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E. KOPPL

2,222,818

UNDERREAMER WITH FLATTENED CUTTER

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Fig. 1.

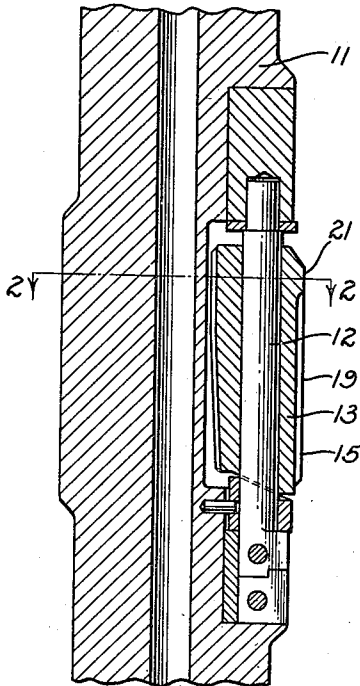


Fig. 2.

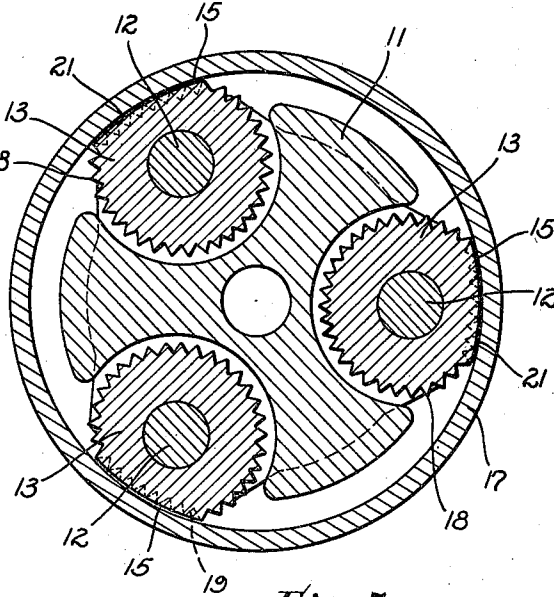


Fig. 3.

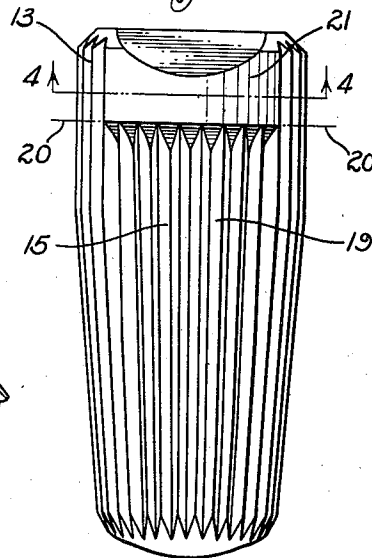
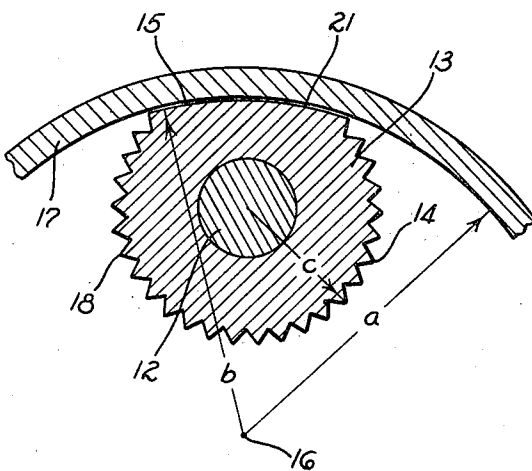


Fig. 4.



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UNDERREAMER WITH FLATTENED CUTTER

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2 Claims. (Cl. 255—73)

My invention relates to the art of forming bore holes in the earth and is especially adapted, but not limited, to the production of such bore holes for use as oil wells. In this art it is common practice to drill or produce a bore hole which may be several thousand feet deep. To prevent earth or other material entering and filling the well, it is also common practice to suspend in the well a string of casing which is usually steel pipe and which extends from a point well down in the bore hole to a point above the surface of the ground.

After such casing is so placed the bore hole may be extended downwardly by further drilling by any of the commonly used bits or boring tools. Since these bits must be passed downwardly through the pipe and frequently withdrawn through the pipe for replacements or repair they are necessarily smaller in diameter than the inside diameter of the pipe, and the bore hole they produce below the pipe is necessarily smaller in diameter than the outside of the pipe.

It is often desired to further lower the pipe after it is first set or hung in place in the bore hole, and to do this it is necessary to enlarge or ream the bore hole below the lower end of the pipe. For many years this has been done by an underreamer, and various forms of such underreamers have long been available for this purpose. The word "underreamer" as used herein means a tool which will pass readily through a pipe when in the retracted position and which, when expanded below the pipe, will enlarge the bore hole to a diameter sufficient to allow the pipe to be further lowered.

