Aug. 14, 1934. A. DIX ET AL 1,970,362

ROTARY JAR

Filed Oct. 17, 1933

Fig. 1.

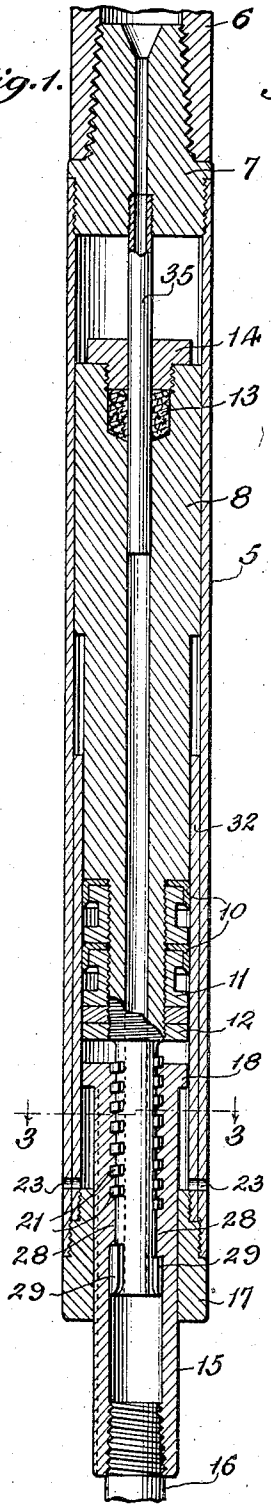


Fig. 2.

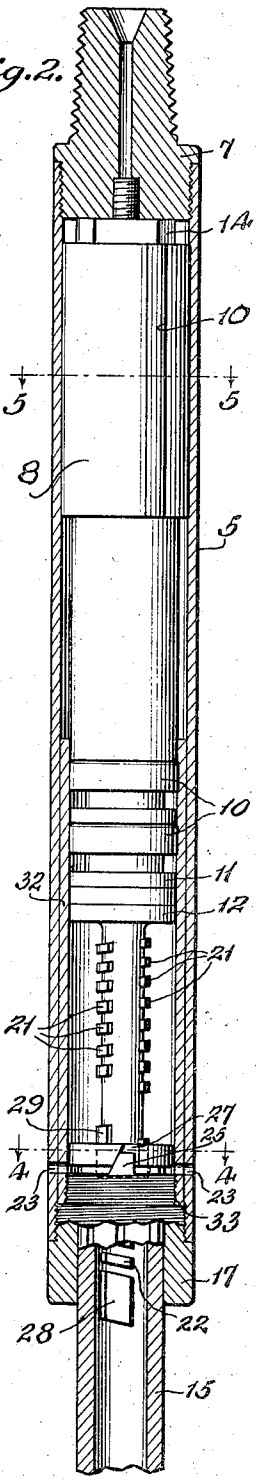


Fig. 3.

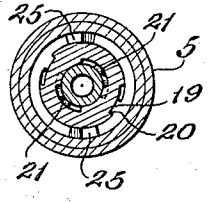


Fig. 4.

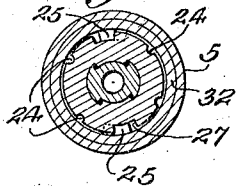
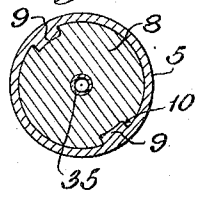


Fig. 5.



INVENTORS
ARTHUR DIX
WALTER C. BARNES
BY Eugene E. Stevens
His ATTORNEY.

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ROTARY JAR

Arthur Dix, Maricopa, and Walter C. Barnes, Taft, Calif.

Application October 17, 1933, Serial No. 693,985

8 Claims. (Cl. 255—27)

This invention relates to jars especially adapted for use in connection with rotary drilling equipment.

As is known to those skilled in the art to which this invention relates, in rotary drilling wells there is present a column of fluid extending for the height of the hole to constitute a vehicle for the cuttings and the invention forming the subject of this application contemplates the employment of the pressure of this column of fluid as a means to bring about successive jarring blows to loosen tools caught in the hole.

