Sept. 18, 1951 J. S. PAGE 2,568,295

WELL PACKER

Filed April 27, 1946

Fig. 1.

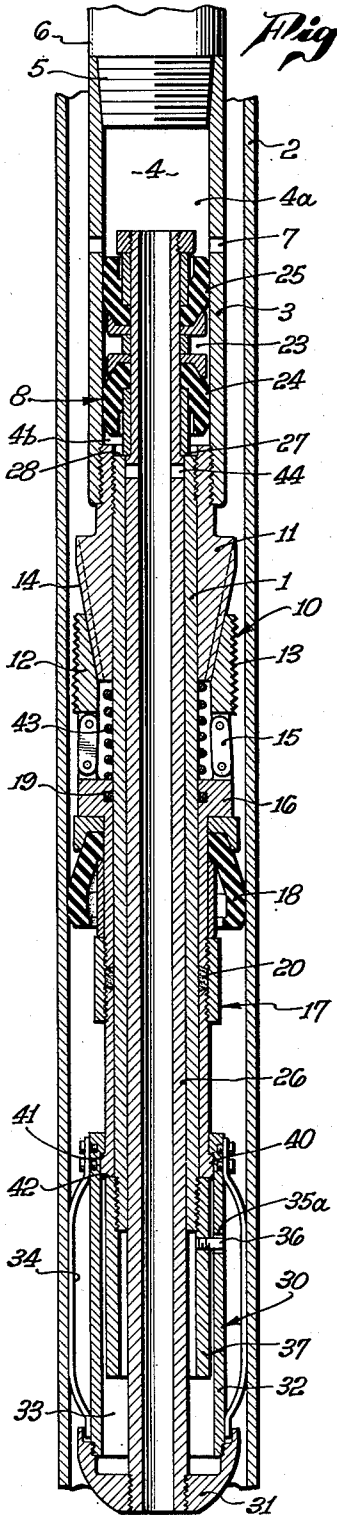


Fig. 2.

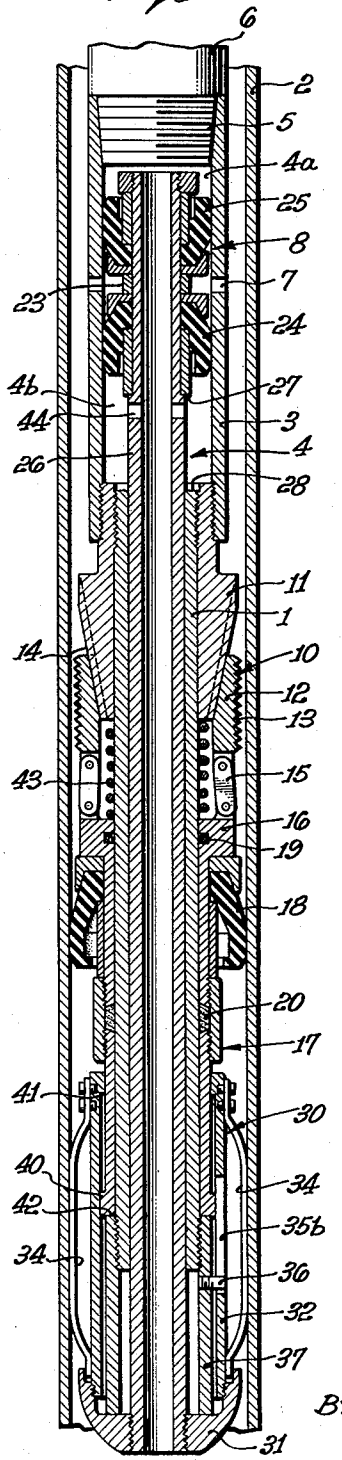
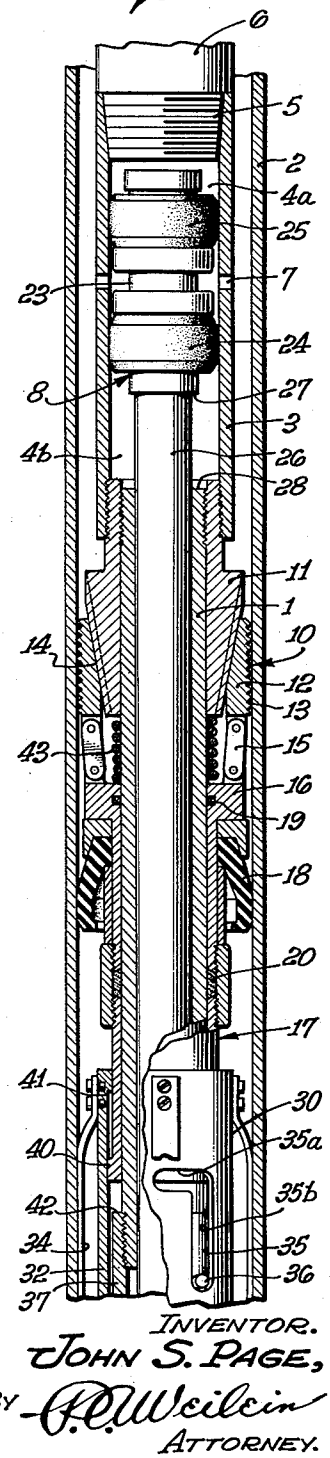


