April 27, 1954 H. E. DAVIDSON ET AL 2,676,788

ROTARY SWIVEL

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Fig. 1.

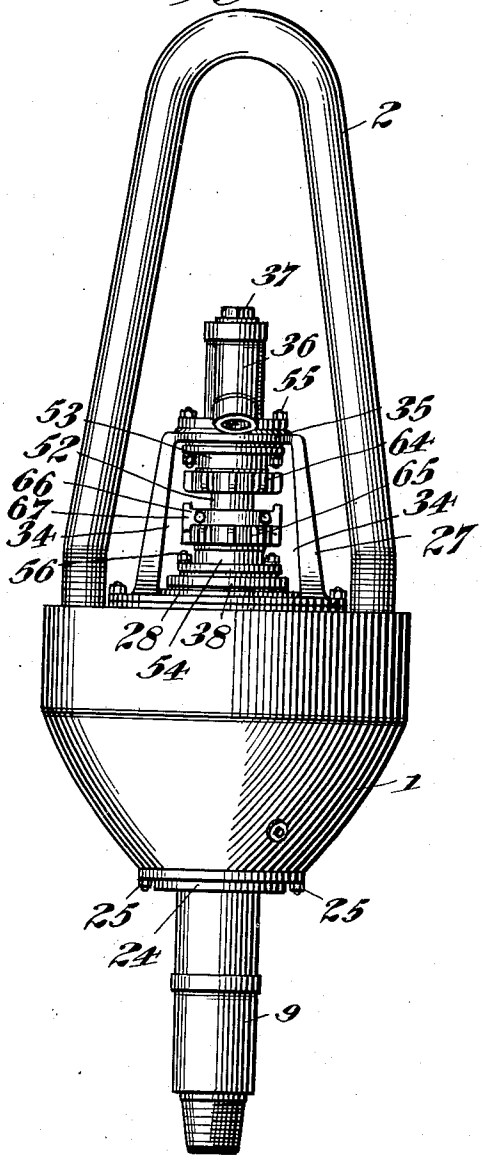
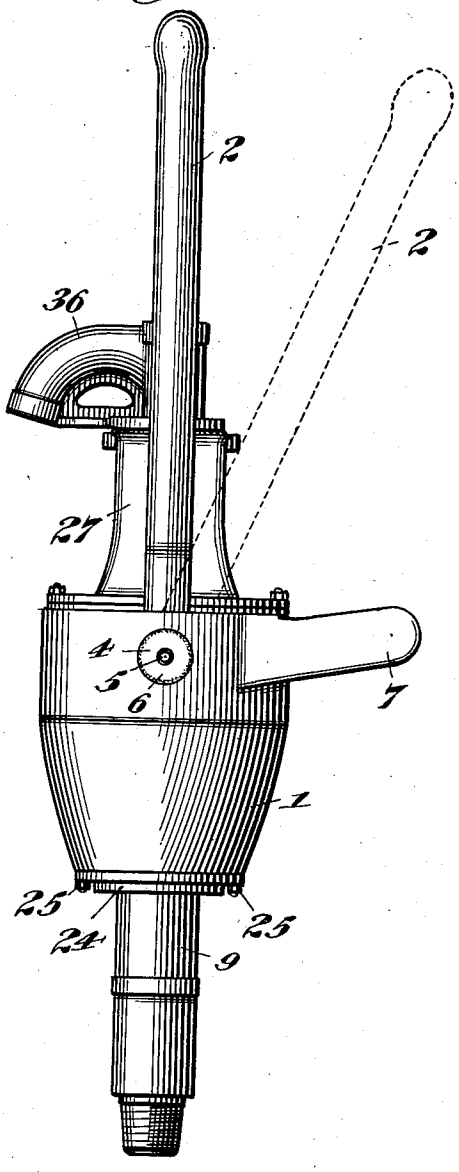


Fig. 2.



