Jan. 5, 1932. E. M. LOPEZ 1,839,767

DRILLING APPARATUS

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FIG. 1.

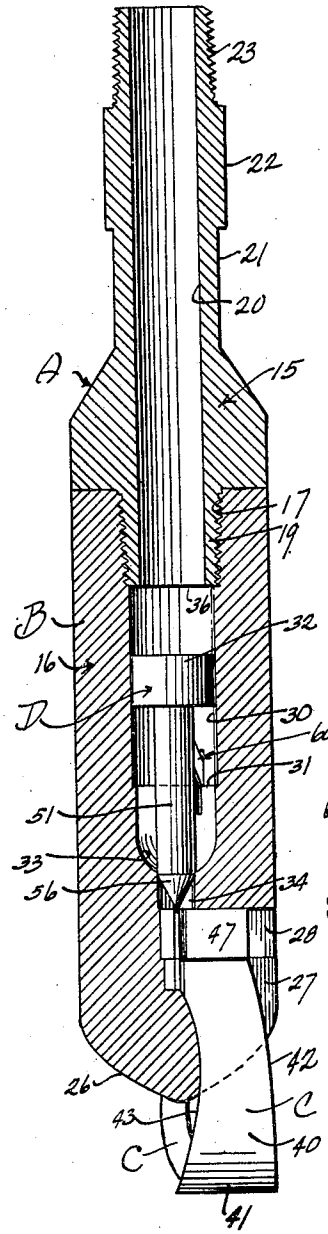


FIG. 2.

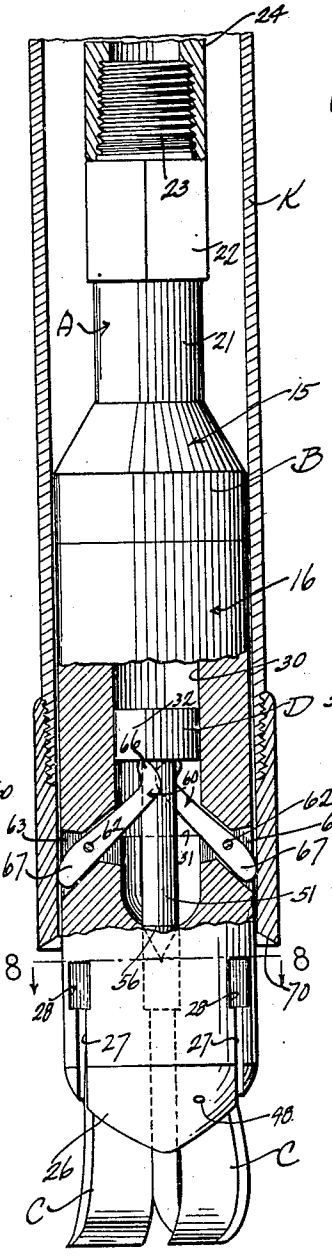


FIG. 3.

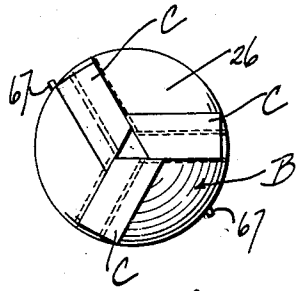
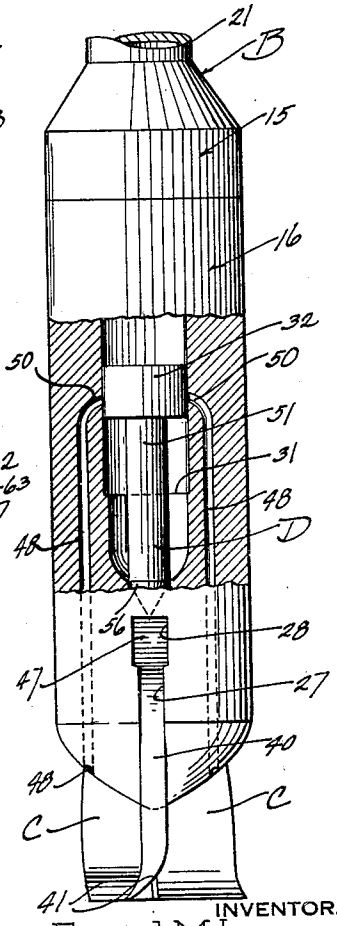


FIG. 4.



INVENTOR.
Ernest M. Lopez

BY Lancaster Allwine & Rommel

ATTORNEYS.

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FIG. 5.

