Nov. 24, 1942. A. PRANGER ET AL 2,303,090

PRESSURE DRILLING HEAD

Filed Nov. 8, 1938 3 Sheets-Sheet 1

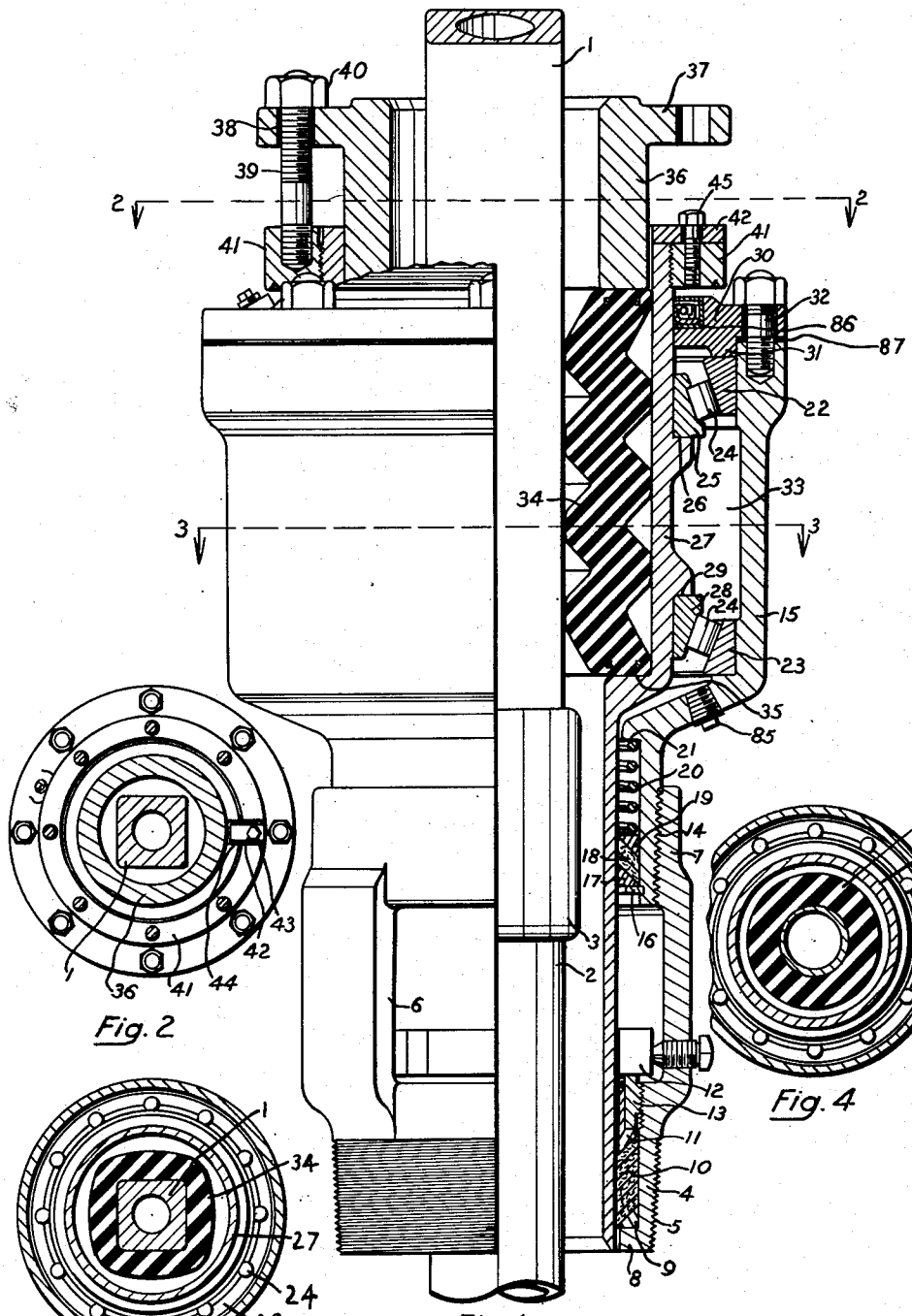

Fig. 1

Fig. 2

Fig. 3

Fig. 4

INVENTOR.
ALBERT PRANGER
BY SAMUEL ALLEN GUIBERSON III
H. W. Baker
ATTORNEY.