More particularly, the invention contemplates novel means by which the main striking or jarring element may, through surface control and movement of the drill pipe, be moved into position to strike a jarring blow, after which the pressure of the drilling fluid is brought to act against the striking or jarring element to cause it to strike its intended blow.

Also the invention will be found to embody novel means by which the device may be easily set and re-set from the surface without withdrawing the same from the hole so that successive jarring blows may be struck, all to the end that the recovery of the lost tool is expedited.

Other objects and advantages will be apparent during the course of the following description.

In the drawing forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a vertical sectional view through the improved jar with the parts in positions occupied immediately prior to the release of the striking element for action by the pressure of the drilling fluid,

Figure 2 is a similar view with the parts in positions occupied upon completion of the striking or jarring blow,

Figure 3 is a transverse sectional view on line 3—3 of Figure 1,

Figure 4 is a transverse sectional view on line 4—4 of Figure 2 and,

Figure 5 is a transverse sectional view on line 5—5 of Figure 2.

In the drawing, the numeral 5 designates an elongated tubular casing or cylinder having its upper and lower end portions internally threaded, the upper end portion of the casing being connected to the drill pipe 6, by an externally threaded combined coupling and anvil member 7.

As best shown in Figures 1 and 2, a striking element in the form of a plunger or ram 8 is mounted within the casing 5 for reciprocatory movement therein, the plunger or ram being held against rotation with respect to the casing by means of a pair of diametrically disposed, longitudinally extending keys or ribs 9 on the inner wall of the casing, fitting in longitudinal grooves 10 in the outer side of the plunger or ram 8.

It is also clearly shown in Figures 1 and 2 that the plunger 8 is provided intermediate its ends, with leather packing cups 10 held in place by the securing sleeves 11 and the nuts 12, threaded on the plunger. The upper end of the plunger carries a packing gland 13 and a packing nut 14, the nut 14 also acting as the hammer face of the plunger or ram for striking the combined coupling and anvil member 7 when the plunger is urged upwardly under the influence of the pressure of the drilling fluid.

From an inspection of Figures 1 and 2 it will be seen that there is mounted in the lower portion of the casing 5 in telescopic relation to the lower reduced end of the plunger or ram 8 a coupling sleeve 15 threaded at the lower portion thereof for connection with a fishing tool 16. A bushing 17 surrounds the sleeve 15 and is threaded into the lower end of the casing 5 and cooperates with an annular flange or collar 18 on the sleeve 15 to prevent separation or disconnection of the sleeve from the casing.

The sleeve 15 is mounted for sliding movement in the casing 5 and also partakes of limited rotary movement, the sleeve being limited in its rotary movement to about one-eighth of a turn relative to the casing by means of circumferentially spaced longitudinally spaced extending keys 19 on the bushing 17 operating in enlarged grooves or keyways 20 in the sleeve.

For the purpose of connecting the plunger or ram 8 and the fishing tool carrying sleeve 15 for sliding movement as a unit relative to the casing 5, the lower reduced portion of the plunger is provided on its exterior with diametrically opposite series of circumferentially extending helical quarter threads 21 which are adapted to be brought into interlocking relation with similar threads 22 on the interior of the sleeve 15 upon rotation of the plunger relative to the sleeve.

Fitting snugly within the casing 5 and in surrounding relation to the lower portion of the plunger 8 and the upper portion of the sleeve 15, is a tubular liner 32 which is fixedly secured in place by a threaded connection 33 with the bushing 17. A fluid-tight engagement is established between the liner 32 and the plunger or ram 8 by the packing cups 10.

To provide for the admission of the well fluid into the tool below the plunger or ram 8, the cas-

ing and the liner 32 are provided with alined annular series of ports 23 and the collar 18 is also provided in its outer periphery with a series of longitudinally extending grooves 24.

Particular reference is now invited to Figure 2 wherein it is clearly shown that the bushing 17 is provided with a pair of diametrically opposed upstanding lugs 25, one side wall of each of which is inclined to form a cam surface.

It is shown in Figure 2 that the collar 18 is formed with recesses 27 in the path of travel of and adapted for the reception of the lugs 25 and that one side wall of each recess 27 is inclined to correspond to the cam face of the adjacent lug 25.

