Sept. 14, 1937. R. K. HENDERSON 2,092,843

PACKER AND MEANS FOR SECURING SAME

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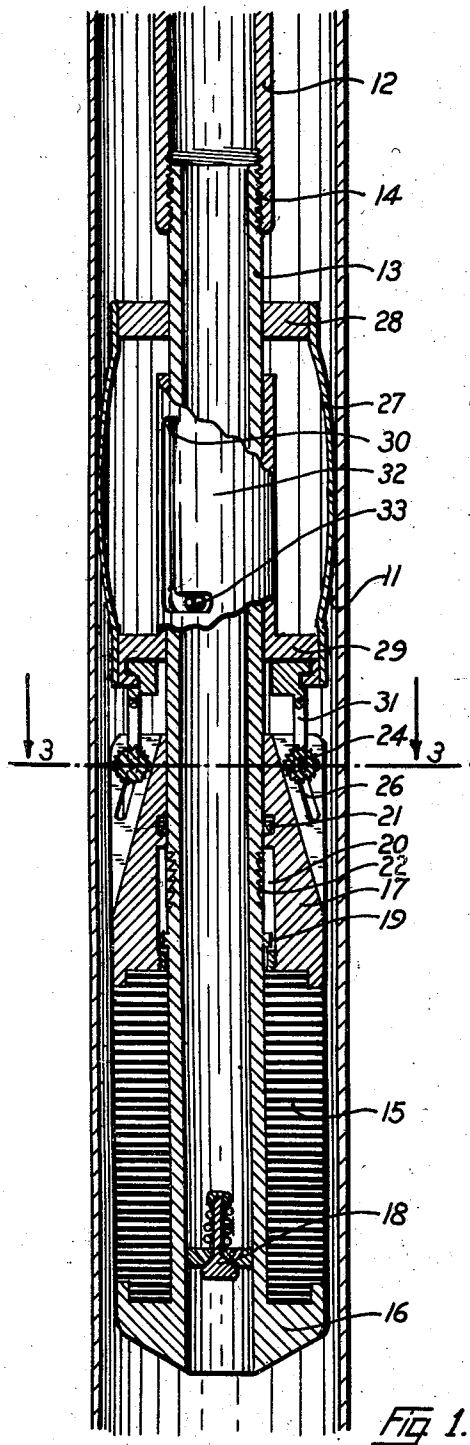


Fig. 1.

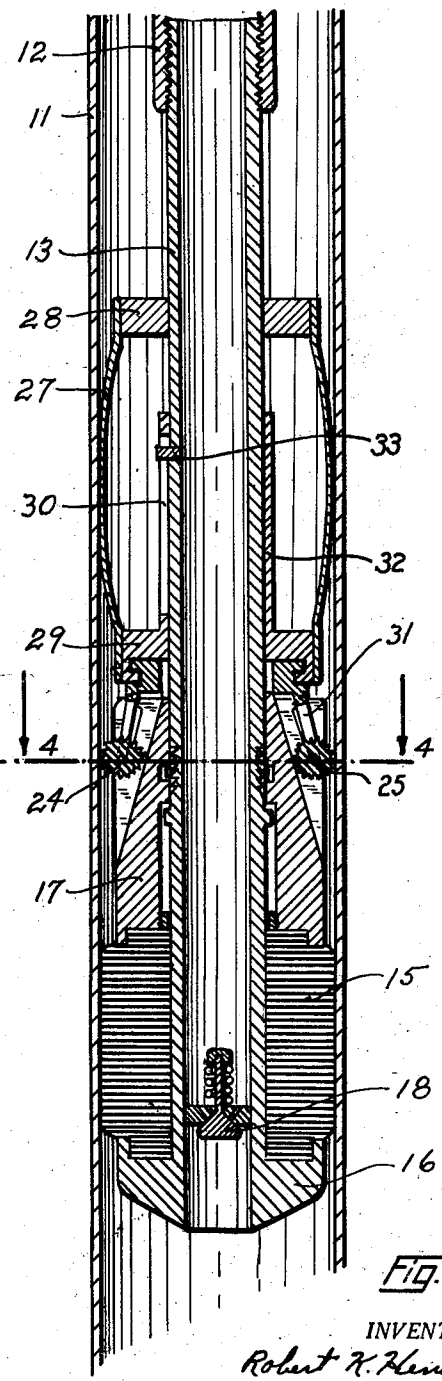


Fig. 2.

