April 7, 1936. H. C. OTIS 2,036,537

KELLY STUFFING BOX

Filed July 22, 1935 3 Sheets-Sheet 1

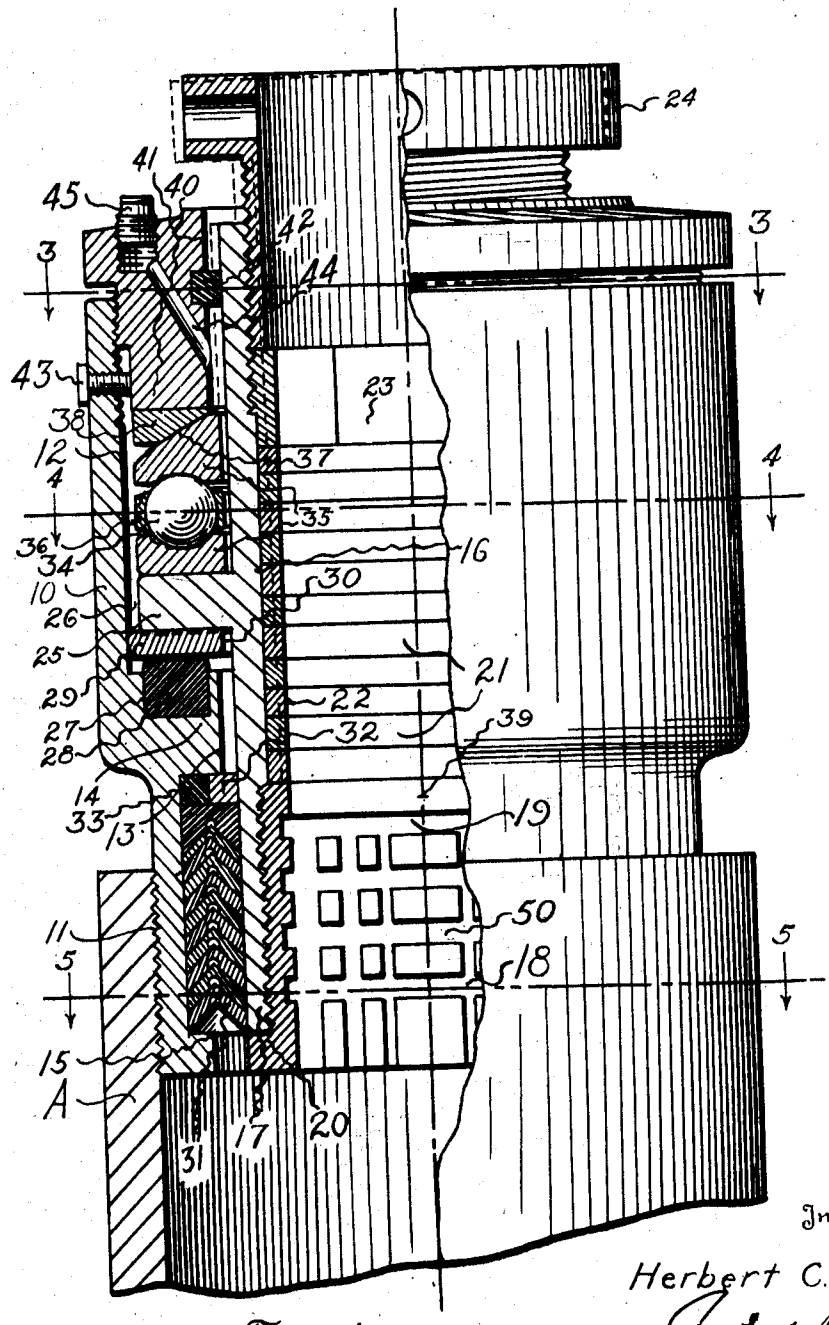


Fig. 1

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KELLY STUFFING BOX

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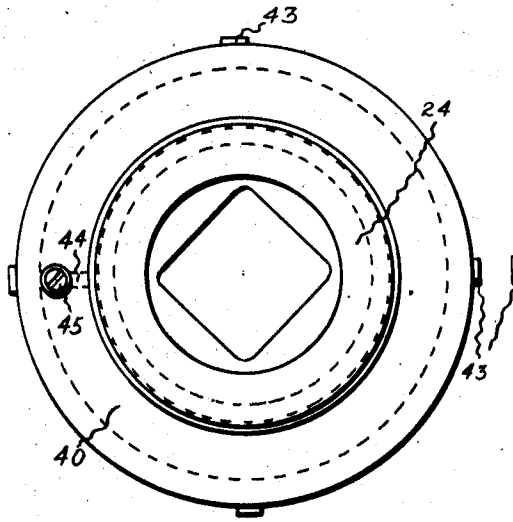


