June 4, 1940. M. HOKANSON 2,203,216

DRILL BIT

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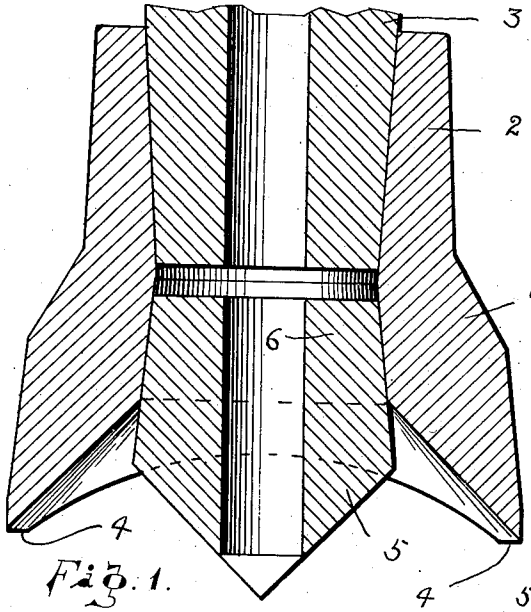


Fig. 1.

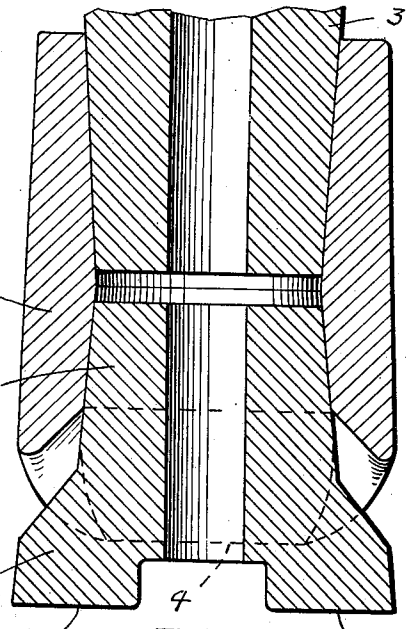


Fig. 2.

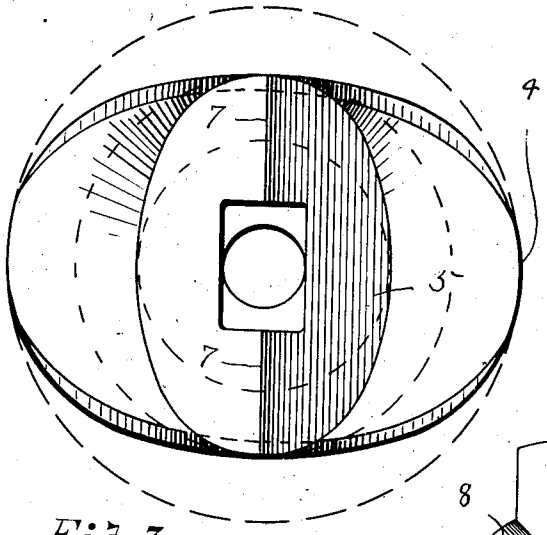


Fig. 3.

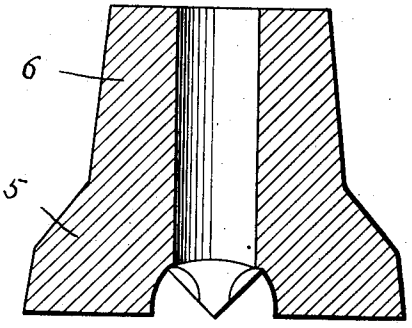


Fig. 4.

