June 19, 1945. E. J. ROE 2,378,374

PACKER

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Fig. 1.

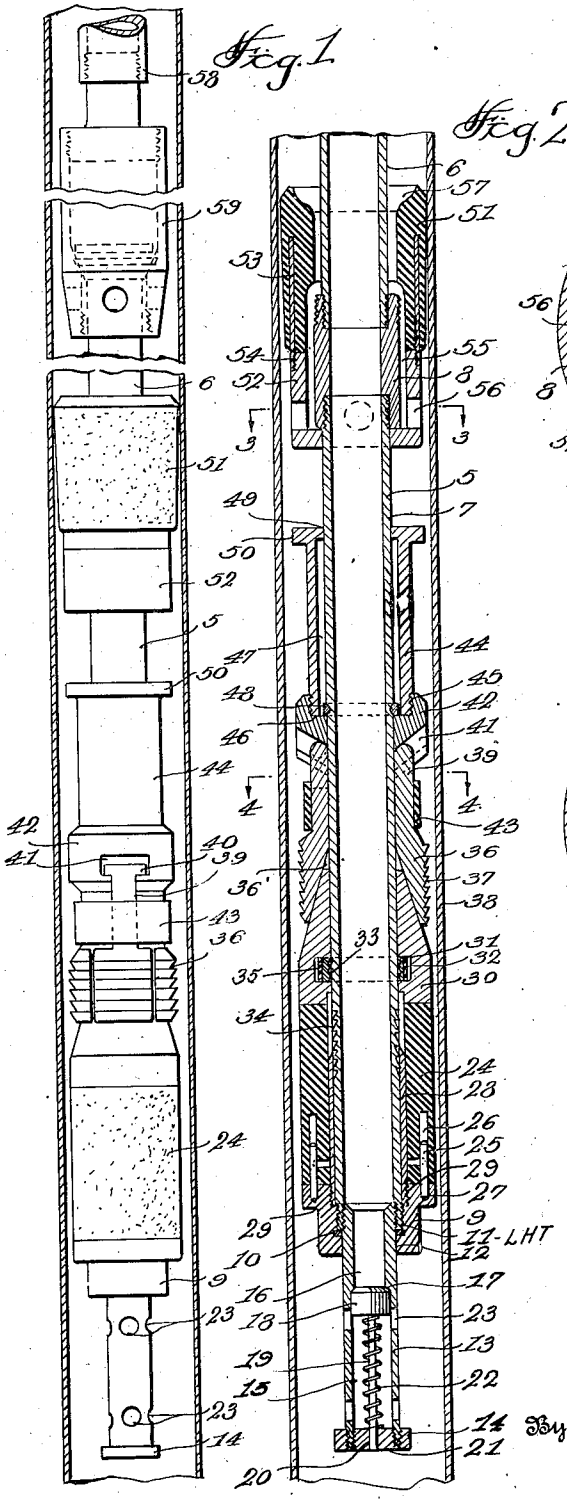


Fig. 2.

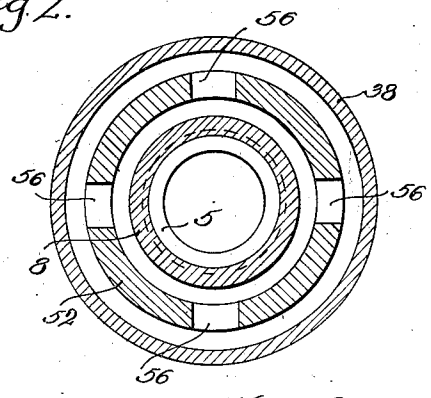


Fig. 3.

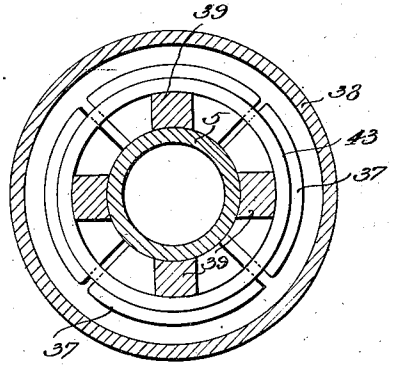


Fig. 4.