Fig. 2

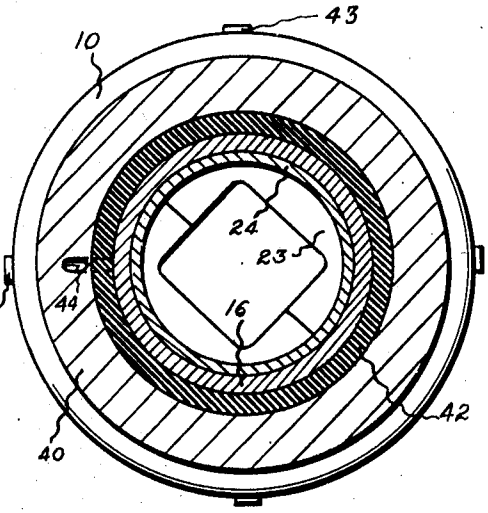


Fig. 3

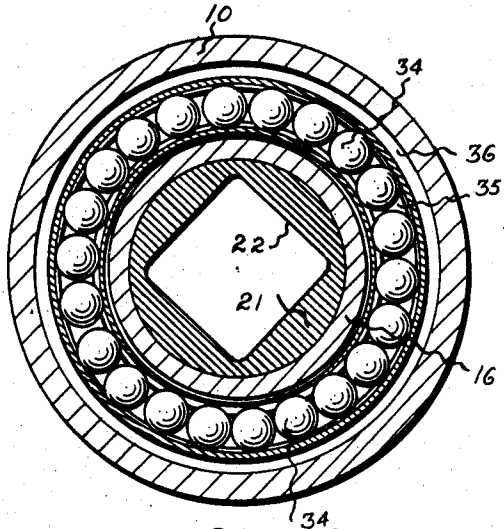


Fig. 4

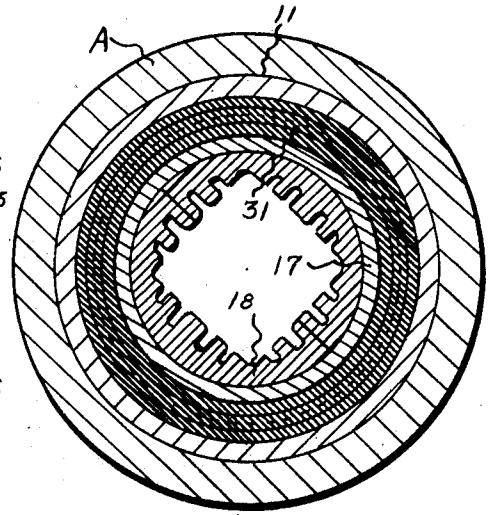


Fig. 5

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KELLY STUFFING BOX

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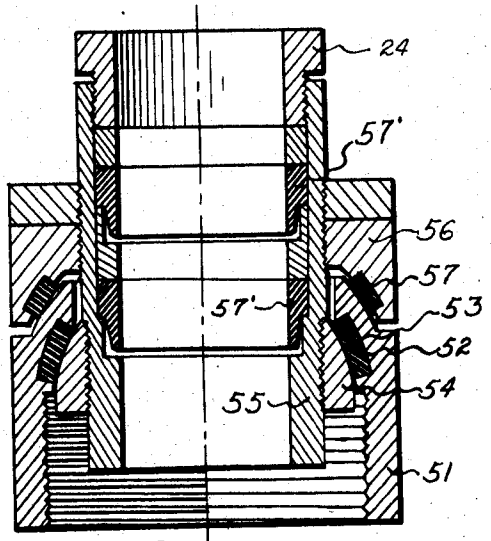