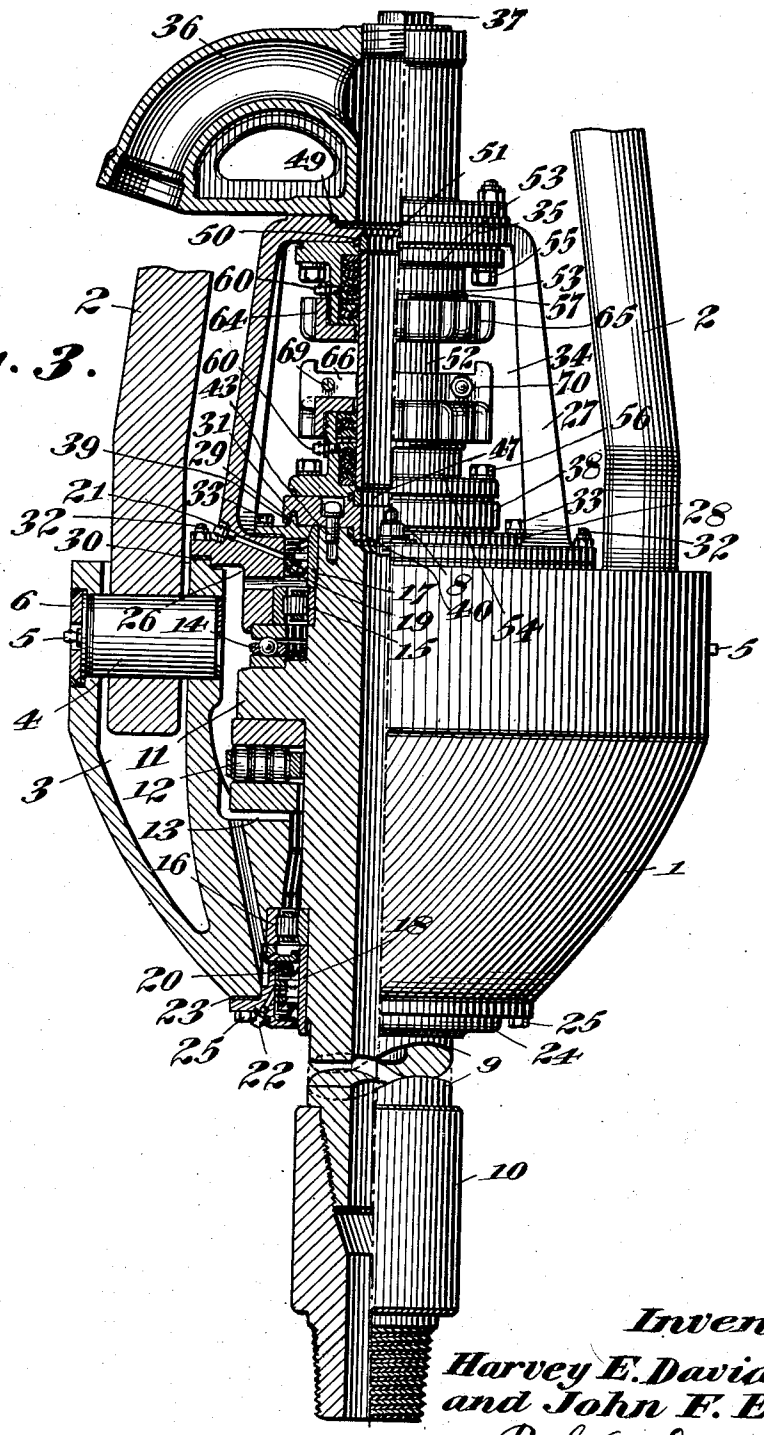
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ROTARY SWIVEL

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Fig. 3.



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Fig. 4.