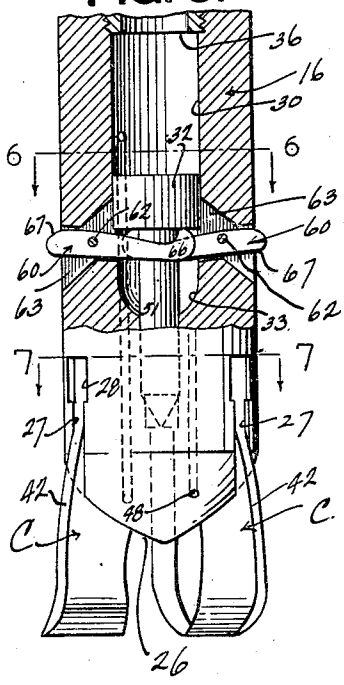


FIG. 9.

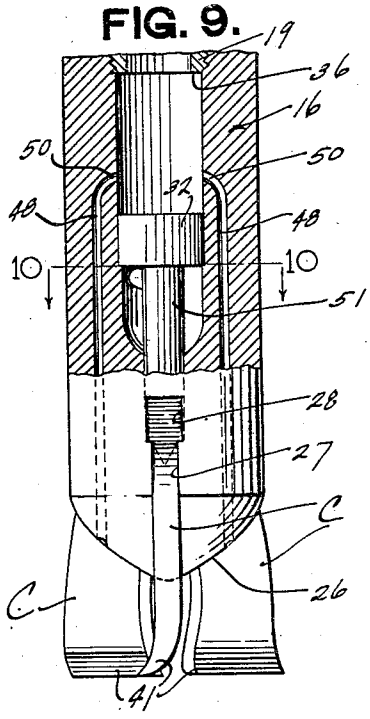


FIG. 6.

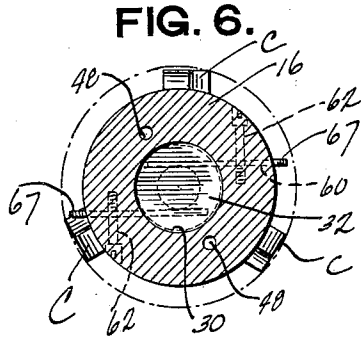


FIG. 10.

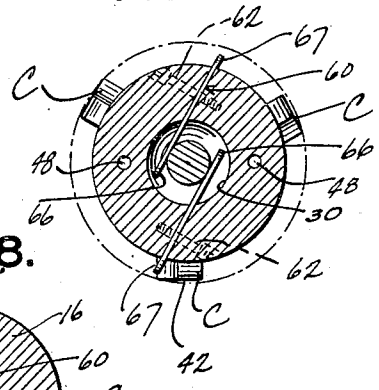


FIG. 8.

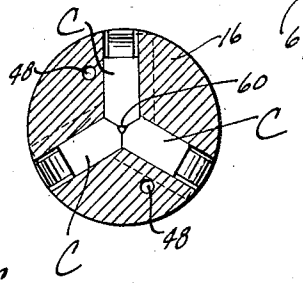
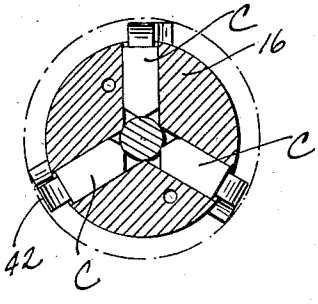


FIG. 7.



INVENTOR.
Ernest M. Lopez

BY Lancaster Allwine and Rommel

ATTORNEYS.

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UNITED STATES PATENT OFFICE

ERNEST M. LOPEZ, OF VENTURA, CALIFORNIA

DRILLING APPARATUS

Application filed February 18, 1930. Serial No. 429,287.

This invention relates to improvements in drilling apparatus.

The primary object of this invention is the provision of an improved drill and reamer bit of the rotary expanding blade type, having a relatively simple and improved arrangement to permit the efficient extension of the blades into an operative relation by hydraulic means, and improved means to permit the retraction of the cutters and blades.

A further object of this invention is the provision of an improved combination drill and reamer bit structure which includes a two-part casing, with all of the blades and operating parts carried by the lower portion of the casing or body structure.

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

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views,

Figure 1 is a longitudinal sectional view of the improved drilling apparatus.

Figure 2 is a view showing the improved drilling apparatus, partly in section, in an operative relation in a well casing; the same being lowered in the casing just prior to an operative extension of the cutting means thereof.

Figure 3 is a bottom plan view of the structure as arranged in Figure 1.

Figure 4 is a sectional view taken through details of the drilling apparatus at a different angle than that shown in Figure 1, to disclose the relation of the blade expansion piston means with respect to drain ducts.

Figure 5 is a fragmentary sectional view of the lower portion of the bit structure, showing the blades extended, with the means which causes their expansion in adjacent operative relation.