Fig. 3.



INVENTOR.
JOHN S. PAGE,
BY P. C. Weilein
ATTORNEY.

Patented Sept. 18, 1951

2,568,295

UNITED STATES PATENT OFFICE

2,568,295

WELL PACKER

John S. Page, Long Beach, Calif., assignor to Page Oil Tools, Inc., Long Beach, Calif., a corporation of California

Application April 27, 1946, Serial No. 665,485

10 Claims. (Cl. 166—12)

1

This invention relates to oil well packers.

It is an object of this invention to provide a well packer having an improved and simplified mode of operation, as well as increased reliability.

It is another object of this invention to provide a well packer having improved means for controlling the by-pass.

It is another object of this invention to provide a well packer having a valve controlled by-pass and so arranged that fluid pressures within the well or tubing have no tendency to operate the valve.

It is another object of this invention to provide a well packer having improved fluid pressure operated means for operating slip mechanism to grip the casing.

It is still another object of this invention to provide a well packer having pressure operated slip mechanism and a by-pass valve which cooperate in a novel manner.

This invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one embodiment of the invention. For this purpose there is shown a form in the drawings accompanying and forming part of the present specification. This form, which illustrates the general principles of the invention, will now be described in detail; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawing:

Figure 1 is an axial section of a well packer embodying the features of the invention;

Figure 2 is a similar view, but showing the parts in a different operating position; and

Figure 3 is a similar view, showing the parts in still another operating position.

Referring to the drawing, the tool comprises an elongated tubular body 1 adapted to be secured to the lower end of a tubing string (not shown) extending to the surface of the ground, for positioning in a well casing 2. The body 1 is built up of several sections appropriately secured together as by threaded connections. The body 1 has an enlarged portion 3 at its upper end to provide a valve chamber 4; the enlarged portion 3 being secured on the threaded pin 5 of a "sub" or other member 6 secured to the lower end of the above mentioned tubing string. The member 6 is tubular, so that the valve chamber 4 is in continuous communication with the tubing string. One or more ports 7 through the wall of the enlarged body portion 3 serve optionally

2

to establish communication between the interior of the tool body 1 and the tubing string, and the interior of the casing 2. The ports 7 are controlled by a valve means 8, to be described hereinafter.

Conventional casing gripping means 10 are provided to restrain movement of the body 1 in the casing 2. The means 10 comprises a slip head 11 fixed on the body 1 and a plurality of slips 12 having teeth or wickers 13 for engaging the casing 2. As is well understood, the slip head 11 provides inclined surfaces 14 to which the slips 12 are respectively dovetailed. Advance of the slip head 11 between the slips 12 urges the slips radially outward to grip the casing 2 securing the tool against movement therein. Retraction of the head 11 from between the slips 12 pulls the slips radially inwardly, releasing the tool for movement in the casing.

Each of the slips 12 is connected by a pivoted link 15 with the upper end or head 16 of a tubular member or sleeve 17 telescoped over the body 1 for free sliding movement thereon. A conventional packer 18 is secured on the sleeve 17 against the lower side of the head 16, and is directed downwardly so as to seal against the casing 2 in response to excess pressure below the packer. This serves to prevent upward fluid flow between the body 1 and the casing 2. To prevent leakage between the body 1 and the sleeve 17, suitable packing indicated at 19 and 20 may be provided.

