Aug. 21, 1962 D. A. SIRACUSA ETAL 3,050,131

JAR WITH SAFETY JOINT AND ADJUSTING MEANS

Filed July 27, 1959 2 Sheets-Sheet 1

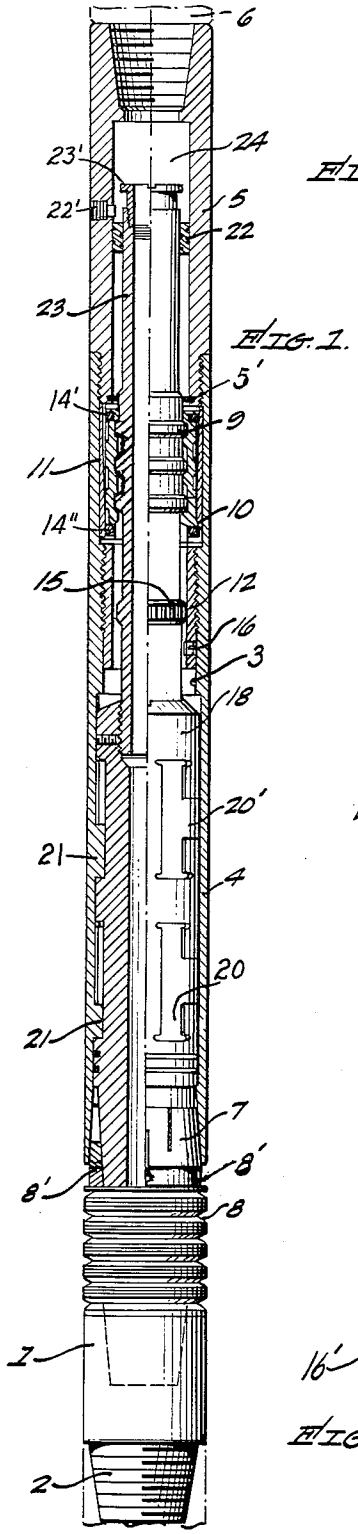

FIG. 1.

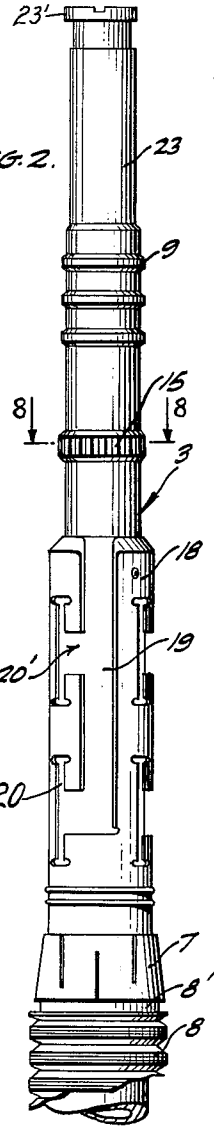

FIG. 2.

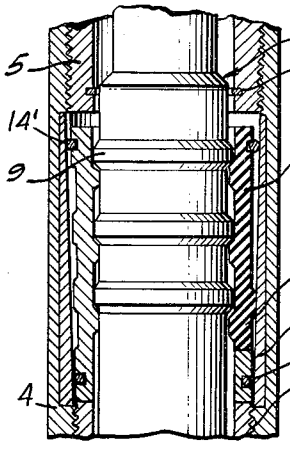

FIG. 3.

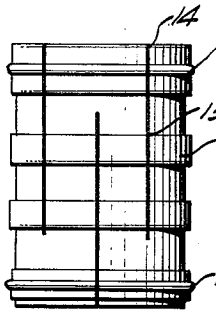

FIG. 4.

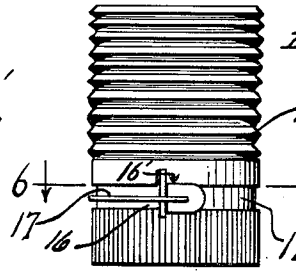

FIG. 5.