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Fig. 5

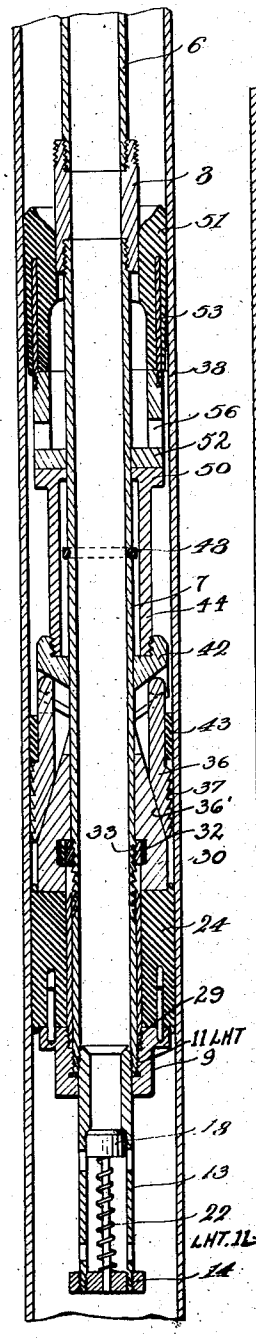


Fig. 6

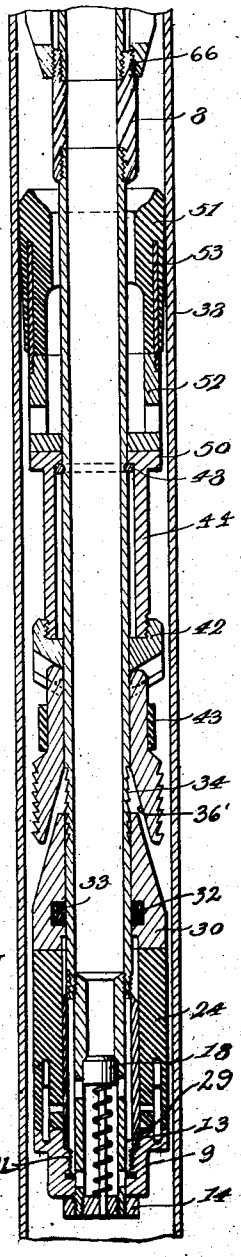
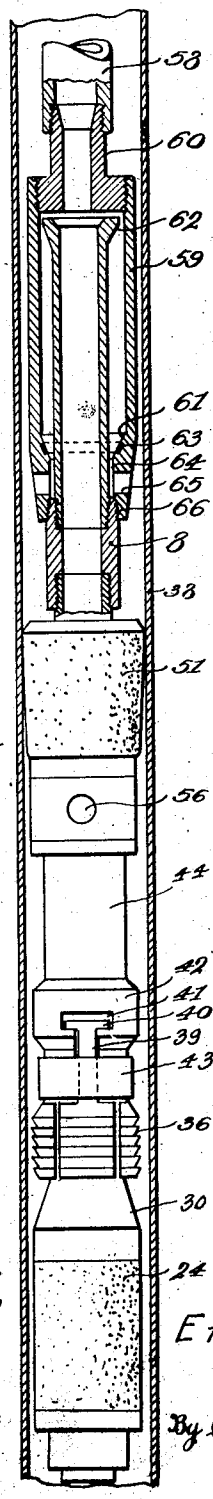


Fig. 7.



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UNITED STATES PATENT OFFICE

2,378,374

PACKER

Emmett J. Roe, Wichita, Kans., assignor, by decree of distribution, to Russell J. Roe

Application January 23, 1941, Serial No. 375,668

5 Claims. (Cl. 166—12)

This invention relates to improvements in packers for well casings and more particularly to a mechanism for setting and retrieving the packer.

It is the primary object of the invention to provide a packer which may be easily run in and set at any desired point in the casing having mechanism operated by the hydro-static pressure in the well to effect a fluid-tight seal between the packer and well casing which will withstand high pressures. After the packer is set and has served its purpose it may be readily released and entirely removed from the well casing without injury to the parts so that it may be re-used again.

Heretofore, packers have been provided with setting mechanisms of various types but these have been found unsatisfactory in actual use due to their complicated construction and difficulty in removing the mechanism after the packer is set. It has also been found that parts of the former setting mechanism have been found to drop into the well and when this happens it is difficult to fish out the parts or destroy them by drilling.

