

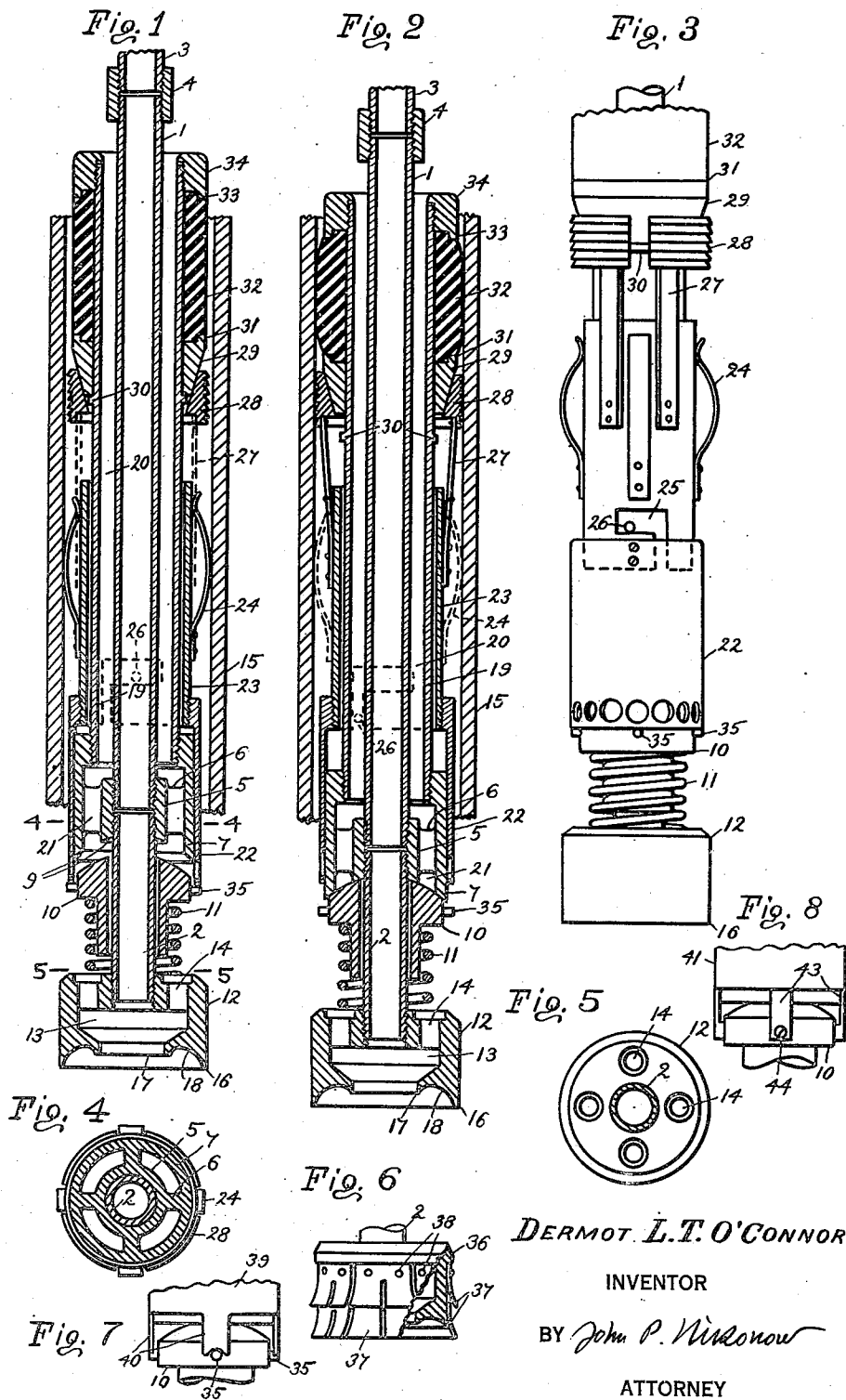
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WELL PACKER

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WELL PACKER

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My invention relates to well packers and has particular reference to packers having circulating channels between the casing and flow pipes.

In my Patent No. 2,009,198 I have disclosed the construction of a packer with circulating channels and an automatic valve normally closing these channels, but permitting them to be opened by a pressure from above the packer, this pressure being used to force oil in the well to flow upward through the central flow pipe. The packer is further provided with an ordinary rubber expanding sleeve which is used to set the packer or seal it in a desired place in the casing pipe. A locking device is also provided operable by the flow pipe and permitting the packer to be moved in the casing pipe while the expanding sleeve is kept in the contracted position.