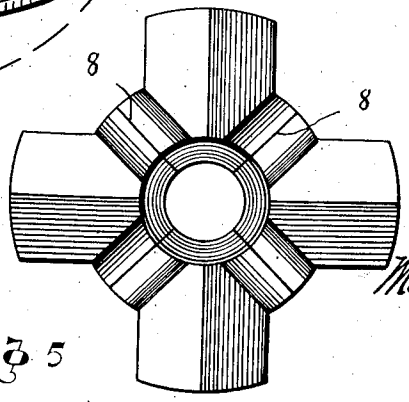


Fig 5

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DRILL BIT

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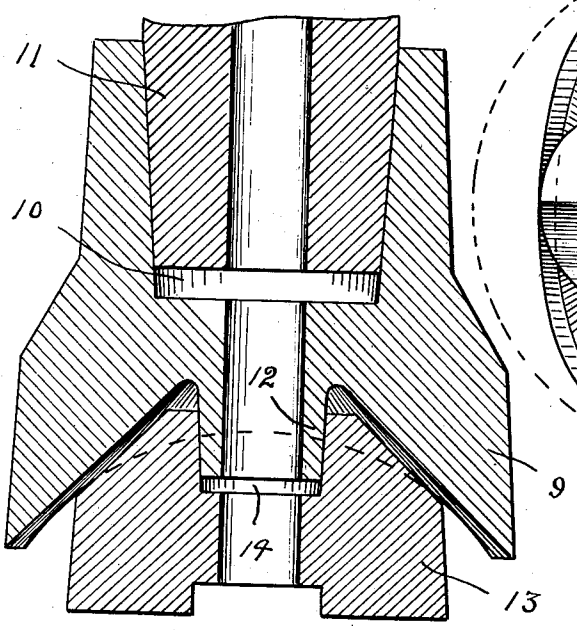


Fig. 6.

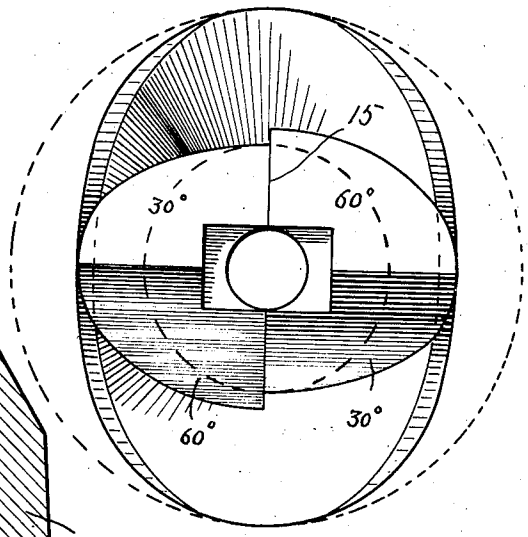


Fig. 8.

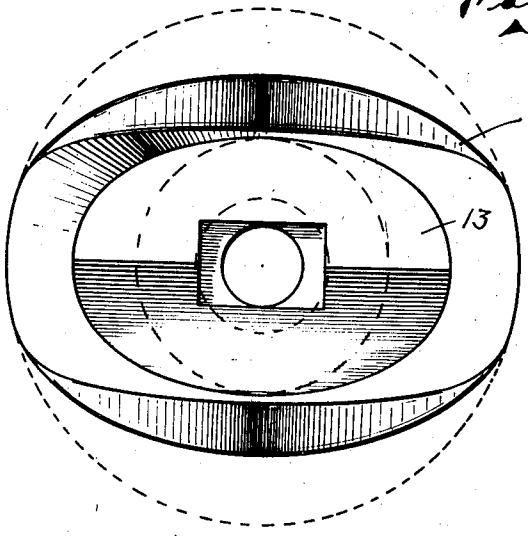


Fig. 7.

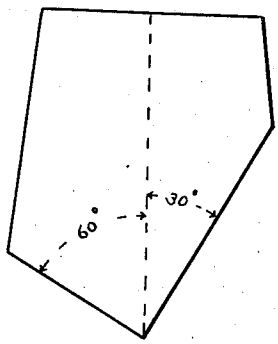


Fig. 9.

