July 6, 1937. J. T. PHIPPS 2,085,997

PACKER

Filed Dec. 23, 1935 2 Sheets-Sheet 1

Fig. 1

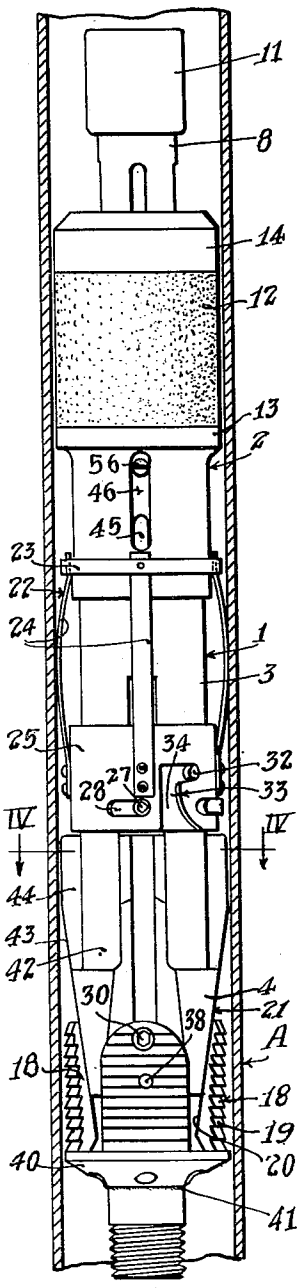


Fig. 2

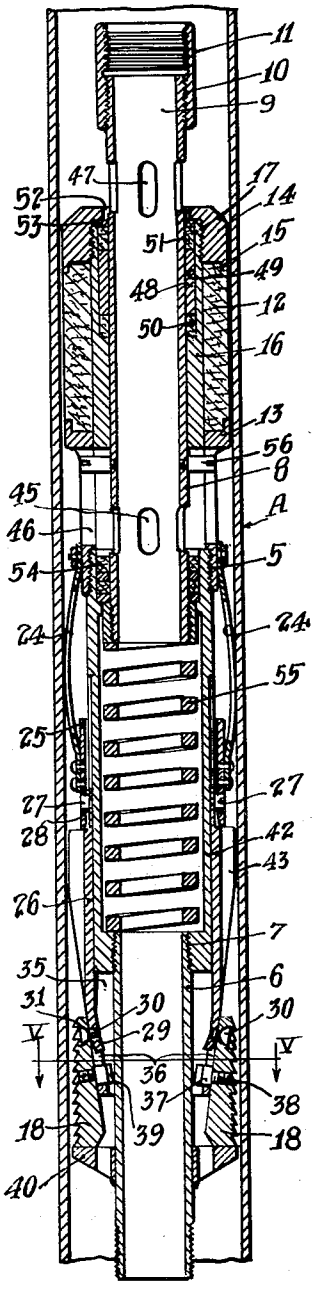
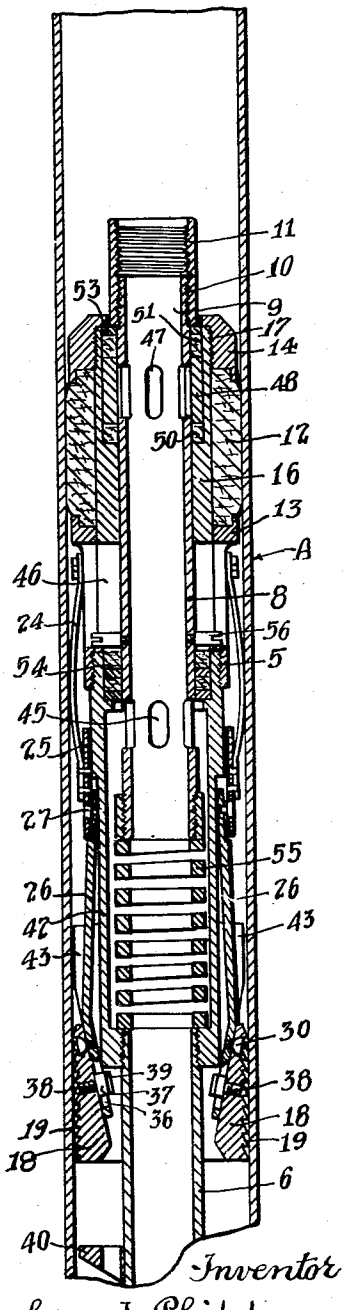


