Feb. 10, 1953 G. G. HEBARD 2,628,112

SELF-ALIGNED LUBRICATING STUFFING BOX

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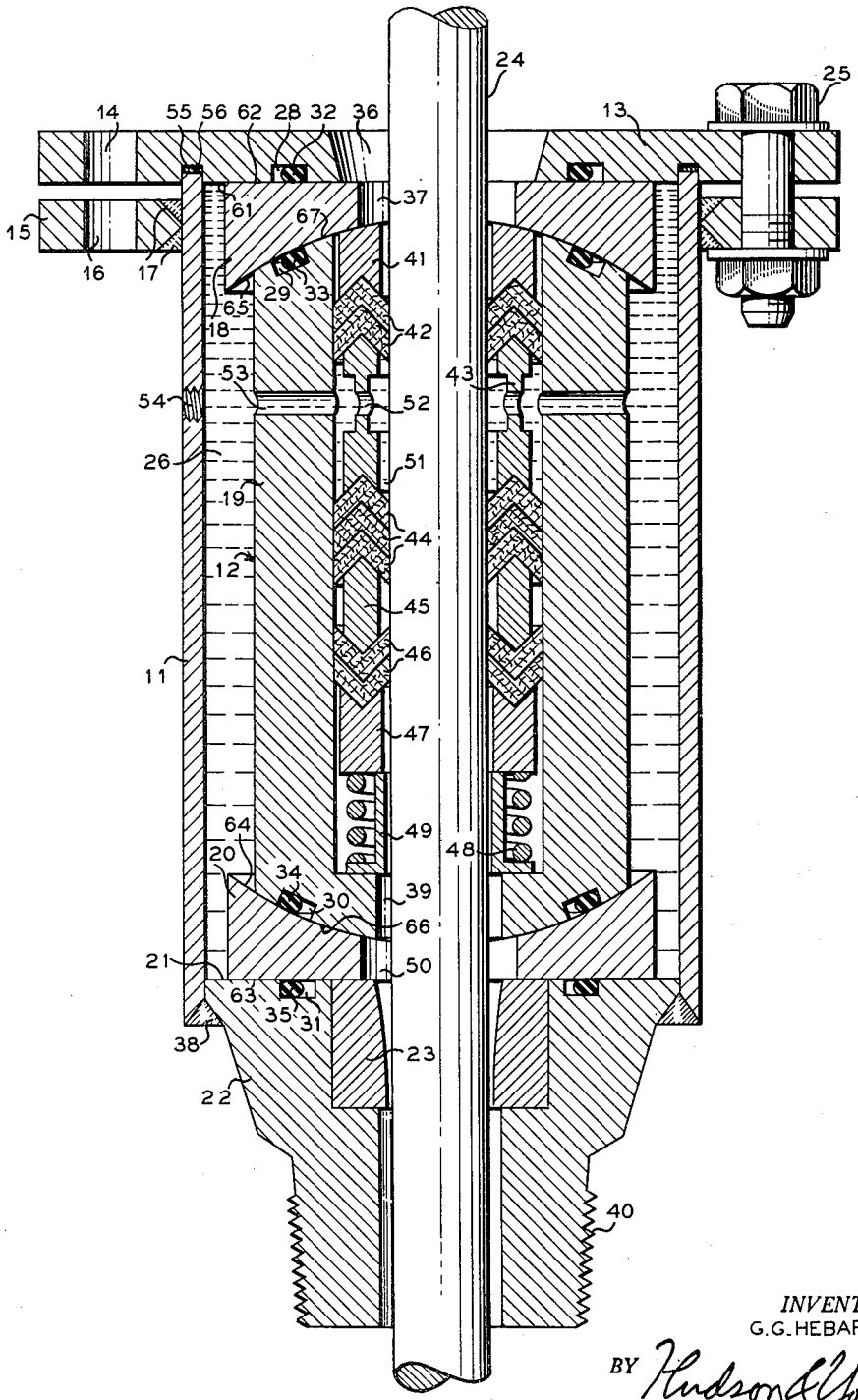


