Aug. 12, 1930. E. KOPPL 1,772,491

UNDERREAMER

Filed April 2, 1928

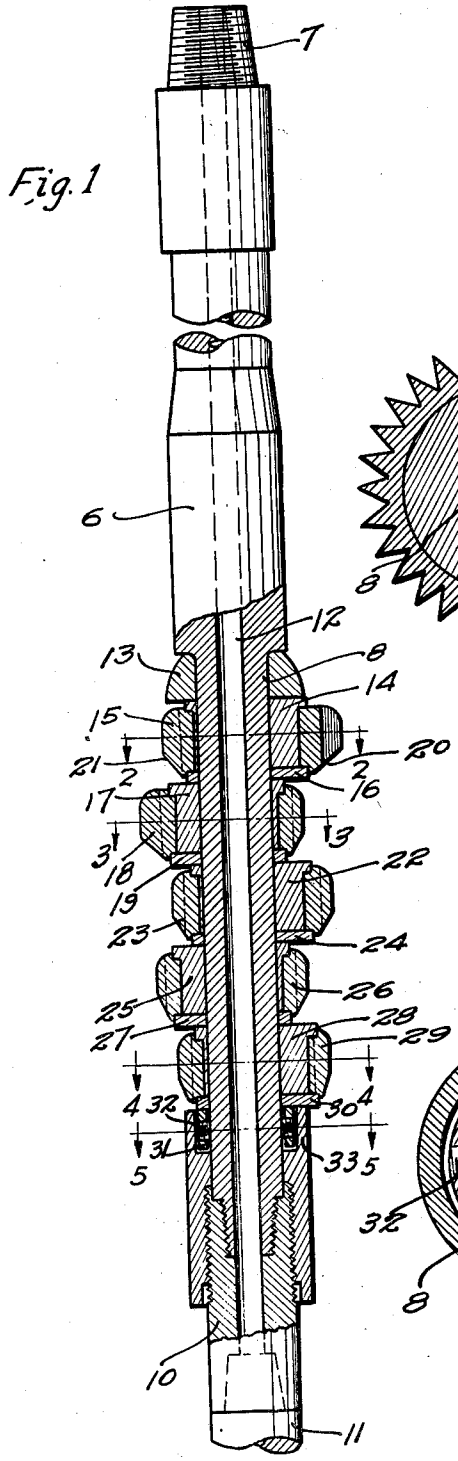


Fig. 1

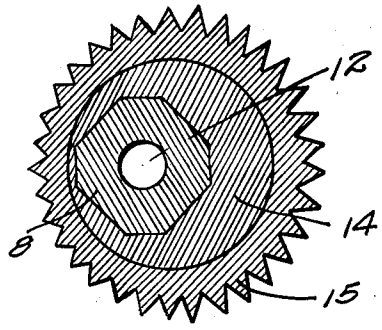


Fig. 2

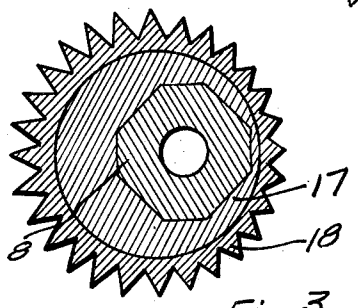


Fig. 3

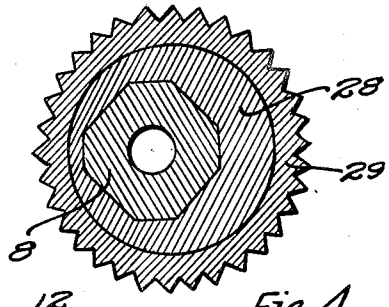


Fig. 4

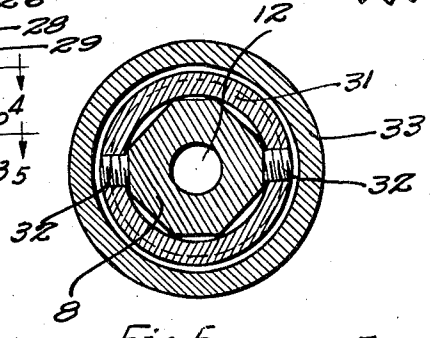


Fig. 5

INVENTOR,
Ernest Koppl

BY Westall and Wallace

ATTORNEYS

Patented Aug. 12, 1930

1,772,491

UNITED STATES PATENT OFFICE

ERNEST KOPPL, OF LONG BEACH, CALIFORNIA

UNDERREAMER

Application filed April 2, 1928. Serial No. 266,695.

This invention relates to underreamers such as are used in enlarging the size of a hole. The embodiment illustrated herein is especially useful in well drilling, more particularly oil well drilling.