Fig. 3



Inventor

John J. Phipps

BY Lyon & Lyon ATTORNEYS

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Fig. 4

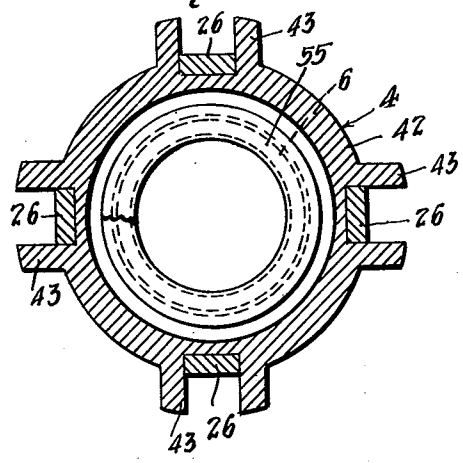
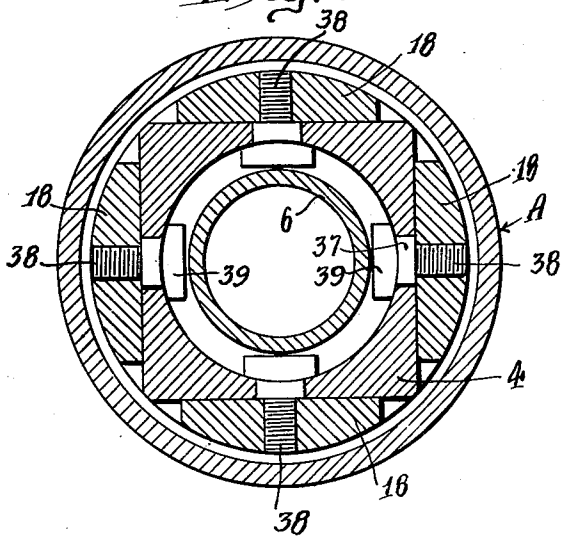


Fig. 5



INVENTOR.

John J. Phipps

BY Lyon & Lyon ATTORNEYS

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2,085,997

PACKER

John T. Phipps, Huntington Park, Calif.

Application December 23, 1935, Serial No. 55,873

6 Claims. (Cl. 166—12)

My invention relates to oil well packers and has particular reference to a tool to pack off oil well casing or tubing at any desired point along the length thereof. In the pumping of oil wells, it is the common practice to insert in a well casing a device which closes off the oil well casing at a predetermined level, thereby dividing the casing into two chambers, namely the upper chamber above the packing or closure member, and a lower chamber, communication between which is established by means of a tubing pipe or passage of less area than the area of the casing through which oil or gas may pass from the lower chamber to the upper chamber. For such operation a tool commonly known as a "packer" is employed, this tool consisting essentially of a tubular packing element constructed of compressible or expansible material arranged between two collars which, when moved toward each other, will squeeze the packing member out into snug engagement with the walls of the casing, these collars being connected, respectively, to a pair of telescopically assembled members, one of which carries a wedge mechanism bearing casing-engaging slips set into operation by means of the usual anchors, while the other of which is slidable with reference to the first telescopic member after the slips have been set to hold the first member in fixed relation in the casing.

These packers, however, as commonly employed, are provided with some means to prevent the dragging of the anchor mechanism on the casing from setting the slips until the tool has been moved to a predetermined level in the casing, at which time this holding mechanism is released to allow the further movement of the tool to cause the anchors to set the slips into gripping relation with the casing.

In most of these prior tools, the slip mechanism and the anchor mechanism have been secured at the lower end of the tool so that if there are obstructions in the well casing they engage the slips, causing them to be set before the tool has been moved into its desired position and the tool must then be backed up and the obstruction removed before the device can be placed at its desired level.

In ordinary packers and similar tools the location of the slips at the lowermost portion of the tools allows frequent loss of the slips. As will be understood by those skilled in the art, when a tool is set into position in the casing, the slips bite into the walls of the casing with considerable force and when the tool is backed up to disengage the slips the force necessary to release the slips frequently breaks the slips and there being nothing on the tool below the slips to engage or hold the slips, such broken slips fall down into the hole and are lost in the well.