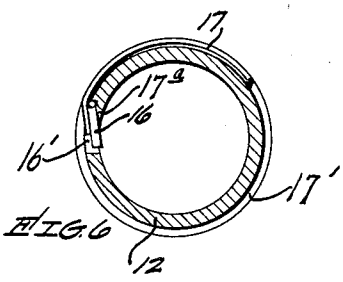

FIG. 6

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JAR WITH SAFETY JOINT AND ADJUSTING MEANS

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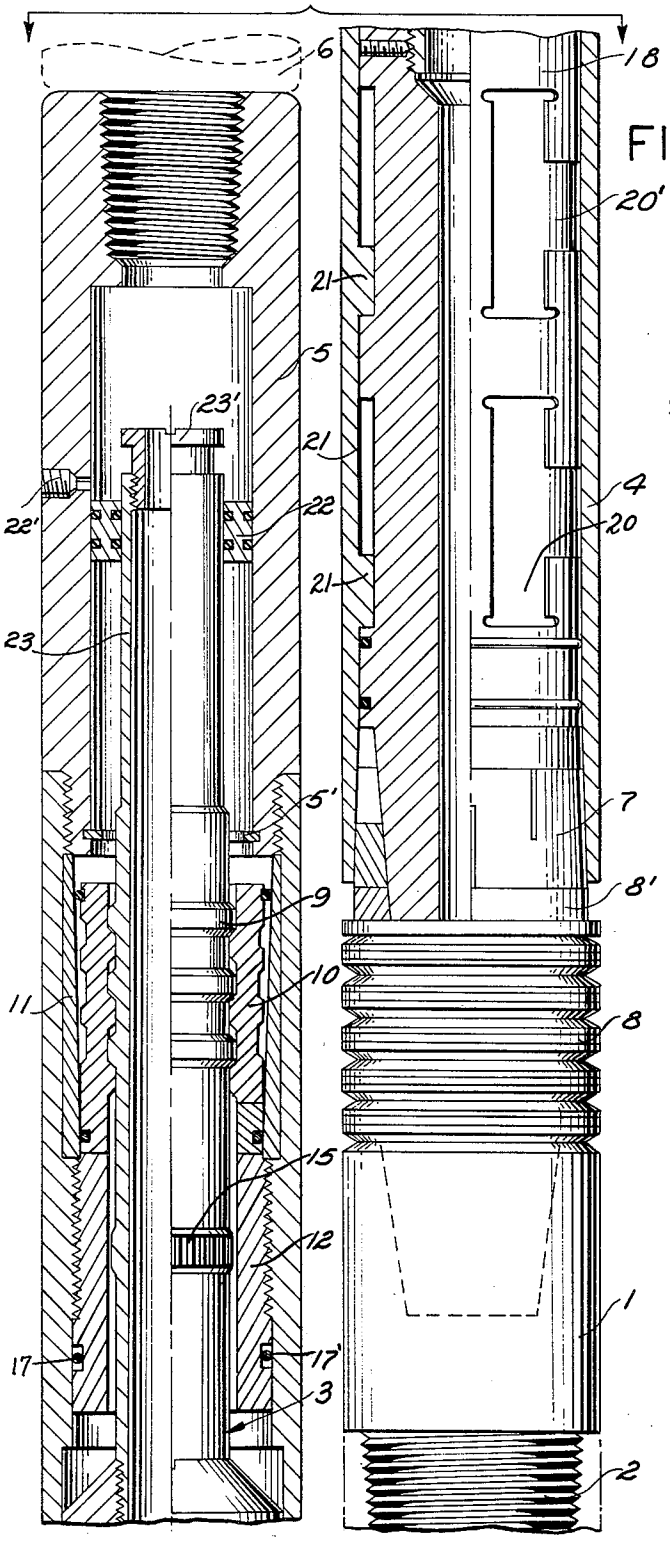

FIG. 7

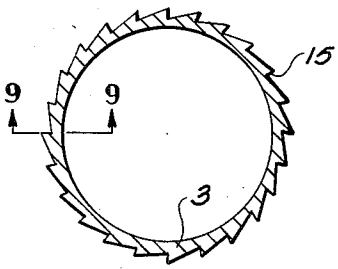

FIG. 8

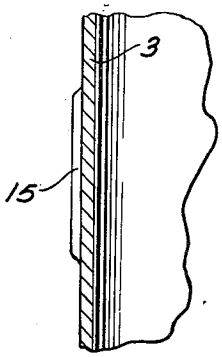

FIG. 9

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3,050,131
JAR WITH SAFETY JOINT AND ADJUSTING MEANS

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Filed July 27, 1959, Ser. No. 829,847
8 Claims. (Cl. 166—178)

This invention relates to an oil well jarring tool by means of which certain objects, such as a bit, a string of pipe or the like, can be loosened and removed from a well if that object should become stuck in the bore of a well. Certain parts of this invention are shown and claimed in Patent No. 2,059,540, issued November 3, 1936, for "Oil Well Jar."