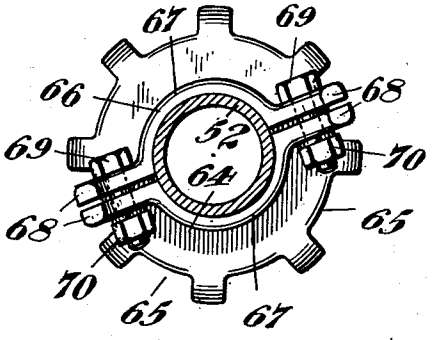
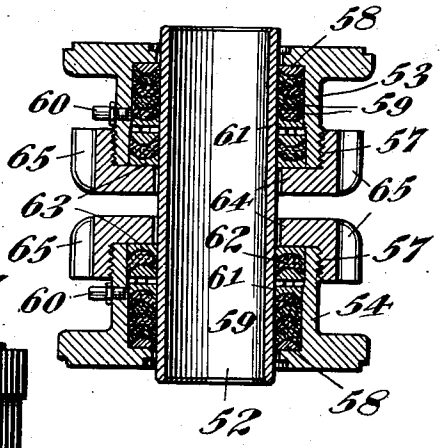


Fig. 5.



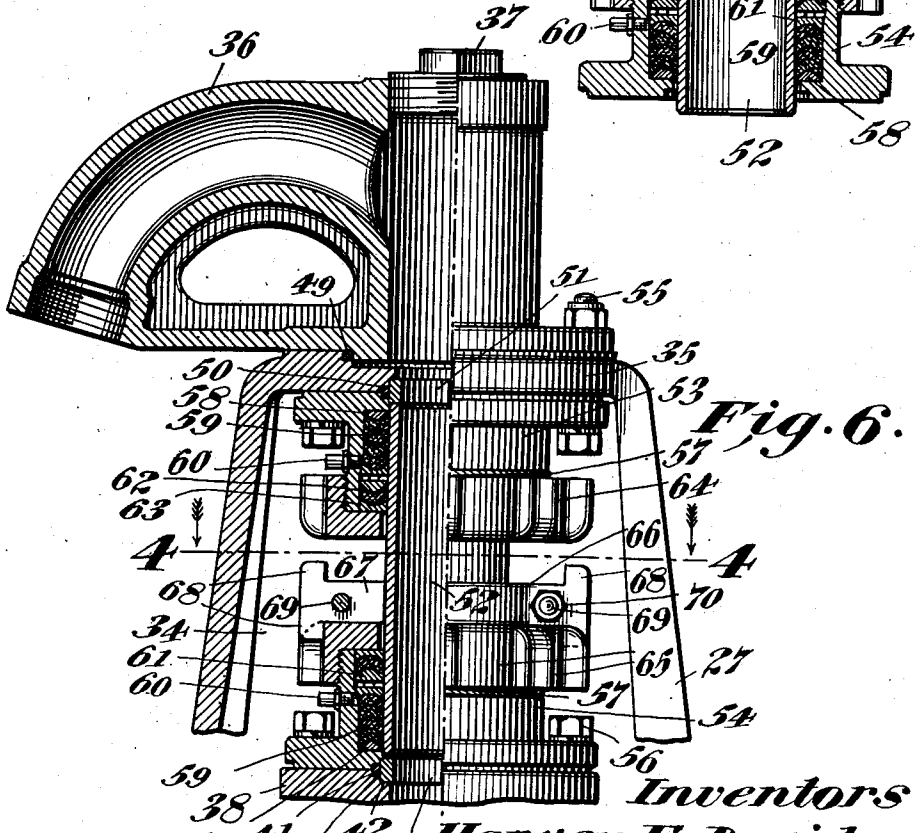


Fig. 6.

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Fig. 7.

