

Nov. 18, 1924.

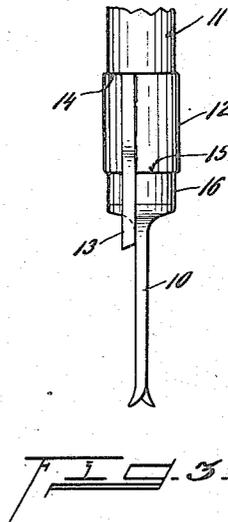
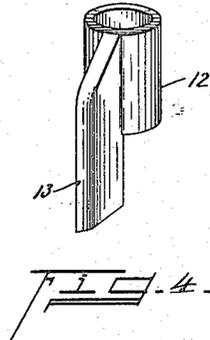
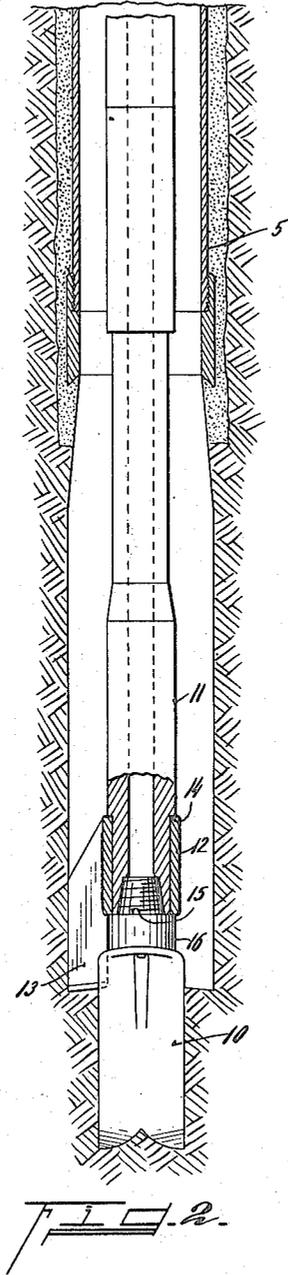
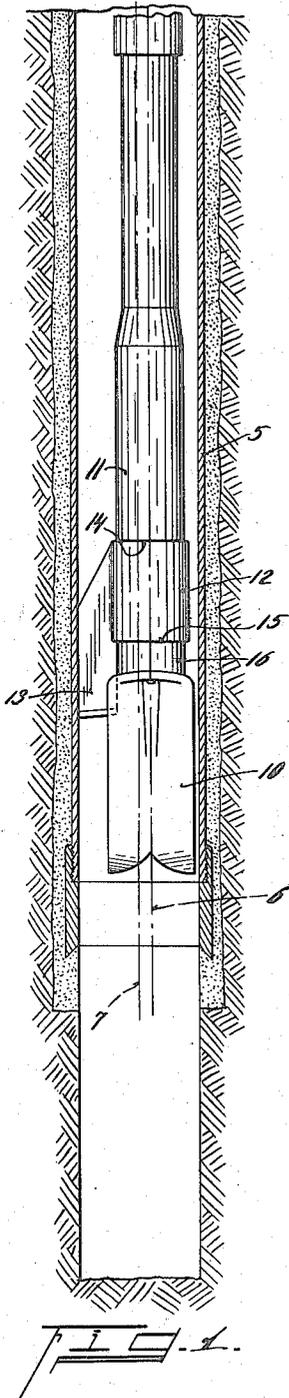
1,515,819

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ROTARY WELL DRILL

Filed Dec. 27, 1922

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

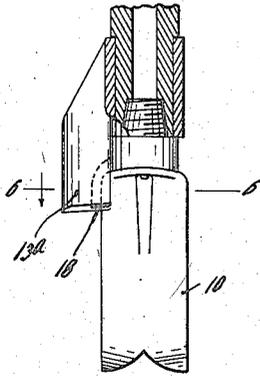


Fig. 5.

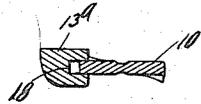


Fig. 6.

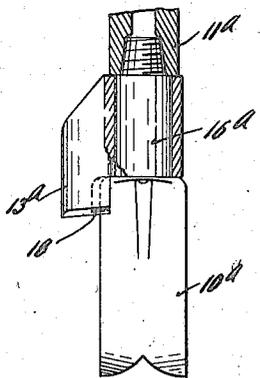


Fig. 7.