The objects of this invention are first, to provide an underreamer having a journal carrying member disposed in alignment with the drill stem and horizontal rotative cutters eccentrically disposed with respect to the axis of the member; second, to provide a tool of the character described having a plurality of such cutters staggered with relation to one another; third, to provide a tool of the character described having enlarging cutters which are eccentrically mounted on their journals; fourth, to provide such a tool with journals for the cutters disposed eccentric to the axis of the journal carrying member; fifth, to provide a journal carrying member, journal parts and cutters, easy of assembly and disassembly; and sixth, to provide roller cutters arranged to insure the cutters taking hold of the formation with rotation of the journal carrying member.

Other objects and advantages will be made fully apparent from the following specification considered in connection with the accompanying drawing, in which:—

Fig. 1 is an axial sectional view of an underreamer constructed in accordance with the invention; and Figs. 2 to 5 are sections taken on the lines correspondingly numbered in Fig. 1.

The underreamer shown herein is adapted to be connected in the drill string, and a drill or bit of any well known type may be connected to the string in advance of the underreamer. The body of the underreamer indicated by 6 is shown provided with a threaded pin 7 for connection to the rotary drill pipe. At 8 it is reduced in size and made polygonal in cross-section, and at the lower end there is a threaded pin to which a box sub 10 may be connected. A fragment of an ordinary drill or bit is indicated in Fig. 1 by 11. The body constitutes a journal carrying member through which circulation passage 12 extends.

A bevelled guide or petticoat 13 is mounted upon the spindle 8, the bore of the petticoat corresponding in shape to the shape of the spindle so that it may be slipped into position and thus held against rotation. Below the guide and in contact therewith is a bushing journal 14 having a bore such that it will be retained against rotation and may be slipped into position contiguous to the guide. The bushing journal is provided with a flange at one end and its cylindrical periphery is eccentric to the axis of the spindle. Rotatably mounted upon the bushing journal is a toothed roller cutter 15. The periphery of this cutter is eccentric to its journal. Contiguous to the journal 14 and at the end opposite to the flange is a washer 16. The roller cutter has its end rounded. Below the washer 16 is a bushing journal 17 like journal 14 but mounted upon the spindle so that it is staggered with respect to journal 14. A roller cutter 18 is rotatably mounted upon the journal 17 and is of similar character to roller 15 but preferably of smaller over-all diameter. A washer 19 is disposed against the lower end of the journal 17. The journals and washers just described are duplicates, but are mounted so that they are eccentrically offset on opposite sides of the spindle. The lower faces of the cutters are bevelled or chamfered as indicated by 20 and 21.

Below washer 19 is a bushing journal 22 which has an eccentric bearing surface staggered with relation to journal 17. Rotatably mounted on journal 22 is a roller cutter 23. This roller cutter has a periphery concentric to the journal bearing surface. The lower face is chamfered and a washer 24 retains it in position upon its journal. Below washer 24 is an eccentric bushing journal 25, upon which is journalled a concentric roller cutter 26 similar to cutter 23 and preferably of smaller diameter. A washer 27 holds the cutter in position. Bushing journal 25 is staggered with relation to bushing journal 22. Below washer 27 is another eccentric bushing journal 28 having a roller cutter 29 concentrically mounted thereon. The journal 28 is offset with respect to the journal 25, and the cutter 29 is similar to

cutter 26, but preferably of smaller diameter. Below journal 28 is a washer 30 for holding the cutter in position upon its journal. It will be noted that the overall diameter of the rollers preferably progressively decrease from top to bottom.

A retaining ring 31 is disposed on the spindle and in engagement with washer 30. Set screws 32 serve to hold the retaining ring in position. Mounted upon the sub 10 is a sleeve 33 having a recess to accommodate the retaining ring. This sleeve has an internal thread in engagement with the thread on the exterior of sub 10.

The parts of the underreamer may be assembled by slipping into position the petticoat guide 13, then the journal 14 with its roller cutter thereon, and next the washer 16. The remaining journals and cutters are then slipped into position, their washers being interposed, and finally retaining ring 31 is slipped over the spindle. This ring is then fixed in position by means of the set screws. Next the sub 10 with the sleeve 33 is screwed upon the end of the spindle and the sleeve then adjusted. Obviously various mechanical refinements of construction may be resorted to, only the essentials of structure being shown herein.

