April 25, 1933. F. A. GOLISH 1,906,056

UNDERREAMER

Filed April 8, 1929

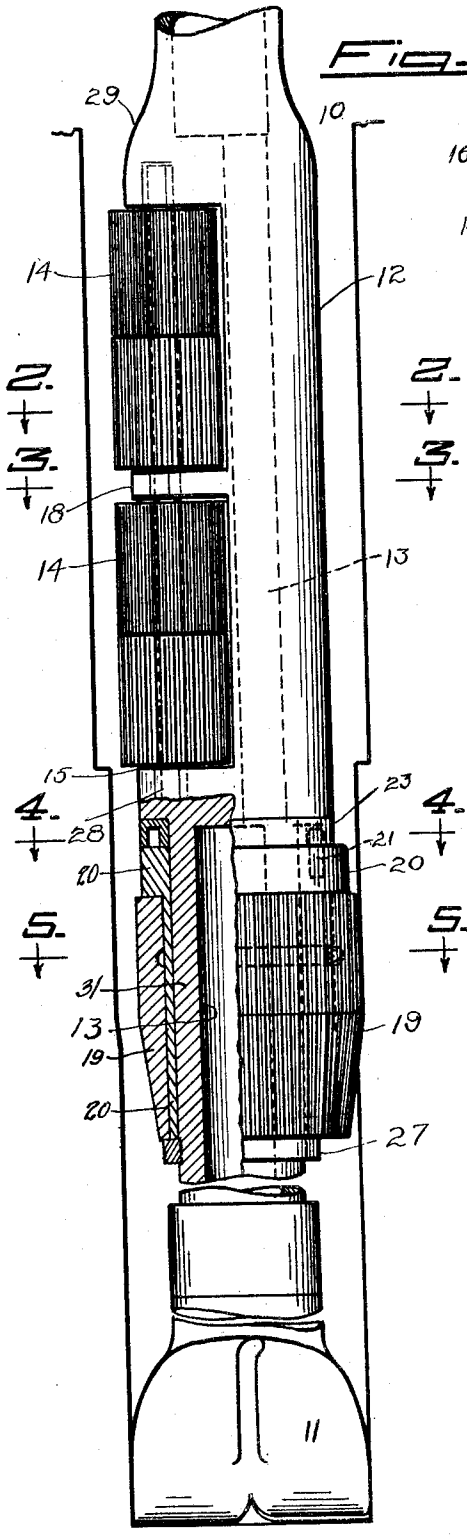

Fig-1-

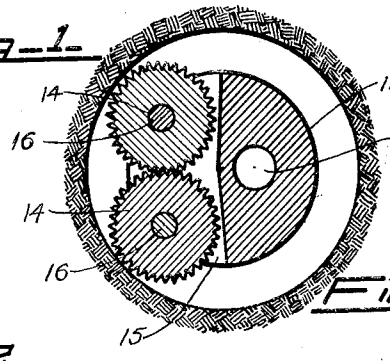

Fig-2-

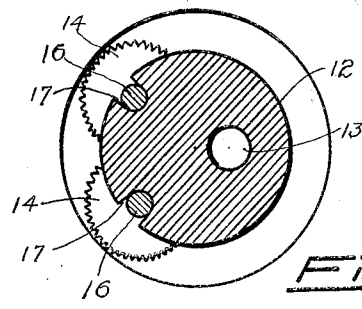

Fig-3-

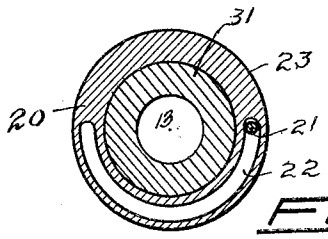

Fig-4-

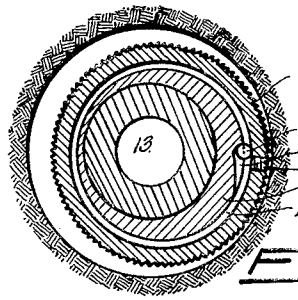

Fig-5-

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Patented Apr. 25, 1933

1,906,056

UNITED STATES PATENT OFFICE

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UNDERREAMER

Application filed April 8, 1929. Serial No. 353,462.

