May 3, 1932. G. W. MITCHELL ET AL 1,856,579

BORING TOOL

Filed May 27, 1930

Fig. 1

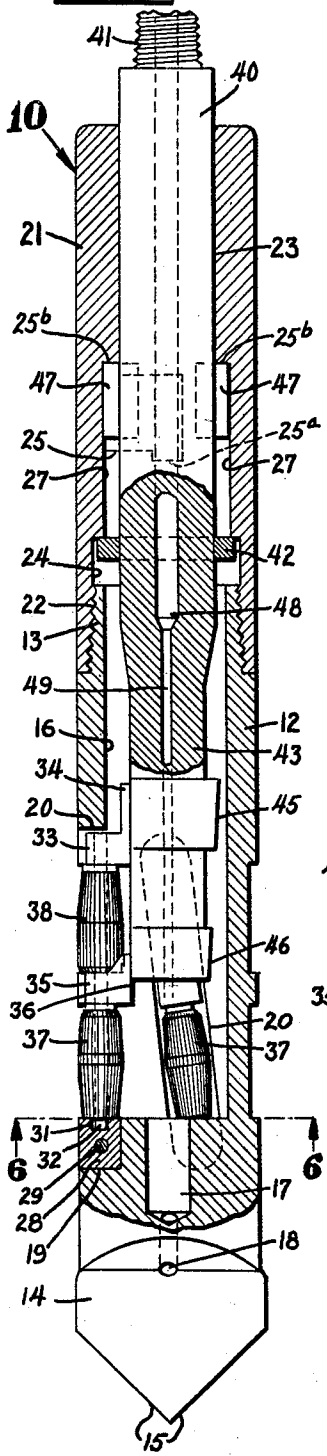


Fig. 2

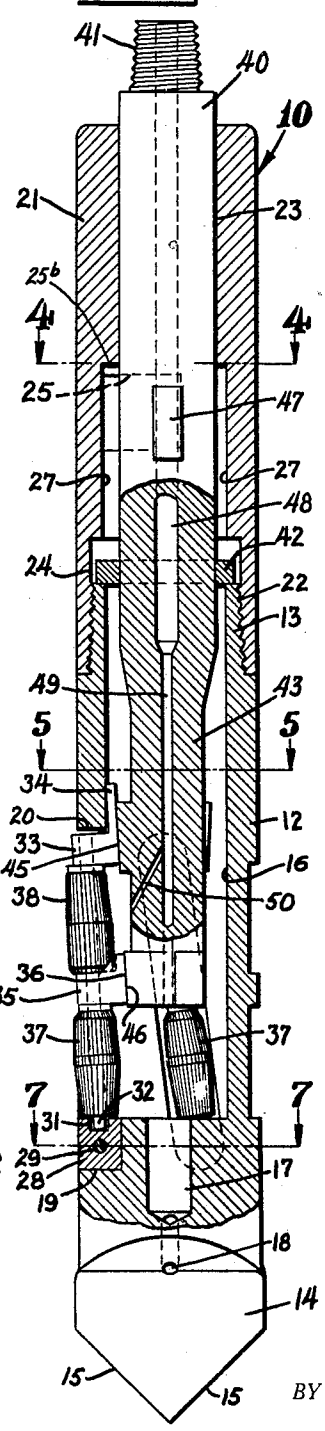


Fig. 3

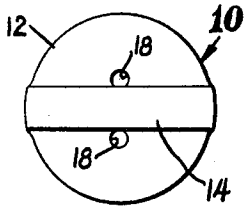


Fig. 4

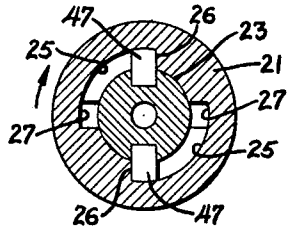


Fig. 5

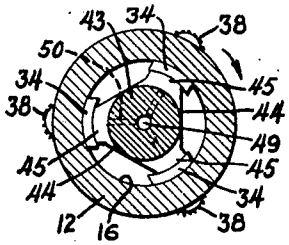


Fig. 6

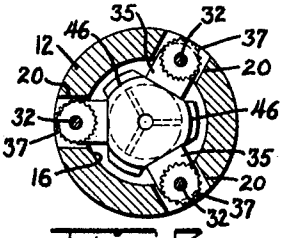
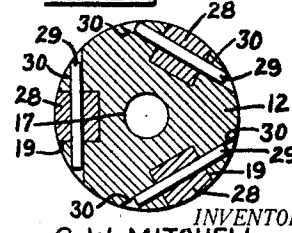


Fig. 7



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UNITED STATES PATENT OFFICE

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BORING TOOL

Application filed May 27, 1930. Serial No. 456,002.