It is also the common practice to employ some valve mechanism through the fluid passage extending through the packer, whereby the pressure of a column of fluid above the packer is allowed to flow down through the packer when it is desired to disengage the packer and move it to a new position, thus making it unnecessary that the entire packing mechanism be elevated against the fluid pressure existing above the packers. Such valve arrangements have ordinarily been of such character that only a relatively small fluid passage is permitted, which frequently clogs, or which is so small that considerable time is required for the release of the pressure above the tool.

It is, therefore, an object of my invention to provide an improved packer, wherein the lowermost end of the packer is provided with a guard means which protects the slips from inadvertent engagement with the walls of the casing, or obstructions therein, during the movement of the packer through the casing.

Another object of the invention is to provide a tool as set forth in the preceding paragraph, wherein such guard means constitutes also a guard for preventing disassembly of the slips from the remainder of the tool and prevents the loss of the slips.

Another object of the invention is to provide a packer of the character set forth, wherein the entire interior of the tool is available as a fluid passage through the tool.

Another object of the invention is to provide a packer as set forth in the preceding paragraph, wherein one of the telescopic members employed in the tool constitutes a relatively large tubing through which fluid may flow, and which tubing constitutes a valve permitting bypass of fluid around the packer during the time the packer is being set into position, and during the time it is being removed from the said position.

Another object of my invention is to provide a new and novel mounting means for slips which may be employed with my packer construction.

Other objects and advantages will be apparent from a study of the following specifications, read in connection with the accompanying drawings, wherein

Figure 1 is a vertical elevational view of a packer constructed in accordance with my invention;

Figure 2 is a vertical sectional view, taken through the packer shown in Fig. 1, and illustrating the same in its free position prior to being set into place in the casing;

Figure 3 is a sectional view, similar to Fig. 2, illustrating the relation of the parts when the packer is set into fixed position in the casing;

Figure 4 is a sectional view, taken along line IV—IV of Fig. 1; and

Figure 5 is a detail sectional view taken along line V—V of Fig. 2.

Referring to the drawings, I have illustrated a section of oil well casing at A, representing a typical section of an oil well at which it is desired to set a packer. I have illustrated my packer as including a body member 1 which may be formed of a plurality of sections, such as an upper tubular section 2, to which is secured a second tubular section 3 upon the lower end of which is formed a cone or wedge 4, the section 3 being secured to the section 2 by any suitable means, such as screw threads 5.

A third section of the body member is formed as a nipple 6, which may be formed integrally with, or may be secured to, the cone section 3, as indicated at threads 7.

Telescopically assembled within the body member 1 is a mandrel 8 preferably constructed in the form of a nipple or section of pipe having a fluid passage 9 extending therethrough, the upper end of the mandrel 8 being threaded, as indicated at 10, to permit attachment thereto of a coupling 11 by which flow-tubing or other pipe may be secured to permit oil to flow upwardly to the surface of the ground.

A rubber packing member is illustrated at 12 as comprising a tubular section of rubber fabric or other compressible material, well known in the art, and which is selected for its characteristic of being capable of expanding or squeezing outwardly when pressure is applied to the upper and lower ends of the tubular packing member 12. The packing member 12 is illustrated as being seated at its lower end in a packing seat or collar 13 formed upon or attached to the upper end of the body member 2, while a similar collar member 14 is formed to engage the upper end of the cylindrical packing member 12, as indicated at 15. It will thus be observed that by moving the collars 13 and 14 toward each other the rubber or similar packing 12 lying between them will be compressed longitudinally, and will expand or squeeze out laterally toward the side walls of the casing A, thus forming a sealing engagement therewith. In order to prevent the inward expansion of the packing member 12, a backing sleeve 16 is provided, preferably secured to the upper collar 14 by threads indicated at 17 so that the backing sleeve 16 moves with the upper collar 14. It will be noted that the sleeve 16 is slidable within the upper section 2 of the body member 1 so that by fixing the body member at the desired point in the well, pressure applied to the upper collar 14 will compress the packing member 12 into sealing engagement with the casing.