FIG. 1

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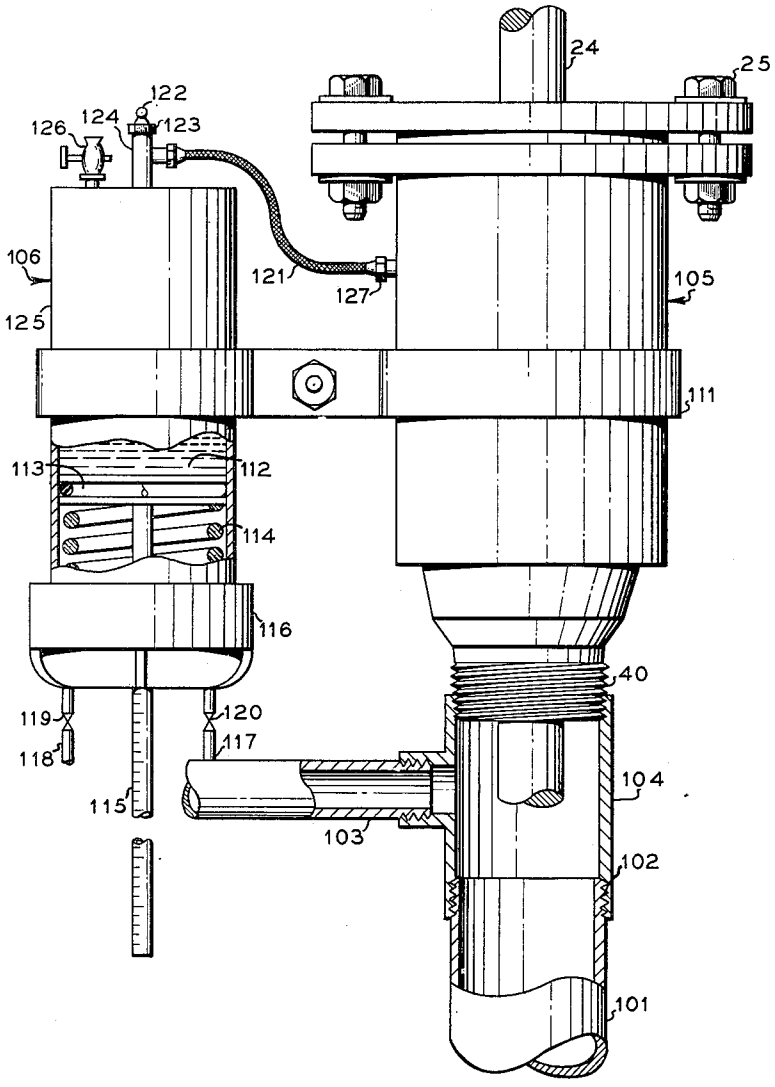


FIG. 2

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SELF-ALIGNED LUBRICATING STUFFING BOX

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3 Claims. (Cl. 286—15)

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This invention relates to polish rod stuffing boxes. In one specific aspect it relates to a self-aligning stuffing box for use with polish rods in a sucker rod actuated oil well pump assembly. In another aspect it relates to a self-aligning polish rod stuffing box that adjusts its position to conform with the irregularities of movement of the polish rod during pumping operations.

In the art of polish rod stuffing boxes a large proportion of the failure of such stuffing boxes is due to misalignment of the polish rods during pumping operations. Another reason for failure of such stuffing boxes is due to the frequent tightening of the packing gland by the pumper even when tightening is not necessary.

An object of this invention is to provide a polish rod stuffing box which is self-aligning and adapted to compensate for irregularities in motion of the polish rod.

Another object of my invention is to provide a polish rod stuffing box in which that portion containing the packing is self-aligning.

Another object of this invention is to provide a polish rod stuffing box in which that portion of the box containing the packing moves in a lubricating reservoir.

Still another object of this invention is to provide a pressure lubricated self-aligning polish rod stuffing box.

Still other objects and advantages of my invention will be apparent upon reading the following description which when taken with the attached drawing forms a part of this specification.

In the drawing,

Figure 1 is an elevational view, in section, of my self-aligning stuffing box assembly.

Figure 2 is a diagrammatic representation of a tubing head assembly including the self-aligning stuffing box and lubricator in operative relationship.