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Fig. 3.

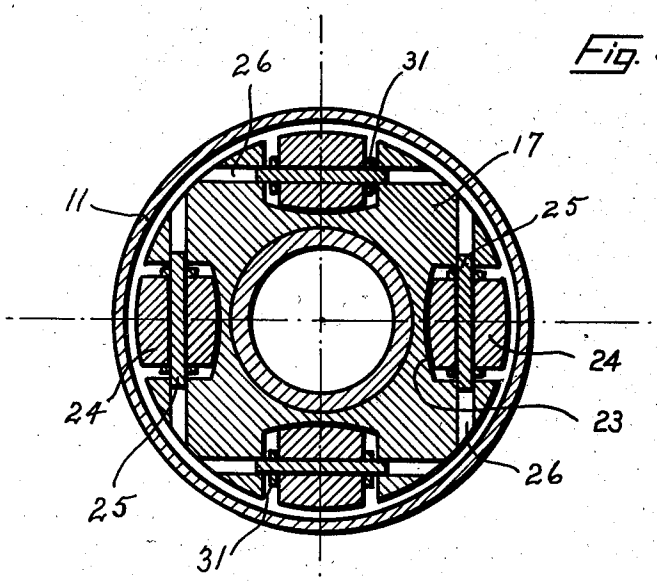
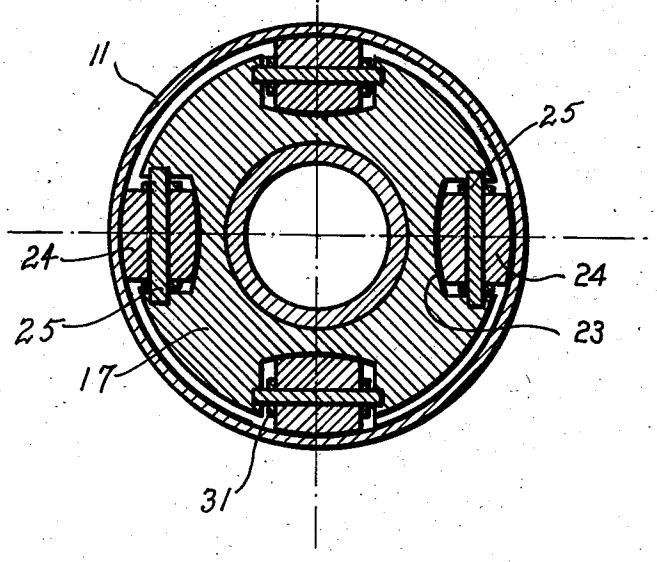


Fig. 4.



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PACKER AND MEANS FOR SECURING SAME

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Application January 25, 1937, Serial No. 122,179

6 Claims. (Cl. 166—12)

This invention relates to packers for oil wells or the like, and more particularly to an arrangement for holding the same in place in the well.

It is sometimes desirable to supply a body of liquid cement to a certain portion of an oil well through tubing. For example, the casing of the well may have sprung a leak and it may be necessary to supply cement to the formation around the break. In other cases it is desirable to supply a body of liquid cement to the lower part of the casing while preventing the cement from plugging up an upper portion of the casing. In such operations a tubing or drill stem is lowered into the casing and the cement is supplied through it to the desired point in the well.

It is an object of the present invention to devise means for retaining or holding the cement in place while it hardens. The arrangement is preferably such that the tubing or drill stem may be disconnected from the retaining means and removed from the well.

Another object of the invention is to devise novel means for connecting an element to the casing of a well and to prevent it from slipping with respect thereto.