Fig. 7

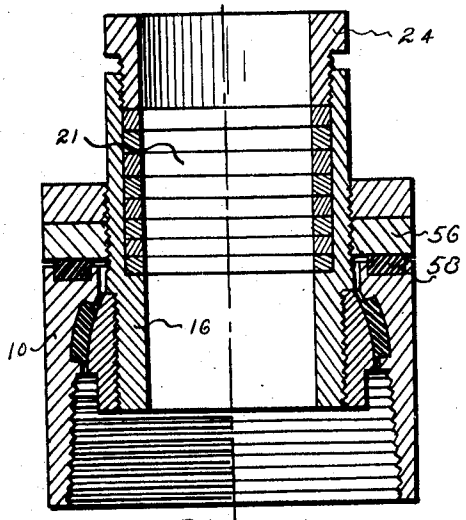


Fig. 8

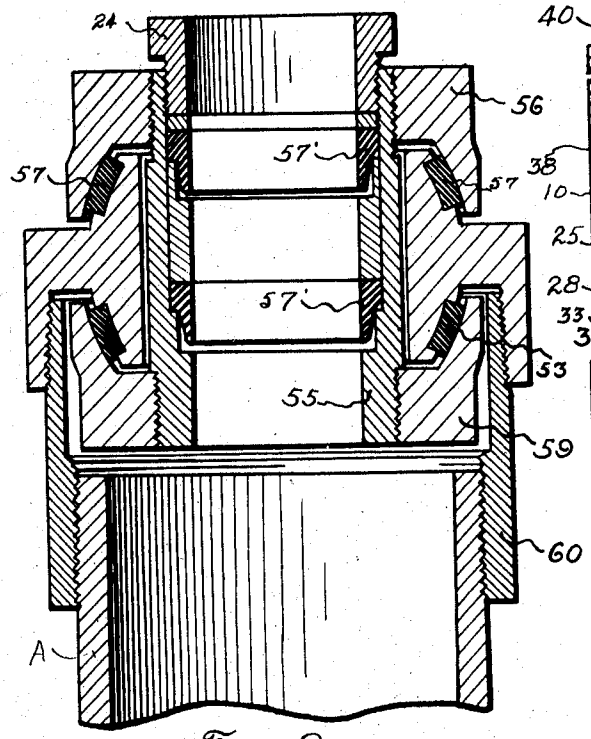


Fig. 9

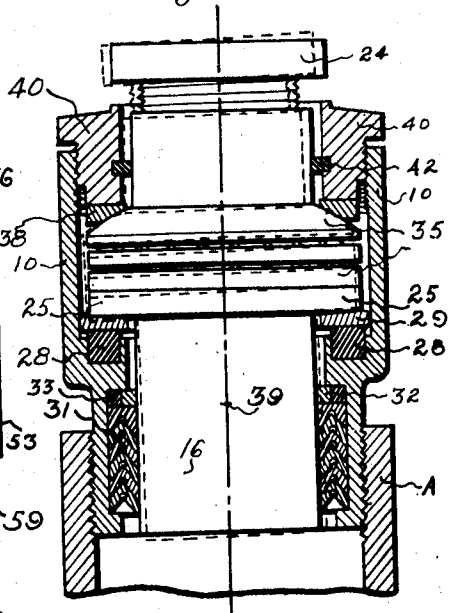


Fig. 6

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2,036,537

UNITED STATES PATENT OFFICE

2,036,537

KELLY STUFFING BOX

Herbert C. Otis, Dallas, Tex.

Application July 22, 1935, Serial No. 32,685

21 Claims. (Cl. 255—1)

This invention relates to new and useful improvements in stuffing boxes.

The present tendency in oil well completion practice is towards completion under pressure, or, instead of employing a fluid column which is greater than that of the formation being drilled, employing a fluid column having a weight less than the formation pressures. This practice necessitates the use of some means of packing off around the drill stem at the surface to maintain the well under control.

The usual practice is to employ a cylindrical drill stem, whereby a simple stuffing box may be used. However, it is, under many conditions, more desirable to drive the drill stem with the usual Kelly joint which is square in cross-section.

It has been found that it is practically impossible to exactly align the well connections with the rotary table which drives the Kelly joint. Further, it is difficult to align the rotary table with the stuffing box which is to pack off the Kelly joint. Since the joint must pass through the box, rotary table and downwardly through the well connections, it is obvious that such misalignment will seriously hamper the rotation of the joint. Even though the well connections, rotary and box were properly aligned, the usual rotary table has a certain amount of "play" or "wobble" so that the rotation would soon throw the Kelly joint out of alignment. This play in the rotary would also cause the well connections to wobble which is especially dangerous when drilling under high pressures.

Where long strings of drill pipe are being handled, the resulting friction, due to Kelly joint and pipe being out of alignment, seriously interferes with the drilling. Therefore, since there is misalignment of the various parts and also since the Kelly joint itself has irregularities in its surface, it is obvious that to successfully drill under pressure, a self-aligning stuffing box, which will compensate for the misalignment and irregularities while still holding its seal, must be provided.

In some cases, it has been attempted to anchor the well connections against lateral or horizontal movement, but this has been found impractical because of the resultant strain and bind on the Kelly joint. Further, this method interferes with the drilling operation because the driller is unable to ascertain how much of the drill stem weight is on the bottom of the well.

