June 11, 1940. T. H. STANCLIFF 2,203,846

DRILL

Filed Dec. 13, 1938 2 Sheets-Sheet 1

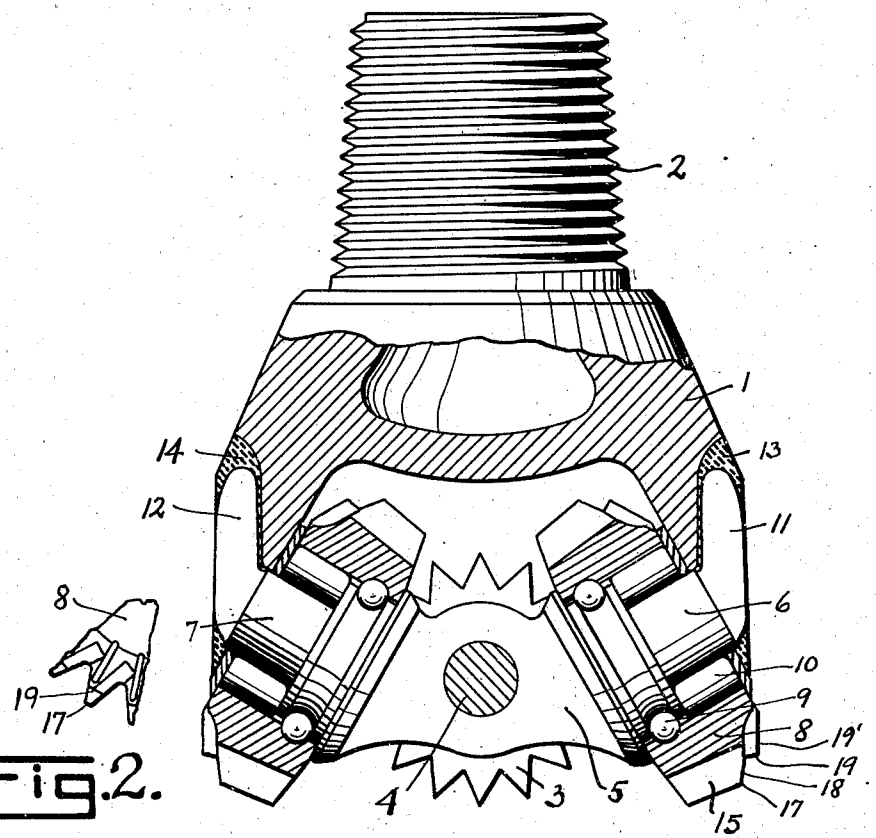


Fig. 2.

Fig. 1.

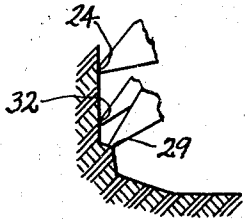


Fig. 3.

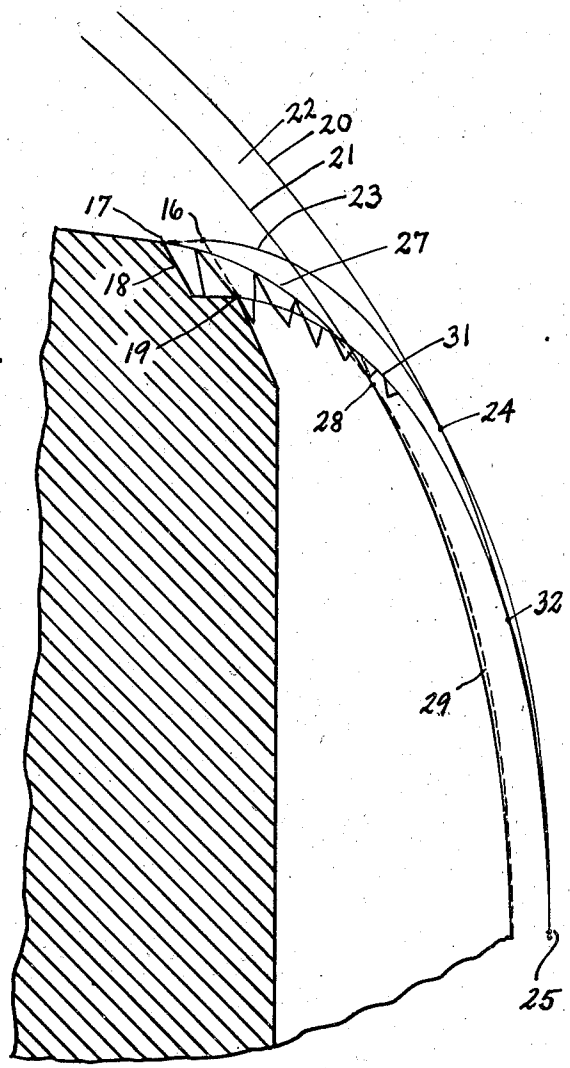
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Fig.4.