I have found that it is sometimes and under certain conditions desirable to lock the valve in an open position while the packer is being lowered or raised in the casing pipe, in order to permit free circulation of fluids through the circulating channels.

I have also found that it is desirable to provide the packer in its lower portion with a means for removing deposits of paraffin or similar waxy or tarry substances from the inner wall of the casing pipe while the packer is being lowered into the well.

The object of my invention is therefore to provide a packer with channels for circulating fluids outside of the flow pipe and with an automatic valve for these channels, with a means for maintaining the valve in an open position when the packer is being moved in the casing pipe.

For this purpose I provide a tubular member slidably fitted on the outside of a valve block and connected with a locking device for the expanding portion of the packer. This locking device is released or locked by manually turning the flow pipe and moving it axially. The tubular member is arranged so that it raises the valve from its seat when the locking device is set or locked.

Another object of my invention is to provide means for removing or scraping off waxy or tarry substances from the inner walls of the casing pipe while the packer is being lowered into the well.

Another object of my invention is to provide means for deflecting the removed waxy substances downward and away from the automatic valve.

My invention is more fully described in the accompanying specification and drawing in which—

Fig. 1 is a sectional elevation of my packer in a locked position with the rubber sleeve contracted and valve opened for free movement of the packer in a casing pipe, Fig. 2 is a similar view of the packer when it is set in the casing pipe, the rubber sleeve being expanded and the valve released so as to be closed by its spring, Fig. 3 is a partial outside view of the packer in its inoperative or locked position, Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1, Fig. 5 is a sectional view taken on the line 5—5 of Fig. 1, Fig. 6 is a detail view of a modified construction of a scraping portion of the packer, Fig. 7 is a modified construction of a valve opening device, and Fig. 8 is a detail view of another modification of the valve opening device.

My packer consists of a flow pipe formed of a middle section 1, a bottom or lower section 2, and an upper section 3, the latter representing the lower end of an ordinary flow pipe extending to the outside of the well and through which oil or other fluid is extracted from the well. The sections 1 and 3 are joined together by a coupling 4 screwed on the ends of the pipes, and the pipes 1 and 2 are connected by a threaded coupling 5. The coupling 5 has radially extending ribs 6 connecting it with a tubular member 7, channels 8 being formed between the coupling 5 and the member 7. The coupling 5 and the member 7 form a valve block with a concave spherical valve seat 9 adapted to be closed by a convex spherical valve 10. A spring 11 presses the valve against the seat 9, the other end of the spring 11 resting against the upper surface of a cylindrical block 12 screwed on the end of the pipe 2. The lower portion of the block 12 is provided with a recess 13. Holes 14 extend from this recess to the upper side of the block and provide passages for the flow of a fluid through the block outside of the flow pipe. The outside diameter of the cylindrical block 12 is slightly smaller than the inside diameter of a casing pipe 15, and the lower edge of the block 16 sharpened, being thereby adapted to scrape off paraffin and other substances adhering to the inside surface of the casing pipe while the packer is being lowered. A deflecting web 17 is formed on the inside of the block 12, an annular groove 18 being formed between the scraping edge 16 and the deflecting web 17. This groove causes shaving from the inner wall of the casing pipe to curve downward and to fall down, the inner space 13 being thereby protected against being clogged by the paraffin shavings.

A tubular shell 19 is fitted by its lower end into

the upper portion of the valve block 7 and extends to the upper end of the packer. The inside diameter of this shell is larger than the outside diameter of the flow pipe 1 so that an annular clearance 20 is formed between these pipes, this clearance being in communication with channels 21 between the inner and outer portions of the valve block. With the valve 10 open it is possible therefore for fluids to flow through these longitudinal channels or passages outside of the flow pipe, even if the packer is set or sealed in the casing pipe as shown in Fig. 2.

A sleeve 22 is slidably fitted over the valve block 7 and is connected on top with the lower end of an outer tubular shell 23. The latter has convex spring bars 24 pressing against the inner surface of the casing 15. The shell 23 has an L-shaped slot 25 engaging a pin 26 extending from the inner shell 19. Straight spring bars 27 are attached to the shell 23 by their lower ends, the upper ends being attached to slips or serrated segmental members 28. These members have conically tapering inner upper portions sliding over conically tapering collar 29. The latter slide on the inner shell 19 resting against an annular shoulder 30. The collar 29 has a flange 31 engaging the lower end of an expanding rubber sleeve 32. The other end of the sleeve 32 is fitted under a flange 33 of a collar 34 attached to the upper end of the shell 19.

