

Nov. 23, 1926.

1,607,791

C. T. DOUGHERTY
DETACHABLE ROTARY BIT

Filed March 3, 1926

2 Sheets-Sheet 1

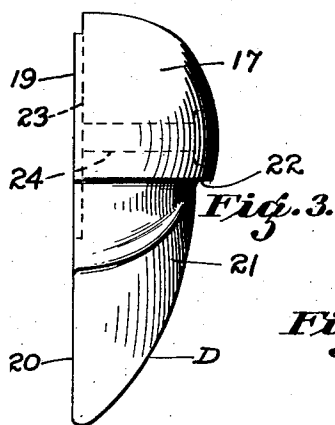


Fig. 3.

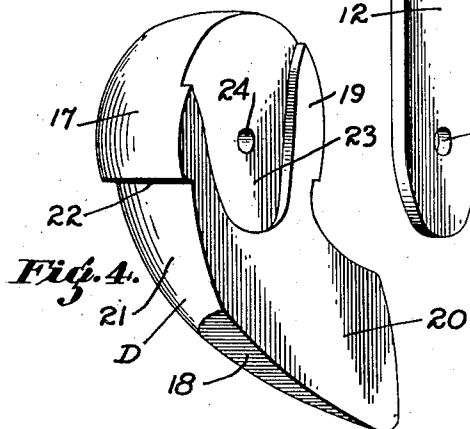


Fig. 4.

Fig. 5.

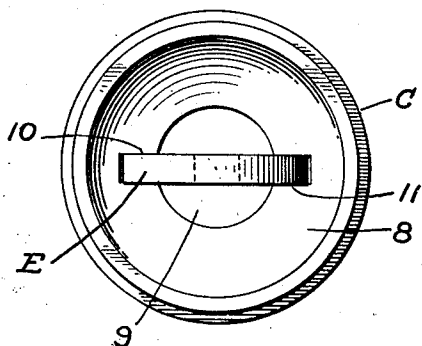
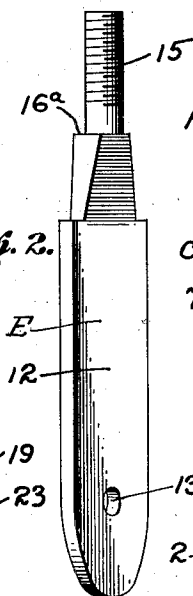


Fig. 2.

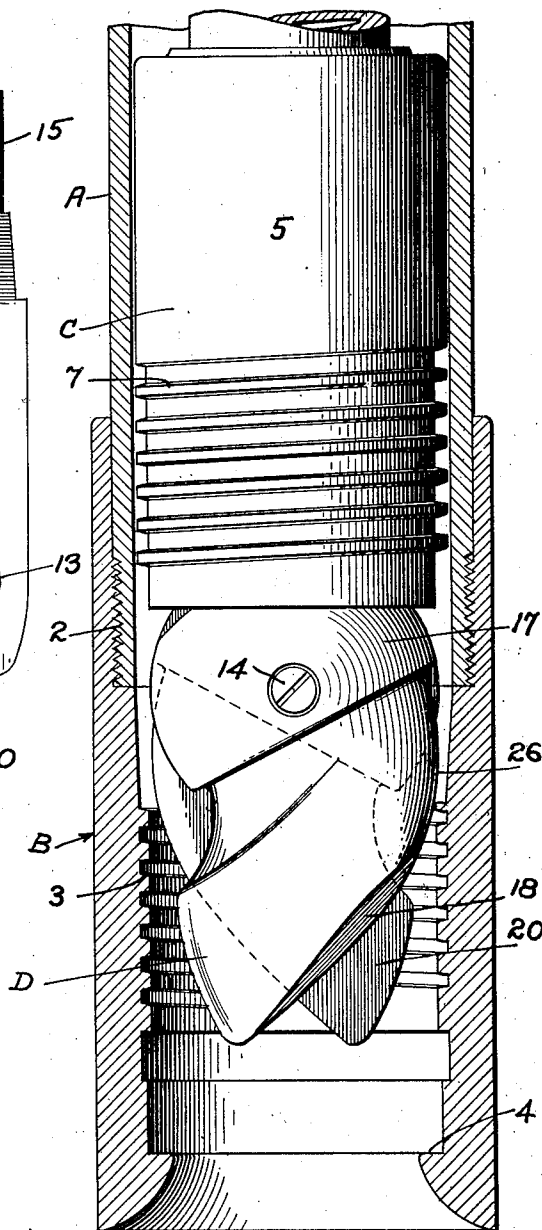


Fig. 1.