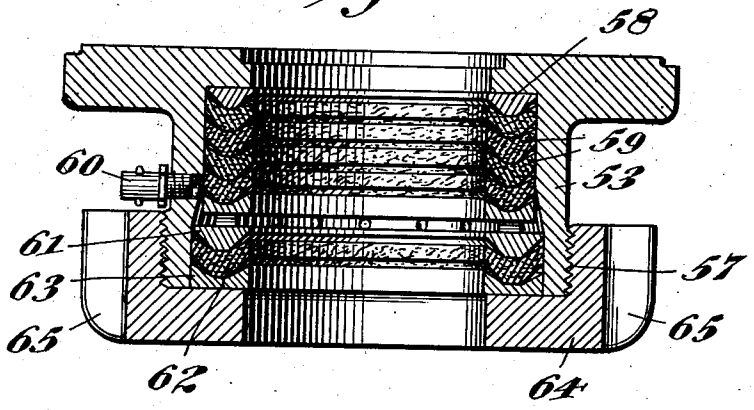


Fig. 8.

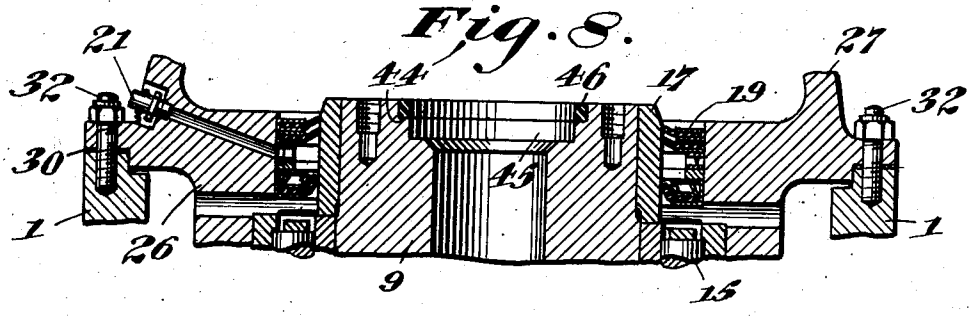
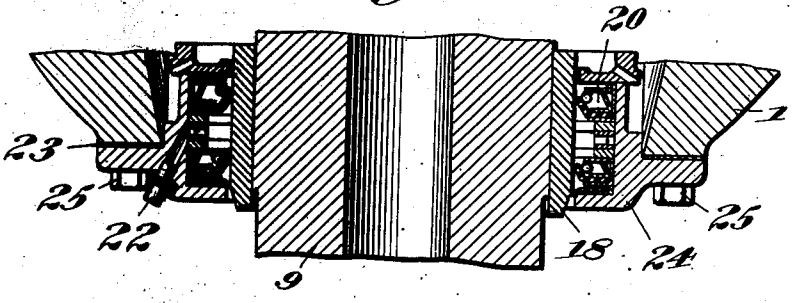


Fig. 9.



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UNITED STATES PATENT OFFICE

2,676,788

ROTARY SWIVEL

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Application March 17, 1951, Serial No. 216,148

5 Claims. (Cl. 255—25)

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This invention relates to rotary swivels of the type used in the petroleum industry for well drilling.

In drilling oil wells, it is the general practice to employ a bit secured to the lower end of a long string of steel pipe upwardly terminating in a kelly. The kelly is suspended from a traveling block by means of a swivel and is turned by a power-driven rotary table. In order to wash out the cuttings and lubricate the bit, mud having the desired characteristics is continuously pumped through the swivel and down the pipe under considerable pressure.

With so many oil wells now being drilled to depths of two miles or more, it is obvious that the swivel must be able to support tremendous loads, and is required to be massive in proportion. A swivel capable of supporting three hundred tons of pipe, for example, will weigh upwards of two tons. The drilling mud, particularly under high pressures, is abrasive and causes rapid wear of the packing and other swivel parts. Even the slight degree of misalignment which is normally found will aggravate this condition. With usual types of swivels it thus becomes necessary, in order to prevent leakage, to replace leaky packing or other worn-out elements at fairly frequent intervals. In drilling operations it is not always safe or convenient to stop mud circulation, however, and badly timed attempts to do so may result in serious damage or even the loss of the hole.