Other objects and advantages reside in certain novel features of the arrangement and construction of parts, as will be more apparent from the following description taken in connection with the accompanying drawings, in which:

Fig. 1 is a vertical cross-sectional view of the apparatus constructed in accordance with the present invention, the parts being shown in the relative position they occupy while the apparatus is being lowered into the casing of an oil well;

Fig. 2 is a vertical cross-sectional view of the same apparatus as that illustrated in Fig. 1 but showing the arrangement of the parts after the apparatus has been fixed to the casing;

Fig. 3 is an enlarged transverse cross-sectional view of the apparatus shown in Fig. 1, the view being taken on the line 3—3 thereof;

Fig. 4 is an enlarged transverse cross-sectional view of the arrangement with the parts shown in the position of Fig. 2, the view being taken on the line 4—4 of Fig. 2.

Referring to the drawings in detail, it will be seen that the casing of an oil well is there illustrated at 11. A drill stem or tubing 12 is lowered into the casing and carries on its lower end apparatus for effecting a seal with the casing. The sealing arrangement includes a central mandrel 13 adapted to be connected to the tubing or drill stem 12 by means of the screw threads 14. The threads 14 are preferably of such a nature that the drill stem can be easily disconnected from the mandrel when desired.

A back-pressure valve 18 is mounted within the lower portion of the mandrel 13 and is so constructed as to permit fluid to flow downwardly through the mandrel but closing and prevent the passage of fluid upwardly therethrough.

The lower end of the mandrel 13 also carries a packer 15. The packer is held in place by means of a lower packer shoe 16 integral with the mandrel 13 and an upper packer shoe 17 slidably mounted upon the mandrel.

The upper packer shoe 17 is restricted to limited longitudinal movement with respect to the mandrel 13 by means of one or more pins 19 on the mandrel 13 which extend into slots 20 of the shoe 17. Means is also provided for latching the shoe 17 to the mandrel, this latching means consisting of a spring ring 21 carried by the shoe 17 and adapted to engage teeth 22 on the mandrel.

The upper portion of the shoe 17 is provided with a number of recesses 23 as best shown in Figs. 3 and 4, the inner walls of which are curved and slope in such a way as to provide wedges or inclined planes for rollers 24 mounted for vertical movement therein.

Each roller 24 consists of a barrel-shaped body of iron or the like having a roughened surface provided by cutting slots therein so as to provide a number of teeth adapted to engage the inner wall of the recesses 23 and also engage the casing 11. The roughened surface may be provided by knurling instead of cutting teeth, if desired. The curvature of the surface of each roller 24 is such that it corresponds to the curvature of the inside of the casing 11, and to the curvature of the inner surfaces of the recesses 23.

The rollers 24 are also provided with pinions 25 adapted to be fitted in slots 26 in the walls of the shoe 17. These pinions retain the rollers in place on the shoe 17 and are also used to control the position of the rollers until it is desired that the packer be set and secured to the casing 11.

Located above the upper shoe 17 of the packer are a number of drag springs 27 of known construction. The upper ends of the drag springs are connected to a sliding collar 28 and the lower ends are connected to a collar 29 which has an upwardly extending sleeve 30 thereon and which is connected by means of the links 31 to the pinions 25 of the rollers 24. The sleeve 30 is provided with a J-slot 32 adapted to cooperate with a pin 33 on the mandrel 13 to control the position of the collar 29.

In operating the apparatus the drill stem 12

with the cement retaining assembly thereon is lowered into the well with the parts in the arrangement illustrated in Fig. 1. When the desired depth is reached the drill stem 12 is rotated to the right a slight amount, causing the pin 33 to move into the longitudinal part of the J-slot 32. The collar 29 is prevented from rotating by means of the drag springs 27. The drill stem 12 and mandrel 13 are then lifted. Due to this lifting action the rollers 24 move outwardly against the casing 11 and wedge between the casing and the inner wall of the recesses 23, thus securing the upper shoe 17 against upward movement in the casing and providing an abutment for the packer 15. The packer 15 is thus expanded into contact with the casing 11 and effects a good seal with respect thereto.