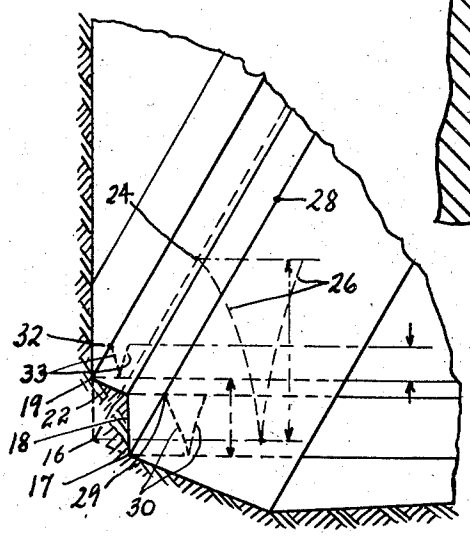


Fig.5.

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Patented June 11, 1940 2,203,846

UNITED STATES PATENT OFFICE

2,203,846

DRILL

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Application December 13, 1938, Serial No. 245,380

2 Claims. (Cl. 255—71)

This invention relates to deep well drilling apparatus, and specifically to bits.

Although not limited thereto it will be found particularly useful in rock bits of the roller type. In bits of that type the diameter of the hole is determined by the so-called side rollers which are customarily mounted to rotate about axes extending downwardly and inwardly toward the center of the bit. In the past these side roller cutters have been formed with cutting teeth which come to a sharp corner adjacent the outermost portion of the cutter which is adapted to cut at the bottom of the hole and determine the gauge or diameter of the hole. In such an arrangement, where the diameter of the side cutters has been made such that it will stand up under the strains of operation, the portions of the cutters which determine the gauge of the hole, namely the outermost corners of the teeth on the cutter, will actually form a hole of larger radius than the distance from the axis of the bit to this outer corner of the cutter teeth when the cutter teeth are in their lowermost position. This is because as the cutter rolls around the bottom of the hole these outer corners of the cutter teeth will not only come in contact with the formation at the bottom of the hole but will scrape along the sides of the hole before reaching the bottom and will dig out the formation at the sides of the hole to a diameter larger than the bottom of the hole. This will be appreciated from the fact that if a cylindrical cutter be rolled about a vertical axis about the inside of a vertical cylindrical hole a true rolling action will take place but if the same cutter be rotated about a horizontal axis and made to traverse the bottom of a hole its outer cutting teeth will constantly be digging into the wall of the hole. This digging in action becomes less and less as the cutter axis is tilted toward the vertical but where it is tilted only part way as in the case of the usual side roller cutter, and the diameter of this cutter is kept large, as it preferably is for purposes of structural strength, et cetera, these teeth will still dig in to a more or less extent. This digging in action tends to quickly wear away the outer portions of these teeth and thus spoil that portion of the bit which determines the gauge of the bore hole being formed. This naturally necessitates frequent replacement of the bits simply because of the action of the cutter in scraping the hole to a larger diameter than is desired in the finished hole.