It will be apparent that with the body 1 restrained against upward movement in the casing 2, excess pressure below the packer 18 will exert a force urging the packer 18 together with sleeve 17 and the slips 12 upwardly of the body 1, and that this force may be controlled by operating the valve 8 to open and close the port 7, thereby releasing or trapping such fluid pressure. For this purpose, means must be provided to establish communication between the port 7 and the interior of the casing below the packer 18.

The valve means 8 comprises a packed piston 23 slidable in the valve chamber 4, and dividing the chamber 4 into upper and lower parts 4—*a* and 4—*b* respectively. The piston 23 may be formed by a pair of cup leathers or packers 24 and 25 assembled back to back on a tubular member or valve stem 26 extending axially through the body 1 and slidable freely therein. This member 26 serves to maintain the upper part 4—*a* of the valve chamber 4 in communication at all times with the interior of the casing 2 below the packer 18. Additionally, with the valve means 8 in its

lower position with respect to the body, as shown in Figure 1, the chamber 4—*a* is in free communication with the interior of the casing 2 above the packer 18 via the port or ports 7. Thus, the port 7 serves to by-pass the packer 18 by permitting fluid in the casing below the packer to pass freely to the interior of the casing above the packer or vice versa. This facilitates positioning of the tool in the well.

To appropriately limit downward movement of the valve 8 with respect to the body 1, a downwardly facing surface 27 is provided on the valve stem 26 for engagement with an upwardly facing surface 28 in the body 1.

Releasable lock means 30 are provided for retaining the valve means 8 in its lower position with respect to the body 1, maintaining the by-pass port 7 open. Thus, the member 26 extends below the body 1 and has a flange 31 secured at its lower end on which is mounted an enlarged tubular section or cup 32 defining an annular well 33 for accommodating the lower end of the body 1.

A plurality of friction springs 34 are provided on the exterior of the cup 32 for frictionally engaging the wall of the casing 2. Additionally, the wall of the cup 32 is provided with an inverted L slot 35 (see Figure 3) for accommodating a pin 36 carried by a downward extension 37 of the body 1. The arrangement is such that with the pin 36 in the horizontal portion 35—*a* of slot 35 (Figure 1), the valve means 8 is retained in its lower position relative to the body 1.

The springs 34 by their engagement with the wall of the casing 2 serve to restrain movement of the cup 32 and the connected valve means 8, thus appropriate manipulation of the tubing string serves to move the tool body 1 and operate the valve means as desired. By moving the body 1 counterclockwise through a small angle, the pin 36 may be aligned with the vertical portion 35—*b* of the slot 35. The body 1 may then be lowered to cause the valve means 8 to close the ports 7. Such movement is limited by the engagement of the lower end of the body extension 37 with the bottom member 31 (see Figure 2). In this position, fluid pressure below the packer 18 can only escape through the member 26 and the tubing string and may be controlled or augmented as desired. Such pressure, if in excess of the pressure in the casing interior above the packer 18, urges the packer 18 together with the sleeve 17 and slips 12 upwardly of the body 1, causing the slips 12 to engage the casing 2, locking the tool against upward movement in the casing. The parts are now in the relative positions of Figure 3.

It is necessary that the slips 12 be retained in their inactive positions while the tool is being "run in" the casing, and means are provided whereby the lock means 30 serves for this purpose in addition to retaining the valve means in by-pass opening position. For this purpose, the lower end of the sleeve 17 is provided with an annular flange or lip 40 adapted to be confined between opposed shoulders 41 and 42, formed respectively on the lock member 32 and body extension 37.

When the valve means 8 and body 1 are locked against relative axial movement, shoulders 41 and 42 are spaced apart a distance equal substantially to the thickness of the flange 40. Thus, sleeve 17 with the slips 12 and the body 1 are also locked against relative movement (see Figure 1). When the lock means 30 is released, and the

valve means 8 and body 1 are moved relatively to each other to by-pass closing position the shoulders 41 and 42 are separated to release the flange 40 and allow sufficient movement of the sleeve 17 to cause the slips to engage the casing 2 (see Figure 2).

However, it is desirable to insure that the slips 12 do not grip the casing until the valve means 8 has closed the by-pass port 7, as premature engagement of the slips might prevent proper closing of the by-pass. Accordingly, a compression spring 43 is interposed between the lower end of the slip head 11 and the upper face of the head 16 of the sleeve 17. This spring 43 serves to prevent upward movement of the sleeve 17 relative to the body 1 due for example to the friction of packer 18 on the casing 2 as the body 1 is lowered to close the by-pass, or to any slight pressure excess below the packer.