Figures 6 and 7 are sectional views taken substantially on their respective lines in Figure 5 of the drawings.

Figure 8 is a sectional view taken substantially on its respective line in Figure 2 of the drawings.

Figure 9 is a fragmentary sectional view showing the parts of the apparatus of Figure 4, with the piston in a different relation with respect to drain and washing ducts.

Figure 10 is a sectional view taken substantially on the line 10—10 of Figure 9.

In the drawings, wherein for the purpose of illustration is shown only a preferred embodiment of the invention, the letter A may generally designate the improved hydraulically operated rotary expanding drill and reamer bit, which may include a body structure or casing B, having supporting at the lower end thereof radially expansible blades C in an operative relation with respect to piston means D to cause their expansion.

The stock or body structure B preferably comprises an upper section 15, and a lower section 16; the latter being provided with a screw threaded socket 17 in its upper end, which receives the tapered externally screw threaded reduced shank 19 on the lower end of the stock section 15. The upper section 15 of the body structure or stock B is tubular, having a passageway 20 therethrough, of uniform diameter, and the upper end 21 thereof is reduced and provided with an externally polygonal wrench engaging head or boss 22. The upper end thereof is externally screw threaded to provide a shank 23 for detachable connection in the lower screw threaded socket of the drill bit 24, as shown in Figure 2.

The lower stock section 16 is cylindrical in form, being of externally the same diameter as the lower portion of the section 15, as shown in Figure 1, and the extreme lower end 26 thereof is convexly tapered in a convergent relation to a point axially thereof, as shown in the various views of the drawings. The lower end of the lower section 15 is preferably provided with radial slots 27 therein, which may be provided in any approved number, preferably three, as shown in the drawings. The said slots 27 open both along the side walls of the section 16 and extend downwardly and open at the bottom thereof through the reduced portion 26, as well shown in Figure 1 of the drawings. The upper ends of the slots 27 are enlarged laterally at 28, at both sides of the plane of each

slot 27, to provide a sort of T-slot, for receiving a blade C in the relation which permits them dropping downwardly through the slots axially of the stock, as can readily be understood.

The stock section 16 is furthermore provided with a passageway 30 therethrough, which aligns with the passageway 20 of the section 15 when the latter is connected to the section 16. The passageway 30 continues downwardly axially through the section 16, and intermediate the ends of the latter it is reduced slightly at 31 to provide a shoulder against which the lower surface of the head portion 32 of the piston means D abuts to limit the lowered movement of the piston means. The passageway 30 at the lower end thereof is concavely restricted at 33 and terminates in a reduced passageway 34 which outlets directly at the meeting point of the various slots 27, which communicate axially in the stock section 16 immediately below the reduced passageway 34, as is quite apparent from Figure 1. It is to be noted that the shank 17 of the section 15 when screw threaded in the section 16 provides a shoulder 36 facing downwardly in the passageway 30, which provides an abutment against which the top surface of the piston head 32 may engage.

The blades C are of novel construction, each including the preferably flat body portion 40, of uniform thickness, which at the lower end thereof is provided with a laterally extending downwardly inclined cutting portion 41, although the cutting edge may be of other design, if desired. The blades C are provided with convex outer edges 42; the upper body portion having the convex edge 42 noticeably sloped at an angle to the axis of the stock B. The opposite edge 43 of the blade is concaved, and the blade in width generally tapers from intermediate its ends downwardly in a wider flaring relation, as shown in Figure 1. The upper end of the body portion 40 of each blade is provided with a T-head 47, mounted on the body 40 in a T-shaped relation, that is, it projects at opposite sides from the plane of the body portin 40, as well shown in Figure 4 of the drawings, and which head 47 is for sliding in the enlarged portion 28 of the T-slot 27, to permit a radial movement of the blade in its respective slot 27, against any other movement except radial sliding movement with respect thereto. As is shown more particularly in Figures 1, 7 and 8 of the drawings, the upper portion of the blade C along the head 47 thereof and partially along the upper body 40, where the same faces the axial bore of the stock section 16, is provided with either a convex edge, or convergent surfaces sloping to a chisel or blunt edge facing parallel with the axis of the stock B, and which edge receives the mandrel or stem 51 of the piston means C thereagainst, to permit of the extension of the blade, in a relation which is perfectly apparent from the drawings. It is to be noted that the lower flaring cutting portion of the blade C depends below the stock section 16, and when the said blades are retracted fully in their slots 27, the edges 42 thereof lie entirely within the outer circumference of the stock section 16, extended.

