the bottom of said body member, said body member and said mass of oil-resistant packing having a passageway therethrough, means forming a well screen extending upwardly from the body, a well tubing extending down into the well screen and detachably connected with said body, valve means in the body to prevent the back-flow of liquid through the body, said valve means and well tubing being operatively connected in such manner that the disconnecting of the well tubing from the body closes said valve, and an upwardly-closing, downwardly opening check valve in the body in addition to said first valve means.

7. An oil well packer for use in water exclusion treatment adapted to close the bottom of the well against up flow of liquid therethrough but constructed to permit of the down flow of liquid through the packer into the zone below the zone below the bottom of the well, comprising a body member, a compressible mass of oil-resistant packing material at the bottom of said body member, said body member and said mass of oil-resistant packing having a passageway therethrough, means forming a well screen extending upwardly from the body, a well tubing extending down into the well screen and detachably connected with said body, and valve means in the body to prevent the back-flow of liquid through the body, said valve means comprising a downwardly-opening, upwardly-closing check valve.

8. An oil well packer for use in water exclusion treatment adapted to close the bottom of the well against up flow of liquid therethrough

but constructed to permit of the down flow of liquid through the packer into the zone below the bottom of the well, comprising a body member, a compressible mass of oil-resistant packing material at the bottom of said body member, said body member and said mass of oil-resistant packing having a passageway therethrough, means forming a well screen extending upwardly from the body, a well tubing extending down into the well screen and detachably connected with said body, valve means in the body to prevent the back-flow of liquid through the body and means at the top of said well screen for anchoring the packer in the well.

9. An oil well packer for use in water exclusion treatment adapted to close the bottom of the well against up flow of liquid therethrough but constructed to permit of the down flow of liquid through the packer into the zone below the bottom of the well, comprising a body member, a compressible mass of oil-resistant packing

material at the bottom of said body member, said body member and said mass of oil-resistant packing having a passageway therethrough, means forming a well screen extending upwardly from the body, a well tubing extending down into the well screen and detachably connected with said body, valve means in the body to prevent the back-flow of liquid through the body, a cone-shaped body surrounding the well tubing at the top of the well screen and radially movable slips cooperating with the cone-shaped body for anchoring the packing in the well.

10. An oil well packer comprising a tubing, a body having a plug of expansible material thereon at the end of the tubing, a well screen member around the tubing attached to said body, and anchoring means at the top of the screen operable upon slight upward movement of the screen for securing the packer in a well.

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