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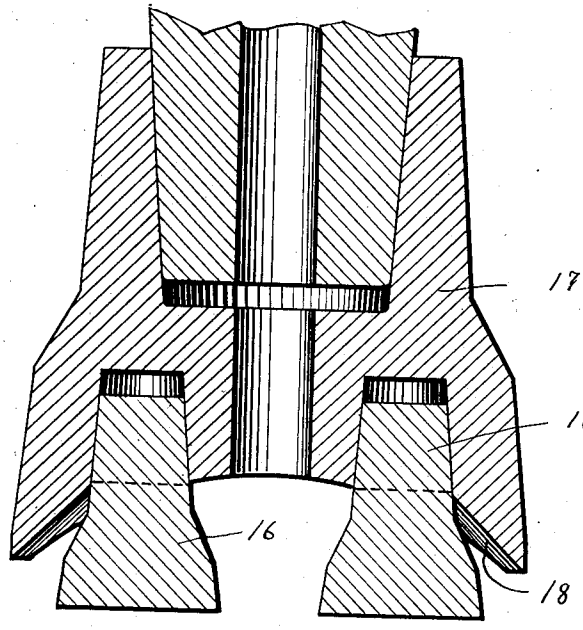


Fig. 10.

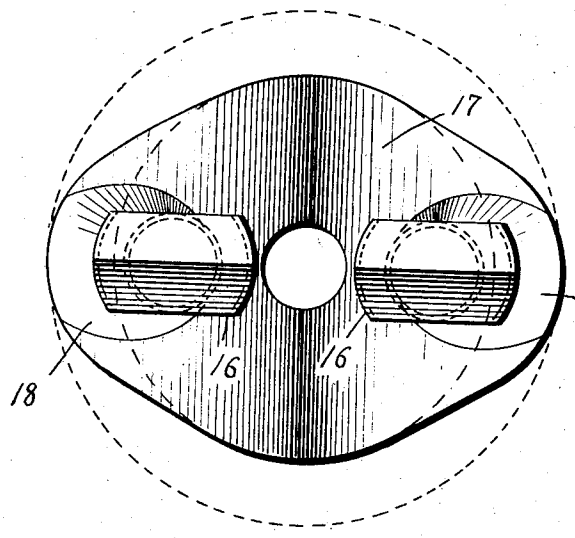


Fig. 11.

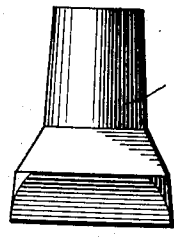


Fig. 12.

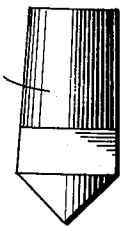


Fig. 13.

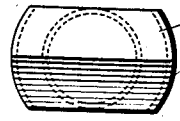


Fig. 14.

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DRILL BIT

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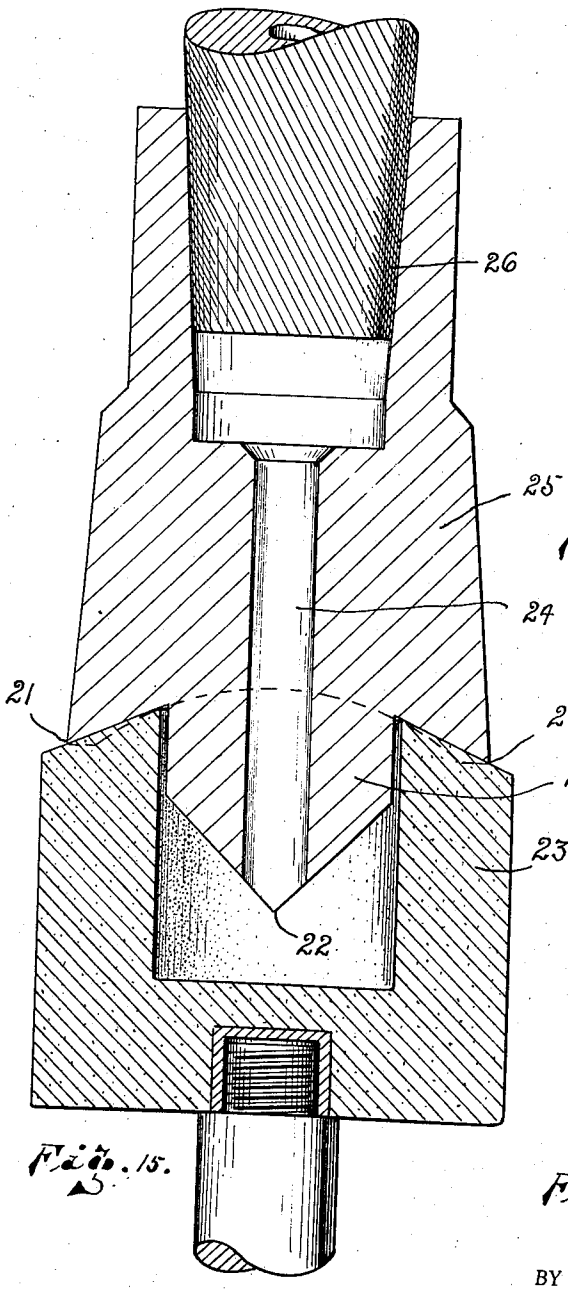


