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DEBRIS PUSHER AND CATCHER FOR WELL PACKERS

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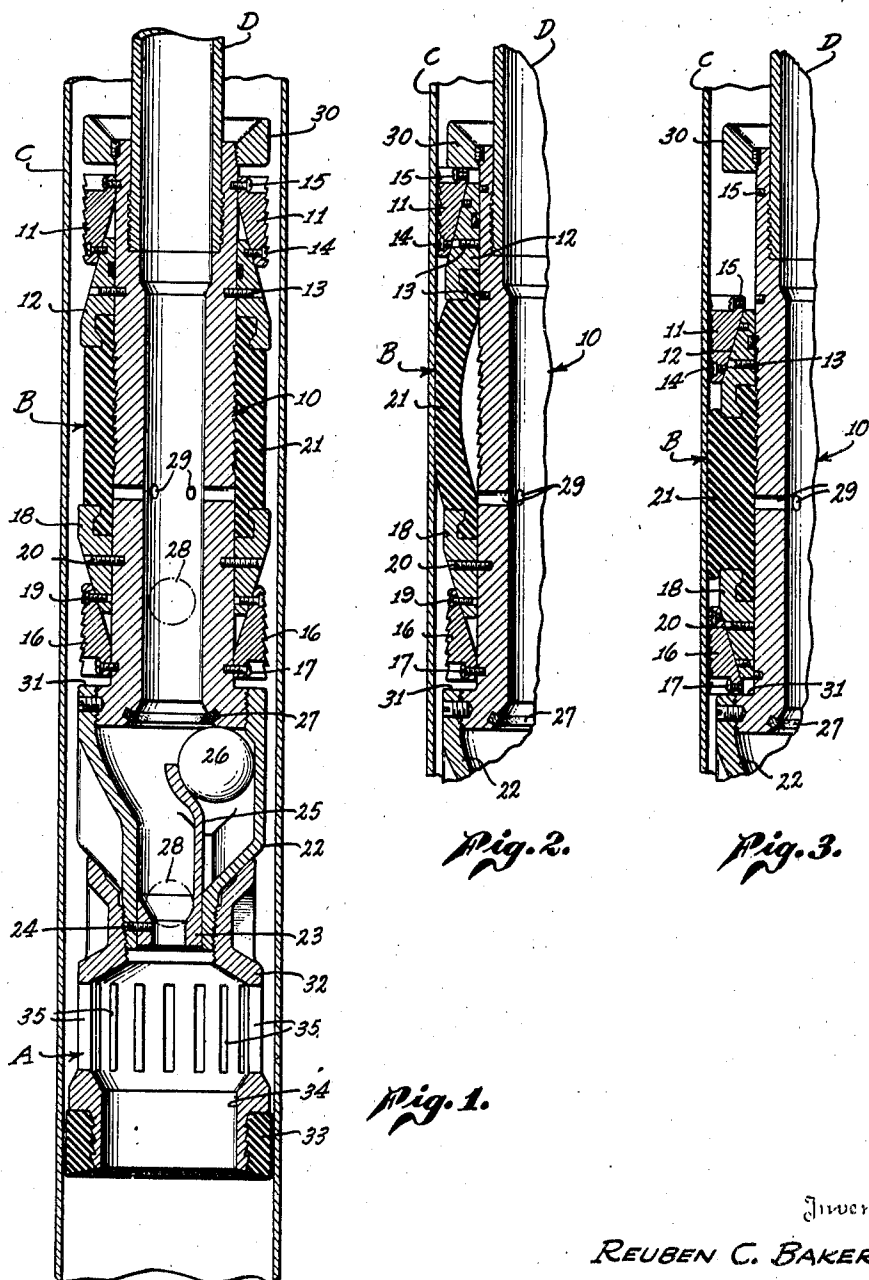


Fig. 1.

Fig. 2.

Fig. 3.

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## UNITED STATES PATENT OFFICE

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## DEBRIS PUSHER AND CATCHER FOR WELL PACKERS

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8 Claims. (Cl. 166—12)

This invention relates to well packers designed to be lowered within and secured to well casings, for the purpose of performing specific functions therein.

Well packers adapted to be run in casings are usually provided with packings carried by their main bodies for the purpose of effecting a seal between the body and the walls of the casing, and also with slips having wickers or teeth capable of digging into the casing to secure the packer thereto. These slips and packings are retained initially on the body in a retracted position to permit lowering of the device to the desired point in the casing before the slips and packing are set. However, under some circumstances, conditions of the hole and casing cause premature setting of those casing engaging parts, as for example, upon their encountering debris within the casing which tends to force them to a setting position before the desired point in the casing or condition of operation is reached. Accordingly, it is an object of this invention to provide a well packer in which debris or other detrimental substances within the casing are prevented from prematurely causing its setting.