One object of the invention is to provide an improved stuffing box which is particularly adapted for use in packing off around a drill stem of a well or other progressive element, and which will effectively hold its seal under all conditions, whereby the well may be drilled under pressure.

An important object of the invention is to provide an improved stuffing box which is arranged to encircle the usual square Kelly joint which is driven by a rotary table to rotate the drill stem, the box being so constructed that it may undergo a limited swinging or tilting movement without breaking its packing seal with the Kelly joint, whereby the stuffing box is self-aligning to compensate for irregularities in the joint, misalignment of the well connections with the rotary table, or lateral play in the rotary table.

Another object of the invention is to provide an improved stuffing box including a non-rotatable casing having a bushing rotatable therein said rotatable bushing having suitable packing therein and being mounted to swing or tilt and also being arranged to move laterally within the casing whereby when the usual Kelly joint is passed through said bushing, the bushing will automatically align itself to effectively pack off around the joint, said self alignment also serving to hold the seal during rotation of said joint, whereby the well may be drilled under pressure.

A further object of the invention is to provide an improved stuffing box including a driving bushing for engaging the drill stem, said bushing being rotatably confined in a non-rotatable member whereby the drill stem is rotated, and means in the drive bushing for dissipating the heat caused by friction during rotation of the bushing, whereby the elastic packings of the stuffing box are kept comparatively cool to prolong the life of said packing.

Still another object of the invention is to provide an improved stuffing box for packing off around a drill stem including a drive bushing which is rotatably confined within a non-rotatable support, there being a resilient packing member between the bushing and support to prevent leakage of well pressure therebetween, the packing member being so constructed as to provide a bearing surface on which the bushing rotates.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, in which an example of the invention is shown, and wherein:

Figure 1 is a view, partly in elevation and partly in section of a stuffing box constructed in accordance with the invention,

Figure 2 is a plan view,

Figure 3 is a horizontal, cross-sectional view, taken on line 3—3 of Figure 1,

Figure 4 is a horizontal, cross-sectional view, taken on the line 4—4 of Figure 1,

Figure 5 is a horizontal, cross-sectional view, taken on the line 5—5 of Figure 1,

Figure 6 is a diagrammatical view showing the various positions of the inner body or housing,

Figure 7 is a transverse, vertical, sectional view of another form of the invention,

Figure 8 is a transverse, vertical, sectional view of still another form of the invention, and

Figure 9 is a transverse, vertical, sectional view of still another form of the invention.

In the drawings, the numeral 10 designates a cylindrical casing or shell which has its lower end reduced and externally screw-threaded at 11, whereby the shell may be mounted on the well control connections A, which are carried by the upper end of the well casing (not shown), or other support. The shell has a vertical bore 12 which has its lower end reduced in diameter at 13. Between the bore 12 and this reduced portion, an internal annular flange 14 is formed. At the extreme lower end of the reduced portion 13, an annular, internal, shoulder 15 is provided.

Rotatably mounted within the shell 10 is an elongated cylindrical body 16 which has substantially the same length as the shell. The diameter of the body is less than the inner diameter of the internal flange 14, whereby the body may move a limited distance laterally within the shell (Figure 1). The lower end of the bore 17 of the body is internally screw-threaded, whereby a drive bushing 18 having a square bore 19 may be screwed therein. If desired, the bushing may be split to facilitate its being engaged around the Kelly joint (not shown). The lower end of the bushing is formed with an external annular shoulder 20, which abuts the lower end of the body when said bushing is threaded therein.

Located within the bore 17 of the body is a plurality of superimposed elastic packing rings 21. The lowermost ring is supported on the upper end of the drive bushing 18 and each ring is formed with a square bore 22, so as to snugly engage the square Kelly joint B which passes through the drive bushing. The packing rings are held in place by a split metal retaining ring 23 having the same shape as the packing rings. The ring 23 engages the upper most packing ring and is held in engagement therewith by a flanged collar 24 which is threaded into the upper end of the bore 17 of the body. It is obvious that as the packing rings wear, the collar may be readily tightened to further compress said rings.

For rotatably supporting the body 16 within the shell 10, said body is formed with an external, annular flange 25 which is located substantially at mid-height thereof. The flange extends into the bore 12 of the shell and is of such width that when the body is disposed axially within said shell, there is a clearance or space 26 between the outer edge of the flange and the bore 12. As clearly shown in Figure 1, the flange 25 overhangs the internal flange 14 within the shell, which latter flange is provided with an annular recess or groove 27 in its upper face. This groove receives an elastic packing ring 28 which has its upper end projecting from the groove. A metal ring 29, preferably of bronze, is supported on the elastic ring and surrounds the body 16. It is noted that the outer edge of the ring is contiguous with the bore 12 of the shell there being a slight clearance therebetween, while there is a comparatively large clearance 30 between the inner edge of said ring and the body 16.