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Fig. 6

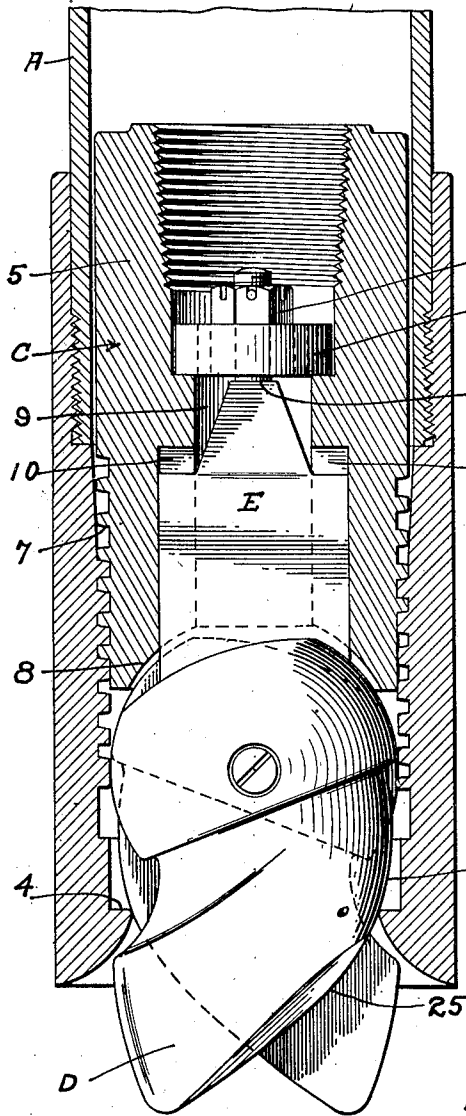
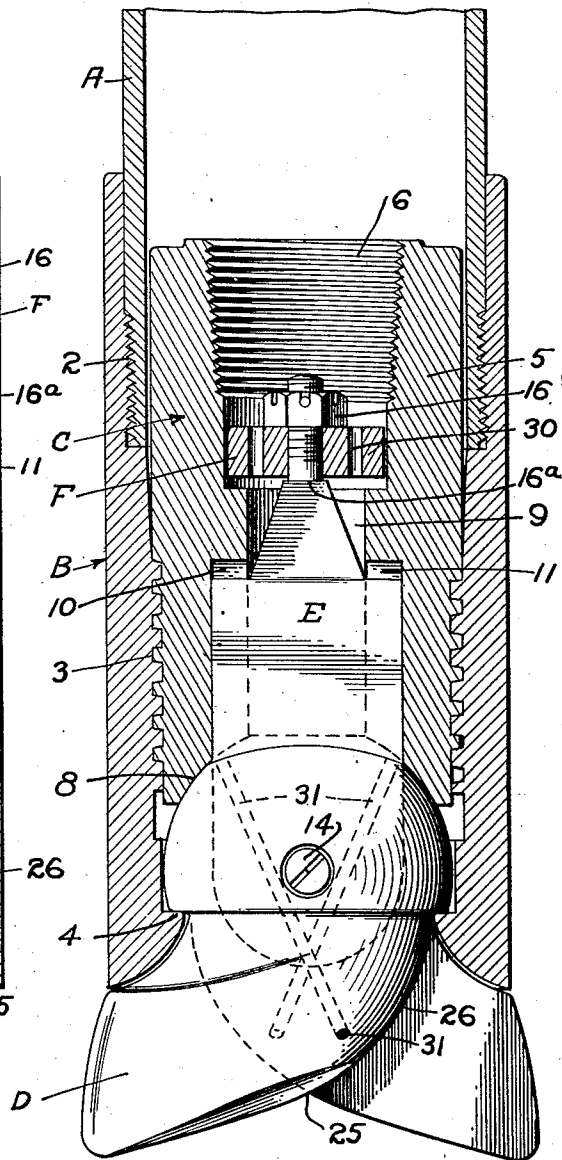


Fig. 7



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UNITED STATES PATENT OFFICE.