One object of our invention therefore, is to provide alternative packing means which may be put into use in an emergency without necessarily stopping mud circulation or even reducing pump pressure.

Another object is to provide means for continuing drilling past a critical point until mud circulation can safely be stopped and permanent repairs effected.

Another object is to provide a swivel having self-aligning conduit means interposed between the fixed and rotary mud conducting means.

Another object is to provide a swivel having means for selectively transferring the greatest burden of stress and wear from one part to another in order to lengthen the entire swivel's useful life.

Another object is to provide a wash pipe and packing assembly which may be very readily reversed or replaced under ordinary operating conditions.

Still other objects, advantages and purposes of this invention will appear hereinafter in the

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specification and drawings, and in the appended claims.

In the annexed four sheets of drawings:

Fig. 1 is a side elevation of the swivel of our invention;

Fig. 2 is another side elevation of the swivel, but rotated 90° from Fig. 1;

Fig. 3 is a broken side elevation similar to Fig. 1, but showing the swivel partly in section and with the gooseneck turned to a different position;

Fig. 4 is a horizontal transverse section taken on the line 4—4 of Fig. 6;

Fig. 5 is a vertical detail section showing the latch removed and the stuffing boxes brought together on the wash pipe, ready for the wash pipe to be inserted into or removed from the swivel;

Fig. 6 is a broken side elevation, partly in section, showing the assembly of the gooseneck, bonnet, stuffing boxes, wash-pipe and adapter;

Fig. 7 is a transverse vertical section of the upper stuffing box assembly, which is identical in all respects with the lower stuffing box assembly;

Fig. 8 is a fragmentary vertical section of the upper oil seal assembly within the swivel housing; and

Fig. 9 is a fragmentary vertical section of the lower oil seal assembly.

Referring now to the drawings, and more particularly to Figs. 1 to 3 thereof, the numeral 1 designates the substantially ovoid bowl or body housing of the swivel, which in use is normally suspended in a stationary position from the hook of a traveling block (not shown) by means of a bail 2 pivotally mounted in the recess 3 of the body housing on the bail pins 4. Said bail pins 4 are provided with "Alemite" lubricating fittings 5 and welded end caps 6. An elevator bumper 7 also projects outwardly from the housing 1 and serves as a guard against accidental impacts, while a breather plug 8 permits escape of gas or fumes from the housing 1.

Extending vertically through the body housing 1 is a rotary hollow spindle or stem 9, the lower end of which is adapted to be attached to a kelly (not shown) by means of a conventional coupling 10. Said stem 9 has an integral circumferential flange 11 whereby the drill pipe load on the stem is transmitted through the main thrust bearings 12 to the abutment 13 of the housing 1, and the upward thrust of the stem 9 is taken by upper thrust bearings 14. Radial bearings 15 and 16, together with stop rings 17

and 18 and oil seal packing assemblies 19 and 20, and "Alemite" fittings 21 and 22, are also provided around the stem 9 inside the top and bottom of said housing 1. Leakage of lubricant from the lower oil seal packing assembly 20 (Fig. 9) is prevented by the gasket 23 and retainer 24 which are attached to the housing 1 by cap screws 25. The upper oil seal packing assembly 19 (Fig. 8) is held in place against the stop ring 17 by means of the depending skirt 26 of the bonnet 27 and the annular flange 28 having a raised circular sealing lip 29, with the aid of gaskets 30 and 31 and bolts 32 and 33.

The bonnet 27 is integrally provided with opposite side apertures or windows 34 and a ring-shaped top portion 35 which functions as a support on which a mud inlet fitting or gooseneck 36 having a pipe plug 37 is mounted above the stem 9 in spaced vertical alignment therewith for threaded attachment to the mud supply hose (not shown).