It is a further object of the invention to provide a debris pusher and catcher on a well packer, such as a cement retainer, which permits circulation of fluid through the packer during its lowering in the casing and thereafter, but which prevents debris from moving externally of the packer.

The invention has other objects that will become apparent from a consideration of an embodiment shown in the drawing accompanying and forming part of the present specification. This form will now be described in detail, but it is to be understood that such detailed description is not to be taken in a limited sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawing:

Figure 1 is a longitudinal section of a well packer and debris pusher within a well casing;

Figure 2 is a fragmentary longitudinal section of the packer with its upper slips in set position; and

Figure 3 is a fragmentary longitudinal section showing the packer in fully set position.

In accordance with the invention, a debris pusher and catcher A is attached to the lower end of a well packer B with the leading terminus of the pusher effecting a close fit with the walls of a casing C, to prevent by-passing of any debris within the casing externally along the packer

of a size which would contact or otherwise influence the slips or packing seal usually provided in well packers. The debris pusher is disclosed in combination with a cement retainer, which will now be described in detail. However, it is apparent that the general principles of the invention are applicable to other forms of cement retainers than the one disclosed, and to a variety of well packers.

The well packer is shown coupled to the end of a string of tubing D or the like, with its parts in retracted position to permit freedom of passage through the casing to the desired setting point. The packer includes a main body 10 carrying a set of upper annular segmental slips 11 adapted to be moved into engagement with the casing by an upper expander cone 12 initially retained in retracted position by one or more shear screws 13 attaching it to the main body. The upper slips 11 are similarly retained in retracted or ineffective position by respective shear screws 14, 15 securing it to the cone and main body. A lower set of annular segmental slips 16 is initially held in retracted position by attaching it to the main body by shear screws 17 and to a lower expander cone 18 through additional shear screws 19, this latter cone being initially held in ineffective position by suitable frangible connections in the form of shear screws 20.

A packing sleeve 21 of synthetic or natural rubber is positioned between and suitably secured to the ends of the expander cones 12, 18, being initially retained free from contact with the casing walls, but being capable of expansion and contraction into engagement therewith and the main body of the packer.

A valve assembly housing 22 is threadedly secured to the lower end of the main packer body, carrying therewithin a tripping ball seat 23 initially secured thereto by a shear screw 24. This seat has an upstanding arm 25 for holding a buoyant back pressure ball 26 in ineffective position against the interior of the housing to prevent its seating against a valve seat 27 provided at the lower end of the main body. Removal of this arm through a proper operation of the packer device will permit the ball 26 to be positioned on its cooperable valve seat whenever reverse flow through the body tends to occur.

The packer B is run into the casing to the desired point and circulation established there-through to remove any undesired foreign matter. Thereafter, a tripping ball 28 is lowered or pumped down through the tubing string to seating engagement with the tripping ball seat 23,

permitting increase of the pressure of the fluid within the packer body and its passage through ports 29 opening through the body into the interior of the packing. This fluid under pressure will move the cone 12 upwardly along the body to disrupt the various shear screws 13, 14, 15 and expand the upper slips 11 outwardly into gripping engagement with the casing (see Figure 2). The extent of this upward movement is limited by a setting ring 30 suitably attached to the upper end of the main body.

After setting the upper slips, the pressure of the fluid is increased to shear the pin 24 holding the tripping ball seat 23 to the valve housing 22 and remove the seat together with its upstanding arm 25 entirely therefrom, allowing the back pressure ball to seat whenever reverse flow of fluid tends to occur. The taking an upwardly directed strain on the tubing D and the main body 10 of the packer will compress the packing 11 between the casing wall and exterior of the main body, whereupon a continuation of this strain will shear the screws 17, 19, 20 holding the lower slips and cone to the body and cause engagement of the abutment 31 at the end of the body with the slips 16 to move them longitudinally along the face of the expander cone 18 and radially into engagement with the casing (see Figure 3). A continuation of this upward strain will further move the lower slips and cone toward the upper set and compress the packing between the casing walls and exterior of the main body, effecting a leak-proof seal therebetween. The cement retainer is now in set position for the performance of a cementing or other operation, or to function as a bridge plug, as explained in United States Patent No. 2,121,051, to which attention is invited.