The external flange 25 on the body rests on the bronze ring 29, whereby the body is suspended from the flange. Due to the clearance spaces 26 and 30, it is obvious that the body 16 may move a limited lateral distance within the shell. Since the underside of the flange rests on the ring, it will be seen that all the wear occasioned by lateral movement of the body is taken by the bronze ring 29. This ring is immovable and therefore, the flange 25 slides thereon. By making the ring of bronze, a friction bearing is provided which reduces friction during rotation.

For packing off the space between the reduced portion 13 of the bore of the shell 10 and the outer surface of the lower end of the body 16, a plurality of superimposed resilient packing rings surround the body between the internal shoulder 15 at the lower end of said shell and the underside of the internal flange 14. The rings are preferably of an inverted V-shape as shown and a metal ring 32, preferably of bronze or steel, is interposed between the uppermost packing ring and the flange 14 and engages the wall of the body. Contiguous to the ring 32 and also interposed between the packing rings and flange is an elastic ring 33 which engages the reduced portion 13 of the shell bore. With this arrangement, it is obvious that when the body 16 moves laterally within the shell, the packing rings 31, as well as the elastic ring 33 are distorted to permit such lateral movement. This lateral movement is, of course, limited to the distortion of the resilient and elastic rings. It will be seen that the packing seal will be positively maintained when the body moves laterally.

For permitting free rotation of the body within the shell 10, ball bearings 34 are mounted in an annular raceway 35 which is supported on the flange 25. The outer edge of the raceway does not contact the bore 12 of the shell 10, leaving a clearance space 36 to permit the raceway to move laterally with the body. The upper face 37 of the raceway is arcuate and is engaged by the arcuate underside of a retaining ring 38. The arc of both the face and ring is swung from a center 39 which is substantially in horizontal alignment with the internal flange 14 at the axial center of the body, whereby the body will swing from this point. Thus, it will be seen that the body 10 can swing a limited distance within the shell to compensate for any irregularities in the square Kelly joint B passing therethrough.

The retaining ring 38 is held in place by a gland 40 which is threaded into the upper end of the bore 12 of the shell. The bore 41 of the gland has a greater diameter than the outside diameter of the body whereby an annular space is provided therebetween. A soft felt washer or ring 42 is inserted between the gland and the body to prevent dirt, or other extraneous matter from entering the shell 10. Radially extending set screws 43 may be employed to hold the gland in adjusted positions.

The gland 40 is provided with an inclined port 44 which leads from the upper end thereof to the bore below the felt ring 42. This port is normally closed by a plug 45. The port permits a suitable lubricating oil to be entered between the body and shell, whereby the flange 25, ring 29 and ball bearings 34 will be immersed in an oil bath at all times.

In operation, the shell is mounted on the well casing A, or other suitable support. The square Kelly joint B which is driven by the usual rotary table is, of course, connected with the drill stem (not shown) extending into the well. In drilling a well under pressure, it is necessary to maintain a packing seal around the Kelly joint B

which moves downwardly as the drilling progresses. The Kelly joint B passes through the drive bushing and packing in the body 16, and since the packing rings 21 have square bores, it is obvious that the joint is packed off.

It has been found that it is seldom possible to exactly align the well connections with the rotary table through which the Kelly joint B passes, and therefore a stuffing box in alignment with the well casing will not be in exact axial alignment with the Kelly joint. With the arrangement shown herein and described, the body 16 may undergo a limited lateral movement to automatically align itself with the joint. Therefore, it will be readily seen that the stuffing box is self aligning.

When rotation of the Kelly joint starts, the body 16 will rotate therewith. The shell remains stationary, the rotation of the body being facilitated by the ball bearings 34. As the drilling operation continues, the Kelly joint, of course, moves downwardly through the body. Due to irregularities in said joint, the downward movement of the joint will swing the body 16 to tilt the same within the shell. This tilting will cause the lateral supporting flange 25 to distort the elastic ring 28 in the groove 27 on which said flange rests. It is pointed out that this ring together with the clearance between the body and shell permits the tilting. The arcuate face 37 of the raceway engaging the arcuate ring 38 serves to guide the body in its swinging movement. From the above, it will be seen that the body 16 will automatically align itself to compensate for any irregularities in the Kelly joint, or any misalignment of the rotary table with the well connections, or to take care of any other conditions.