It is an object of the present invention to provide a fluid actuated valve member on the tubular body of the packer which is acted upon by the hydro-static pressure in the well to tightly engage the well casing when an upward pull is exerted on the body whereby the setting mechanism is actuated to move the packer into sealing engagement with the well casing.

Another object of the invention resides in providing mechanism of the above character which is simple and durable in construction, reliable and efficient in operation and inexpensive to manufacture.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this specification and in which like numerals are employed to designate like parts throughout the same,

Fig. 1 is an elevation of the packer with the parts in their positions while being inserted in the well casing,

Fig. 2 is a longitudinal sectional view of the packer with the parts in the same position as shown in Fig. 1,

Fig. 3 is a cross section taken on line 3—3 of Fig. 2,

Fig. 4 is a cross section taken on line 4—4 of Fig. 2,

Fig. 5 is a longitudinal section of the packer with the parts in set position,

Fig. 6 is a longitudinal section of the packer with the parts in withdrawal position, and

Fig. 7 is an elevation of the packer showing the coupling sleeve between the tubing and packer in longitudinal section.

In the drawings, wherein for the purpose of illustration I have shown a preferred embodiment of my invention, the numeral 5 denotes generally a tubular body member composed of sections 6 and 7 which are coupled together by a union 8 having an external circumference greater than that of the sections. A nut 9 having a central recess 10 provided with left hand screw threads 11 receives the lower end of section 7 provided with corresponding screw threads thus connecting the nut to the tubular body so that when the body is turned to the right the nut will be unscrewed. The nut is provided with a central aperture 12 to slidably receive the tubular valve casing 13 which is threadedly connected to the lower end of section 7 and threaded on the lower end of the valve casing is a nut 14 adapted to abut the nut 9 when the valve casing is pulled up thus limiting its upward movement. The bore 15 of the valve casing is reduced at its upper portion and the upper and lower ends of the reduced portion 16 have beveled shoulders 17. The lower beveled shoulder 17 provides a seat for the poppet valve 18 having a stem 19 slidably mounted through an aperture 20 in a plug 21 threaded in the lower end of the valve casing. A coil spring 22 mounted on the stem 19 between the poppet valve and plug normally seats the valve against the shoulder 17, but permits the valve to open when pressure is applied to the valve head. The casing 13, between the shoulder 17 and the lower end thereof is provided with a series of openings 23 to permit discharge of the fluid from the valve casing when the valve is open. The packing means includes an expansible packing sleeve 24, preferably formed of rubber, mounted on a metal sleeve 26 slidably mounted on the lower end of section 7 of the tubular body and has its lower end seated on the nut 9 and connected thereto by a series of pins 25 slidably disposed in recesses 26 formed in the walls of the packer sleeve, the lower ends of said pins being fixed in pockets 27 formed in the face of the nut. The metal tube 26 has its lower end threadedly connected with the nut 9, as at 29, to prevent the tube from turning independently of the sleeve. A cone shaped slip expanding member 30 is mounted on the body 5 above the packing sleeve 24 and rests on the upper end of the sleeve. The bore of the member 30 is provided with an annu-

lar groove 31 intermediate its ends in which locking dogs 32 having ratchet teeth 33 are disposed for engagement with the ratchet teeth 34 formed on the body 5. A rubber band 35 surrounding the locking dogs 32 normally moves said dogs toward the body 5 but yieldably holds the dogs so as to permit the teeth 34 on the body to pass the dogs when the body is pulled upwardly. Mounted above the cone shaped member 30 are slip members 36 having bevelled inner faces 36' which coact with the tapered face of the member 30 to force said slip members outwardly to bring the teeth 37 on the outer face of the slips into gripping engagement with the well casing 38. The slips 36 have upwardly extending stems 39 provided with opposed trunnions 40 adapted to slidably engage in the inclined T slots 41 formed in an annular member 42 slidably mounted on the body 5. A rubber band 43 surrounds the stems 39 of the slips and normally holds said slips in a retracted position. A tubular sleeve 44 is mounted on the body 5 above the annular member 42 having its lower end threadedly engaged, as at 45, with the recess 46 in the top of the annular member. The internal diameter of said sleeve is greater than the external diameter of said body to provide a space 47 between the sleeve and body to receive the annular ring 48 which is fixedly mounted on the body 5. The upper end of the sleeve 44 is provided with inwardly and outwardly extending flanges 49 and 50, the flange 49 serving to limit the upward movement of the ring 48.