This operation cannot take place accidentally during the lowering of the apparatus into the well, because the rollers 24 are then maintained in the position shown in Fig. 1 by the links 31, the collar 29 and the J-connection 32—33. It is only after the pin 33 has been rotated with respect to the sleeve 30 that the rollers 24 come into operative position to prevent upward movement of the collar 17.

After the packer has been expanded and set it is retained in that position by the ratchet means 21—22 which prevent the shoes 16 and 17 from separating.

The cement or other fluid which is to be placed within the well may then be forced downwardly through the drill stem 12 and the mandrel 13, the fluid flowing through the valve 18. The pressure of this cement is usually high and tends to lift the retainer assembly against the rollers 24 at all times. Even though the casing 11 is filled with mud, there will be no tendency for the packer assembly to slide downwardly in the well.

As soon as the cement is in place the pumping through the drill stem 12 is discontinued and the valve 18 closes.

The drill stem 12 may then be removed from the well by disconnecting at the joint 14 and the packer assembly will remain in the well to prevent the cement moving upwardly until it hardens.

It is desirable to make all parts of the apparatus of drillable material so that after the cement has hardened it may be drilled out and removed from the well. The mandrel and shoe 17 may be made of aluminum or other drillable material, the packer of rubber, the valve of "Bakelite", and the rollers 24 of cast iron, with the teeth thereof casehardened to insure good binding action with the casing.

While only one embodiment of the invention has been shown and described herein, it is obvious that various changes may be made without departing from the spirit of the invention or the scope of the annexed claims.

I claim:

1. Apparatus for securing a device to the casing in a well against movement in one direction comprising a member forming an abutment for the device, said member having inclined surfaces in recesses therein, rollers carried by the abutment member and located in the recesses thereof, said inclined surfaces being curved and said rollers having curved surfaces conforming to the curvature of the casing to which the device is to be secured and to the curvature of said inclined surfaces.

2. Apparatus for securing a device to the casing in a well against movement in one direction comprising a member forming an abutment for the device, said member having inclined surfaces in recesses therein, rollers carried by the abutment member and located in the recesses thereof, said rollers having a roughened surface to assist the same in wedging between the casing and the inclined surfaces on said member.

3. Apparatus for securing a device to the casing in a well against movement in one direction comprising a member forming an abutment for the device, said member having inclined surfaces in recesses therein, rollers carried by the abutment member and located in the recesses thereof, and releasable means for holding the rollers out of engagement with the casing.

4. The combination with a packer of an arrangement for securing the same in the casing of an oil well or the like, said arrangement including an upper and a lower shoe, means for securing the upper shoe against upward movement with respect to the casing, said means including wedges and rolling members located between the wedges and the casing, means for raising the lower shoe with respect to the upper shoe to expand the packer and means for latching the two shoes together.

5. The combination with a packer of an arrangement for securing the same in the casing of an oil well or the like, said arrangement including a mandrel carrying the packer, a lower shoe fixed on the mandrel beneath the packer, an upper shoe slidably mounted on the mandrel, said upper shoe having a number of inclined surfaces thereon, rolling members disposed adjacent said surfaces and adapted to be wedged between the same and the casing of the well and releasable means for holding said rolling members out of engagement with the casing while the arrangement is being lowered into the well.

6. The combination with a packer of an arrangement for securing the same in the casing of an oil well or the like, said arrangement including a mandrel carrying the packer, a lower shoe fixed on the mandrel beneath the packer, an upper shoe slideably mounted on the mandrel, said upper shoe having a number of inclined surfaces thereon, rolling members disposed adjacent said surfaces and adapted to be wedged between the same and the casing of the well and releasable means for holding said rolling members out of engagement with the casing while the arrangement is being lowered into the well, said releasable means consisting of drag springs connected to the rollers and a J-slot connection device connecting the drag springs to the mandrel.

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