An object of our invention is to provide a novel jarring tool, including means for releasing the major portion of the jarring tool from the lower portion thereof, so that the major portion of the tool may be removed from the well leaving only the lower portion thereof attached to the lost object, providing that that lost object should be immovably stuck in the well.

Another object of our invention is to provide a novel jarring tool of the character stated, in which the body of the tool is sealed or packed off in such a way as to prevent abrasive materials from being deposited on the machined surfaces of the tool.

Another object of our invention is to provide a means whereby the friction gripping means may be adjusted while the tool is in the well.

Other objects, advantages and features of invention may appear from the accompanying drawing, the subjoined detailed description and the appended claims.

This application is a continuation in part of my co-pending application, Serial No. 414,672, filed March 8, 1954, for "Jar With Safety Joint and Adjusting Means," now abandoned, after the filing of this application.

In the drawing:

FIGURE 1 is a longitudinal sectional view of our jarring tool.

FIGURE 2 is a fragmentary side elevation of the mandrel or lower portion of the tool.

FIGURE 3 is a fragmentary longitudinal sectional view of the friction gripping mechanism of the tool.

FIGURE 4 is a side elevation of the mandrel gripping sleeve.

FIGURE 5 is a side elevation of the adjusting nut for the mandrel gripping sleeve.

FIGURE 6 is a transverse sectional view taken on line 6—6 of FIGURE 5.

FIGURE 7 is a separated longitudinal sectional view of our jarring tool.

FIGURE 8 is a transverse sectional view of the mandrel showing the adjusting teeth.

FIGURE 9 is a fragmentary sectional view of the mandrel taken on line 9—9 of FIGURE 8.

Referring more particularly to the drawing, the numeral 1 indicates the bottom sub, the lower end of which is threaded as shown at 2. These threads permit the tool to be connected or threaded into the bit, the tool joint, the pipe, or any similar structure which may be stuck in the bore of the well. The sub 1 threads onto the lower end of the mandrel structure 3. The outer shell 4 surrounds the mandrel 3 and the upper end of this shell is threaded onto the lower end of the coupling 5 which, in turn, screws onto the lower end of the drill pipe 6 upon which the tool is run. The shell 4 and the coupling 5 may be considered one piece, since they are fixedly connected together and are merely separate parts because of ease of manufacture. A split ring 5' may be provided on the lower part of the coupling 5 which extends inwardly and

prevents the movable parts below the ring 5' from dropping out of the tool, especially during assembly and if the tool should be turned upside down accidentally.

A frictional fitting 7 connects the mandrel 3 and the shell 4 in the following manner: The friction fitting 7 consists of a split and tapered ring which is forced onto a tapered seat in the bottom of the shell 4 by the springs 8 which bear against the bottom of the split ring 7. The springs 8 are termed Belleville springs. The block 8' shown between the spring 8 and the sleeve 7 is merely a ring, which is common machine shop practice. This ring or block 8' is usually placed between a coil spring and a member against which it bears to provide an even bearing surface. These springs bear against the sub 1 at the bottom and against the bottom of the ring 7 at the top thereof. These springs serve to press the split ring 7 onto its seat in the bottom of the shell 4 and thus will frictionally couple the shell 4 and the mandrel 3. This frictional type of fitting will, however, permit longitudinal movement of the shell 4 for jarring purposes, as will be further described. The purpose of the split ring 7 is to prevent vibration or side movement of the mandrel 3 in the shell 4. The mandrel 3 includes all of the structure shown in FIG. 2 with the exception of the split ring 7 and the springs 8, and while the various parts of the mandrel 3 as subsequently described, are shown as an integral unit it is possible that the various parts may be separately manufactured and threaded together for ease of manufacture. Substantially, however, the mandrel 3 is a unitary structure.