My invention relates to under reamers used in drilling holes in the ground by the rotary method, for enlarging a portion of the hole at some point below the surface. The reamer must pass through the hole or casing to the point where it is desired to enlarge the hole and must then expand so as to cut the larger hole. It must also be able to retract positively and completely so that it can be drawn up through the smaller hole to the surface again.

The object of my invention is to provide a reamer of this class that is positive in its action and will not get stuck in the hole.

Another object of my invention is to provide a reamer which will cause a minimum deviation of the drill pipe while reaming and thus reduce the probability of twisting the drill pipe off in the hole.

One of the principal objects of my invention is to provide a reamer that will work with the minimum effort and cannot hog into the side of the hole, thus obviating the chance of caving in the hole and sticking the reamer.

Another object of my invention is to provide a reamer in which the cutting elements may be changed quickly and simply when they become dull.

Another object of my invention is to provide a reamer in which the teeth of the roller cutters will not become clogged in use and render the reamer ineffective.

Other objects and advantages will be apparent from the following description and illustration.

In the drawing

Figure 1 is a general view of my reamer in use.

Figure 2 is a section on line 2—2 of Figure 1.

Figure 3 is a section on line 3—3 of Figure 1.

Figure 4 is a section on line 4—4 of Figure 1.

Figure 5 is a section on line 5—5 of Figure 1.

The same numeral refers to the same part in the different views of the drawing.

In Figure 1 is shown my reamer as it it used to enlarge a hole or keep it to size as the bit becomes worn and makes a smaller hole. The reamer 10 is placed in the usual string of rotary drill pipe at any desired distance above the bit 11, in this case shown as an ordinary fish-tail bit.

The reamer consists of the main body 12 having a water course 13 through it. The roller cutters 14—14 are mounted in one side of this main body in recesses 15—15 on pins 16—16.

These roller cutters are toothed for crushing the material as they roll around the side of the hole. There are several cutters on each pin; in this case four, and half of them have fine pitch teeth while the other half have coarse pitch teeth. In this way the different cutters will not track and produce corrugations around the side of the hole. Also the cutters are so arranged that the cutter on one pin meshes with the opposite cutter on the other pin as shown in Figure 2. In this way the teeth of one cutter force the detritus from between the teeth of the other cutter and keep them clear at all times, thus obviating the present difficulty of having the toothed cutters mud up and become useless for any further cutting so that the reamer has to be pulled out of the hole to clean the cutter teeth. This is a long and expensive operation when the reaming is being done at a considerable depth, where most of the reaming is done.

The pins 16, 16 are supported mid-way of their length by resting in recesses 17, 17 in a projecting portion 18 of the main body 12. The top and bottom cutter of each set may be made tapered to prevent it catching on any obstruction in the hole and to distribute the cutting action over more of the face of the cutters.

On the lower portion of the body a tapered toothed cutter 19, in the form of a cylinder, is mounted on an eccentric mandrel or bushing 20, which turns on a reduced portion of the body 12 this reduced portion forming a journal for the bushing 20. The upper portion of this eccentric bushing has a pin 21 projecting from it, parallel with

the body portion. This pin enters in a half circular slot or groove 22 in a collar 23 fastened on the main body portion above the eccentric bushing 20.

When the reamer is to be lowered in the hole the eccentric bushing is turned so that its greatest throw is on the same side of the body as the cutters 14. The reamer is then lowered in the hole and rotated in the usual manner. The cutter 19 rolls on the side wall of the hole and rotates on the eccentric bushing 20. The friction of the cutter rotating on the bushing tends to turn the bushing on the body so that the greatest throw of the eccentric is on the opposite side of the body 12 from the cutters 14. This increases the effective size of the reamer and allows it to generate a bigger hole than it will enter in the collapsed condition. The bushing 20 is prevented from turning any farther by the pin 21 in the slot 22 of the collar 23.

The cutter 19 acts as a cutter to enlarge the hole to a certain extent and it also acts as a guiding or forcing member to force the cutters 14 against the side of the hole so that they do the rest of the cutting and enlarge the hole still further to the final required diameter.