In my Patent No. 2,033,638, patented March 10, 1936, I show such an underreamer. The underreamer shown in this patent has been quite successful and I have used it to underream many wells. It is desirable when using this type of underreamer, however, to refrain from rotating the underreamer when inside the casing, as in some cases the cutters thereof will engage the casing if the underreamer is rotated in the casing. This may result in the cutters damaging the casing.

The principal object of the invention disclosed herein is to provide an underreamer of the type shown in my patent, supra, which is so constructed that it can be rotated inside a casing without danger of the cutters engaging the casing.

Other objects and advantages will be made evident hereinafter.

In the drawing, which is for illustrative purposes only:

Fig. 1 is a section through a portion of an underreamer embodying my invention.

Fig. 2 is a section on a plane represented by the line 2—2 of Fig. 1;

Fig. 3 is an elevation of a cutter; and

Fig. 4 is diagram showing the configuration of the cutter on a plane represented by the line 4—4 of Fig. 3.

The drawing illustrates a three cutter underreamer but the invention may be embodied in underreamers having one or more cutters. In the form shown in the drawing, a body 11 carries three pins 12 which may be secured in the body by the means shown in my prior patent or by any other convenient means. Each of the pins 12 carries a cutter 13. The configuration of these cutters is best shown in Fig. 4. The outer surface of the cutters on any plane parallel to the plane 2—2 consists of a circular portion 14 having a radius c and concentric with the axis of the pin 12, and a circular portion 15 having a radius b which is concentric with a point 16 which is in the axis of pipe or casing 17 through which the underreamer is designed to pass. The inner surface of the pipe is a cylinder having a radius a which is slightly, but only slightly, larger than the radius b .

For the purpose of enabling the cutter 13 to cut the earth formations surrounding the bore hole and thus enable the reamer to enlarge the diameter of the bore hole, the outside surface of the cutter 13 is provided with teeth which extend substantially parallel to the axis of the pin 12. The teeth 18 in the portion 14 extend over substantially the whole length of the cutter, but the teeth 19 on the portion 15 extend from the bottom of the cutter only to a line 20, leaving a portion 21 at the top of the cutter smooth and without teeth. This portion 21 slides freely on the inside surface of the pipe 17.

It will be evident from an inspection of Fig. 4 that with the cutter 13 and the pipe 17 in the position shown in that figure, the pipe 17 prevents the cutter from turning and since the portion 21 has no teeth, there is very little tendency for it to turn.

The method of operation is as follows:

As the reamer is lowered to pass into, and just before it passes into, the upper end of the casing 17, the user turns the three cutters 13 into the position shown in Fig. 2. The reamer will then pass into and through the casing. While it is in the casing 17 the reamer may be rotated inside the

casing 17 without engaging said casing. After the reamer leaves the lower end of the casing if it is rotated, it readily cuts or reams the wall of the hole to a size larger than the outside of the pipe 17.

5 When it is desired to withdraw the reamer from the well means, such as those shown in my prior patent, return the cutters to the position shown in Fig. 4 and the reamer can be readily with-
10 drawn through the casing 17.

The reamer, in accordance with standard practice, is carried on and may be rotated through a string of drill pipe and is secured to the lower end of the drill pipe. It is necessary to unscrew the separate stands of this string of drill pipe as
15 the reamer is withdrawn, and it is a positive advantage to be able to turn this drill pipe inside the casing when so unscrewing or screwing together the individual stands without danger of
20 the cutters 13 turning on the pins 12 and jamming into or against the drill pipe.

I claim as my invention:

1. In an underreamer adapted to be used for enlarging a bore hole in the earth, below a pipe
25 suspended in said bore hole, by said underreamer assuming a retracted position in which the reamer may pass readily through the pipe, the reamer being adapted to ream a hole larger than the inner diameter of the pipe after the
30 reamer has passed through the pipe, the combination of: a body; and a cutter mounted to

turn in said body, said cutter being provided with teeth that engage and cut the walls of the hole in such a manner as to so ream said bore hole and being provided with a portion having a cylindrical surface concentric with the walls of the
5 pipe when the cutter is in the retracted position, said portion being so formed and proportioned that the reamer with the cutter in its retracted position is locked against rotation in the body due to the position of said portion in relation to
10 the inner wall of the pipe.

2. In an underreamer adapted to be used to enlarge a bore hole in the earth below a pipe suspended in said bore hole so that said pipe can be further lowered into said bore hole, said underreamer by assuming a retracted position in
15 which said underreamer may be readily passed downwardly through the pipe and thereafter assuming an expanded position in which it enlarges or reams said bore hole so that the pipe may be so lowered, the combination of: a body; and a rotating toothed cutter on said body, said cutter being so mounted that it may rotate and thus
20 so ream said bore hole, and said cutter being provided with a cylindrical portion which is concentric with and close to the inner wall of said pipe with the underreamer in its retracted position, said portion being so placed that the cutter cannot rotate with relation to said body while
25 said underreamer is in said pipe.

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