This invention relates to improvements in boring tools.

The general object of this invention is to provide an improved rotary boring tool.

Another object of the invention is to provide an improved boring tool including a plurality of reamer rolls.

An additional object of this invention is to provide a novel reamer.

A further object of the invention is to provide a device of the class described including a novel means for expanding the reamer rolls.

Other objects and the advantages of this invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

Fig. 1 is a central longitudinal section through our improved boring tool showing the reamer rolls in a retracted position.

Fig. 2 is a similar view showing the reamer rolls in an extended position.

Fig. 3 is a bottom plan view of the device.

Fig. 4 is a section taken on line 4—4 of Fig. 2.

Fig. 5 is a section taken on line 5—5 of Fig. 2.

Fig. 6 is a section taken on line 6—6 of Fig. 1, and

Fig. 7 is a section taken on line 7—7 of Fig. 2.

Referring to the drawings by reference characters we have indicated our improved boring tool generally at 10. As shown the device 10 comprises a body portion 12 having a reduced externally threaded hub 13 at its upper end while at the lower end it is shown as formed into a flat bit 14 having tapered sides 15 which converge to a point. Within the body 12 a coaxial recess or chamber 16 is provided at the bottom of which a reduced recess 17 is provided from which apertures 18 extend outwardly to points adjacent the sides of the bit 14.

In the outer face of the body 12 adjacent the bottom of the chamber 16 we provide a plurality of recesses 19 and in the sides of the body we provide a plurality of apertures 20 which register with the recesses 19 and are preferably arranged at an angle to the perpendicular with the lower end in advance in the direction the device is adapted to be rotated.

A cap 21 is adapted to be secured to the upper end of the body 12 and as shown this cap includes a threaded recess 22, the threads of which are adapted to engage the threads of the hub 13. The cap is provided with a reduced coaxial bore 23 and between the threaded recess 22 and the reduced bore 23 an enlarged chamber 24 is provided. Intermediate the length of the bore 23 we provide arcuate coaxial recesses 25 which terminate at one end in shoulders 26 and at the opposite end communicate with longitudinal slots 27 (see Fig. 4). At the shoulder end of each of the coaxial recesses 25 a downwardly extending seat 25^a is provided and at the slot end of each of the recesses 25 an upwardly extending seat 25^b is provided.

Positioned in each of the recesses 19 of the body 12 we provide a block 28 which is adapted to be secured in position by a pin 29 positioned in apertures 30 provided in the body. In the upper face of each of the blocks we provide a recess 31 in which the lower end of a shaft 32 is positioned. The upper ends of the shafts 32 are positioned in blocks 33 which are positioned in the apertures 20 and each of the blocks 33 include an upwardly extending cam engaging tongue 34 which is provided in the chamber 16 and extends upwardly above the top of the aperture 20. Intermediate the length of the shafts 32 other blocks 35 are provided through which the shafts extend and which are positioned in the apertures 20 and which include enlarged cam engaging inner portions 36.

Mounted to rotate on the shafts 32 intermediate the lower blocks 28 and the center blocks 35 we provide a reamer roller 37 which may be a single roller or made up of a plurality of sections as shown. Similarly mounted on the shafts 32 intermediate the center block 35 and the upper block 33 we provide reamer rolls 38.

For actuating the reamers to operative position we provide a stem 40 which is positioned in the bore 23 of the cap and includes at its upper end a reduced externally threaded hub 41 by means of which it is adapted

to be secured to a string of drill pipe. Intermediate the length of the stem 40 we provide an enlarged collar 42 which may be made integral therewith or secured thereto by welding or in any desired manner. The collar 42 is positioned in the chamber 24 and is of less height than the chamber to allow the stem to move longitudinally the distance of the depth of the seat portions 25[a] and 25[b] in the recesses 25.

Adjacent the lower end of the stem 23 we provide a reduced portion 43 which includes a plurality of flat surfaces 44 and an upper set of a plurality of circumferentially extending radially disposed cam surfaces 45, and a lower set of a plurality of similar cam surfaces 46 (see Figs. 5 and 6). Secured to the stem 40 above the collar 42 we provide a pair of opposed wings 47 which are adapted to be positioned in the cap recesses 25.