By this arrangement, when the lugs 25 are received within the recesses 27 and engaged with the inclined side walls thereof a turning motion is imparted to the casing 5 and plunger 8. This turning motion disengages the threaded lower portion of the plunger from the member 15 with the result that the plunger is released for endwise movement under the influence of the drilling fluid.

In more specifically adverting to this phase of the invention, it is pointed out that when the lugs 25 are engaged with the cam surfaces forming the side walls of the recesses 27 the threads 21 will be released from interlocking engagement with the threads 22. This releases the plunger 8 so that the same may be moved upwardly under the influence of the pressure of the drilling fluid.

As is known, the drilling fluid of rotary drilling wells of substantial depth produces a tremendous pressure in the bottom of the well and it is this pressure that is utilized to move the plunger 8 into striking engagement with the coupling and anvil member 7.

The ports 23 and the grooves 24 allow of the admission of the drilling fluid to the space within the casing 5 immediately below the plunger with the result that instantly upon the disconnection of the previously interlocked threads 21 and 22 the tremendous pressure of the drilling fluid is allowed to move the plunger upwardly into striking engagement with the element 7.

Of course, the impact of the plunger 8 with the anvil 7 exerts jarring action on the drill or other part sought to be released and this may be repeated as often as is necessary or expedient.

Immediately below the helical threads 22 on the sleeve 15 are a pair of splines 28 with helicoidal faces to cooperate with similar splines 29 on the external lower end of the ram or plunger 8. The purpose of these splines is to prevent the ends of the quarter-threads 21 on the ram 8 from rubbing the ends of the quarter-threads 22 on the sleeve 15. As shown in Fig. 1, the splines 28 and 29 are adapted for interlocking engagement simultaneously with the interlocking engagement of the threads 21 and 22 and are released from such engagement by the releasing means 25—27.

The numeral 35 designates a waste pipe which is threaded into the element 7 and slidably extends into and communicates with the central bore of the ram 8.

Briefly, the operation of the tool is as follows:

The lower end of the sleeve 15 is first connected to the fishing tool end then the tool is connected to the lower end of the drill pipe through the medium of the combined coupling and anvil 7 whereupon the tool is lowered into the well hole and the fishing tool engaged with the object to be jarred. Subsequently the tool is let down until the sleeve 15 pushes the plunger or ram 8 upwardly against the anvil 7, after which a torsional strain to the right (if fishing or operating with right handed string of drill pipe), is taken which effects an interlocking engagement of the members 8 and 15 through the helical threads 21 and 22. The rotary table (not shown) is then locked to hold the torsional strain on the drill pipe. Now, a tensile strain or upward pull is exerted on the drill pipe which results in the upward sliding movement of the casing 5 relative to the plunger 8 and the sleeve 15 and creates a vacuum in the tool. The picking up or tensile strain on the drill pipe is continued until the lugs 25 engage the recesses 27 which engagement results in turning movement of the casing 5 and plunger 8 to the right against the right-handed torsional strain on the drill pipe and thereby moves the threads 21 and 22 and the splines 28 and 29 out of interlocking engagement and thus releases the plunger 8 which is quickly and forcibly urged upwardly under the influence of the pressure of the drilling fluid to impart a striking blow on the anvil 7 and the object to be jarred. Now, since there is still present a right-handed torsional strain all that is necessary is to lower the drill pipe so that the ram 8 and sleeve 15 again interlock and then pick up or exert an upward pull on the drill pipe until the plunger is released by the means 25—27.

If the plunger is released before the proper amount of tensile strain is taken, it is simply necessary to take additional torsional strain as the plunger releasing or tripping means operates against the torsional strain.

It is to be understood that the herein illustrated and described embodiment of the invention is to be taken merely as a preferred example of the same and that such changes in the arrangement and construction of the parts may be made as remain within the spirit of the invention and the purview of the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a rotary jar, a cylinder, an anvil element associated therewith, a plunger in said cylinder and adapted to engage said anvil element, said cylinder and said plunger being related for relative longitudinal movement, means for releasably holding said plunger in a fixed position until said cylinder is moved longitudinally to the end of a predetermined stroke to create a vacuum in said cylinder, and means for releasing said holding means at the end of the predetermined stroke of said cylinder to allow said plunger to exert a striking blow on said anvil element to effect a jarring action.