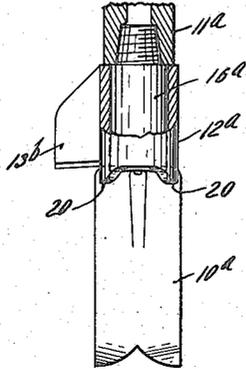


Fig. 8.

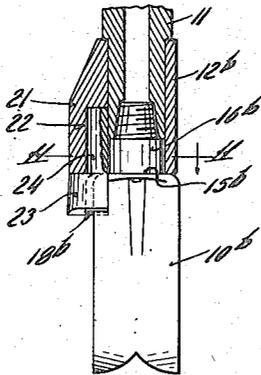


Fig. 9.

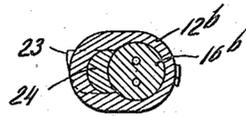


Fig. 10.

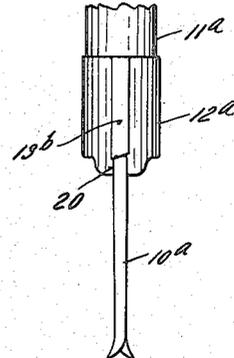


Fig. 11.

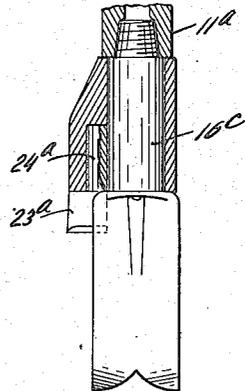


Fig. 12.

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# UNITED STATES PATENT OFFICE.

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## ROTARY WELL DRILL.

Application filed December 27, 1922. Serial No. 609,303.

*To all whom it may concern:*

Be it known that I, JOHN A. ZUBLIN, a citizen of the Republic of Switzerland, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Rotary Well Drill, of which the following is a specification.

This invention relates to rotary well drills, and is particularly directed to improvements in a rotary drill of the general type shown and described in my co-pending application Serial No. 600,840, titled "Means for forming a well bore," in which an eccentric non-collapsible rotary underreaming drill is provided and is lowered through a well casing and subsequently rotated to form an enlarged bore below the casing.

An object of the present invention is to provide a drill of the above character which is composed of separable units having a definite cooperating relation when assembled and adapted to be taken apart for the replacement or repair of any of said units.

Another object is to provide a drill having a central pilot bit and an eccentrically disposed reaming member, and in which the pilot bit may be a standard type of rotary well bit, with the reaming member positioned near the upper end of the pilot bit and adapted to engage therewith to maintain said reaming member in a definite position with relation to the pilot bit.

It is a further object to provide a reaming member which is adapted for use with pilot bits of various sizes.

Another object is to provide a holder to be associated with the pilot bit and having a removable reaming cutter positioned in definite relation to the pilot bit.

Another object is to provide a drill including a pilot bit adapted to be secured directly to a drill collar, and a reaming member near the upper end of the pilot bit and definitely positioned in relation thereto.

A further object is to provide a drill in which the reaming member and the pilot bit are separable to permit them to be constructed of different materials and to be separately tempered or otherwise treated.

Various other objects and advantages will be more fully apparent from the following description of the accompanying drawings which form a part of this disclosure, and which illustrate a preferred form of embodiment of the invention.

Of the drawings:

Figure 1 is a vertical section through the lower portion of a well bore showing a cemented casing and illustrating the method of lowering or raising the drill through the casing.

Figure 2 is a similar section showing the drill in position for forming an underreamed bore.

Figure 3 is a side elevation of the drill and lower end of the drill collar.

Figure 4 is a perspective view of the reaming member.

Figure 5 is an elevation, partly in section, showing a modified form of reaming member.

Figure 6 is a plan section on line 6—6 of Figure 5.

Figure 7 is a view similar to Figure 5, and showing the reaming member of Figure 5 as applied to a pilot bit having a long shank.

Figure 8 is a view similar to Figure 5, showing a further modified form of reaming member.

Figure 9 is a side elevation of Figure 8.

Figure 10 is a view showing a reaming member in the form of a holder carrying a removable reaming cutter.

Figure 11 is a plan section of line 11—11 of Figure 10.

Figure 12 is a view similar to Figure 10, showing the reaming member of Figure 10 as applied to a pilot bit having a long shank.

A drill of the general character herein referred to has particular utility in the forming an enlarged bore below the lower end of a string of casing, and of a diameter which is greater than the inside diameter of said casing so as to permit the lowering into said enlarged bore, of a second string of casing of the largest size which is capable of being lowered through the first casing string.