Since the body rotates within the shell, it will be seen that the outer wall of said body frictionally engaging the packing rings 31 will cause the rings to become heated. Unless this heat is dissipated, the rings will soon deteriorate, which would necessitate replacement. To dissipate this heat, the inner surface of the drive bushing 16, is formed with horizontal and vertical grooves 50, whereby the well pumping fluid may flow therethrough. Since this fluid surges upwardly at intervals, it is obvious that the grooves provide increased contact surface for the fluid and therefore a heat exchange occurs. Thus, the heat built up by friction due to the rotation of the body within the rings 31 will be carried off by the fluid, whereby said rings are kept comparatively cool, which increases the life of said rings.

In Figure 7, I have shown another form of the invention wherein the shell 51 is provided with an arcuate recess 52 at its upper end. An arcuate packing member 53 is inserted in the groove and rests on a ring 54 arcuate in cross-section, which is secured to the inner body 55 through which the Kelly joint B passes. The body has a collar 56 threaded on its upper end and this collar has a depending annular flange which overhangs the upper end of shell 51. An elastic ring 57 arcuate in cross-section is interposed between the collar and shell and, as clearly shown, the body is supported by the collar. Suitable packing rings 51 are inserted in bore of the body to pack off the joint (not shown) passing therethrough. The operation of this form is the same as the first form for it is obvious that the body may undergo a limited lateral, as well as a swinging movement.

In Figure 8 is shown a form similar to Figure 7, except that the flange on the collar 56 is eliminated, and an elastic ring 58 rectangular in cross-section, is interposed between the flat top of the shell and the underside of the collar.

Figure 9 shows a slightly modified form wherein a second collar 59 is employed for retaining the lower ring 53 in the shell. In this form the shell is made in two pieces with a lower depending sleeve 60 for attachment to the support A. In all three of the latter forms, the rings serve not only to permit limited lateral displacement of the body, but also provide a bearing surface on which the body may swing or tilt to compensate for irregularities in the Kelly joint passing therethrough.

What I claim and desire to secure by Letters Patent is:

1. A stuffing box for rotating elements including, a non-rotatable outer member, and a rotatable inner member journaled in the outer member and having a work receiving opening extending axially therethrough for receiving a work element, the inner member having recesses in its work-receiving opening for receiving a cooling fluid and applying it to the work element to dissipate the generated heat.

2. A stuffing box for rotating elements including, an outer non-rotatable member, an inner rotatable member having an angular opening therethrough for receiving a longitudinally progressing flat-sided element and disposed in the outer member, packing located in the opening of the inner member and engaging the flat sides of the progressing element for sealing off said element as the same moves through said opening, bearing elements supporting the inner member within the outer member, and flexible packing between the members, there being sufficient clearance between the members to permit the inner member to undergo self alignment within the outer member, the bearing elements being mounted to permit the inner member to tilt within the outer member without losing contact and the packing being arranged to preserve a fluid tight joint between the members at all deflections of the inner member.

3. A stuffing box for rotating elements including, a non-rotatable outer member, a rotatable inner member journaled in the outer member and having a work receiving opening extending axially therethrough for receiving a work element, means contiguous to the work opening of the inner member for receiving a cooling fluid and applying it to the work element to dissipate the generated heat, and a packing located in the opening of the inner member and engaging the progressing element for sealing off said element as the same moves through said opening.

4. A stuffing box for rotating elements including, a non-rotatable outer member, a rotatable inner member journaled in the outer member and having a work receiving opening extending axially therethrough for receiving a work element, the inner member having recesses in its work-receiving opening for receiving a cooling fluid and applying it to the work element to dissipate the generated heat, and a packing located in the opening of the inner member and engaging the progressing element for sealing off said element as the same moves through said opening.

5. A stuffing box including, an outer non-rotatable member having an annular shoulder therein, a bearing member carried by said shoulder and inner rotatable member having an angular opening for receiving a progressive element, said inner member being mounted in the outer member and

having an annular support carried by said bearing member, the inner member being movable laterally within the outer member, an anti-friction hold-down bearing member engaging the support of the inner member within the outer member, means for confining a body of lubricant between the members and around the bearing elements and a flexible packing between the members below said confining means.

6. A stuffing box including, an outer non-rotatable member having an annular shoulder therein, a bearing member carried by said shoulder, an inner rotatable member having an angular opening for receiving a progressive element, said inner member being mounted in the outer member and having an annular support carried by said bearing member, the inner member being movable laterally within the outer member, an anti-friction hold-down bearing member engaging the support of the inner member within the outer member, means for confining a body of lubricant between the members and around the bearing elements, a flexible packing between the members below said confining means and means contiguous to the opening of the inner member for receiving a cooling fluid and applying it to the inner member to dissipate the heat generated by rotation.