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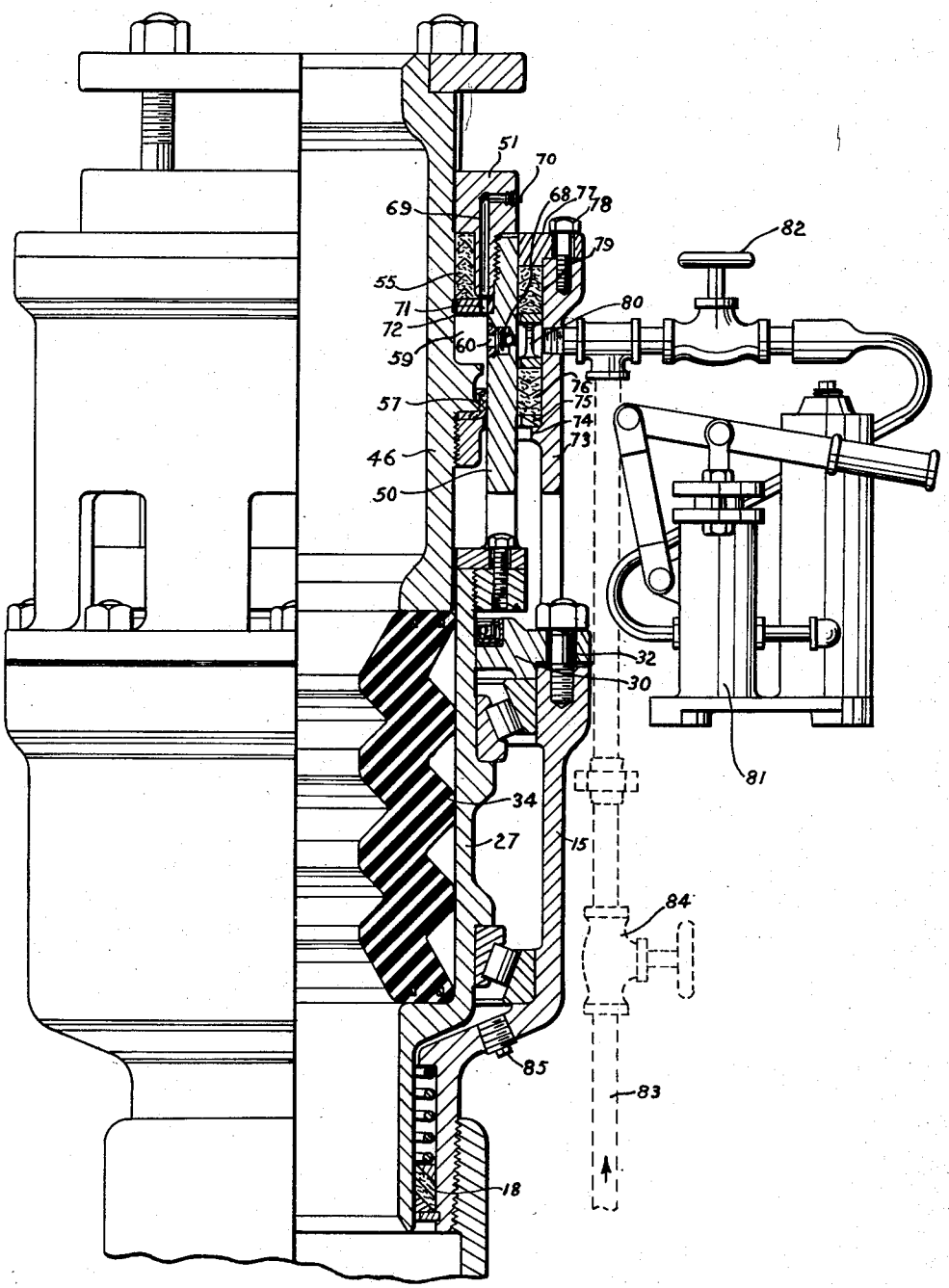

Fig. 6

INVENTOR.
ALBERT PRANGER
BY SAMUEL ALLEN GUIBERSON III
H. W. Baker
ATTORNEY.