The means of releasably gripping or frictionally gripping the mandrel 3 by a mechanism within the shell 4 is specifically described in Patent No. 2,059,540, issued November 3, 1936. This mechanism is briefly described as follows: A plurality of friction rings 9 are formed adjacent the upper end of the mandrel 3. A slip or sleeve 10 is mounted within the shell 4, and this sleeve is provided with annular grooves to receive the rings 9, all of which is more specifically set forth in the patent enumerated above. The sleeve 10 fits within an annular seat 11 and may be adjusted longitudinally within the annular seat 11 by means of the adjusting nut 12. The adjusting nut 12 is threaded into the shell 4 and bears against the bottom of the sleeve 10 and thus can move this sleeve longitudinally within the tool, and the method of rotating the nut 12 when the tool is in the hole will be further described. The sleeve 10 is provided with a number of vertical slots therein which permit the sleeve to expand or contract and we prefer that these slots 13 shall be filled with rubber or some other resilient material, as shown at 14. With this construction the sleeve 10 can still contract and expand as necessary, and the slots therein being filled with rubber will exclude any dirt, sand, or other abrasive material. At the top and bottom of the sleeve 10 we may provide O-ring packing 14' and 14''. The packing 14' and 14'' also serves to exclude sand from interior parts.

To permit vertical adjustment of the sleeve 10 on its seat 11 we provide the following means of rotating the nut 12 which engages the sleeve 10 to move that sleeve relative to its seat, and thus increase or decrease the force required to enable the sleeve 10 to release its hold or engagement with the rings 9, and thereby increase or decrease the jarring blow. The mandrel 3 is held stationary as far as vertical movement is concerned, since it is attached to the lost object in the well, having been threaded into that object by screwing the pin 2 into the object. A ring of teeth 15 are cut in the mandrel 3 and these teeth are spaced above the lower edge of the nut 12 when the objects are in nonadjusting position. The teeth 15 protrude above the surface of the mandrel 3 and the upper and lower edges of each of the teeth are tapered, that

is, they curve or taper downwardly into the outer surface of the mandrel 3. Thus any object striking the upper or lower ends of any of the teeth 15 will be cammed or deflected outwardly rather than to meet with a square shoulder, which would obstruct an object attempting to pass the teeth 15. A pawl 16 is pivotally mounted in the wall of the nut 12 and projects through a hole 16' in this wall. The pawl 16 is urged inwardly by the spring 17 which is welded or otherwise attached at one end within the groove 17' in the nut 12. The free end of the spring 17 presses against the pawl 16 and yieldably holds the pawl in its innermost position, as shown in FIG. 6. In this position the pawl engages a lip 17a on the nut 12 which prevents the pawl from moving too far in an inward direction. The pawl can readily spring outwardly, however, against the tension of the spring 17, and if the pawl should strike the tapered ends of the teeth 15 it will merely be pushed outwardly against the tension of the spring 17 due to the taper or cam shape of the ends of these teeth. When the shell 4 is moved upwardly with relation to the mandrel 3 the pawl 16 will engage the teeth 15 and partial ratcheting rotation of the shell 4 will thus thread the nut 12 downwardly away from the sleeve 10, thus permitting the sleeve to move downwardly in its seat 11 to increase the jarring blow. The partial rotation of the shell 4, both clockwise and counterclockwise, is permitted by positioning certain lugs on the shell within horizontal portions of T-grooves, as will be further described. This positioning of the lugs will permit the shell 4 to be rotated over several degrees of arc sufficient to adjust the nut 12, as might be required. The sleeve 10 is pressed inwardly as that sleeve is carried upwardly by reason of the upward movement of shell 4 and the shape of the seat 11, thus causing the rings 9 to be more tightly engaged and, as a result, the rings 9 will be disengaged from the sleeve 10 with greater force, thus increasing the jarring blow.