The piston means D, as above mentioned, includes the head 32 slidably mounted in a reciprocating relation in the passageway 30 between the shoulders 31 and 36, and in such a relation that pressure supplied upon the top thereof may not leak therepast. To this end, it may be provided with piston rings, if found necessary. The head 32 is provided with a reduced stem or mandrel 51, the lower end of which is conically pointed at 56, and adapted to extend into the passageway 34 of the stock section 16, into the small opening between the meeting ends of the blades C when the latter are fully retracted; said small opening being shown at 60 in Figure 8 of the drawings. Water pressure is preferably applied upon the top of the piston 32, through the passageways 20 and 30, forcing the piston means D downwardly so that the pointed end of the mandrel extends into a wedging relation between the meeting ends of the blades C; forcing the same outwardly in their guide slots 27, into radial cutting extension at their lower ends with respect to the stock section 16. The tapered end 56 enables as gradual an extension of the blades C to their cutting position, as desired, and the final rest position of the piston means D enables the mandrel 51 to assume a position where the facing edges of the blades C engage against the vertical sides of the cylindrical portion of the mandrel, so that there cannot be a retraction of the blade C with respect to the stock B.

The stock section 16 is provided with vertical ducts 48 therein, in parallelism with the passageway 30; the upper ends 50 thereof being laterally inclined and communicated with the passageway 30 at a point between the shoulders 31 and 36 and in relation to the head 32 of the piston means D so that as soon as the piston means D has been moved downwardly to fully move the blades C to their expanded cutting position the head 32 will ride to a position below the ends 50 of the ducts 48 and permit the water to pass into the ducts 48 and downwardly therethrough, outletting on the lower surface of the stock B, into detritus washing relation with respect to the cutting ends of the blades C, in a relation which is apparent from the drawings.

Means is provided to enable a retraction of the blades C when the drill pipe or stem is withdrawn, by movement of the piston means D to an inoperative position. This means consists in the provision of lever-like dogs 60 and 61 pivoted upon pins 62 within

slots 63 cut through the walls of the stock section 16, at opposite sides of the passageway 30. The dogs 60 have inner piston engaging ends 66 which extend into the passageway 30 of the stock section 16, and at the opposite sides of the pivots are provided with ends 67 which may be retracted entirely within the slots 63, or extended transversely beyond the outer surfaces of the cylindrical portion of the stock section 16, in the position shown in Figure 5 of the drawings, when the piston means D is held in a pressure relation in the stock section 16 for expanding the blade C to a cutting position. They are in their retracted position as shown in Figure 2. Their function will be well understood. With the drilling tool in its operating condition, with the blades C expanded as shown in Figure 5, the piston means D moves down and the dogs at their ends 67 extended beyond the outer surface of the stock section 16. When the drill stem is to be withdrawn it will of course be necessary to retract the blades C. This is accomplished upon upward withdrawal of the drill stem, inasmuch as the projecting ends 67 will then engage against the preferably inclined lower edge 70 of the well casing structure K, moving the ends 67 of the levers 60 downwardly and inwardly into their slots 63 and moving the ends 66 upwardly within the passageway 30 of the stock section 16 where they engage the lower surface of the piston head 32, at opposite sides of the mandrel 51, and lifts the entire piston means D upwardly to position the cone end 56 at a point where the blades C are not engaged thereby. Then, as the drill stem is elevated further the convex edges 42 ride into engagement with the lower end of the casing K, and are slid into collapsed relation in the slots 27, since there is no force nor means holding them positively expanded. The collapsed relation is shown in Figure 1 of the drawings. It is to be particularly noted that when the blades are held in their expanded condition by the piston means D, the ends 67 of the dogs or levers 60 at their extreme edges do not project radially for as great a distance as the effective cutting radius of the blades C, so that the dogs at their projecting ends will not interfere with nor contact the walls of the bore, as is shown in the relation of parts designated in Figure 6.

It is to be particularly well noted that all of the operating parts are carried by the lower section 16 of the stock structure B.

Various changes in the shape, size, and arrangement of parts may be made to the form of invention herein shown and described, without departing from the spirit of the invention or the scope of the claim.

I claim:

In a drill construction the combination of a stock having transverse guide slots intermediate its ends and an axial bore, blades slidably mounted in said slots, a mandrel slidably mounted in said bore and movable into expanding relation between the blades, said stock above the mandrel having a portion sliding in piston-like engagement within said bore, said bore above the piston-like portion being unobstructed for admission of a pressure liquid thereto for moving the mandrel into its expanding relation with the blades, and lever means carried by the stock extensible therefrom when the mandrel is in blade expanding position so that the same may engage a well casing upon withdrawal of the stock therefrom to move the mandrel out of blade expanding relation.

ERNEST M. LOPEZ.