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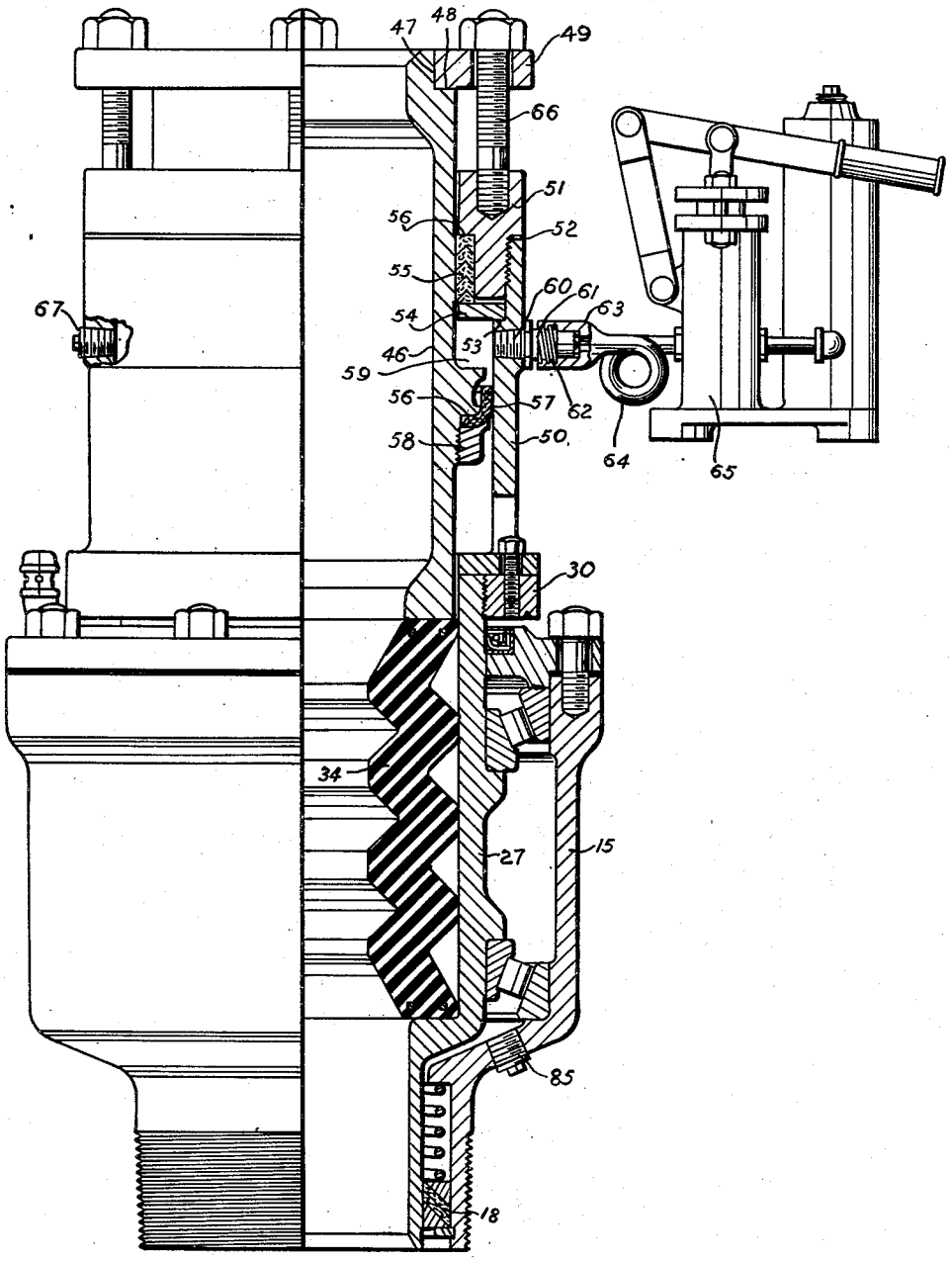

Fig. 5

INVENTOR.
ALBERT PRANGER
BY SAMUEL ALLEN GUIBERSON III
A W Baker
ATTORNEY.