The mandrel 3 is formed with an enlargement 18 thereon, and this enlargement is formed with two or more vertical grooves 19 which are open at the top, and two or more T-grooves 20 extending from each of the vertical grooves 19. The shell 4 is formed with inwardly projecting lugs 21 which fit within the T-grooves 20, and also within the vertical groove 19. When the lugs 21 are within the vertical portion of the T-groove 20 the shell 4 can be reciprocated vertically, restrained however, by the sleeve 10 in its engagement with the friction rings 9, and thus a jarring blow can be imparted when the lugs strike the top or the bottom of the vertical portion of the T-slots 20. The hammer element consists of the lugs 21 and the anvil consists of either the top or the bottom of the vertical grooves 20. If it is desired to remove the shell 4 and all of its attached parts, this can be accomplished by moving the lugs 21 into the vertical groove 19, thus permitting the shell to be pulled upwardly, leaving the mandrel 3 attached to the lost object in the well. A floating seal or ring 22 surrounds the upper portion 23 of the mandrel 3 and this seal can also move within the bore 24 in the coupling 5, thus enabling the seal to follow the portion 23 of the mandrel 3, as relative movement occurs between the mandrel and the shell 4, due to the jarring action as described above. A stop plug 22' is threaded into the wall of the coupling 5 which limits the upward movement of the ring 22. Also a sleeve 23' is threaded into the upper end of the portion 23. This sleeve 23' is formed with a shoulder to hold the ring 22 in position on the portion 23 during assembly of the parts. The enlargement 18 has a set screw extending therethrough bearing against the portion 23 for the purpose of preventing these parts from unscrewing. This is usual machine shop practice in this field. The T-slots 20 are provided with horizontal openings 20' into which the lugs 21 can be moved, thus permitting the lugs to move from the groove 20 into the groove 19 and thus permitting partial rotation of the shell 4 relative to the mandrel 3. This is the motion which is necessary in order to adjust the sleeve 10 relative to its seat 11, as previously described.

In Operation

The tool assembled, as shown in FIG. 1, is lowered into the bore of the well on drill pipe or the like, and in this position the split ring 7 is engaging the shell 4 under pressure of the springs 8. When the lost tool is reached the entire jarring tool can be rotated with the drill pipe, thus screwing the threads 2 into the lost tool. The lugs 21 are positioned within the vertical parts 20 of the T-slots. By pulling upwardly on the shell 4 a jarring action will occur when the lugs 21 strike the top of the portion 20 of the T-slots. The shell 4 is restrained in its movement and released suddenly by the action of the sleeve 10 against the rings 9, as described in Patent No. 2,059,540. If it is necessary to increase the blow, this can be done while the tool is in the well by pulling the shell 4 upwardly until the pawl 16 engages the teeth 15, and with the lugs 21 within the horizontal groove portions 20'. Rotation of the shell 4 will screw the nut 12 downward away from the sleeve 10, thus allowing the sleeve 10 to travel downward further into its tapered seat 11, thereby increasing the grip of the sleeve 10 on the mandrel 3. The floating seat 22 will seal off the upper end of the mandrel 3 even though the shell 4 is reciprocating.

Having described our invention, we claim:

1. A jar and safety joint for bored wells comprising a mandrel, means on the lower end of the mandrel attachable to a lost object in the well, a shell extending over the mandrel, means on the upper end of the shell attachable to drill pipe, mandrel gripping means in the shell and means on the mandrel releasably engaged by said gripping means, an elongated and tapered split ring on the mandrel frictionally fitting into the bottom of the shell, said ring being slidably mounted on the mandrel, and spring means pressing the split ring into the shell, thereby fitting the mandrel in the shell.

2. A jar and safety joint for bored wells comprising a mandrel, means on the lower end of the mandrel attachable to a lost object in the well, a shell extending over the mandrel, means on the upper end of the shell attachable to drill pipe, mandrel gripping means in the shell and means on the mandrel releasably engaged by said gripping means, said mandrel having a vertical groove formed therein, said groove being open at the top, and T-slots extending from the vertical groove, lugs on the shell projecting inwardly therefrom and into said T-slots in one position of the parts, and into the vertical groove to permit separation of the sleeve and mandrel in another position of the parts, a split ring on the mandrel frictionally fitting into the bottom of the shell, and spring means pressing the split ring into the shell, thereby fitting the mandrel in the shell.

3. A jar and safety joint for bored wells comprising a mandrel, means on the lower end of the mandrel attachable to a lost object in the well, a shell extending over the mandrel, interengaging means on the shell and mandrel, said interengaging means permitting partial rotation of the shell relative to the mandrel, means on the upper end of the shell attachable to drill pipe, mandrel gripping means in the shell including a sleeve positioned within the shell, a tapered seat on which said sleeve rests, a nut threaded into the shell and engaging the sleeve to move said sleeve vertically on its seat, shoulders on the mandrel releasably engageable by said sleeve, a pawl on said nut, and teeth on the mandrel engageable by the pawl, said nut being adjustable in the shell on rotation of said shell relative to the mandrel.