With the by-pass 7 closed, well pressure below the packer 18 may be allowed to build up to urge the sleeve 17 and the slips 12 upwardly, or such pressure may be supplemented or supplied by fluid forced down the tubing string. The upward movement of the sleeve 17 compresses the spring 43 and moves the slips upwardly of the slip head 11, so that they are forced outwardly to grip the casing 2. The parts are now in the relative positions shown in Figure 3.

When the piston 23 is in position to close the by-pass 7, provision is made for equalizing the pressures in spaces 4—*a* and 4—*b* on opposite sides of the piston so that no force is present urging relative movement between the body 1 and the valve means 8. This is accomplished by providing one or more ports 44 in the tubular member 26 opening into the lower chamber 4—*b* when the by-pass is closed.

The operation of setting the tool should be apparent from the foregoing. When it is desired to remove the tool from the well, the tubing string is raised, causing the body 1 to move upwardly with respect to the sleeve 17 and slips 12, the movement of the slip head 11 with respect to the slips serving to retract the slips from casing gripping position. The body also moves upwardly with respect to the valve means 8 opening the by-pass 7, and bringing the pin 36 into alignment with the horizontal port 35—*a* of the slot 35. In this condition all parts are again in the relative positions of Figure 1, and clockwise movement of the body 1 will bring pin 36 into the horizontal slot portion 35—*a*, locking the slips 12 and valve means 8 against further movement with respect to the body 1.

I claim:

1. A well tool for attachment to a tubing string for positioning in the casing of a well comprising a tubular elongated body, a pair of tubular elements mounted coaxially on said body for limited independent movement relative thereto, a packer on the outer of said tubular elements for sealing against the well casing, casing gripping means comprising a slip head and slips on said body, means attaching the outer of said tubular elements to said slips to effect movement of the latter into and out of casing gripping position on relative movement of said outer tubular element and said body, said body having an opening through its wall to permit well fluid to by-pass said packer, a valve on the inner of said tubular elements for controlling said opening on relative movement of said inner element and body, and interengaging members on said elements and said body for releasably locking said

elements against movement in positions in which said by-pass is open and said gripping means are out of casing gripping position.

2. A well tool for attachment to a tubing string for positioning in the casing of a well comprising a tubular elongated body, a pair of tubular elements mounted coaxially on said body for limited independent movement relative thereto, the inner of said tubular elements having an extension in telescoping engagement with the outer of said tubular elements, a packer on said outer element for sealing against the well casing, casing gripping means on said body actuated by movement of said outer element relative to said body, said body having an opening through its wall to permit well fluid to by-pass said packer, a valve on the inner of said tubular elements for closing said opening on relative movement of said inner element and body, and interengaging members on said body, on said outer element and on the extension of said inner element for releasably locking said elements and said body against relative movement in positions in which said by-pass is open and said gripping means are out of casing gripping position.

3. A well packer for attachment to a tubing string for positioning in the casing of a well comprising a tubular elongated body, a pair of tubular elements mounted on the interior and on the exterior respectively of said body for limited movement relative thereto, packings on the outer of said tubular elements for sealing between said body and the well casing, casing gripping members on said body having means connected to the outer of said tubular elements for moving said members to grip the casing on movement of said last named element in one direction relative to said body, said body having a port through its wall above said packings to permit well fluid to by-pass the same, a valve on the inner of said tubular elements for closing said by-pass port, an annular flange on the outer of said tubular elements, stop shoulders on said body and on the inner of said elements for engaging the opposite sides of said flange and for maintaining said tubular elements in assembled relation with said body while permitting limited relative movement, and interengaging means on said body and on the inner of said tubular elements for releasably locking the same in position to maintain said stop shoulders in contact with said flange during insertion and removal of the well packer.

4. In a well packer for positioning in the casing of a well by means of a tubing string, in combination, a tubular elongated body to be attached to the tubing string, a packing element on said body for sealing between said body and the well casing, said body having a port through its wall to serve as a by-pass for well fluid around said packing, said body providing a valve chamber adjacent said port, a valve mounted for limited movement in said chamber to control said port, means on said valve for making frictional contact with the well casing whereby movement of said valve to close or to open said port is effected by lowering or raising said body, and means for releasably locking said valve in position to leave said port open.