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UNITED STATES PATENT OFFICE

2,303,090

PRESSURE DRILLING HEAD

Albert Pranger and Samuel Allen Guiberson, III, Dallas, Tex., assignors to The Guiberson Corporation, Dallas, Tex., a corporation of Delaware

Application November 8, 1938, Serial No. 239,458

5 Claims. (Cl. 255—19)

This application is an improvement of the structure shown in our application #185,482, filed January 18, 1938. Not only is it an improvement on the structure shown in the said application, but it shows a much simpler structure to secure the same or substantially the same results.

The invention relates to a pressure drilling head and is useful when wells are drilled under pressure or to prevent a blowout in case an excessive pressure results from drilling into a high pressure zone.

Until comparatively recently mud was practically the only drilling fluid used and it was pumped downwardly through the kelly and drill pipe, passing from the lower end of the drill pipe around the drill, thereby lubricating the drill and picking up the bits of rock and bringing them to the surface between the drill pipe and the well casing. Sometimes if high pressures were incurred, this mud was weighted to prevent a blowout. The mud had the disadvantage of being forced into the oil bearing sands and therefore acting as a dam to prevent the free flow of the oil. Accordingly, it has been suggested to use oil instead of mud, as the oil could never form such a dam and clog the free flowing of the oil from the oil bearing sands, but of course, oil is considerably lighter than the weighted mud and this has necessitated the use of a pressure head so that an auxiliary supply of gas might be introduced so as to create a sufficient pressure to prevent the oil between the drill pipe and the casing being blown out with disastrous consequences. Pressure drilling heads had heretofore been proposed, but all of these drilling heads had to be removed in order to remove the drill pipe with outside collars. Some means would, therefore, have to be employed to retain the pressure when the pressure drilling head was removed. Various arrangements have been proposed to attach some apparatus which would hold in the pressure when the pressure drilling head was removed. This meant that two pressure holding means were required, that is, a pressure drilling head was employed while the drilling was taking place and the supplemental device, such as an oil saver of the ram type was used when the pipe with outside couplings was being removed.

The object of this invention is to avoid all of the objections heretofore experienced and to provide one device which serves as a pressure drilling head and which will accommodate either a square or a round kelly and will conform to outside collars on drill pipes while the same are being removed. This one structure therefore may be utilized to hold the pressure while drilling and may also be utilized to hold the pressure when the drill pipe with outside collars is being removed.

Another object of the invention is to employ novel means to compress the packer which acts as the seal around the kelly or drill pipe.

Other objects and advantages of the invention will appear in the detailed specification and claims which follow.

In the drawings

Fig. 1 is a side elevational view partly in cross section of an improved pressure drilling head,

Fig. 2 is a cross sectional view on the line 2—2 of Fig. 1,

Fig. 3 is a cross sectional view taken on the line 3—3 of Fig. 1 and showing the packer surrounding the square kelly shown in Fig. 1,

Fig. 4 is a view similar to Fig. 3 but showing the packer engaging a round kelly or drill pipe,

Fig. 5 is a modification and is a figure similar to Fig. 1 but with an auxiliary pressure supply to force the packer downwardly into pressure sealing engagement with the kelly, and

Fig. 6 is a view similar to Fig. 5 but showing a second modification.

In Fig. 1 I have shown the parts in drilling position in which the square kelly 1 which is, of course, rotated by the rotary table in the usual manner, is attached to a drill pipe 2 by means of an outside collar 3. While we have not shown succeeding sections of drill pipe, it is obvious that outside collars similar to the collar 3 could be utilized to connect the succeeding sections of the drill pipe.