In order to fix or set the body member 1 in fixed relation at a desired point in the casing, I provide a plurality of casing-engaging slips 18 having teeth 19 formed thereon to engage and dig into the interior walls of the casing whenever the slips 18 are moved into engagement with the casing.

As will be understood by those skilled in the art, the slips are each formed as a segment of a cylinder, the outer surface of which is generally cylindrical in shape and bears the teeth 19, while the inner surface of each of the slips is formed with a taper, indicated at 20, adapted to engage the tapered surface 21 of the cone or wedge member 4.

It will also be understood by those skilled in the art, that the size and shape of the cone member 4 is such that when the tool is in its normal, free position the slips 18 will be in their contracted position, as shown in Figs. 1 and 2, being spaced inwardly to such position as to prevent them from engaging the walls of the casing, thus permitting the tool to be moved freely up and down in the casing without engagement between the slips and the casing.

However, when it is desired to set the slips into operation, it is only necessary to stop the downward movement of the slips, while downward movement of the cone 4 is continued. For this purpose, I provide an anchor mechanism 22 for supporting the slips, which anchor mechanism may be of any desired construction, though I prefer to provide a collar 23 surrounding the body section 2, but freely slidable thereon, to which collar is attached a plurality of bowed springs 24, one for each of the slips employed, the lower ends of the springs 24 being secured to a second collar 25 freely slidable upon the body section 3. The bowed springs 24 extend outwardly beyond the periphery of the remaining parts of the tool to normally engage the inner walls of the casing A and to drag thereon during the downward movement of the tool through the casing.

Each of the slips 18 is connected to the collar 25 by means of a strap or rein 26, the upper end of the rein being secured as by means of a screw 27 engaging loosely in a slot 28 in the collar 25, while the lower end of the rein 26 is bent inwardly as indicated at 29 and is secured to the slip 18 by means of a bolt or screw 30 preferably having a rounded head to engage in a semispherical seat 31 formed in the slip 18 to constitute a ball and socket joint therewith, allowing the slip to have substantially free movement in all directions about the screw 30.

As will be understood by those skilled in the art, the bowed springs 24, dragging on the casing, normally cause the entire mechanism to slide upwardly on the body sections 2 and 3 unless restrained from such movement. Thus when it is desired to lower the tool into a well casing, a pin 32 on the body section 3 is placed in engagement with a bayonet slot 33 formed in the anchor collar 25 to prevent movement of the collar 25 longitudinally on the body 1. However, when the tool has been moved to the desired level in the casing, a rotation of the tool in a right-hand direction will cause the pin 32 to move into alignment with the vertical leg 34 of the bayonet slot 33 and then subsequent lowering of the body member 1 will leave the anchor free to remain stationary in the casing, while the remainder of the tool moves downwardly. This downward movement of the remainder of the tool, particularly the cone section 4 of the body member, while the anchor 22 and the slips 18 are prevented from downward movement, will cause the tapered or wedged shaped cone member 4 to move down past the slips 18, squeezing these slips outwardly into engagement with the walls of the casing. The cone section 4 of the body member is preferably hollow, as indicated at 35, so that the extreme lower end of the cone member is con-

stituted by a relatively thin shell, adapting the slips 18 to be readily secured thereto by providing elongated slots 36 through the cone section 4 to slidably receive therein the head 37 of a T-headed screw or bolt 38 attached to the slips 18, the extreme outer end 39 of the head 37 of the bolt 38 being preferably of greater width than the slot 36 so as to engage the rear surface of the cone section 4 to prevent the slips from falling away from the cone, while permitting free longitudinal movement of the slips relative to the cone.

I prefer to form the section 39 of the bolt 38 of rectangular cross section, having one of its dimensions greater than the slot, while the other of its dimensions is slightly smaller than the slot so that by rotating the slip through an angle of 90° to the position shown in Fig. 1, the head 37—39 of the bolt 38 may be inserted through the slot and then the slot may be rotated back to the position shown in Fig. 1, thus securing the slip to the cone by a key and slot construction. The employment of the bolt and slot construction herein described provides a ready means for attaching the slip or of removing a broken or worn slip without requiring disassembly of any other parts of the tool other than disconnection of the rein from the particular slip which is to be inserted or removed.