An annular adapter 38 having a circular bottom slot 39 and a depending skirt portion 40, also stepped upper recesses 41 and 42, is secured by countersunk screws 43 to the top of the stem 9, which has stepped recesses 44 and 45 for receiving said adapter skirt portion 40 and a rubber gasket 46. The adapter slot 39 cooperates with the gasket 31 and flange lip 29 to complete the liquid seal.

The adapter recesses 41 and 42 receive the lower halves of a hardened steel wear ring 47 and rubber gasket 48. In similar manner, the bonnet top portion 35 is recessed to receive the packing ring 49 and rubber gasket 50 and the upper steel wear ring 51. A small clearance is maintained between the lower wear ring 47 and the wash pipe 52, and between the upper wear ring 51 and the gooseneck 36, as in Figs. 3 and 6.

Interposed between the wear rings 47 and 51 is the wash pipe 52, being a symmetrical tube of heat treated alloy steel polished to give a smooth surface and close fit in the upper and lower stuffing boxes 53 and 54, which encircle the wash pipe and are fastened by the bolts 55 and 56 to the bonnet top portion 35 and the adapter 38 respectively, as shown in Fig. 6.

The stuffing boxes 53 and 54 are identical, each comprising a flanged exteriorly threaded tubular box portion 57, which box portion has associated therewith an inner packing retainer ring 58, a plurality of V-shaped packing rings 59 to hold the mud pressure, an "Alemite" fitting 60, a bronze spacer ring 61 to provide a grease space, a larger V-shaped packing ring 62 to retain the grease, and an outer packing retainer ring 63. A clamping nut 64 provided with a series of equally spaced peripheral notches 65 is screwed onto said tubular box portion 57.

Referring particularly to Figs. 4 and 6, a latch 66 consisting of a pair of substantially H-shaped members 67 having upwardly and downwardly extending end portions 68 is arranged to be clamped between the stuffing boxes 53 and 54 on the wash pipe 52 by means of the bolts 69 and nuts 70, so that its end portions 68 may engage with the clamping nut notches 65 on whichever stuffing box is preferred.

The function of the latch 66 is to control selectively the wear in each of the two stuffing boxes 53 and 54. With the latch 66 either omitted or placed in inoperative central position between the stuffing boxes, the floating wash pipe 52 obviously will turn in the stuffing box having the looser packing and hence offering the less friction, unless for some reason packing or wash pipe wear under the abrasive action of the drilling mud increases the friction in the acting stuffing box to the point where it causes rotation to begin in the other stuffing box. By setting the latch in either the upper or lower position, the relative rotation of the wash pipe is thereby restricted to the particular stuffing box desired and the other one is saved for future use, in accordance with operating conditions and personal preferences. In other words, the wash pipe 52 may be utilized either as a rotating extension to the stem 9 or as a fixed extension to the gooseneck 36, depending upon the position of the latch 66.

It is therefore optional whether the latch 66 is initially engaged with either the upper or the lower stuffing box, but if we assume for the sake of example that the swivel has been operated with the latch 66 engaged in the lower position until leakage caused by the rotating wash pipe has developed past the upper packing, the operation is as follows: Drilling is temporarily stopped until the latch is shifted to the upper position and fibrous grease is injected into the leaking upper stuffing box packing through the "Alemite" grease connection 60. This will usually stop the leakage, because the latch prevents further rotation of the wash pipe in the worn stuffing box and transfers the rotation to the other box having unused packing. If leakage still occurs past the worn stuffing box it may be stopped by tightening the clamping nut 64 to compress the packing if sufficient packing remains, or by inserting an additional ring or two of packing under said nut and then tightening the nut to compress the packing tightly. Should the latch 66 be initially engaged in the upper position, it may similarly be transferred to the opposite position to counteract leakage in the lower packing. The important fact is that since no further rotation is necessary in the worn packing, a seal between this packing and the stationary end of the wash pipe, even though the latter may be worn quite rough and grooved also, can be obtained, which seal will be at least sufficient for temporary operation until it is convenient for drilling to be stopped, mud pressure cut off, circulation stopped, and the wash pipe assembly removed for complete replacement of the pipe and both sets of stuffing box packing.