7. A stuffing box including, an outer non-rotatable member having an annular shoulder therein, a bearing member carried by said shoulder and inner rotatable member having an angular opening for receiving a progressive element, said member being mounted in the outer member and having an annular support carried by said bearing member, the inner member being movable laterally within the outer member, an anti-friction hold-down bearing member engaging the support of the inner member within the outer member, means for confining a body of lubricant between the members and around the bearing elements, and a flexible packing between the members below said confining means, the inner member having recesses in its inner wall opposite the flexible packing to receive a cooling fluid whereby the frictional heat generated by the rotation of the inner member within the packing is dissipated.

8. A stuffing box including, an outer non-rotatable member having an annular shoulder therein, a bearing member carried by said shoulder, an inner rotatable member mounted in the outer member and having an annular support carried by said bearing member, the inner member having an angular opening for receiving a rotatable flat-sided drill stem and being movable laterally within the outer member, an anti-friction hold-down bearing member engaging the support of the inner member within the outer member, there being a space between the members for receiving a body of lubricant between the members and around the bearing elements, and a flexible packing between the members below the lubricant space.

9. A stuffing box for rotating elements including, an outer non-rotatable member, an inner rotatable member having an opening which has one or more contact surfaces, a longitudinal upright flat progressive element having one or more contact surfaces engaging the flat surfaces of the inner member for contributing rotation thereto while progressing therethrough, packing located in the opening of the inner member and having one or more contact surfaces so as to snugly engage the progressive element to pack off the same, bearing elements supporting the inner member within the outer member, and flexible packing between the members, there being sufficient clearance between the members to permit the inner member to undergo lateral self alignment within the outer member, the bearing elements being mounted to permit the inner member to tilt within the outer member without losing contact and the packing being arranged to preserve a fluid tight joint between the members at all deflections of the inner member.

10. A stuffing box including, an outer non-rotatable member having an annular shoulder therein, a bearing member carried by said shoulder, an inner rotatable member having an angular opening for receiving a progressive element, said member being mounted in the outer member and having an annular support carried by said bearing member, the inner member being movable laterally within the outer member, an anti-friction hold-down bearing member engaging the support of the inner member within the outer member, there being a space between the members for receiving a body of lubricant between the members and around the bearing elements, a flexible packing between the members below said lubricant chamber, and packing disposed in the opening of the inner member for engaging and sealing off the progressive element.

11. A stuffing box including, an outer non-rotatable member having an annular shoulder therein, a bearing member carried by said shoulder, an inner rotatable member having an angular opening for receiving a progressive element, said member being mounted in the outer member and having an annular support carried by said bearing member, the inner member being movable laterally within the outer member, an anti-friction hold-down bearing member engaging the support of the inner member within the outer member, there being a chamber between the members for receiving a body of lubricant between the member and around the bearing elements, a flexible packing between the members below said lubricant chamber, means contiguous to the opening of the inner member for receiving a cooling fluid and applying it to the inner member to dissipate the heat generated by rotation, and packing disposed in the opening of the inner member for engaging and sealing off the progressive element.

12. A stuffing box including, an outer non-rotatable member having an annular shoulder therein, a bearing member carried by said shoulder, and an inner rotatable member having an angular opening for receiving a progressive element, said member being mounted in the outer member and having an annular support carried by said bearing member, the inner member being movable laterally within the outer member, an anti-friction hold-down bearing member engaging the support of the inner member within the outer member, there being a space between the members for receiving a body of lubricant between the members and around the bearing elements, a flexible packing between the members below said lubricant space, the inner member having recesses in its inner wall opposite the flexible packing to receive a cooling fluid whereby the frictional heat generated by the rotation of the inner member within the packing is dissipated, and pack-disposed in the opening of the inner member for engaging and sealing off the progressive element.

13. A stuffing box for rotating elements includ-

ing, an outer non-rotatable member, an inner rotatable member having an angular opening therethrough for receiving a longitudinally progressing element and disposed in the outer member, flexible packing between the members, and means resting upon the packing for supporting the inner member within the outer member and upon which the inner member is rotatable, there being sufficient clearance between the members to permit the inner member to undergo lateral self alignment within the outer member, the disposition of the flexible packing being such as to permit the inner member to tilt within the outer member while said packing preserves a fluid tight joint between the members at all deflections of the inner member.