Heretofore many types of expansible tools have been proposed to accomplish these results, therefore for the purpose of accentuating one of the distinguishing features of a drill of the character to which this invention refers, attention is directed to the fact that such drill has no parts which expand or collapse and may properly be termed a non-collapsible rotary underreaming drill.

Referring particularly to Figures 1 to 4 of the drawings, the drill consists of a pilot bit shown as comprising a fishtail blade

which is directly connected to the lower end of a drill collar 11, and a reaming member 12 of a fixed boring radius carried near the upper end of the pilot bit and maintained  
 5 positioned in definite relation to the pilot bit, the reaming blade 13 of said member being eccentrically disposed to one side of the pilot bit, and the pilot bit and reaming blade being of a combined width permitting the  
 10 drill to be lowered through a casing below which it is to be operated.

As illustrated in Figure 1, the drill is lowered through the casing 5 with its axis, which is indicated by broken line 6, to one  
 15 side of or out of registry with the axis 7 of the casing.

In this manner it is possible to lower through the casing the non-collapsible drill which has a fixed boring radius greater than  
 20 the internal radius of the casing.

By subsequently rotating the drill there will be created a natural tendency for the drill to automatically center itself with the pilot bit in axial alignment with the axis of  
 25 the casing so that the reaming blade will effect an enlargement of the pilot bit bore.

When so centered the pilot bit blade 10 will bore a pilot hole in advance of the blade 13 and said blade will function to ream said  
 30 pilot hole to a diameter larger than the internal diameter of the casing (see Figure 2). One particular advantage of the pilot bit resides in the fact that it serves to positively guide the drill, and thereby prevent  
 35 side thrust to which the reaming blade may be subjected, from causing a transverse deflection of the drill.

In the drill shown in Figures 1 to 4 of the drawings, a standard type of fishtail bit is utilized as the pilot bit unit, and the reaming  
 40 member 12 is in the form of a sleeve positioned on a reduced lower portion of the drill collar 11, between the shoulder 14 formed by such reduced portion, and the  
 45 upper surface 15 of the shank 16 of the fishtail bit. The reaming blade 13 is in this instance formed integral with said sleeve and extends downwardly in front of the blade portion of the fishtail bit to be engaged and driven thereby in a drilling operation. Standard fishtail bits of different  
 50 widths all are provided with shanks 16 of uniform diameter and a standard size of tapered pin 17 adapted to be screwed into the lower end of the drill collar, so it will be evident that in the construction shown I may utilize fishtail bits of various widths, any of which will have an effective cooperation with the reaming member and drill collar in fulfillment of the purposes of the invention. It may be stated that the length of the reduced portion of the drill collar in relation to the height of the sleeve 12 is such as to insure the fishtail bit being  
 65 screwed up tightly on the drill collar.

Among the advantages incident to the above described construction is an interchangeability of parts contributing to a quick and easy replacement of worn or broken parts, and when several fishtail bits  
 70 of different widths and several reaming members of different boring radius are available, permitting the selective assembling of these to form a drill structure having the proper dimensions for the work to be performed.

Further this detachable unit structure will permit the reaming member being made of a different material than is the pilot bit, for instance the reaming member may be constructed of cast metal such as manganese  
 80 steel while the fishtail bit may be forged in the usual manner.

Another factor which enters largely into the advantages of this improved construction is that of the dressing and tempering  
 85 or otherwise treating the blades. If the reaming blade and fishtail pilot bit were made integral it would be quite difficult to temper one blade without drawing the temper from the other, therefore it is very advantageous to provide such a detachable structure as herein shown so that when the reaming blade is made of a forging requiring  
 90 redressing and tempering, said reaming blade and the fishtail pilot bit may each be separately dressed and tempered, or when the reaming blade be made of cast steel, the pilot bit alone may be separately dressed and tempered without affecting the cast reaming member.

The provision of a cast steel reaming member eliminates the necessity of redressing and tempering the reaming blade in the field and provides an inexpensive member which when worn may be discarded and a new reaming member substituted. This is very desirable from the standpoint of the saving of time in the field as well as from a manufacturing standpoint, first for the reason that only a few minutes will be required to replace a worn reaming blade with a new one, and second the providing of properly sharpened reaming blades is not dependent upon the individual ideas of tool dressers in the field.

In Figures 5 and 6 there is shown a construction in which the lower inner edge of the reaming blade 13<sup>a</sup> is longitudinally grooved as at 18 and engages upon opposite sides of the fishtail pilot bit.