The stem 40 is provided in the upper portion thereof with a coaxial bore 48 which communicates with a coaxial reduced bore 49 which extends through the bottom of the stem and opens into the chamber 16 and communicating with the reduced bore 49 we provide reduced apertures 50 which extend diagonally through the stem and open into the chamber 16 intermediate the upper and lower sets of cam surfaces.

When the stem 40 is moved downwardly and rotated in the direction indicated by the arrows in Figs. 4 and 5, the wings 47 engage the shoulders 36 of the cap and the cam surfaces 45 engage the tongues 34 of the upper reamer blocks 33 and the cam surfaces 46 engage the cam portions 36 of the center block 35 thereby moving the reamers to an extended position as shown in Fig. 2. Upon continued rotation of the stem the wings 47 rotate the body and cap with it.

When the stem is moved upwardly and rotated in the opposite direction the stem cam surfaces 45 and 46 move out of engagement with the cam portions 34 and 35 of the reamers whereupon the cam portions 34 and 35 may move inwardly until they engage the flat surfaces 44 of the stem as shown in Fig. 6.

In operation the hub 41 of the stem 40 is secured to the sub of a string of drill tubing, the body 12 is then rotated so that the cam portions 34 and 36 may engage the flat surfaces 44 of the stem and then the device is lowered into the well. When the device is being lowered into the well and the stem is rotated to allow the retraction of the reamers the weight of the body and cap retains the wings 47 in the seats 25[b]. Thus the drill pipe may be rotated when coupling additional sections thereto without rotating the stem relative to the body and cap.

When the device reaches the bottom of the well the weight of the body and cap is carried by the formation whereupon when it is desired to operate the device the stem 40 is moved downward so that the wings 47 move out of the seats 25[b], the drill tubing is then rotated thereby rotating the stem 40 in the direction indicated by the arrows in Figs. 4 and 5. As the stem is thus rotated the cam surfaces 45 and 46 move the reamers to an extended position as shown in Fig. 2, and the wings 47 engage the cap shoulders 26 and are positioned in the seats 25[a] whereby upon continued rotation of the stem the body and cap will be rotated thereby causing the reamers to enlarge the well hole and the bit 14 to cut a new hole.

The circulating fluid passes from the drill tubing into the stem bores 48 and 49 thence into the chamber 16 and through the recess 17 and the apertures 18 out adjacent each side of the bit. Some of the circulating fluid passes through the stem apertures 50 by which it is directed toward the upper reamer rolls 38 and thence out through the apertures 20 and some of the fluid passes from the chamber 17 through the apertures 20 around the lower reamer rolls 37.

To withdraw the device 10 from the well the drill tubing is moved upwardly to disengage the wings 47 from the seats 25[a] and is rotated in a reverse direction, thereby rotating the stem 40 in a reverse direction whereupon the reamer cam surfaces may move inwardly into engagement with the flat surfaces 44 of the stem, thus allowing the reamers to be retracted when they are drawn upwardly though the well casing.

When the device is being drawn out of the hole the wings 47 are positioned in the seats 25[b] thereby allowing the drill pipe to be rotated to remove sections thereof without rotating the stem 40 relative to the cap and body whereby the rotation of the stem does not actuate the reamers to an extended position.

From the foregoing description it will be apparent that we have provided a novel boring tool which is simple in construction and highly efficient in use.

Having thus described our invention, we claim:

1. In a boring tool, a casing, the lower end of said casing including a cutting bit, a plurality of reamers pivoted on said casing, each of said reamers including a cam engaging surface, a bore in said casing, a plurality of opposed recesses intermediate the length of said bore, an upper seat recess adjacent one end of each of said opposed recesses and a lower seat recess adjacent the opposite end of each of said opposed recesses, a stem, said stem being positioned in said bore, a plurality of opposed wings on said stem, said wings being positioned in said recesses and having restricted radial movement therein, said stem including a plurality of flat surfaces and a plurality of cam surfaces, said cam surfaces being adapted in one position of said stem to engage said cam engaging surfaces of said

reamers to move said reamers outwardly, said stem in another position being adapted to allow said reamer cam surfaces to move inwardly into engagement with said flat surfaces of said stem, said stem wings when said stem is rotated to move said reamers outwardly being adapted to engage a portion of said casing whereby continued movement of said stem will rotate said casing, said wings when said cam surfaces are in said first position being positioned in said lower seat recesses and said wings when said cam surfaces are in said second position being positioned in said upper seat recesses.