When the outer and inner shells are locked together by the pin 26 moved into the horizontal portion of the L-shaped slot, the sleeve 22 rests by its lower end against pins 35 fitted into the sides of the valve 10 forcing the latter away from the valve seat 9 against the tension of the spring 11.

A modified construction of the scraping device is shown in Fig. 6. A block 36 attached to the lower end of the pipe 2 is provided with sharp resilient knives or scrapers 37 fastened with screws 38. The resiliency of these scrapers permits them to move over rough spots on the inside of the casing pipe. In case of damage to the scraping edges the knives can be easily replaced by new ones.

A modified arrangement for opening the valve is shown in Fig. 7. Here the sleeve 22 is replaced by a sleeve 39 having lugs 40 with recesses on the lower ends fitting over pins 35 fastened to the valve 10. Four lugs and pins are shown in Fig. 7, although, of course, any suitable number may be used, preferably not less than two. The lugs are placed on the pins with the pin 26 locked in the slot 25, and in this position, with the valve open, the packer is lowered into the well. If desired, however, the lugs may be placed at the side of the pins, and then the valve will remain closed regardless of the position of the flow pipe in the packer or pin 26 in the slot 25. This is because the valve 10 has no operative connection with the pipes 1, 2 or 3, and remains closed regardless of the position of the flow pipe in the packer, except for the operation of the valve opening sleeve 22 or 39.

Another modification is shown in Fig. 8 in which a sleeve 41 takes place of the sleeve 22 and rests against lugs 43 attached to the valve 10 by screws 44. The operation of this device is similar to the one shown in Figs. 1 and 2.

The operation of my packer is as follows:

The packer is attached to the end of the flow pipe 3 by the coupling 4. The resiliency of the rubber sleeve 32 will tend to keep the collar 29 against the shoulder 30 so that the sleeve will

freely pass through the aperture in the casing pipe 15. By turning the packer on the flow pipe the pin 26 is placed in the side portion of the slot 25 thereby locking the outer shell 23 in a lowered position in relation to the inner shell 19, so that the sleeve 22 will press on the pins 35 and depress the valve 10 into an open position as shown in Fig. 1. In this locked position with the valve open the packer is lowered into the well until a desired depth is reached. The flow pipe is then turned (to the left with the left handed slots 25 as shown on the drawing) so as to bring the pin 26 in line with the longitudinal portion of the slot 25, the outer shell being prevented from rotation by the friction of the springs 24 against the inner wall of the casing pipe. The flow pipe is then pressed downward causing the collar 29 to slide under the slips 28. The latter will accordingly expand and engage the wall of the casing pipe. The further downward movement of the pipe 3 will compress the rubber sleeve causing it to expand and seal the packer against the wall of the casing pipe 15. The valve block 7 will slide accordingly below the sleeve 22 and will come to rest against the valve 10 as shown in Fig. 2. In this position the valve will operate entirely automatically and independently of the flow pipe 3. It can be opened only by the pressure of a fluid (liquid or gas) from above the packer if this pressure exceeds the pressure of fluids under the packer.

My automatic valve renders the operation of the packer entirely automatic. When there is high pressure in the well under the packer, the valve remains closed, and the oil or gas flows through the flow pipe out of the well by its own pressure. Whenever this pressure falls, however, below the value necessary for raising the column of liquid in the flow pipe, or if the flow becomes too slow for practical purposes, the pressure in the well may be raised to a desired degree by pumping liquids or gases into the space in the casing pipe around the flow pipe, and when this pressure exceeds the pressure under the packer, the valve automatically opens admitting the fluids into the well.

The scraper at the bottom of the packer cleans the casing pipe inside from dirt, paraffin and other matter, thereby rendering the sealing of the pipe by the rubber sleeve more effective, and removing the dirt which otherwise might become wedged in the valve opening. The scraped wall of the casing pipe can be more readily engaged by the anchoring slips 28.

I claim as my invention:

1. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the outer portion of said member being adapted to be expanded by the movement of said flow pipe for sealing a well, said member being provided with longitudinal passages extending from one end of the packer to the other, a valve adapted to close the passages, a yieldable means for closing said valve, said valve being adapted to be opened by the pressure of a fluid in said well above the packer, and means to lock the valve in an open position coordinately with the contracted position of said expanding portion of the cylindrical member.

2. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the outer portion of said member being adapted to be expanded by the movement of said flow pipe for sealing a well, said member being provided with longitudinal passages ex-

tending from one end to the other, a valve adapted to close said passages, a yieldable means for closing said valve, said valve being adapted to be opened by the pressure of a fluid in said well above the packer, means on said tubular member for locking said expanding portion in a contracted position, said locking means being operable by the flow pipe, and means connected with said locking means for opening the valve against said yieldable means.

3. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the upper outer portion of said member being adapted to be expanded by the movement of said flow pipe for sealing a well, said member being provided with longitudinal passages extending from one end to the other, a valve adapted to close said passages at their lower ends, a yieldable means for closing the valve, said valve being adapted to be opened by the pressure of a fluid in said well above the packer, an outer member slidably fitted on said cylindrical member below the expanding portion, said outer member being adapted in its lowered position to open the valve, and means to lock said outer member in its lowered position with the valve open, said locking means being adapted to be operated by the movement of the flow pipe.

4. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the upper outer portion of said member being adapted to be expanded by the movement of said flow pipe for sealing a well, said member being provided with longitudinal passages extending from one end to the other, a valve adapted to close said passages, said valve being adapted to be opened by the pressure of a fluid in said well above the packer, an outer member slidably fitted on said cylindrical member, anchoring slips on said outer member in cooperation with said expanding portion and adapted to engage the wall of said well, an extension on said outer member adapted to open the valve when said slips are moved into inoperative position, and means to lock the outer member in its inoperative position with the valve open, said locking means being operable by the movement of the flow pipe.

5. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the upper outer portion of said member being adapted to be expanded by the movement of said flow pipe for sealing a well, said member being provided with longitudinal passages extending from one end to the other, a valve adapted to close said passages, said valve being adapted to be opened by the pressure of a fluid in said well above the packer, an outer member slidably fitted on said cylindrical member, anchoring slips on said outer member in cooperation with said expanding portion for engaging the wall of said well, a tubular extension on said outer member, the outer edge of said extension being adapted to engage said valve and to open it when said outer member is moved into inoperative position for said slips, and means to lock the outer member in said inoperative position with said valve open, said tubular extension forming a clearance with said valve for the passage of fluids in its locked position.

6. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the upper outer portion of said member being adapted to be expanded by the movement of the flow pipe for sealing a well, said

member being provided with longitudinal passages extending from one end to the other, a valve adapted to close said passages and being adapted to be opened by the pressure of fluids above said packer, an outer member slidably fitted on said cylindrical member, lugs on the sides of the valve, an extension on said outer member adapted to engage said lugs and to open the valve, and means to lock said outer member with the valve opened, said locking means being adapted to be released by the movement of the flow pipe for expanding said upper outer portion of the cylindrical member.

7. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the outer portion of said member being adapted to be expanded by the movement of said flow pipe for sealing a well, said member being provided with longitudinal passages extending from one end to the other, a valve adapted to close said passages and adapted to be opened by the pressure of a fluid in said well above said packer, a cylindrical block attached to the lower end of said packer, and means on said block for scraping the walls of said well when said packer is being lowered therein, said block being provided with passages for said fluid outside of said flow pipe.

8. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the outer portion of said member being adapted to be expanded by the movement of said flow pipe for sealing said well, a cylindrical block attached to the lower end of said packer, and an annular sharp edge on said block for scraping the wall of said well while said packer is being lowered therein.

9. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the outer portion of said member being adapted to be expanded by the movement of said flow pipe for sealing a well, a block attached to the lower end of said flow pipe under said packer and provided with a central recess in communication with said flow pipe, and scrapers on the outside of said block for the inside wall of said well.

10. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the outer portion of said member being adapted to be expanded by the movement of said flow pipe for sealing a well, a block attached on the outside to the lower end of said flow pipe under said packer, and resilient scrapers removably attached to the outside of said block for scraping the inner wall of said well.

11. In a well packer, the combination of a cylindrical member mounted on the lower portion of a flow pipe, the outer portion of said pipe being adapted to be expanded by the movement of said flow pipe for sealing a well, said member being provided with longitudinal passages extending from one end to the other, a valve adapted to close said passages, a spring adapted to keep said valve closed, said valve being adapted to be opened by the pressure of a fluid in said well above said packer, a cylindrical block attached to the lower end of said flow pipe below said packer, said spring being placed between said valve and said block, and means on the outside of said block for scraping the inner wall of said well when said packer is being lowered therein.

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