CHARLES T. DOUGHERTY, DECEASED; BY WINFIELD W. SMITH, ADMINISTRATOR, OF COALINGA, CALIFORNIA, ASSIGNOR OF SIX FIFTY-FIFTHS TO HATTIE E. DOUGHERTY, SIX FIFTY-FIFTHS TO E. H. DOUGHERTY, AND SIX FIFTY-FIFTHS TO F. C. DOUGHERTY, ALL OF HUNTINGTON BEACH, CALIFORNIA; SIX FIFTY-FIFTHS TO C. C. CAMPBELL, OF COALINGA, CALIFORNIA; SIX FIFTY-FIFTHS TO R. L. JOHNSTON, OF SANTA BARBARA, CALIFORNIA; THREE FIFTY-FIFTHS TO P. A. CAMPBELL, OF LONG BEACH, CALIFORNIA; THREE TWENTY-FIFTHS TO W. W. SMITH, TWO TWENTY-FIFTHS TO J. H. DUNAWAY, TWO TWENTY-FIFTHS TO RAY M. WAGNER, TWO TWENTY-FIFTHS TO CLARENCE WAGNER, AND ONE TWENTY-FIFTH TO ETHEL G. SMITH, ALL OF FRESNO COUNTY, CALIFORNIA.

DETACHABLE ROTARY BIT.

Application filed March 3, 1926. Serial No. 91,901.

This invention relates to detachable rotary bits for oil well drills and the like and especially to improvements in the structure of the bit shown in Patent Number 1,585,540, entitled Detachable rotary bit and patented May 18, 1926.

The object of the present invention is to generally improve and simplify the construction and operation of bits of the type shown in the patent referred to, to provide a structure which is more rugged and substantial to produce better water circulating conditions, to provide a structure whereby the bits are more rigidly secured when in cutting position; and, further, to insure positive extension or contraction of the cutting bits during insertion or removal with relation to the casing shoe.

The preferred form and structure which the improved bit will assume is illustrated and described in the accompanying specification and drawings, in which—

Fig. 1 is a central vertical longitudinal section of the lower end of a well casing, said section showing the shoe on the end of the casing and said section also showing the nut and bits being lowered into position.

Fig. 2 is a perspective view of the bit supporting plate.

Fig. 3 is an end view of one of the cutting blades of the bit.

Fig. 4 is a perspective view of one of the blades of the cutting bit.

Fig. 5 is a bottom view of the nut.

Fig. 6 is a view similar to Fig. 1 showing the nut and bit lowered to a position where the cutting blades of the bit are about to be extended.

Fig. 1 is also a view similar to Fig. 1, this view, however, showing the bits completely extended to cutting position and also showing the nut in final position where it rigidly secures the blades of the bit in cutting position.

When using a rotary bit such as here illustrated it must be understood that the well

casing proper indicated at A and the shoe B on the lower end thereof is employed to rotate the bit and that it is not necessary to remove the casing when changing bits as the bit is lowered down through the casing to the shoe and there attached, and is similarly detached and removed when it becomes necessary to resharpen or replace the same.

The bit proper consists of the pulling members, a holding nut C, a pair of cutting blades, the bit D, a bit driving and supporting plate E, and a washer F.

Before describing the specific construction of the holding nut, the cutting blades, etc., it is first necessary to state that the shoe B is permanently attached to the lower end of the well casing by a threaded connection or the like, such as indicated at 2, also that the lower part of the shoe is provided with an internal heavy thread 3 and that the extreme lower end of the shoe is provided with an annular internal shoulder 4 which forms a support for the heads of the cutting blades or bit D as will hereinafter be described.