The collar 4 is screw threaded as shown at 5 and is adapted to be attached to the top of the well casing. This collar 4 is provided with upstanding arms 6 integral with the collar 7. The collar 4 is provided with an inwardly extending flange 8 on which rests a packing ring 9. If desired, this packing ring may be made into two semi-circular sections or may be formed as one continuous ring. Seated on the packing ring 9 is a packing 10 on which rests a packing ring 11. The packing may be compressed by screwing downwardly on a pressure ring 12 having a depending threaded flange 13 which engages female threads on the collar 4.

The collar 7 is provided with female threads 14 which receive the threads on the lower portion of a head 15. It will be noted that all of the parts 4 to 15 inclusive remain stationary with the casing. The head 15 is provided near its lower end with a pressure ring 16 on which is seated a packing ring 17. A conventional packing 18 is interposed between the packing ring 17 and the upper packing ring 19. A coil spring 20 rests on the upper packing ring 19 and on a seat 21 forming a part of the head 15. In the structure shown in the said patent application #185,482 a packing arrangement

somewhat similar to the packer last described was shown, but it was found in practice that the fluid between the casing and the drill pipe might be forced past said packer and upwardly into the roller bearings presently to be described. By providing the lower packing 10 if there was a tendency for the well fluid to gradually leak by the packing 10 it would flow outwardly between the arms 6 and escape. There would be no tendency for it to flow upwardly by the packer 18 and into the roller bearing assembly. This is one of the improvements over the structure shown in the said patent application.

The head 15 is provided with an upper roller bearing raceway 22 and a lower raceway 23. Rollers 24 are interposed between the raceway 22 and an inner raceway 25 seated on a shoulder 26 of the housing 27 and the lower set of rollers are interposed between the raceway 23 and an inner raceway 28 which is seated against a shoulder 29 of the housing 27. A cover plate 30 is provided with a downwardly extending circular ring 31 which contacts with the upper end of the raceway 22 which when the bolts 32 are tightened will press downwardly on the upper raceway 22 pressing it into contact with the upper rollers 24 and pressing the inner raceway 25 against the shoulder 26. This tends to move the entire housing 27 downwardly and therefore presses the lower inner raceway 28 into engagement with the rollers 24 and presses the said rollers into engagement with the lower raceway 23. In order to adjust the bearings it is only necessary to insert or remove more shims 87 and retighten bolts 32. The chamber 33 between the housing and the head is filled with a lubricant so as to eliminate friction and to reduce wear.

A corrugated packer 34 is clearly shown in Fig. 1 rests at its lower end on a seat 35 forming an inwardly extending projection of the housing 27. The lower end of the gland 36 rests on the upper end of the packer 34 and this gland is provided with an outwardly extending upper ring 37 provided with a plurality of circular holes 38 through which pass studs 39 having nuts 40 above the rung 37 and which screw into the ring 41 screwed to the upper portion of the housing 27. In order to prevent the ring 41 from working loose, a key 42 is seated in a channel 43 in the ring 41 and into a notch 44 in the upper portion of the housing 27, being held in place by a bolt 45.

It will be noted that the head 15 remains stationary and if a square kelly 1 is employed, the gland 36 presses the corrugated packer 34 into tight engagement with the square kelly making a seal as shown in Fig. 3 around the square kelly so that if the square kelly is rotated the packer 34 will rotate with it, which will in turn cause rotation of the housing 27 and the gland 36. Since the housing 27 is mounted in roller bearings, friction is reduced to an absolute minimum. As the well is drilled deeper, the square kelly 1 will slide downwardly through the packer 34 without breaking seal. The packer 34 will maintain the pressures between the casing and the drill pipe and even if the operator should suddenly drill into a very high pressure zone, the worst that could happen would be that the pressure would engage the lower end of the packer and press it upwardly, but this would make the engagement between the packer and the kelly all the tighter. In actual experience it has been found that this packer will hold any reasonable pressure likely to be encountered. If, after drilling into a high pressure zone, it was necessary to remove the drill pipe this could be accomplished by simply elevating the kelly and drill pipe, the parts sliding through the packer without loss of well pressure and thereby avoiding a blow out. Of course, after each section of the drill pipe was elevated above the well packer it would be removed in the customary manner.