It is, therefore, an object of this invention to provide a bit which will give longer wear than those heretofore used.

It is a further object of this invention to provide a bit which will be capable of maintaining the gauge of a hole over a longer period of use than bits heretofore employed.

Another object of this invention is to provide a bit which will eliminate to a large extent the unnecessary scraping of the sides of the hole during the operation of the bit.

Other objects will hereinafter appear.

Referring now to the drawings:

Fig. 1 illustrates a bit constructed in accordance with this invention, the same being shown partly in vertical cross section for the purpose of illustration.

Fig. 2 is a fragmentary side elevation of one of the side cutters forming part of the bit shown in Fig. 1.

Fig. 3 is a diagrammatic illustration for the purpose of comparing the amount of side wall scraping done by various types of side cutter teeth.

Fig. 4 is a diagrammatic illustration showing a plan view of the bottom of a hole and the paths taken by cutter teeth of various shapes shown with reference to the side walls of the hole.

Fig. 5 is a diagrammatic vertical cross section of a portion of the bottom of a well being cut by a bit constructed in accordance with this invention and illustrating the scraping action of various portions of the teeth carried thereby.

Referring now more specifically to the drawings, the numeral 1 indicates the usual bit head having a threaded upper end 2 adapted to receive a drill collar on the lower end of a drill stem, and the numeral 3 indicates the usual cross roller cutter employed in this type of bit. These cross roller cutters are rotatably mounted upon a shaft 4, the central portion of which is in part supported by means of a bridge 5. This bridge 5 has oppositely disposed upwardly and outwardly inclined bearing portions 6 and 7 adapted to rotatably mount the side roller cutters 8. Suitable ball and roller bearings 9 and 10, respectively, may be employed within these cutters. On the opposite ends of the bridge 5 there are provided upstanding lugs 11 and 12 which are welded or otherwise secured as at 13 and 14 to the body of the bit.

As is well known, the cross roller cutters 3 are adapted to cut the central portion of the bottom of the hole while the side roller cutters are adapted to cut the outer portion of the bottom of the hole and determine the gauge or diameter

of the hole. Heretofore it has been customary for the teeth 15 of these cutters to extend outwardly to a sharp corner, as shown in dotted lines at 16 in Fig. 5, and then upwardly along the outside of the cutter. In accordance with this invention, the teeth 15 are terminated at a point 17 short of the gauge size of the hole and extended upwardly as at 18 at this point. Then a second outward extension is provided to a second corner 19 and the teeth extended upwardly therefrom along the line 19' to provide the gauge cutting portions of the cutter.

Referring now to Figs. 3 and 4, there has been illustrated a comparison between the amount of scraping done by the two corner portions 17 and 19 of the cutter teeth provided by this invention and the amount of scraping which would be done by the old form of cutter extending to a single sharp corner 16 to determine the gauge size of the bit. In Fig. 4 the numeral 20 designates the outer wall of the hole which is to be formed while the numeral 21 designates the edge of the shoulder 22 which would be formed by the cutting parts 17 and 19 around the bottom of the hole.

Now, if the cutter teeth be extended to a single sharp corner 16, Fig. 5, these corners will lie along the line 23 which takes the form of an ellipse when viewed from above as shown in Fig. 4. This ellipse would intersect the line 20 which indicates the outside wall of the hole beginning at the point 24 and extending to the point 25 where the cutter is in contact with the bottom of the hole. Referring to Fig. 5, it will be seen that the vertical distance between the point 24 and the bottom of the hole for a given size of hole and cutter will be, for example, three quarters of an inch. Still referring to Fig. 5, the path which this point on the cutter would take in moving to the bottom of the hole and up again would be substantially along the dotted lines 26, and throughout this entire distance along the dotted line 26 the tooth corner 16 would be scraping into and digging into the side wall of the hole, thus making the hole larger than desired and wearing out the cutting gauge determining corner of the cutter tooth.