The holding nut consists of an upper section 5 which is provided with an internal tapering blade 6. The lower section is externally threaded as shown at 7 to engage the internal threads 3 of the shoe and the extreme lower end is provided with a concave or socket-shaped recess 8 which is adapted to engage the head of the bit as will later be described. The holding nut is provided with a central cylindrical opening 9 and this opening is provided with a pair of radially opposed slots 10 and 11 which serve the function of guiding and driving the bit supporting plate E. This plate is perhaps best illustrated in Fig. 2. It consists of a lower elongated plate section 12 which is perforated as at 13 to receive a pivot bolt 14 on which the blades of the bit are pivoted. The upper end of the plate terminates in a threaded bolt 15 which extends through a central opening in the washer F and it is

secured in the washer by means of a nut 16. The bit proper consists of a pair of cutting blades such as shown in Figs. 3 and 4. Each blade consists of a semi-spherical half-head section 17 and a blade extension 18. The head is shaped as a quarter section of a solid sphere. One side of the head is accordingly flat as shown at 19 and so is one face of the blade indicated at 20. The opposite side of the blade is rounded out and heavy and is gradually thickened as at 21 to increase the strength of the blade as much as possible.

A supporting shoulder 22 is formed between the blade and the head and this shoulder is adapted to engage and rest upon the annular shoulder 4 of the shoe. The blades are identical in shape and construction, but are right- and left-hand. The flat faces 19 and 20 of two blades are brought together and these flat faces are recessed as at 23, see Fig. 4, to receive the lower perforated end of the bit supporting plate 12. The bolt 14 passes through the head member 17 as these are perforated as indicated at 24 and it also passes through the opening 13 in the plate 12. The cutting sections or two halves of the bit are, in other words, pivotally supported on the lower end of the plate, and they have a free pivotal movement on the plate so that the individual bit sections may be retracted or closed with relation to each other as shown in Fig. 1, or completely extended to cutting position as shown in Fig. 7.

The bit or blade sections are automatically extended or contracted when the holding nut is inserted or removed. By referring to either Figs. 1, 6 or 7, it will be noted that the inner end of each blade or bit section is rounded from the supporting shoulder 22 to the point 25 to form a continuous cam surface 26 which is engaged by the annular shoulder 4 to either extend or contract the bit sections. When the holding nut is lowered down through the casing and as it approaches the shoe B, the bit or blade sections D assume the contracted position shown in Fig. 1. When the holding nut is lowered further the threads 7 are engaged with the threads 3 of the shoe and when engagement is made, the holding nut is rotated as will hereinafter be described so as to screw the holding nut down into the shoe. During this movement the points 25 of the cam section 26 on the respective bits first engage the annular shoulder 4, and as the holding nut is gradually lowered by screwing it into the shoe, the bit sections or blades are gradually projected by engagement of the cam surface 26 with the annular shoulder, until they assume their full projected position shown in Fig. 7.

When the bit or blade sections finally reach full extended position as shown in Fig. 7, the threads 22 engage the supporting

shoulder 4 and further advancement of the nut causes the rounded lower socket surface thereof to engage the heads 17 of the respective bits and they are thus clamped and rigidly secured between the shoulder 4 and the lower end 8 of the holding nut. In this position it is only necessary to rotate the casing A in any well-known manner. The shoe, as previously stated, is rigidly secured thereto so this is also rotated. The holding nut, is, of course, secured with relation to the shoe as it is screwed into the same, and as the plate 12 is secured against rotation with relation to the holding nut by being guided in the slots 10 and 11, it is obvious that a positive driving connection is formed between the casing, the shoe, the holding nut and the cutting bits, and that pressure of the holding nut on top of the head members of the bits is not necessarily depended upon to secure the bits with relation to the holding nut and shoe. The threads 3 and 7 connecting the holding nut and shoe, are, of course, reversed with relation to the rotation of the casing and shoe so that any twisting movement imparted to the holding nut through the cutting blades will merely tend to tighten the connection. The cutting blades remain in extended position until they become sufficiently dull to warrant resharpening or replacement. It is accordingly obvious that they must be removed.