A cup shaped flexible valve member 51 is slidably mounted on the body 5 between the union 8 and upper end of the sleeve 44, being preferably formed of rubber. The valve member 51 is supported by an annular base member 52 which carries a flexible metal sleeve 53 threadedly connected to the base member, as at 54, which extends into the walls of the valve member for reinforcing the same. The base member and valve member are mounted on the body 5 in spaced relation thereto to provide a passage 55 between the body and said members, the base member having openings 56 to provide a by-pass for fluid passing through the passage 55. The bore of the valve member at its upper end is of such diameter that when the valve member is set and the body 5 is pulled upward the union 8 enters the upper end as shown in Fig. 5, and closes the passage 55. The upper end of the valve member is beveled, as at 57, so that when the passage 55 is closed the pressure of fluid will expand the valve member into tight sealing engagement with the well casing.

The packer is lowered into and removed from the well by the conventional tubing 58 which is connected to the tubular body 5 by a sleeve coupling 59 connected to the lower end of the tubing by a nipple 60. The coupling 59 telescopically receives the upper end of the body and is provided with a beveled shoulder 61 in its lower end forming a seat for the flared end 62 of the body member 5 when the tubing is pulled upwardly. A packing ring 63 surrounds the shoulder 61 to establish a tight seal between the flared end and the shoulder. The reduced bore at the lower end of the coupling is larger in diameter than the body member 5 to provide a fluid passage 64 and extending radially from the passage through the walls of the coupling are openings 65. When the coupling is lowered on the tubular body 5 the lower end contacts the upper end of the union 8 and the end of the reduced bore of the coupling is provided with screw threads which engage the exterior screw threads on the union, as at 66, thus connecting the coupling and body member 5 together so that the body member may be turned by turning the tubing.

In operation, when the packer is lowered into the well casing the parts of the packer are in the positions shown in Figs. 1 and 2 and the fluid in the well passes between the packing means and well casing and by-passes the valve 51 by entering the openings 56 and passing through the passage 55. When the packer has been lowered to the desired point an upward pull on the tubing 58 will raise the body 5 so that the union 8 will close the passage 55 and the hydro-static pressure of the fluid in the well above the valve 51 will then expand the valve into tight engagement with the well casing thereby causing the valve to remain stationary. At the same time the upward pull on the tubular body causes the slip expanding member 30 to expand the slips 36 into gripping engagement with the well casing which causes the expansible packer sleeve 24 to be expanded into sealing engagement with the well casing. The packing sleeve 24 is locked in its expanded position by the teeth 34 engaging the teeth of the locking dogs 32. When the packer is set the parts are in the positions shown in Fig. 5, and it will be observed that in this position the union 8 has moved into the upper end of the valve 51 and closed the passage 55. The valve 18 at the lower end of the body 5 permits cement to be pumped through the tubing and body into the well below the packing means and holds the back pressure until the cement has been set and the packer is removed. When it is desired to remove the packer from the well the tubing 58 is lowered to allow the sleeve coupling 59 to slide down the body 5 so that the lower end of the coupling may be connected to the union 8 and then the tubing is turned to the right which rotates the body 5 and unscrews the body from the nut 9. The body 5 is then free to move longitudinally of the packing means sleeve but before pulling the body upward a downward force is applied to the body which moves the member 30 downward releasing the slips 36 so that the packing sleeve will contract. After the packing sleeve is released, the body is pulled upward and the ring 48 engages the flange 49 of the sleeve 44 and lifts the sleeve to raise the member 42 and slips 36, while the nut 9, the packing sleeve 24, and the member 30 are lifted by the nut 14. While this is taking place the union 8 has been raised above the valve 51, thus opening the by-pass 55 to allow fluid to pass downwardly through the passage and relieve the pressure from the valve 51. As the upward pull on the body 5 continues the upper end of the sleeve 44 engages the base member 52 of the valve 51 and carries the valve 51 upwardly with the body 5 so that all parts of the packer are removed.