It has been suggested that it might be well to interpose some form of a kelly clamp between the kelly 1 and the gland 36, but this has been found to be entirely unnecessary if the engagement between the kelly, the packer and the housing are sufficiently tight so that the housing and the packer 34 will rotate with the kelly instead of the kelly rotating relative to the packer and thereby unduly wearing it.

In Fig. 5 we have shown a modification in which the packer 34 may be compressed by means of a pump. In Figs. 5 and 6 we have not shown the lowermost packer corresponding to the packer 10 but of course it will be understood that the lower packer could be used if desired. The housing 27 and head 15 together with the roller bearing assembly as shown in Fig. 5 are identical with the structure shown in Fig. 1. Instead of the gland 36 as shown in Fig. 1 the modification shown in Fig. 5 shows an elongated gland 46 which bears against the lower end of the upper packer 34. This elongated gland 46 is provided at its upper end with an annular channel 47 and seat 48 on which rests a ring 49. Integral with the ring 30 is a housing 50 to which is screwed a closure 51, a suitable shim 52 being interposed between the housing 50 and the closure 51 and thereby making the same pressure tight. The housing 50 is provided with an annular seat 53 on which rests a ring 54. Packing 55 rests on the ring 54 and against a shoulder 56 of the closure 51, which packing 55 prevents the passage of fluid between the closure 51 and the gland 46. The gland 46 is provided with a shoulder 56 which receives a cup-shaped sealing ring 57 which is pressed tightly against the shoulder by means of a ring 58 screwed to the gland 46. The sealing ring 57 prevents fluid from passing downwardly between the gland 46 and the housing 50 so that a pressure type chamber 59 is maintained between the packing 55 and the housing 50 and gland 46.

A port 60 extends through the housing 50 and opening into the chamber 59 and into this port is screwed a nipple 61 provided with screw threads 62 to which may be attached a nozzle 63 on a tube 64 leading from a pump 65. By operating the pump 65 a fluid may be pumped into the pressure chamber 59 and since it is impossible for the closure 51 to be moved upwardly the result is that the gland 46 is pushed downwardly compressing the packer 34. The ring 49 will move downwardly with the gland 46 for there is a clearance between the bolts 66 corresponding to the bolts 39 in Fig. 1 and the ring 49. If desired, the nuts on bolts 66 may then be screwed downwardly so as to hold the packer in its depressed position even though the pressure in the pressure chamber was relieved. If it is desired to relieve the pressure in the chamber 59, the pressure plug 67 may be removed.

The above described arrangement is especially advantageous where it is desired to depress the packer by means of a pump when the operator is not drilling, but of course, the connection between the pump and the housing 50 would have to be removed when drilling because the hous-

ing 50 would rotate with the housing 27, the packer 34 and kelly 1.

If it is desired to maintain pressure in the pressure chamber while the kelly is rotating, this may be accomplished by the modification shown in Fig. 6. The structure shown in Fig. 6 is very similar to the structure shown in Fig. 5, it having a pressure chamber 59 between the gland 46, sealing ring 57, packing 55 and housing 50. It is also provided with a port 60 in which a check valve 68 may be interposed if desired. Instead of the pressure plug 67 shown in Fig. 5, a channel 69 may be provided extending upwardly through the closure 51 and then outwardly, having its end sealed by a relief plug 70. A communicating channel 71 would, of course, also be provided in the ring 72.

A head 73 may be attached to the upper end of the head 15 and, if desired, this head may be integral with the head 30 secured by the bolts 32 to the head 15. The head 73 will, therefore, remain stationary while the housing 50 will rotate with the housing 27. The head 73 is provided with a shoulder 74 on which rests a ring 75 which supports packing 76. A closure ring 77 is secured to the upper end of the head 73 by bolts 78. Packing 79 is placed beneath the closure ring 77 and between the head 73 and housing 50. A spacer ring 80, which is I shaped in cross section and which has passageways between the connecting portions of the I, is interposed between the lower packing 76 and the upper packing 79. A pump 81 is connected to the space between the upper packing 79 and the lower packing 76 in the same manner as shown in Fig. 5, but if desired, a valve 82 may be placed in the pipe connecting the pump in the pressure head. By operating the pump 81 with the valve 82 open, the pressure from the pump enters the spaces in the spacer ring 80 thereby unseating the check valve 68 and passes into the chamber 59, thereby pressing the gland 46 downwardly and compressing the packer 34. It is obvious that since the head 73 remains stationary while the housing 50 and the gland 46 rotate when the kelly is rotated, the pump 81 may be employed to depress the packer 34 regardless of whether the kelly is rotating or not.