Referring now to the drawing and specifically to Figure 1, reference numeral 11 refers to a cylindrical housing member which contains the floating gland assembly 12 of my invention. At a point near the top of the cylindrical housing 11 is attached by welds 17 or other means, a flange member 15. This flange member 15 contains bolt holes 16 for use in attaching an upper flange or cap member 13. This cap flange member 13 is generally round in shape and has bolt holes 14 that align with bolt holes 16 in flange 15. Bolts 25 when inserted rigidly attach the cap flange to the main body of the packing assembly. This cap flange is provided with a centrally disposed opening 36 to accommodate a polish rod 24. The opening 36 is sufficiently large that the polish rod will not touch the walls of the cap flange 13. The lower portion of the housing 11 is attached to a housing base 22 by a weld 38. The lower portion of the housing base 22 has threads 40 for assembly into the pumping T. This housing base 22 is provided with a bushing 23 which may be of brass or bronze so that upon contact with a polish rod the bushing will be the element worn. The top portion of the housing base and the lower surface of the cap flange form plane and parallel ends of a cylindrical main housing in which the self-aligning packing elements are contained. Resting upon the bottom plane surface 21 is a lower bearing ring 20. This lower bearing ring 20 has its bottom so constructed as to form a plane surface 63 for resting upon the surface 21. This bearing ring also is of a smaller diameter than the diameter of housing 11 so that as the occasion arises this bearing ring may move horizontally as required by the horizontal movement of the polish rod 24. This bearing ring 20 is provided with an opening 50 at its center through which the polish rod is disposed with the diameter of this opening sufficiently large so that the polish rod will not touch the bearing ring at any time. Disposed against the bottom surface of the cap flange 13 is an upper bearing ring 18. This upper bearing ring 18 is similar in construction to the lower bearing ring 20, but of course is inserted in the apparatus so that its plane surface will be in contact with the underside of the cap flange. The top plane surface of the bearing ring 18 is identified by the reference numeral 62, while the opening in its center for the accommodation of the polish rod is identified by reference numeral 37. The lower surface 65 of the upper bearing ring 18 and the upper surface 64 of the lower bearing ring 20 are spherical surfaces. The floating gland is disposed between these two spherical surfaces. The top spherical end surface 67 of the gland body 19 is convex upward while its lower end surface 66 is also a spherical surface and convex downward.

The packing gland body 19 has a channel 39 along its axis to accommodate the polish rod and packing elements. In the lower part of the body 19 this channel 39 is just slightly larger in diameter than the diameter of the polish rod, but in the remainder of the body the channel is sufficiently large to accommodate the packing

elements. These packing elements include an upper metal packing ring 41, inverted V-packing rings 42, a lantern ring 43, some V-type packing rings 44, a center metal ring 45, some V-type packing rings 46 and a lower metal packing ring 47. Inserted immediately below this metal packing ring 47 is a spring guide 49 and a compression spring 48. When these packing elements are installed in the assembly the pressure exerted by the compression spring 48 is the only pressure exerted against the packing members and by this type of spring loading, the pumping operator cannot subject the packing to a greater pressure as he can do with conventional stuffing boxes by giving the packing gland nuts a half turn or so as he visits the wells.

For lubrication purposes an opening 54 is provided in the housing 11 for insertion of a tubing or other fitting for transfer of lubricant from an outside source into a lubricant space 26 and associated lubricant spaces. These associated spaces are openings 53 in the packing gland body member 19, the openings 52 in the lantern ring 43 and the spaces 51 between the lantern ring and gland member, and between the polish rod and the gland body. A plurality of openings 53 and 52 are provided so that there will be free flow of lubricant from the space 26 to the packing elements.

In the lower surface of the cap flange 13 is a groove 28 in which is disposed an O-ring 32 made of resilient material. In the top spherical surface of the packing gland body 19 is a groove 29 which also contains an O-ring 33 made of resilient material. In like manner the upper plane surface of a housing base 22 contains a groove 31 containing an O-ring 35 and the lower spherical surface of the gland body 19 contains a groove 30 and an O-ring 34.