As the bit 11 decreases in size the pilot cutter 19 crowds the reaming cutters 14 further into the side wall and automatically maintain the hole to the required size. In this way the tool is useful not only as an under reamer to go through a small hole and enlarge it at some predetermined place, but it is also useful as a reamer to run back of a bit to maintain the hole to gauge and obviate the necessity of going in with a reamer and cleaning the hole out to the required size as is so often done at present.

A ratchet clutch is provided between the pilot cutter 19 and the eccentric bushing 20 so that the cutter is free to rotate in the normal manner. If the direction of rotation is reversed, however, the clutch rotates the eccentric bushing to its original position and the reamer can be withdrawn through the restricted hole above where the under reaming was being done, or through the casing that is being under reamed so that it may be lowered into the hole more freely and easily.

The ratchet is shown here in the form of a ball 24 in a continuous half groove 25 on the inside surface of the pilot cutter 19 and a tapered groove 26 on the outside of the eccentric bushing 20. Ball 24 may be inserted through a hole closed by a screw plug 30 as shown in Fig. 5. The action of such a clutch or ratchet is well known. Any other suitable ratchet or clutch may be used such as a spring actuated dog on one member engaging ratchet teeth on the other member.

The pilot cutter 19 is held in place on the eccentric bushing 20 by a collar 27 on the main body 12 below the pilot cutter. This collar is fastened on the body in any suitable manner such as threading it on the body.

To change the cutters when they become dull the reamer is removed from the drill stem and the collar 27 is removed from the body 12. The pilot cutter 19 and the eccentric bushing 20 may then be slipped off of the body 12. The collar 23 is then removed from the body 12 which allows pins 16, 16 to be withdrawn through the bottom of the holes 28 in the main body 12 and the cutters 14 drop out of the recesses 15, 15 . The new cutters are placed in the reamer by reversing this procedure.

The shoulder 29 above the cutters 14 is hard surfaced with any wear resisting alloy such as "Stellite" so that when the reamer is used to ream or underream upwards in a hole the body will not be worn away too rapidly by abrasion against the side wall of the hole.

Obviously for this kind of service the pilot cutter 19 may be placed at the top of the reamer or an additional pilot reamer on an eccentric bushing may be placed above the cutters 14.

By meshing the pairs of cutters 14, the tendency of any one cutter to stick and become flat is materially reduced, as it will be forced to rotate by its mating cutter.

The foregoing description is by way of illustration of my invention and is not intended to be construed as the only form that it may take. The scope of the invention is set forth in the following claims.

I claim:

1. In a reamer adapted to function when rotated right-hand: a body, a wall engaging member projected in fixed position from one side of said body; a journal portion formed on said body, longitudinally adjacent said wall engaging member and concentric with the axis of revolution of said body; an eccentric bushing rotatably mounted on said concentric journal; stops on said bushing and said body cooperating to fix limits to the rotation of said journal within said bushing, the limit to said rotation in a left-hand direction being that at which the throw of said eccentric bushing is on the same side of said body as said wall engaging member and the limit to said rotation in a right-hand direction being that at which said throw is on the side of said body opposite said wall engaging member; and a cutter rotatably mounted on said eccentric bushing.

2. A device substantially as and for the purpose set forth in claim 1, in which said wall engaging member is a roller arranged

to rotate on a vertical axis, said axis being fixed in position as regards said body.

3. A device substantially as and for the purpose set forth in claim 1, in which said wall engaging member is a roller reamer cutter arranged to rotate on a vertical axis, said axis being fixed in position as regards said body.

4. A device substantially as and for the purpose set forth in claim 1, including means for preventing left-hand rotation of said eccentric bushing within last said cutter while permitting free right-hand rotation of said bushing within said cutter.

5. A device substantially as and for the purpose set forth in claim 1, including a unidirectional clutch interposed between said eccentric bushing and last said cutter, said clutch being arranged to prevent left-hand rotation and to permit right-hand rotation of said bushing within said cutter.

6. In a reamer having a body, an eccentric bushing rotatably mounted on said body and a sleeve cutter rotatably mounted on said bushing: a unidirectional clutch interposed between said sleeve and said bushing and arranged to permit said sleeve to revolve on said bushing when said body is revolved in a cutting direction and to lock said sleeve to said bushing when said body is revolved in the reverse direction.

In witness that I claim the foregoing I have hereunto subscribed my name this 15th day of October, 1932.

FRANK A. GOLISH.