Sometimes it may be desirable to utilize the pressure in the well to move the gland 46 downwardly. In order to accomplish this a pipe 83 may be provided which communicates with the space between the upper end of the casing and the drill pipe and which pipe extends to the same pipe connecting the pump to the pressure head. A valve 84 should be inserted in the pipe 83. It will, of course, be understood that when the pump is used the valve 82 will be open and the valve 84 closed, but when the well pressure is to be utilized the valve 84 will be open and the valve 82 closed. Regardless of whether the fluid pressure comes from the well or from the pump, the pressure depresses the gland 46 and presses downwardly on the upper portion of the packer 34 while the pressure from the well itself directly presses against the lower portion of the packer 34.

The check valve 68 is not absolutely necessary, but it is valuable in that pressure may be inserted in the pressure chamber 59 and retained therein even though the pressure is relieved from the pump that is in the space around the spacer ring 80 and thereby the packing 79 and 76 is relieved from the pressure existing in the pressure chamber 59, thereby avoiding wear between the said packings and the housing 50.

Of course, the usual drain plugs 85 are provided which when removed from it the oil in the roller bearing assembly would be drained out.

The cup washer 86 carried by the cover plate 30 serves to prevent water, mud, and dirt from entering chamber 33.

We realize that many changes may be made in the form of the invention as shown by way of illustration and not by way of limitation in the attached drawings and we, therefore, desire to claim the same broadly except as we may limit ourselves in the attached claims.

Having now described our invention, we claim:

1. In a pressure head for an oil well, a housing, a packer mounted in said head and adapted to receive a kelly, the lower end of said packer being exposed at least in part to the pressure in the oil well, a gland to press downwardly on the upper end of said packer to force it into packing engagement with said housing and kelly, fluid operated means to actuate said gland, and adjustable means to hold the gland in depressed position after the fluid operated means has depressed the same.

2. In a pressure head for an oil well, a packer mounted in said head and adapted to receive a kelly, a gland to compress said packer to force the packer into sealing engagement with the kelly, fluid operated means to actuate said gland and means to hold the gland in position after the fluid operated means has compressed the packer.

3. In a pressure head for an oil well, a packer mounted in said head and adapted to receive a kelly, a gland to compress said packer to force the packer into sealing engagement with the kelly, fluid operated means to actuate the gland to compress the packer, a plurality of bolts operatively connected to said head and adjustable holding means cooperating with the bolts to hold the gland in position after the fluid operated means has compressed the packer.

4. In a pressure head for an oil well, a housing, a rotatable gland in said housing, a packer mounted in said housing and adapted to receive a kelly, fluid tight packing carried by said gland and said housing and spaced apart to form a fluid chamber therebetween, means to force pressure fluid into said chamber to move the gland to compress the packer and holding means to hold the gland in position to compress the packer, said holding means holding the gland so as to compress the packer even if the fluid pressure should be released.

5. In a pressure head for an oil well, a housing, a gland in said housing, a packer mounted in said housing and adapted to receive a kelly, a fixed fluid tight packing carried by said housing, a fluid tight packing carried by said gland and spaced apart from the packing carried by the housing so as to form a fluid tight chamber therebetween, a pump to force pressure fluid into said chamber against the packing carried by the gland so as to move the gland to compress the packer and adjustable holding means adapted to be operated after the fluid pressure means has compressed the packer to hold the gland in position to retain the packer in compressed condition even if the fluid pressure should be released.

ALBERT PRANGER.
SAMUEL ALLEN GUIBERSON, III.