14. A stuffing box for rotating elements including, an outer non-rotatable member, an inner rotatable member having an angular opening therethrough for receiving a longitudinally progressing element and disposed in the outer member, packing disposed in the opening of the inner member for engaging and sealing off the progressive element as the latter moves therethrough, flexible packing between the members, and means carried by the packing for supporting the inner member within the outer member and upon which the inner member is rotatable, there being sufficient clearance between the members to permit the inner member to undergo lateral self alignment within the outer member, the disposition of the flexible packing being such as to permit the inner member to tilt within the outer member while said packing preserves a fluid tight joint between the members at all deflections of the inner member.

15. A stuffing box for rotating elements including, an outer non-rotatable member, an inner rotatable member having an angular opening therethrough for receiving a longitudinally progressing element and disposed in the outer member, bearing elements supporting the inner member within the outer member, flexible packing between the members, there being sufficient clearance between the members to permit the inner member to undergo lateral self alignment within the outer member, the bearing elements being mounted to permit the inner member to tilt within the outer member without losing contact and the packing being arranged to preserve a fluid tight joint between the members at all deflections of the inner member, and means for dissipating the heat generated by the rotating members.

16. A stuffing box including, an outer non-rotatable cylindrical member, an inner member mounted to rotate within the outer member and having an angular opening for receiving and rotating a flat-sided drill stem, flexible packing in the opening of the inner member engaging the drill stem and forming a fluid-tight joint therewith, the outer member having a lower annular support, a flexible packing interposed between the lower support and the inner member, an upper flexible packing carried by the outer member, the inner member having a rotating part engaging the upper packing, there being sufficient clearance between the inner and outer members to permit the inner member to move laterally therein to vertically align with the drill stem when the latter moves laterally, the inner rotatable member also being arranged to tilt at an angle to the perpendicular.

17. A stuffing box including, a non-rotatable outer casing having an annular support therein, an elongate axially rotatable member rotatably mounted on the support within the casing and having an angular opening provided with packing for receiving and packing off an angular vertically movable rotatable element, means for confining the inner member in the casing so that it may undergo lateral self-adjustment, flexible packing interposed between the casing and inner member below the support and exposed to fluid pressure therebelow to be expanded thereby, and fluid-tight packing between the casing support and the inner member.

18. A stuffing box including, a non-rotatable outer casing having an annular support therein, an elongate axially rotatable member rotatably mounted on the support within the casing and having an angular opening provided with packing for receiving and packing off an angular vertically movable rotatable element, anti-friction hold-down means within the casing arranged to confine the inner member on the support and permitting said member to undergo lateral self-adjustment so as to vertically align itself with the vertical movable element, said inner member also being mounted to tilt at an angle to the perpendicular, and flexible packing interposed between the casing and the inner member to provide fluid-tight joints.

19. A stuffing box including, a non-rotatable outer casing having an annular support therein, an elongate axially rotatable member rotatably mounted on the support within the casing and having an angular opening provided with packing for receiving and packing off an angular vertically movable rotatable element, means for confining the inner member in the casing so that it may undergo lateral self-adjustment, flexible packing interposed between the casing and inner member below the support and exposed to fluid pressure therebelow to be expanded thereby, fluid-tight packing between the casing support and the inner member, and a sealing element between the casing and the rotatable member immediately above the flexible packing to retain a lubricant in the casing thereabove.

20. A stuffing box including, a stationary outer casing having an annular shoulder therein, and an elastic packing ring immovably carried by said shoulder, a metal bearing ring resting on said packing ring, an inner rotatable body having an outwardly extending annular flange bearing on the metallic ring, said member having an angular opening provided with packing for receiving and packing off an angular drill stem, and an anti-friction hold-down device engaging the flange of the body within the casing, said device being constructed to permit a rocking movement of the body, and means for confining the device in the casing.

21. A stuffing box including, a stationary outer casing, a rotatable member mounted on the casing and having an axial bore, a plurality of packing rings mounted in the bore of the body, a retaining ring secured in the body for engaging the uppermost packing ring, and a drive bushing mounted in the bottom of the bore of the body for supporting said packing rings, said bushing having passages in its inner face for permitting the circulation of a cooling fluid between said bushing and the flat sides of a drill stem, the retaining ring, the packing rings and the bushings having angular openings in vertical alignment for engaging the flat sides of a drill stem.

HERBERT C. OTIS.

DISCLAIMER

2,036,537.—*Herbert C. Otis*, Dallas, Tex. KELLY STUFFING BOX. Patent dated April 7, 1936. Disclaimer filed December 30, 1939, by the patentee.

Hereby enters this disclaimer to claims 2, 9, 13, 14, 18, and 20 of the specification.

[*Official Gazette January 30, 1940.*]