With conventional swivel design it is generally necessary to remove the wash pipe assembly through the top of the swivel. This is a considerable disadvantage because the rotary hose and the gooseneck 36, which interfere with such removal and therefore must usually be removed first, are heavy and difficult to handle. Our invention renders the wash pipe assembly very accessible and allows it to be removed through either of the bonnet side windows 34, without having to remove any of the top structure.

Thus, to remove the wash pipe assembly from the swivel of this invention, the latch 66 is removed from the wash pipe 52, the clamping nuts 64 are loosened but not completely unscrewed from the stuffing boxes 53 and 54, the bolts 55 and 56 are removed, and the stuffing boxes 53 and 54 are slid toward the center of the wash pipe 52 as in Fig. 5, so that the stuffing boxes 53 and 54 will clear the wear rings 47 and 51. The wash pipe assembly may then be removed as a unit from the swivel, and a completely or partly new assembly may be substituted.

Although we have illustrated and described our invention herein in considerable detail, we do not

wish to be limited to the exact and specific details so shown and described, but we may use such modifications, substitutions or equivalents thereof as are embraced within the scope of the invention or pointed out in the appended claims.

We claim:

1. In a rotary swivel, the combination of a substantially stationary housing, a support on said housing, a gooseneck mounted on said support, bearings within the housing, a hollow stem rotatably supported on said bearings in vertical alignment with the gooseneck, a pair of separate stuffing boxes secured to the stem and to the support respectively, a wash pipe rotatably fitted within said stuffing boxes so as to provide a fluid conduit between the gooseneck and the stem, and a latch slidably mounted on the wash pipe for selectively preventing relative rotation between said wash pipe and one or the other of the stuffing boxes.

2. In a rotary swivel, the combination of a bowl-shaped housing, a bail thereon for suspending said housing in a fixed position, a hollow bonnet having apertures on opposite sides and mounted on said housing, a gooseneck mounted on the bonnet, a rotary stem vertically supported on bearings within the housing assembly, an adapter mounted on said stem, a wash pipe adapted to be inserted laterally into the bonnet between the adapter and the upper part of the bonnet, a pair of stuffing boxes encircling the wash pipe, one of said stuffing boxes being secured to the adapter and the other to the bonnet, and latch means adapted to lock the wash pipe into the preferred engagement with either of said stuffing boxes.

3. In a rotary swivel, the combination of a housing, a support on said housing, a gooseneck on said support, a hollow stem rotatably supported in said housing in spaced vertical alignment with the bottom of the gooseneck, a wash pipe interposed between said stem and the bottom of the gooseneck, stuffing boxes supporting the ends of the wash pipe, and a vertically slidable latch on the wash pipe for causing said wash pipe to engage one of said stuffing boxes and thereby to function alternatively as an extension affixed to the stem or to the gooseneck.

4. In a rotary swivel, the combination of a housing, a support on said housing, a gooseneck on said support, a hollow stem rotatably supported in said housing in vertical alignment with the gooseneck, a wash pipe and wear rings at each end thereof between the stem and the gooseneck, stuffing boxes encircling the wear rings and wash pipe, a separate slidable latch member for selectively preventing relative rotation between said wash pipe and one or the other of said stuffing boxes, and means for injecting lubricant into each stuffing box.

5. In a rotary swivel, the combination of a housing, a support on said housing, a gooseneck mounted on said support, a hollow stem rotatably supported in said housing in alignment with the gooseneck, a wash pipe interposed between the stem and the gooseneck, a pair of stuffing boxes encircling the wash pipe and secured in fixed relation to the stem and to the support respectively, each stuffing box having its outer portion provided with a series of peripheral notches, and a latch movable on the wash pipe to engage one or more of said notches on either stuffing box alternatively to prevent rotation of the wash pipe therein.

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