It will also be observed that the lowermost section 6 of the body member is provided with a radially extending flange 40 which may be rigidly secured thereto by any suitable means, such as welding, indicated at 41. The radial flange 40 is preferably formed of a diameter just slightly less than the diameter of the casing A in which the tool is to be employed, and I prefer that the lower surface of the flange 40 be beveled as indicated in Figs. 1, 2, and 3 so that this flange constitutes a guard moving downwardly with the tool in advance of the slips 18. As illustrated herein, the slips 18, when in their normal retracted position, have all of their surfaces lying within the limits of the flange 40 so that any obstructions in the casing A would be encountered by the flange before such obstructions could engage the slips. The movement of the guard flange 40 therefore protects the slips against accidental setting into gripping relation with the casing, while, also, the flange 40 constitutes a reamer or cleaner which will engage and remove any minor obstructions in the casing, such as hard mud, dirt, or debris which may be adhering to the casing and which would otherwise interefere with the insertion of the tool.

The location of the flange 40 on the body section is preferably such that when the anchor 22 is in its normal position, as shown in Fig. 1, the lower ends of the slips 18 will rest upon the flange 40. It will, therefore, be observed that after the tool has been set into one position in the well and it is desired to move it, upward movement of the body member 1 to withdraw the cone 4 from the slips 18 will allow the slips to be free to move inwardly out of the casing-engaging position, and, in the event that one or more of the slips should bind on the casing the upward movement of the body member will bring the flange 40 into abutting relation with the lower ends of the slips and positively lift them upwardly in the casing, releasing them from gripping relation with the casing. Moreover, should one of the slips become broken, or disengaged from the remainder of the tool, as by breakage of the bolts 38 or of the reins 26, the flange 40 will pick up such slip and remove it from the hole without danger of its falling from the tool into the well.

It will also be observed that by forming the cone member of hollow construction it may be rendered relatively light in weight, as by forming it as a length of relatively thin walled tubing, as indicated at 42, while the tapered surfaces on which the slips are wedged outwardly may comprise a plurality of wings 43 built up upon or extending outwardly from the tubular section 42. These wings 43 are located in groups of two each for each of the slips, the pair of wings in each group constituting two spaced tapered bearing surfaces upon which the slips may ride, while the upper ends of the wings 43 project outwardly to approximately the same distance as the flange 40 projects to form a stabilizer or guide on the tool above the slips 18. The upper ends of these wings, indicated at 44, therefore constitute a guard of solid material above the slips protecting these slips from injury when the tool is lifted in the casing.

Upon the setting of the slips 18 into engagement with the walls of the casing by the downward movement of the cone 4, relative to the slips and anchor, the body member will be wedged in the casing at the desired level and further downward movement of the body member will therefore be prevented. Thus with the body member 1 fixed against further downward movement in the casing, the packer 12 may be set into sealing relation with the casing by producing a downward movement of the collar 14, relative to the body member 1. This is preferably accomplished by moving the mandrel 10 downwardly through the body member 1 until the coupling 11 abuts the collar 14. Thus further downward pressure exerted upon the coupling 11 will cause the collar 14 to press downwardly upon the packer 12, expanding the packer out into engagement with the walls of the casing.

It will also be understood by those skilled in the art that the packer is frequently required to be placed below the level of the fluid in the well casing so that as the packer is moved down through the casing, and through the fluid, the fluid will be required to pass around the small space permitted by the contracted diameter of the packer 12. However, this would constitute considerable resistance to the movement of the packer and it is desirable to provide other fluid passages through the packer. By constructing the lower section 6 of the body 1 as a nipple or tube, fluid below the packer may pass upwardly therethrough and through the hollow mandrel 8. Also, fluid may pass upwardly around the exterior of the nipple 6 and along the exterior of the body sections 4, 3 and 2, and a bypass may be provided for relieving such fluid below the packer 12 by providing a plurality of ports 45 in the mandrel 8 and by providing a plurality of ports 46 in the upper section 2 of the body member 1, so that fluid flowing up around the exterior of the tool may pass inwardly through the ports 46 and 45 and upwardly through the mandrel 8. It is also desirable that such fluid as is bypassed through the mandrel 8 may be permitted to escape exteriorly of the mandrel upon the upper side of the packer 12, and for this purpose a plurality of ports 47 may be provided in the mandrel 8, communicating with the well casing above the collar 14.