In assembling the apparatus of Figure 1 the cylindrical housing 11 and base member 22 are slipped down over the polish rod and attached to a pumping T 104 (of Figure 2) by threads 40. The wear bushing 23 is next inserted, followed by the insertion of the O-ring 35. The lower bearing ring 20 is next positioned. The O-ring 34 may preferably be placed in its retaining groove 30 prior to positioning of the gland body 19. After this gland body 19 is lowered into place, the spring guide 49 is inserted followed by the spring 48. The lower packing ring 47 is now dropped into place and the packing rings 46, ring 45, packings 44, lantern ring 43, packings 42, and the packing ring 41, are positioned in succession. The O-ring 33 may have previously been placed in its groove 29 or it may now be placed. The upper bearing ring 18 is next positioned and finally the cap flange with the O-ring 32 in groove 28 is placed upon this packing assembly. Bolts 25 are then inserted and tightened. If desired a groove 55 may be made in the lower surface of cap flange 13 for accommodation of the upper end of the housing member 11. A gasket 56 of resilient material should preferably be placed in this groove 55 in order to obtain a fluid-tight seal at this joint.

The compression spring 48 is of such magnitude that when the bolts 25 are tightened so that the cap flange 13 is firmly in place the force exerted by the spring 48 upwards against the assembly of packing elements 42, 44 and 46 will be substantially constant throughout the life of the packing and therefore provide a uniform seal. The design of this spring may be varied from well to well as packing conditions or problems at a particular well arise. Lubricant within chamber 26 flows through channels 53, channels 51 and 52 so that all elements which are in contact with the polish rod will be lubricated to reduce friction and provide a tight seal against pumping pressure.

Referring now to Figure 2, the self-aligning packing assembly 105 is shown diagrammatically. Polish rod 24 extends above and below this packing assembly. Attached to the threads 40 of the housing base is a pumping T 104. T 104 in turn is attached to the top coupling of a well tubing 101 by means of some threads 102. A flow line 103 carries the pumped fluid from the well to tanks, not shown. A pressure tap 117 may be made into the flow line 103 for pressurizing of a lubricator assembly 106. This assembly is held firmly in relation to the packing assembly by a clamp 111.

This lubricator assembly 106 consists of a lubricant chamber 112 within a body member 125. In this chamber is a piston 113 connected to a guide and indicator rod 115. A cap member 116 covers the lower end of the body 125. A compression spring 114 is disposed between this cap 116 and the piston 113 so as to exert at all times a pressure against the lubricant. At the top end of the chamber 125 is a T 124. The side outlet of this T is connected by a conduit 121 to a fitting 127 which is inserted in opening 54 (see Figure 1). When pressure is exerted against the lubricant in the chamber 112, lubricant is urged to flow through fitting 124 and conduit 121 into the packing gland.

Opening 122 in fitting 123 which is in the top end of the T 124 is for introduction of new lubricant from an exterior source into the apparatus without dismantling any portion of the apparatus. A valve 126 is for removal of the lubricant.

At the bottom portion of this lubricator assembly are several small pipes 118 and 117. Pipe 117 is provided with a valve 120. Pipe 117 provides fluid communication between flow line 103 and the underside of the piston 113. When valve 120 is open, tubing head pressure is communicated through conduit 117 to the underside of the piston and this pressure in addition to the pressure of the spring 114, tends to force lubricant into the polish rod packing assembly. When valve 120 is open, valve 119 in tube 118 should be closed in order that pressure will not escape. If it is desired to force the lubricant into the packing assembly by spring 114 alone, then valve 120 may be closed and valve 119 opened.

True straight line motion cannot be obtained in the present day pumping unit, consequently in addition to moving vertically, the polish rod also moves horizontally in a more or less wobble action. In addition, pumping equipment such as oil well pumping jacks and the like may frequently be slightly out of line which adds greatly to the normal wobble of a polish rod. This wobble motion in polish rods is an important reason for rapid failure of polish rod packing. However, in the packing gland of my invention, if the polish rod vibrates or moves horizontally during its up or down stroke, the inner assembly consisting of the upper bearing ring 18, the lower bearing ring 20 and the packing gland body with its packing may move horizontally with the polish rod. This horizontal movement is actually between the surfaces 61 and 62 at the top and between the surfaces 63 and 21 at the bottom. Any wobble action movement of the polish rod is compensated for by the rotation of the packing

gland body 19 on its upper and lower spherical surfaces.