5. In a well packer for positioning in the casing of a well by means of a tubing string, in combination, a tubular elongated body to be attached to the tubing string, a packing element on said body for sealing between said body and

the well casing, said body having a port through its wall to serve as a by-pass for well fluid around said packing, said body providing a valve chamber adjacent said port, a valve mounted for limited movement in said chamber to control said port and dividing the latter into two pressure spaces on opposite sides of said valve, one of said spaces being in continuous communication with both the tubing string and the interior of the casing below the packer, means on said valve for making frictional contact with the well casing whereby said valve is moved to close or to open said port by lowering or raising said body, interengaging members on said body and valve for limiting the movement of the latter and for releasably locking said valve in position to open said port, and a passage opened by said valve when in port closing position for admitting well fluid to said other pressure space.

6. In a well packer for positioning in the casing of a well by means of a tubing string, in combination, a tubular elongated body to be attached to the tubing string, a packing element on said body for sealing between said body and the well casing, said body having a port through its wall to serve as a by-pass for well fluid around said packing, said body providing a valve chamber adjacent said port, a valve mounted for limited movement in said chamber to control said port, an extension on said valve projecting beyond said body and movable axially to cause said valve to open and to close said port, and flexible members on said extension for frictionally contacting the well casing so that movement of said valve in said valve chamber is effected by lowering and raising said body, and interengaging members on said body and on said extension for releasably locking said valve in port opening position.

7. In a well packer for positioning in the casing of a well, by means of a tubing string, in combination, a tubular elongated body to be attached to the tubing string, a packing element on said body for sealing between said body and the well casing, said body having a port through its wall to serve as a by-pass for well fluid around said packing, said body providing a valve chamber adjacent said port, a tubular valve mounted for limited movement in said chamber to provide continuous communication between the tubing string and the interior of the well casing below the packer and to control said port, a tubular extension secured to said valve and extending through and beyond said body, resilient friction means on said tubular extension for frictionally engaging the well casing, whereby movement of said body relative to said tubular extension and valve moves the latter to cover and to uncover said by-pass port, and interengaging members on said body and on said extension for releasably locking said valve in position to uncover said port.

8. A well tool for attachment to a tubing string for positioning within the casing of a well bore, comprising a tubular elongate body, a sleeve slidable on said body, a downwardly directed packer on said sleeve for sealing against the well casing, means comprising slip members movably mounted on said body for gripping said casing, means actuated by movement of said sleeve relative to said body for forcing said members into and out of gripping engagement with said casing, said body having a port through the wall thereof above said sleeve for permitting well fluid to by-pass said packer, a valve mounted for lim-

ited movement within said body for controlling said by-pass port, and means attached to said valve and frictionally engaging said casing to adjust the position of said valve within said body in relation to said by-pass port.

9. A well tool for attachment to a tubing string for positioning within the casing of a well comprising a tubular elongate body, a sleeve slidable on said body, a downwardly directed packer on said sleeve for sealing against the well casing, slip members on said body for gripping the casing of the well, means connecting said members and said sleeve to move said members into and out of gripping position on movement of said sleeve relative to said body, said body having a port therethrough above said sleeve to permit well fluid to by-pass said packer, a valve for controlling said port, said valve having an extension beyond said body, resilient friction means on said extension for frictionally engaging the well casing, and stops on said body and said extension for limiting the movement of said valve and for releasably locking said valve in port opening position.

10. A well tool for attachment to a tubing string for positioning within the casing of a well comprising a tubular elongate body, a sleeve slidable on said body, a downwardly directed

packer on said sleeve for sealing against the well casing, slip members on said body for gripping the casing of the well, means connecting said members and said sleeve to move said members into and out of gripping position on movement of said sleeve relative to said body, said body having a port therethrough above said sleeve to permit well fluid to by-pass said packer, a valve for controlling said port, said valve having a tubular extension projecting beyond said body and having a portion in slidable telescoping engagement with said sleeve, resilient friction means on said portion for frictionally engaging the well casing, and stops on said portion and on said body and sleeve for limiting movement of said valve and for releasably locking said valve in port opening position and said sleeve out of gripping position.

JOHN S. PAGE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,343,076	Otis et al.	Feb. 29, 1944