When the packing tool has been set into place,

and the packer 12 compressed into sealing relation with the casing, the only fluid passage which should be permitted through the packer should be that which leads directly from the tubular section 6 of the body member upwardly through the tubing string or flow pipe which is connected upon the upper end of the mandrel 8, and for this purpose it is desirable that the ports 45 and 47 should be closed off at this time.

By referring to Figs. 2 and 3, it will be observed that when the packing tool is in its free position—(that is as it is being moved up and down in the well)—the extended position of the mandrel is such that the ports 45 are open for communication with the well casing below the packer 12, while, at the same time, the ports 47 are also open for communication with the well casing above the packer 12.

However, when the packing tool has been set in place and the packer 12 compressed, the mandrel 8 will have been moved downwardly relative to the body member 1, to the position shown in Fig. 3, at which time the ports 45 and 47 will be closed off. The ports 47 are preferably located in the mandrel 8 at a position immediately above the collar 14, and the spacing between the backing sleeve 16 for the packer 12 and the exterior of the mandrel 8, includes a sleeve member 48 which will act as a shut-off for the ports 47. The sleeve 48 is preferably located in a longitudinally extending recess 49 formed in the backing sleeve 16, between the lower end of which and the lower end of the sleeve 48 I provide a ring of packing material 50, while a similar ring 51 is located at the upper end of the sleeve 48 adapted to be compressed when the coupling 11 presses downwardly upon the collar 14. It will be observed that the opening 52 in the collar 14 is such that it will permit the coupling 11 to pass through the upper end of the collar 14 so as to come to rest upon a washer 53 located above the ring of packing material 51. Thus the downward pressure of the coupling 11, necessary to expand or compress the packer 12, will be transmitted through the packing rings 50 and 51 and the sleeve 48 to the backing sleeve 16, and thus tighten the packing around the mandrel 8.

At the time, however, that this compression of the packer 12 and the packing rings 50, 51 occurs, the mandrel will have been moved down into the body member a sufficient distance to bring the ports 47 into alignment with the sleeve 48 to close off the ports 47 with a packed seal, and thus close the bypass which up to this time has permitted fluid to flow outwardly in the casing above the packer 12.

In like manner the lower ports 45 are located in such position that when the mandrel is in its extended position, as shown in Fig. 2, these ports will be immediately above a series of packing rings 54, but when the mandrel is in the contracted position, as shown in Fig. 3, the ports 45 will have been moved downwardly past the packing rings 54 and there will be no opportunity for fluid to flow into or through the body member at any point other than through the nipple 6.

As will be understood by those skilled in the art, when the packing tool has been set into operation below the level of the fluid in the well, the column of fluid above the well will resist removal or disengagement of the packing tool and particularly when there is a relatively tall column of fluid above the packer great force is required to be exerted to lift the collar 14 sufficiently to allow the packer 12 to return to its contracted position free of the walls of the casing. However, by employing the bypass formed by the mandrel 8 and its ports 45, 47, the lifting of the mandrel member provides a bypass through the ports 47—45 preventing the necessity of lifting the entire column of fluid when the packer is to be released. Further, to assist in the lifting of the mandrel member to create the bypass, I may provide a relatively heavy spring 55 interposed between the lower end of the body section 3, which spring normally holds the mandrel in its extended position, but which is compressed upon the exertion of downward force upon the flow pipe or tubing string when the packer is set into place. Hence the elevation of the flow pipe or tubing string to release the packer will be assisted by the forces which have been accumulated in the spring 55.

Since it is necessary to slightly rotate the tool when the desired level is reached, I provide a plurality of pins 56 secured to and extending radially from the mandrel 8 through the ports 46 in the body section 2. These pins, operating in the elongated slots forming the ports 46, will permit free vertical movement of the mandrel relative to the body member, but will connect the mandrel and body members together against rotation relative to each other.

It will therefore be observed that I have provided a packing tool in which the anchor and slip mechanism necessary for securing the body of the tool to the wall of the casing is located below the packing member 12 but which is protected against injury by two guard mechanisms, namely the flange 40 which guards the lower ends of the slips and the guards 42 which protect the upper ends of the slips and the slip reins. Further, the flange 40 and the wings 43 being spaced longitudinally along the tool, constitute casing-engaging stabilizers which hold the tool substantially centered in the casing while it is moving downwardly or upwardly therethrough and act as bearing guides permitting the tool to follow any small dents or depressions encountered in the casing.