In the operation of pumping cement into a well there is no way of determining the amount of cement required and in most cases when the pumping is stopped the tubing is full of cement and this cement must be quickly removed. In my device when the sleeve coupling 59 is lowered the passage 64 is opened and by building up a pressure between the tubing and casing, the fluid will pass into the passage 64 through openings 65 and will flow up through the coupling and tubing thus washing the tubing free of cement.

In actual use it has been found the packer will withstand a pressure up to ten thousand

pounds pressure per square inch and yet it is easy to set and may be completely retrieved from the well when it has served its purpose. The packer may be employed in all types of oil well operations where packers are employed.

It is to be understood that the form of my invention herein shown and described is to be taken as a preferred example of the same and that certain changes in the shape, size, and arrangement of the parts may be made without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. A device of the character described comprising a body member adapted for movement down a well casing, an expansible packing means on said body, means slidably mounted on said body for expanding said packing means, an annular flexible valve member slidable on said body above said expanding means and adapted to co-act with said body to operate said expanding means when the body is pulled upwardly, the upper portion of said valve member being spaced from said body and having openings therein communicating with the annular space between the valve member and the body member to provide a by-pass for the passage of fluid, means on said valve member engageable by means on said body for holding said valve member in one position with the by-pass open when the device is being lowered in the well casing, said valve member engaging means on said body being movable upwardly to another position relative to the valve member for closing the by-pass of the valve member when the body is pulled upwardly relative to the valve member whereby the fluid column in the casing above said valve member will expand the valve member into sealing engagement with the casing and hold the valve stationary to engage and actuate the packing expanding means as the upward movement of the body is continued.

2. A device of the character described comprising a tubular body member adapted for movement down a well casing, a packing means including an expansible packing mounted for slidable movement on the lower end of said body, releasable means securing said body and packing means together against relative slidable movement therebetween and adapted upon rotation of said body relative to said packing means to release the packing means for slidable movement on the body, means slidably mounted on said body for expanding said packing, an annular flexible valve member slidably mounted on said body above said packing expanding means, means on said body engageable with and adapted to move said valve member downwardly upon downward movement of the body and also adapted to enter and seal between the valve member and the body when said body is moved upwardly relative to the valve member whereby the fluid column in the casing above the valve member will expand said valve into frictional sealing engagement with the casing to hold the valve stationary to engage and actuate the packing expanding means and expand the packing as the upward movement of the body is continued, a back pressure valve casing detachably secured to the lower end of the said body and projecting therebelow, and means on the lower end of said valve casing to engage and support said packing means upon relative downward movement of the packing after release of the releasable means securing the body and packing together against relative slidable movement.

3. A device of the character described comprising a body member adapted for movement down a well casing, an expansible packing means on said body, means slidably mounted on said body for expanding said packing means, an annular flexible valve member slidably mounted on said body above said packing expanding means, and means on said body engageable with and adapted to move said valve member downwardly upon downward movement of the body and also adapted to enter and seal between the valve member and the body when said body is moved upwardly relative to the valve member whereby the fluid column in the casing above the valve member will expand said valve into frictional sealing engagement with the casing to hold the valve stationary to engage and actuate the packing expanding means and expand the packing as the upward movement of the body is continued.

4. A device of the character described comprising a tubular body member adapted for movement down a well casing, an expansible packing means mounted on said body, a nut releasably secured on said body and having connection with the lower end of said packing means, said nut being adapted upon rotation of said body relative to said packing means to release the lower end of said packing means for slidable movement on the body, means slidably mounted on said body for expanding said packing, and locking means between said packing and body for securing the upper end of said packing against upward movement on said body when in expanded position whereby downward pressure on said body will cause said packing to move downwardly when said nut is released.

5. A device of the character described comprising a tubular body member adapted for movement down a well casing, an expansible packing means mounted on said body, a nut releasably secured on said body and having connection with the lower end of said packing means, said nut being adapted upon rotation of said body relative to said packing means to release the lower end of said packing means for slidable movement on the body, means slidably mounted on said body for expanding said packing, locking dogs carried by the upper end of said packing means, and ratchet teeth on said body adapted to engage with said locking dogs when the packing means is expanded to hold the packing means in expanded position, said ratchet teeth being adapted to exert a downward pressure on the packing means when the body is forced downwardly to slide the packing means downwardly when said nut is released from connection with said body.

EMMETT J. ROE.