4. A jar and safety joint for bored wells comprising a mandrel, means on the lower end of the mandrel attachable to a lost object in the well, a shell extending over the mandrel, interengaging means on the shell and mandrel, said interengaging means permitting partial rotation of the shell relative to the mandrel, means on the upper end of the shell attachable to drill pipe, mandrel gripping

means in the shell including a sleeve positioned within the shell, a tapered seat on which said sleeve rests, a nut threaded into the shell and engaging the sleeve to move said sleeve vertically on its seat, shoulders on the mandrel releasably engageable by said sleeve, a pawl on said nut, and teeth on the mandrel engageable by the pawl, said nut being adjustable in the shell on rotation of said shell relative to the mandrel, and means on the mandrel frictionally engaging the shell to couple the mandrel and shell.

5. A jar and safety joint for bored wells comprising a mandrel, means on the lower end of the mandrel attachable to a lost object in the well, a shell extending over the mandrel, means on the upper end of the shell attachable to drill pipe, mandrel gripping means in the shell including a sleeve positioned within the shell, a tapered seat on which said sleeve rests, a nut threaded into the shell and engaging the sleeve to move said sleeve vertically on its seat, shoulders on the mandrel releasably engageable by said sleeve, a pawl on said nut, and teeth on the mandrel engageable by the pawl, said nut being adjustable in the shell on rotation of said shell relative to the mandrel, said mandrel having a vertical groove formed therein, said groove being open at the top, and T-slots extending from the vertical groove, lugs on the shell projecting inwardly therefrom into said slots in one position of the parts, and into the vertical groove in another position of the parts to permit separation of the sleeve and mandrel, and also permitting partial rotation of the sleeve relative to the mandrel.

6. A jar and safety joint for bored wells comprising a mandrel, means on the lower end of the mandrel attachable to a lost object in the well, a shell extending over the mandrel, means on the upper end of the shell attachable to drill pipe, mandrel gripping means in the shell including a sleeve positioned within the shell, a tapered seat on which said sleeve rests, a nut threaded into the shell and engaging the sleeve to move said sleeve vertically on its seat, shoulders on the mandrel releasably engageable by said sleeve, a pawl on said nut, and teeth on the mandrel engageable by the pawl, said nut being adjustable in the shell on rotation of said shell relative to the mandrel, and means on the mandrel frictionally engaging the shell to couple the mandrel and shell for simultaneous rotation, said mandrel having a vertical groove formed therein, said groove being open at the top, and T-slots extending from the vertical groove, lugs on the

shell projecting inwardly therefrom and into said slots in one position of the parts, and into the vertical groove in another position of the parts to permit separation of the sleeve and mandrel, and also permitting partial rotation of the sleeve relative to the mandrel.

7. A jar and safety joint for bored wells comprising a mandrel, means on the lower end of the mandrel attachable to a lost object in the well, a shell extending over the mandrel, means on the upper end of the shell attachable to drill pipe, mandrel gripping means in the shell including a sleeve positioned within the shell, a tapered seat on which said sleeve rests, a nut threaded into the shell and engaging the sleeve to move said sleeve vertically on its seat, shoulders on the mandrel releasably engageable by said sleeve, a pawl on said nut, and teeth on the mandrel engageable by the pawl, said nut being adjustable in the shell on rotation of said shell relative to the mandrel, said sleeve having vertical slots therein extending partly through the length thereof, said slots being filled with a rubber substance to seal the same.

8. A jar and safety joint for bored wells comprising a mandrel, means on the lower end of the mandrel attachable to a lost object in the well, a shell extending over the mandrel, means on the upper end of the shell attachable to drill pipe, mandrel gripping means in the shell including a sleeve positioned within the shell, a tapered seat on which said sleeve rests, a nut threaded into the shell and engaging the sleeve to move said sleeve vertically on its seat, shoulders on the mandrel releasably engageable by said sleeve, a pawl on said nut, and teeth on the mandrel engageable by the pawl, said nut being adjustable in the shell on rotation of said shell relative to the mandrel, said sleeve having vertical slots therein extending partly through the length thereof, said slots being filled with a rubber substance to seal the same, and an annular packing at the top and bottom of said sleeve.

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