It will be observed that I have provided a slip construction which is guarded both above and below the slips to prevent injury to the slips as the tool is set into place, while, at the same time, the guard flange 40 acts as a "pick-up" slip, preventing loss of slips should they become broken or damaged or separated from the remainder of the tool.

It will also be observed that I have provided a relatively simple bypass construction, wherein substantially the entire interior of the tool constitutes a fluid passage through which fluid may be bypassed around the packer 12 when it is moved into and out of its set position, while a simple valve construction constituted as mere ports in the mandrel member acts as a cutoff valve closing this bypass by the same movement of the packer which causes the packer to be set into active position in the well or causes it to be removed from such active position.

While I have shown and described the preferred embodiment of my invention, I do not wish to be limited to any of the details of construction shown herein, except as defined in the appended claims.

I claim:

1. In a packing tool for well casings, a body member, a mandrel telescopically mounted there-

in for longitudinal movement relative to said body member, means carried by said body member for engaging said casing to fix the position of said body member at a predetermined level in said casing, a packing member normally contracted to permit passage of such packing member through said casing and expansible upon movement of said mandrel relative to said body member, a fluid passage through said mandrel, and ports in said mandrel above and below said packing member communicating with the interior of the casing above and below said packing member.

2. In a packing tool for well casings, a body member, a mandrel telescopically mounted therein for longitudinal movement relative to said body member, means carried by said body member for engaging said casing to fix the position of said body member at a predetermined level in said casing, a packing member normally contracted to permit passage of said packing member through said casing and expansible upon movement of said mandrel relative to said body member, a fluid passage through said mandrel, and ports in said mandrel above and below said packing member communicating with the interior of the casing above and below said packing member, and means on said body member for closing said ports when said mandrel is moved downwardly relative to said body member.

3. In a packing tool for well casings, a body member, a hollow tubular mandrel telescopically mounted in said body member for longitudinal movement relative thereto, means carried by said body member for engaging said casing to fix the position of said body member at a predetermined level in said casing, a packing member carried by said body member, normally contracted to permit passage of said packing member through said casing and expansible to engage and seal against said casing when said mandrel member is moved downwardly in said body member through a predetermined distance, a fluid bypass around said packing member including ports in said mandrel member communicating between said casing and said hollow mandrel above said packing member and other ports in said mandrel member communicating between said casing and the interior of said mandrel member below said packing member.

4. In a packing tool for well casings, a body member, a mandrel telescopically mounted therein for longitudinal movement relative to said body member, means carried by said body member for engaging said casing to fix the position of said body member at a predetermined level in said casing, a packing member normally contracted to permit passage of such packing member through said casing and expansible upon movement of said mandrel relative to said body member, a fluid passage through said mandrel, ports in said mandrel above and below said packing member communicating with the interior of the casing above and below said packing member, and means on said body member engaging said mandrel member to close said ports when said mandrel member is moved downwardly in said body member to expand said packing member.

5. In a slip and cone construction for oil well tools, a body member having a tapered surface thereon, a plurality of slips in said body member extending longitudinally thereof, a plurality of slips engageable with the tapered surface of said body member to be removed thereby from a normally free position to an active position engaging the casing of an oil well, the upper end of the tapered portion of said body member extending outwardly beyond the surface of the slips when said slips are in their free positions, a T-head bolt secured to each of said slips and extending through said slots to hold said slips on said body member.

6. In a slip and cone construction for oil well tools, a body member having a tapered surface thereon, a plurality of slips in said body member extending longitudinally thereof, a plurality of slips engageable with the tapered surface of said body member to be removed thereby from a normally free position to an active position engaging the casing of an oil well, the upper end of the tapered portion of said body member extending outwardly beyond the surface of the slips when said slips are in their free position, a T-head bolt secured to each of said slips and extending through said slots to hold said slips on said body member, the cross bar of said T having a width less than the width of said slot and having a length greater than the width of said slot and secured to said slip with the longer dimension extending at right angles to the longitudinal axis of said slip.

JOHN T. PHIPPS.