2. In a rotary jar, a cylinder, an anvil element associated therewith, a plunger in said cylinder and adapted to engage said anvil element, said cylinder and said plunger being related for relative longitudinal movement, means for releasably holding said plunger in a fixed position until said cylinder is moved longitudinally to the end of a predetermined stroke, means for admitting drilling fluid into said cylinder below said plunger, and means operable at the end of the predetermined stroke of said cylinder to release said holding means and permit the drilling fluid to move said plunger into striking engagement with said anvil element.

3. In a rotary jar, a cylinder, an anvil element associated therewith, a plunger in said cylinder and adapted to engage said anvil element, said cylinder and said plunger being related for rela-

tive longitudinal movement, means for releasably holding said plunger in a fixed position under torsional strain until a vacuum is created within said cylinder by a tensile strain exerted thereon to move the same longitudinally, and means operable by the tensile strain to overcome the torsional strain and release said holding means to permit said plunger to strike a blow on said anvil element.

4. In a jar for rotary drilling equipment, a casing having means whereby the same may be suspended from a rotary drill pipe and having an anvil, a plunger slidable longitudinally in said casing for striking engagement with said anvil, a coupling element slidable longitudinally of said casing, said plunger being provided with means to interlock with said coupling element, and means to limit movement of said coupling element in one direction.

5. In a jar for use in connection with rotary drilling equipment, a cylinder having means whereby the same may be connected to a rotary drill pipe and being provided with an anvil, a plunger slidable longitudinally within said cylinder and having means for striking engagement with said anvil, a connection between said plunger and cylinder for holding the plunger against turning with respect to the cylinder, said plunger being provided with a stem having circumferentially spaced sets of threads defining intervening clearance spaces, a coupling member receiving said stem and having circumferentially extending spaced sets of threads for engagement with said first-named threads to lock said plunger to said coupling member, there being means to disconnect the first and second-named threads, said cylinder being provided with means admitting fluid to the cylinder to act against one end of said plunger to move the plunger endwise into engagement with said anvil.

6. In a tool of the class described, a casing, a combined coupling and anvil member mounted in the upper end of said casing for connecting said casing to a drill pipe, a sleeve slidably mounted in the lower portion of said casing and projecting beyond the lower end thereof for connection with a fishing tool, a plunger reciprocably mounted in said casing and having telescopic relation with said sleeve, means for releasably connecting said sleeve and plunger for sliding movement as a unit relative to said casing, means for admitting drilling fluid into said casing below said plunger, and means for releasing said connecting means upon a predetermined sliding movement of said sleeve and plunger relative to said casing whereby said plunger is forced upwardly by the pressure of the admitted fluid to exert a hammer-like blow on said anvil.

7. In a tool of the class described, a casing, a combined coupling and anvil member mounted in the upper end of said casing for connecting said casing to a drill pipe, a sleeve mounted in the lower portion of said casing for limited sliding movement and having means for connection with a fishing tool, a plunger reciprocably mounted in said casing and having telescopic engagement with said sleeve, cooperating means carried by said sleeve and said plunger for releasably connecting the same for sliding movement as a unit relative to said casing, means for admitting drilling fluid to said casing below said plunger and means for releasing said connecting means when the sleeve has reached its limit of sliding movement to permit the drilling fluid to forcibly actuate said plunger into contact with said anvil.

8. In a tool of the class described, a casing, a combined coupling and anvil member mounted in the upper end of said casing for connecting said casing to a drill pipe, a sleeve mounted in the lower end portion of said casing for sliding movement and having means for connection with a fishing tool, a plunger reciprocably mounted in said casing and having telescopic engagement with said sleeve, cooperating segmental helical threads on said sleeve and plunger and adapted for interlocking engagement for releasably connecting the same for sliding movement as a unit relative to said casing, means for admitting drilling fluid to said casing below said plunger, and means operable upon a predetermined movement of said plunger and sleeve as a unit for moving said threads out of interlocking engagement to release the plunger whereby the same may be forcibly actuated into contact with said anvil by the drilling fluid.

ARTHUR DIX.
WALTER C. BARNES.