This is accomplished by employing a tool operator of the character described in a co-pending application entitled "Oil well tool operator," filed December 3, 1923, Serial Number 678,371. This tool is lowered down through the well casing and is provided with a threaded extension which is screwed into the upper end of the holding nut in the opening 6. The blade in this opening is reversed to the blades 3 and 7 so that continued rotation of the tool after engagement has been made will cause the holding nut to be unscrewed with relation to the shoe. The bits are gradually retracted during this operation and finally assume the position shown in Fig. 1, when the holding nut is completely released. The holding nut, together with the bits, is then raised to the surface and sharpened or replaced and the new bits are then lowered and connected in the same manner. The operation of replacing or removing the bits is accomplished in a comparatively short interval of time. The advantages of so removing or replacing a bit of this character has already been explained in the patent previously referred to and it is thought an unnecessary repetition in this application.

The main features to be dwelled upon in this application are the shaping of the cutting blades which permit the individual bits to be materially reinforced and strengthened; the provision of the head members

whereby they may be rigidly clamped when in cutting position and the use of the plate 12 to support and rotate the bits. This plate, by the way, has a slight vertical movement with relation to the socket seat 8 on the lower end of the holding nut. This vertical motion is limited by a shoulder 16^a and the nut 16. This vertical movement is sufficient to release the head members 17 of the cutting bits with relation to the socket end 8 of the holding nut and thus permits free pivotal movement of the individual cutting bits when contracting or extending the same. Plate 12 might accordingly be referred to not only as a driving and supporting plate, but also as a floating plate due to its slight vertical movement within the holding nut. The washer F supporting the plate 12 is provided with a series of perforations as indicated at 30. These perforations permit circulating water to pass downwardly to the heads of the cutting bits. These heads are provided with a water discharge opening such as indicated by dotted lines at 31. Circulating water under pressure delivered to the upper end of the well casing travels down through the casing through the threaded opening 6 in the upper end of the holding nut, then through the perforations 30 in washer F and then passes down through the central passage 9 on the opposite sides of the plate E or 12 and finally discharges through the opening 31 against the flat faces 20 of the respective bits thus furnishing the water required for drilling and furthermore applying it at the point of greatest advantage.

While certain features of my invention have been more or less specifically described and illustrated I wish it understood that various changes may be resorted to within the scope of the appended claims. I also wish it understood that the material and finish of the several parts employed may be such as the experience and judgment of the manufacturer may dictate or various conditions may demand.

Having thus described my invention what I claim and desire to secure by Letters Patent is—

1. The combination with a well casing which is adapted to be rotated and having a shoe secured on its lower end of a holding nut adapted to be screwed into the shoe and secured therein, said nut being removable with relation to the shoe through the casing, a plate in the holding nut, a pair of cutting bits pivotally mounted on the plate and projecting from the lower end of the holding nut, said plate forming a driving connection between the nut and the bits, and means for automatically projecting or retracting the bits when the holding nut is screwed into the shoe or removed with relation thereto.

2. The combination with a well casing

which is adapted to be rotated and having a shoe secured on its lower end of a holding nut adapted to be screwed into the shoe and secured therein, said nut being removable with relation to the shoe through the casing, a plate in the holding nut, a pair of cutting bits pivotally mounted on the plate and projecting from the lower end of the holding nut, said plate forming a driving connection between the nut and the bits, and means on the cutting blade of each bit cooperating with the shoe to automatically project or retract the bits when the holding nut is screwed into the shoe or removed with relation thereto.

3. The combination with a well casing which is adapted to be rotated and having a shoe secured on its lower end of a holding nut adapted to be screwed into the shoe and secured therein, said nut being removable with relation to the shoe through the casing, a plate in the holding nut, a pair of cutting bits pivotally mounted on the plate and projecting from the lower end of the holding nut, said plate forming a driving connection between the nut and the bits, an annular shoulder near the lower end of the shoe, and a cam-shaped surface on the cutting blade of each bit engageable with the annular shoulder to automatically project or retract the bits when the holding nut is screwed into the shoe or removed with relation thereto.