The construction shown in Figure 7 is similar to that shown in Figures 5 and 6, excepting that in this instance the fishtail bit 10<sup>a</sup> has a shank 16<sup>a</sup> of sufficient length to entirely support the reaming member so that the drill collar 11<sup>a</sup> may be of the standard type, without a reduced portion.

Referring to Figures 8 and 9 the reaming member 13<sup>b</sup> has the lower edge of its sleeve portion notched on diametrically opposite  
 130

sides as at 20 to engage the upper edge of the fishtail blade, the reaming blade 13<sup>b</sup> in this instance being shorter than in the previous described constructions.

5 In Figures 10 and 11 there is shown a construction in which the shank 16<sup>b</sup> of the fishtail bit 10<sup>b</sup> is of the same diameter as the reduced portion of the drill collar and engaging both the shank 16<sup>b</sup> and the reduced  
10 portion of the drill collar 11 is a holder 12<sup>b</sup> of sleeve form, and which rests upon the surface 15<sup>b</sup> of the bit 10<sup>b</sup>. This holder has an offset portion 21 which has a semi-circular recess 22 extending upwardly from its  
15 lower surface and intersecting the bore of said holder.

A removable cutter blade 23 has a semi-circular shank 24 having its inner surface contoured to fit against the shank 16<sup>b</sup> of  
20 the fishtail bit and the reduced portion of the drill collar. The blade portion of the cutter 23 has its inner surface grooved as at 18<sup>b</sup> to engage upon opposite edges of the fishtail blade.

25 In Figure 12 the shank 16<sup>c</sup> is of sufficient length to entirely support the reaming blade holder so that in this instance a standard type of drill collar may be used, and the removable reaming cutter 23<sup>a</sup> is not  
30 grooved to embrace the fishtail blade but abuts the side of said blade in the same manner as does the blade 13 in Figures 1 to 4.

While the several forms of embodiment herein specifically disclosed are well adapted to fulfil the objects primarily stated it is  
35 to be understood that the invention is not to be limited in this regard, for it is susceptible of embodiment in various other forms, all coming within the scope of the  
40 following claims.

I claim:

1. A rotary well drill comprising a plurality of separable units including a drill collar, a concentric pilot bit, and an intermediate non-collapsible underreaming unit  
45 having an eccentrically disposed cutter element of a boring radius greater than that of the pilot bit and rotatable by engagement therewith.

50 2. A rotary well drill comprising a plurality of separable units including a drill collar, a concentric pilot bit, and an intermediate non-collapsible underreaming unit having a cooperating engagement with the  
55 bit whereby the bit upon rotation will drive said underreaming unit, said underreaming unit having an eccentrically disposed cutter element extending laterally beyond the bit.

3. A rotary well drill comprising a drill collar, a concentric pilot bit detachably secured at the lower end of said collar, and a reaming unit detachably supported at the lower end of the drill collar in axial alignment with the pilot bit and having an eccentrically disposed cutter element of a boring  
60 radius greater than that of the pilot bit and rotatable by engagement therewith.

4. A rotary well drill comprising a drill collar, a concentric pilot bit detachably secured upon the lower end of said collar, and a non-collapsible underreaming unit  
70 mounted between the pilot bit and said drill collar, and having an eccentrically disposed cutter element laterally extended beyond the bit, a part of said underreaming unit being engageable by said bit to insure a simultaneous rotation of both.

5. A rotary well drill comprising a drill collar, a concentric pilot bit detachably secured to the lower end of said collar, and a non-collapsible eccentric underreaming  
80 member detachably supported at the upper end of the pilot bit and having a driving engagement therewith defining the circular disposition of the underreaming member relative to the pilot bit.

6. A rotary well drill comprising a concentric pilot bit formed for attachment to a drill collar, and a non-collapsible underreaming unit detachably associated with the  
90 bit and having an eccentrically disposed cutter element extending laterally beyond the bit, said unit being engageable directly by said bit to insure their simultaneous rotation.

7. A non-collapsible underreaming unit for a rotary well drill comprising a member adapted to be supported in engagement with both a drill collar and a concentric boring  
100 bit and having a reaming cutter eccentrically disposed relative to the axis of the bit, said unit being provided with means for direct engagement by said bit whereby a rotation of the bit will effect a rotation of said unit.

8. A rotary well drill comprising a concentric pilot bit adapted for attachment to a drill collar, and a non-collapsible underreamer unit including a holder engaged by both of said members and carrying an underreaming cutter rotatable directly by a blade  
110 of said pilot bit.

Signed at Los Angeles, California, this 20th day of December 1922.

JOHN A. ZUBLIN.