Although under many circumstances the well packer or cement retainer B can be lowered in the casing to the desired point and set therein in the manner aforementioned, conditions sometimes are presented which effect its premature setting upon being moved through the casing. I propose to obviate such premature setting by threadedly attaching a supplementary body 32 to the lower end of the retainer or valve housing 22, this body being provided with a scraper 33 of rubber or other suitable material secured to its lower terminus and adapted to make a comparatively close fit with or slidably engage the walls of the casing with a reasonable degree of pressure. Thus, as the packer is lowered through the casing, the scraper will prevent any debris from moving externally of the packer and having possible detrimental effects upon the slips 11, 16 and packing sleeve 21. In place of moving externally of the packer, the debris is directed into and through a bore 34 provided in the supplementary body, the intermediate portion of this body being provided with suitable perforations or slots 35 permitting exiting of fluids or liquids therefrom. However, these slots are of insufficient dimensions to allow passage of the debris, which will be either contained within the supplementary body 32, or which might be of such quantity in some instances as to pass into the main body 10 of the packer. This latter possible circumstance will have no detrimental effects upon the packer either during its lowering in the casing to the desired setting point, or during subsequent operations, since circulation of fluid downwardly through the string of tubing and packer will effectively remove all of the debris in order that unimpeded operation of the

packer can be obtained after it has been positioned at the desired region in the casing.

The scraping portion 33 of the debris pusher is either slightly spaced from or engages the walls of the casing with a slight force, which, however, is insufficient to retard or prevent lowering of the packer therein. Its lower end, however, is slightly inclined so that both fluid and debris are guided inwardly toward its opening.

I claim:

1. In a well packer, a body having a longitudinal central passage adapted to be lowered in a casing, slips supported by said body in retracted position as the packer moves through said casing, a one-way valve assembly fixed to the lower end of said body and provided with valve means adapted to close said passage, a supplementary hollow body secured to said valve assembly and communicating therewith, a scraper attached to the end of said hollow body in circumferential juxtaposition with said casing, said supplementary body being provided with openings above said scraper establishing communications between its interior and exterior to permit by-passing of fluid around the scraper.

2. A debris pusher for a well packer, including a hollow body having an upper end adapted for attachment to said packer and an opening at its lower end, a scraper secured to the periphery of said body at its lower end, said body having elongated openings through its side walls of dimensions permitting fluid to by-pass said scraper while preventing passage of debris.

3. A debris pusher for a well packer, including a hollow body having an upper end adapted for attachment to said packer and an opening at its lower end, a rubber scraper secured to the periphery of said body at its lower end, said body having circumferentially arranged slots through its side walls intermediate its ends and above said scraper of dimensions permitting fluid to by-pass said scraper while preventing material passage of debris.

4. In a well packer, a body adapted to be lowered in a casing, slips supported by said body in retracted position as the packer moves through said casing, a device fixed to said body below said slips with its lower end circumferentially contiguous to said casing to prevent passage of debris externally of said packer as it is lowered through the casing, said body having a passage therethrough, a chamber in said device opening through the bottom thereof and communicating with said passage, said chamber having circumferentially spaced elongated openings through its side walls permitting by-passing of fluid around the contiguous portion of said device between the exterior and interior of said chamber.

5. A debris pusher for a well packer, including a hollow elongated body having an upper end adapted for attachment to said packer and an opening at its lower end, a rubber scraper sleeve secured to the periphery of said body at its lower end, said body having circumferentially arranged slots through its side walls intermediate its ends and above said scraper of dimensions permitting fluid to by-pass said scraper while preventing material passage of debris, the bottom of said scraper being tapered inwardly and upwardly.

6. A debris pusher for a well packer, including a hollow body having an upper end adapted for attachment to said packer and an opening at its lower end, a scraper secured to the periphery of said body at its lower end, said body having openings through its side walls of dimensions permit-

ting fluid to by-pass said scraper while preventing passage of debris.

5 7. A debris pusher for a well packer, including a hollow body having an upper end adapted for attachment to said packer and an opening at its lower end, said lower end being of such dimensions as to be circumferentially contiguous to a casing through which said packer is adapted to pass, said body having openings through its side walls of dimensions permitting fluid to by-pass said 10 lower end of the scraper while preventing passage of debris.

8. In a well packer, a body adapted to be lowered in a casing, slips supported by said body

in retracted position as the packer moves through said casing, a device fixed to said body below said slips with its lower end circumferentially contiguous to said casing to prevent passage of debris externally of said packer as it is lowered through 5 the casing, said body having a passage there-through, a chamber for said body opening through the bottom thereof and communicating with said passage, said chamber having spaced openings through its side walls permitting by-passing of 10 fluid around the contiguous portion of said device between the exterior and interior of said chamber.

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