4. The combination with a well casing which is adapted to be rotated and having a shoe secured on its lower end of a holding nut adapted to be screwed into the shoe and secured therein, said nut being removable with relation to the shoe through the casing, a plate in the holding nut, a pair of cutting bits pivotally mounted on the plate and projecting from the lower end of the holding nut, said plate forming a driving connection between the nut and the bits, a head member on each bit, an annular shoulder adjacent the lower end of the shoe and interior thereof adapted to form a support for the heads, said heads presenting a spherical surface, a spherical recess in the lower end of the holding nut engageable with the heads to clamp and secure them on the annular shoulder, and a cam-shaped surface on the cutting blade of each bit engageable with the annular shoulder in the shoe and adapted to be automatically projected or retracted when the holding nut is screwed into the shoe or removed with relation thereto.

5. The combination with a well casing which is adapted to be rotated and having a shoe secured on its lower end of a holding nut adapted to be screwed into the shoe and secured therein, said nut being removable with relation to the shoe through the casing, a plate in the holding nut, a pair of cutting bits pivotally mounted on the plate

and projecting from the lower end of the holding nut, said plate forming a driving connection between the nut and the bits, a head member on each bit, an annular shoulder adjacent the lower end of the shoe and interior thereof adapted to form a support for the heads, said heads presenting a spherical surface, a spherical recess in the lower end of the holding nut engageable with the heads to clamp and secure them on the annular shoulder, and a cam-shaped surface on the cutting blade of each bit engageable with the annular shoulder in the shoe and adapted to be automatically projected or retracted when the holding nut is screwed into the shoe or removed with relation thereto, and means permitting a limited vertical movement of the plate and the bits with relation to the holding nut.

6. The combination with a well casing which is adapted to be rotated and having a shoe secured on its lower end of a holding nut adapted to be screwed into the shoe and secured therein, said nut being removable with relation to the shoe through the casing, a pair of cutting bits pivotally supported by the holding nut, an annular shoulder adjacent the bottom of the shoe and interior thereof, a head member on each bit adapted to be received and supported by said annular shoulder, said heads presenting a spherical upper surface which is adapted to be engaged by the lower end of the holding nut to clamp and secure the heads on the annular shoulder, means permitting a limited vertical movement of the bits with relation to the holding nut, and means for automatically projecting or retracting the bits when the holding nut is screwed into the shoe or removed with relation thereto.

7. In a tool of the character described, a bit, consisting of two cutting blades, a head member on each blade, said head members having a shape substantially the same as a quarter section of a solid sphere.

8. In a tool of the character described a bit, consisting of two cutting blades, a head member on each blade, said head members having a shape substantially the same as a quarter section of a solid sphere, said blades being comparatively thin at their outer ends and being gradually and substantially thickened as they join the heads.

9. In a tool of the character described, a bit, consisting of two cutting blades, a head member on each blade, said head members having a shape substantially the same as a quarter section of a solid sphere, said blades being comparatively thin at their outer ends and being gradually and substantially thickened as they join the heads, said blades and heads having flat contacting surfaces, and a pin extending through the heads and forming a support and a pivot therefor.

10. In a tool of the character described, a bit, consisting of two cutting blades, a head member on each blade, said head members having a shape substantially the same as a quarter section of a solid sphere, said blades being comparatively thin at their outer ends and being gradually and substantially thickened as they join the heads, said blades and heads having flat contacting surfaces and said surfaces having a recess formed therein, a flat elongated plate extending downwardly between the heads and adapted to be received by said recesses, a pin extending through the heads and the plate and forming a pivotal connection between the heads and the plate, and a holding nut carrying the plate.

11. In a tool of the character described, a bit, consisting of two cutting blades, a head member on each blade, said head members having a shape substantially the same as a quarter section of a solid sphere, said blades being comparatively thin at their outer ends and being gradually and substantially thickened as they join the heads, said blades and heads having flat contacting surfaces, and said surfaces having a recess formed therein, a flat elongated plate extending downwardly between the heads and adapted to be received by said recesses, a pin extending through the heads and the plate and forming a pivotal connection between the heads and the plate, a holding nut, said nut having a slot formed in its lower end for the reception of the plate, said plate forming a driving connection between the nut and the heads of the bits and means permitting a limited vertical movement of the plate and the bits in the holding nut.

WINFIELD W. SMITH,
Administrator of Charles T. Dougherty,
Deceased.