Now, with a cutter formed according to this invention, the tooth corner 17 would move downwardly along the line 27 crossing the line 21 which indicates the size of the hole that this portion of the cutter will cut at the bottom at the point 28. The shoulder which is formed by this type of cutter, however, is for the size of the path and hole taken by way of example only one quarter of an inch, whereas the point 28, as shown in Fig. 5, is more than three quarters of an inch above the bottom of the hole. Therefore, the scraping of the tooth corner 17 will not begin until this tooth corner moves downwardly to the upper end of the shoulder at which time it will begin scraping and will scrape a distance equal to the height of the shoulder or, in other words, from the point 29 downwardly along the dotted line 30 and back again, the point 29 being not more than one quarter of an inch from the bottom of the hole.

Now, the tooth corners 19 will lie along the line 31 in Fig. 4 and will be in contact with the side wall of the larger hole which they are cutting, beginning at the point 32. It will be readily seen, however, that the overlapping between the point 32 and the point 25 is very slight so that these teeth although they will scrape from the point 32 to the point 25 will not dig in an appreciable amount and will not cause an appreciable enlargement of the hole. By the same token, they will not be greatly worn by the scraping action. Furthermore, referring to Fig. 5, a tooth at the point 32 will move downwardly along the dotted line 33 and back again and this line will represent the entire scraping action of the corner 19 on one tooth. The vertical distance between the point 32 and the top of the shoulder where the line 33 terminates is only one eighth of an inch in the size of the bit being used for an example.

Thus, by this invention it will be seen that instead of having a scraping action for a vertical distance of three quarters of an inch for each tooth in a given size of bit (9''), which scraping action will all be done by the gauge maintaining portion of the cutters, a bit has been produced having two cutting parts, one of which will scrape only one quarter of an inch and the other, which is the gauge maintaining part, will scrape only one eighth of an inch. This makes a total of three eighths of an inch scraping action in a vertical direction instead of the three quarters of an inch which would be present in a conventional type of bit. In addition to the reduction in the total amount of the scraping action, it will be seen that almost all of this scraping action is taken by a part of the bit which does not serve to maintain the gauge of the hole. The gauge maintaining part of the bit will for this reason wear much longer and the life of the bit as a whole will be accordingly increased. The wear of this gauge maintaining part of the bit will be still further decreased by the fact that although this part scrapes for a vertical distance of one eighth of an inch, this scraping does not dig deeply into the side wall of the hole but digs only a relatively inconsequential amount.

From the foregoing it will be seen that a means has been provided which will greatly reduce the wear taking place upon the cutting teeth of drilling bits of the type to which this invention relates, without in any way making it necessary to reduce the size or effectiveness of the cutting parts or to alter the disposition of the cutters with respect to each other in any way which might reduce the efficiency of the bit as a cutting or digging implement. Means has also been provided for carrying out all of the other objects and advantages sought by this invention.

Having described my invention, I claim:

1. A drill bit including a side roller cutter, said cutter having cutting portions thereon adapted to cut the outer annular portion of a hole being drilled of slightly less than the desired gauge, and other cutting portions on the same cutter outwardly of and stepped upwardly from said first cutting portions adapted to cut at a higher level than said first cutting portions to enlarge said smaller hole to the desired gauge.

2. A drill bit including a cutter thereon mounted for rotation about an axis at an angle with respect to the axis of the bit and to cut the bottom and side of the hole being drilled, said cutter having a cutting part of greater radius adapted to cut a path at the bottom of the hole of less diameter than the diameter of the hole desired, and a second cutting part of less radius disposed outwardly of and non-continuous with said first cutting part adapted to enlarge said hole to the desired gauge.

THOMAS H. STANCLIFF.