In actual use, packing gland assemblies constructed and installed according to my invention have been used as long as seven months in continuous operation in contrast to periods as short as one month and less when conventional rigidly fixed packing gland assemblies are used.

The V-type packing elements 42, 44, and 46 may be obtained commercially as such elements have long been used for many packing purposes. These packing elements should of course be resistant to action of hydrocarbons such as will be present in oil well production fluid. They should also be resistant to any action exerted by the lubricant. In like manner, the O-rings 32, 33, 34, and 35 should be composed of resilient material which is not affected under the conditions of their use.

The O-rings used in this apparatus may be considered as functioning in the following manner. The O-rings 35 and 34 which are nearest the tubing head may be exposed to a pressure higher than the other O-rings. Well head fluid pressure from the opening 50 which exerts itself between the plane surfaces of contact 63 of the lower bearing ring 20 and the upper surface 21 of the base plate 22, respectively, will be transmitted into the groove 31 on the side of the O-ring nearest the polish rod. This pressure will then tend to force the O-ring 35 radially away from the polish rod to effect a seal against the escape of high pressure fluid from the space 50 to the space 26. In like manner, tubing head fluid pressure which may be transmitted along the spherical surfaces 64 and 66 is sealed by O-ring 34. Since the pressure in the space 26 is normally greater than atmospheric pressure, O-rings 32 and 33 are urged into sealing engagement against leakage of lubricant, as shown.

The above-described detailed embodiment is given for illustrative purposes and should not be regarded as limiting the invention, the scope of which is set forth in the following claims.

Having described my invention, I claim:

1. A self-aligning mounting structure for the packing of a polish rod packing gland comprising, in combination, a housing adapted to be secured to an oil well pumping T, the interior of said housing defined by a cylindrical side wall and parallel top and bottom end walls normal to the axis of the cylindrical side wall, a top bearing ring having a top plane surface in slidable contact with said top end wall and a bottom spherical surface concave downward, a bottom bearing ring having a bottom plane surface in slidable contact with said bottom end wall and a top spherical surface concave upward, a hollow cylindrical floating packing gland body member disposed, in general, concentrically within the cylindrical side wall of said housing, said body member being open at its top end and having a bottom end wall, said housing, said top and bottom bearing plates and said bottom end wall of said body member having openings concentric with their respective axes to accommodate a polish rod, the inner diameter of said hollow floating body member being sufficiently large to accommodate annular packing rings adapted to surround said polish rod, and the surfaces of the top and bottom ends of said hollow cylindrical floating body member being spherical zones of the same radius as the spherical surfaces of the top and bottom bearing rings.

2. In the self-aligning mounting structure of claim 1, an O-ring seal in sealing relation between the top plane surface of the top bearing ring and the top end wall of said housing, an O-ring seal in sealing relation between the bottom plane surface of the bottom bearing ring and the bottom end wall of said housing, an O-ring seal in sealing relation between the bottom spherical surface of the top bearing ring and the top convex upward end of said floating gland body member and an O-ring seal in sealing relation between the top spherical surface of the bottom bearing ring and the bottom convex downward end of said floating gland body member.

3. A self-aligning polish rod stuffing box assembly comprising, in combination, a housing adapted to be secured to an oil well and having parallel interior plane top and bottom end walls, a top bearing plate having a top plane surface in slidable contact with said top end wall and a bottom spherical surface concave downward, a bottom bearing ring having a bottom plane surface in slidable contact with said bottom end wall and a top spherical surface concave upward, a floating packing gland for packing a substantially axially disposed polish rod comprising a cylindrical body member disposed substantially axially within said housing, said housing, said top and bottom bearing plates and said body member having openings to accommodate said polish rod and packing in said body member surrounding said polish rod, the surfaces of the top and bottom ends of said body member being spherical zones of the same radius as, and disposed in contact with, the spherical surfaces of the top and bottom bearing rings whereby disalignment of said polish rod may be accommodated for.

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