2. In a boring tool, a body portion, the lower end of said body including a flat sided cutting bit, a plurality of blocks pivoted on said body portion, said blocks each having a socket recess in the upper face thereof, a plurality of shafts, the lower ends of said shafts being positioned is said sockets of said blocks, a plurality of upper blocks, the upper ends of said shafts being positioned in said upper blocks, a chamber in said body, said upper blocks being positioned in said body and including cam engaging tongues positioned in said body chamber, a center block positioned on said shafts intermediate the length thereof, said center blocks including cam engaging portions, a reamer roller rotatably mounted on each of said shafts between said lower block and said center block and a reamer roller rotatably mounted on each of said shafts between said upper block and said center block, a stem, said stem being positioned in said body portion with the lower end of said stem extending into said body chamber, the lower portion of said stem including a plurality of flat surfaces and an upper set of cam surfaces and a lower set of cam surfaces, said upper set of cam surfaces being adapted in one position of said stem to engage said cam engaging portions of said center blocks and move said reamers outwardly, said stem in another position being adapted to allow said reamer cam surfaces to move inwardly into engagement with said flat surfaces of said stem.

3. In a boring tool, a casing, the lower end of said casing including a flat sided cutting bit, said casing having a chamber and a recess at the bottom of said chamber, there being a plurality of apertures communicating with said recess and opening through said casing adjacent the sides of said bit portion, a plurality of recesses in the outer face of said casing adjacent the lower end thereof, a block positioned in each of said plurality of recesses, said blocks being pivotally secured to said casing, a socket recess in the upper face of each of said blocks, a plurality of shafts, the lower ends of each of said shafts being positioned in one of said socket recesses of said blocks, a plurality of upper blocks, the upper ends of said shafts being positioned in said upper blocks, said upper blocks being positioned in said casing recesses and including cam engaging tongues positioned in said chamber and extending above said recesses, a center block positioned on said shafts intermediate the length thereof, said center blocks including cam engaging portions, a reamer roller rotatably mounted on each of said shafts between said lower block and said center block and a second reamer roller rotatably mounted on each of said shafts between said upper block and said center block, there being a bore in said casing and a pair of opposed circumferential recesses intermediate the length of said bore and longitudinal grooves in the inner face of said bore communicating with said circumferential recesses, a stem positioned in said bore with the lower end of said stem extending into said chamber, opposed wings on said stem, said wings being positioned in said circumferential recesses and having restricted radial movement therein, the lower portion of said stem being reduced and including a plurality of upper flat surfaces and an upper set of cam surfaces and a plurality of lower flat surfaces and a lower set of cam surfaces, said upper set of cam surfaces being adapted in one position of said stem to engage said cam engaging portions of said upper blocks and said lower surfaces to engage said cam engaging portions of said center blocks to move said reamers outwardly, said stem in another position being adapted to allow said reamer cam surfaces to move inwardly into engagement with said flat surfaces of said stem, said stem wings when said stem is rotated to move said reamers outwardly being adapted to engage a portion of said casing whereby continued movement of said stem will rotate said casing.

4. In a boring tool, a body portion, a plurality of blocks pivoted on said body portion, said blocks each having a recess therein, a plurality of shafts, the lower ends of said shafts being positioned in said recesses of said blocks, a plurality of upper blocks, the upper ends of said shafts being positioned in said upper blocks, a chamber in said body, said upper blocks being positioned in said body and including cams positioned in said body chamber, a reamer roller rotatably mounted on each of said shafts, a stem, said stem being positioned in said body portion and means on said stem to engage said cams to move said reamer rollers.

5. In a boring tool, a body portion, a plurality of blocks pivoted on said body portion, said blocks each having a socket therein, a plurality of shafts, the lower ends of said shafts being positioned in said sockets of said blocks, a plurality of upper blocks, the upper ends of said shafts being positioned in said upper blocks, a chamber in said body,

said upper blocks being positioned in said body and including cams positioned in said body chamber, a center block positioned on each of said shafts intermediate the length thereof, said center blocks including cams, a reamer roller rotatably mounted on each of said shafts between said lower blocks and said center blocks and a reamer roller rotatably mounted on each of said shafts between said upper blocks and said center blocks, and means positioned in said body portion to engage said cams and move said reamer rollers.

In testimony whereof, we hereunto affix our signatures.

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GAROLD O. SHISLER.
EDWARD E. MYERS.