The tool is collapsed by turning the eccentric cutters with their eccentric throw or longest arm opposite to the longest eccentric arms of their journals. In this position the tool may be lowered through the usual casing present in oil wells. When the tool has passed the lower end of the casing or shoe, the drill string is rotated. This will cause the cutters by reason of their contact with the side of the hole to be rotated and eventually the eccentric cutters 15 and 18 reach the positions shown in Figs. 2 and 3 thereby enlarging the hole. By reason of the bevelled lower faces, rotation will be insured as the tool is advanced. In withdrawing the tool, it is lifted and rotation continued until the eccentric cutters properly position themselves with their longest arms opposite to the longest arms of their journals.

What I claim is:—

1. An underreamer comprising a journal carrying member in longitudinal alignment with the drill string by which it is to be rotated and having a journal thereon, and a roller cutter having an eccentric bearing on said journal to rotate in a plane transverse to the axis of said member so as to cause a throw in its rotation.

2. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is rotated, a journal thereon eccentrically disposed in relation to the axis of said carrying member, and a roller cutter having an eccentric bearing on said journal.

3. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals thereon, roller cutters mounted on said journals to rotate in planes transverse to the axis of said member one of said cutters being eccentrically mounted on its journal.

4. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals thereon eccentrically disposed with relation to the axis of said carrying member, roller cutters mounted on said journals, one of said cutters being eccentrically mounted on its journal.

5. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals thereon eccentrically disposed in relation to the axis of said carrying member and staggered with respect to one another, and roller cutters eccentrically mounted on said journals.

6. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a journal thereon eccentrically disposed in relation to the axis of said carrying member, and a roller cutter eccentrically mounted on said journal and having a bevelled lower face.

7. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals thereon eccentrically disposed with relation to the axis of said carrying member, roller cutters eccentrically mounted on said journals, one of said cutters being eccentrically mounted on its journal and having a bevelled lower face.

8. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals eccentrically disposed in relation to the axis of said carrying member and staggered with respect to one another, and roller cutters eccentrically mounted on said journal, said cutters having bevelled lower faces.

9. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals mounted thereon eccentrically disposed in relation to the axis of said carrying member and staggered with respect to one another, roller cutters eccentrically mounted on said journals, said cutters having their eccentricities progressively increasing.

10. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals thereon eccentrically disposed in relation to the axis

of said carrying member and staggered with respect to one another, roller cutters eccentrically mounted on said journals, said cutters having their eccentricities progressively increasing from bottom to top of the underreamer.

11. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals thereon eccentrically disposed in relation to the axis of said carrying member and staggered with respect to one another, roller cutters eccentrically mounted on said journals, said cutters having their eccentricities progressively increasing from bottom to the top of the underreamer and being bevelled on their lower faces.

12. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals thereon eccentrically disposed in relation to the axis of said carrying member, a roller cutter concentrically mounted on the lower journal and roller cutters eccentrically mounted on the upper journals.

13. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals thereon eccentrically disposed in relation to the axis of said carrying member, a roller cutter concentrically mounted on the lower journal, and roller cutters eccentrically mounted on the upper journals, said last mentioned cutters having their eccentricities progressively increasing from bottom to top of the underreamer.

14. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, a plurality of journals thereon eccentrically disposed in relation to the axis of said carrying member, a roller cutter concentrically mounted on the lower journal, and roller cutters eccentrically mounted on the upper journals, said cutters being bevelled on their lower faces.

15. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, eccentric bushing journals having slip-on mountings on said member, said carrying member being of such contour with respect to the bores of said bushing journals as to prevent relative rotation, the peripheries of said bushing journals being staggered with relation to one another, rotative cutters mounted on said journals, one of said cutters being eccentrically mounted on its journal, and an end member mounted on said carrying member to prevent longitudinal displacement of said cutters.

16. An underreamer comprising a journal carrying member arranged in longitudinal alignment with the drill string by which it is to be rotated, eccentric bushing journals having slip-on mountings on said member, said carrying member being of such contour with respect to the bores of said bushing journals as to prevent relative rotation, the peripheries of said journal bushings being staggered with relation to one another, roller cutters eccentrically mounted on said journals, and an end member mounted on said carrying member to prevent longitudinal displacement of said cutters.

17. An underreamer comprising a body for connection to a rotary drill string, a roller cutter journalled on said body on an axis parallel to the drilling axis of said body, the bearing of said cutter being eccentric to its cutting periphery so as to cause a throw of said rubber on rotation thereof.

In witness that I claim the foregoing I have hereunto subscribed my name this 21st day of March, 1928.

ERNEST KOPPL.

CERTIFICATE OF CORRECTION.

Patent No. 1,772,491. Granted August 12, 1930, to

ERNEST KOPPL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 85, claim 17, for the word "rubber" read cutter; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 21st day of October, A. D. 1930.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)