Fig. 15.

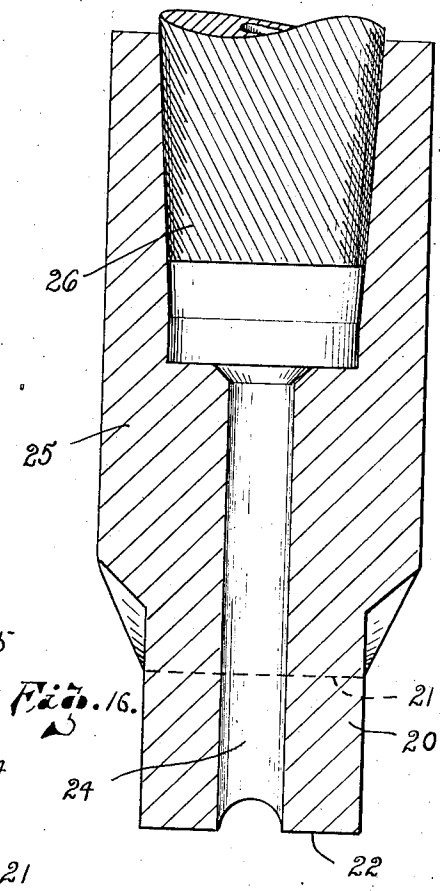


Fig. 16.

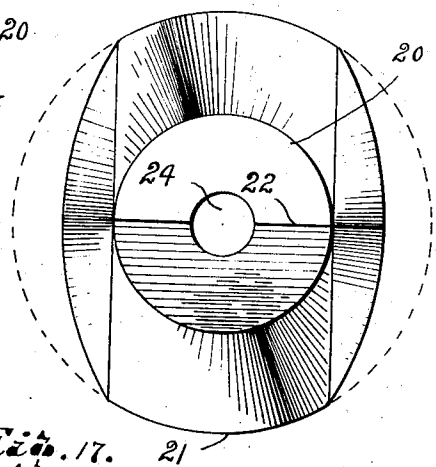


Fig. 17.

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Patented June 4, 1940 2,203,216

UNITED STATES PATENT OFFICE

2,203,216

DRILL BIT

Martin Hokanson, Duluth, Minn., assignor to Eidco, Incorporated, Duluth, Minn., a corporation of Minnesota

Application January 18, 1939, Serial No. 251,630

9 Claims. (Cl. 255—64)

This invention relates to percussion drills, and this application is a continuation-in-part of my copending application Ser. No. 145,726, filed June 1, 1937.

The principal object or novelty of the invention is that the bit has inherent flexibility and which may be modified to suit the specific characteristics or quality of the material drilled in, and for which purpose it is preferably formed of a plurality of separable parts, resulting in the following novel and advantageous features:

1. Increased speed in drilling.
2. Decreased gauge loss.
3. Less work involved in resharpening.
4. Greater number of resharpenings.
5. More durable.
6. Less expensive to use, because any part that wears faster than another part can be replaced when worn at less cost than the cost of a regular bit.
7. Perfect reaming quality, thus drilling a perfect hole.
8. Reaming and cutting edges are separate and independent of each other and can be regulated independently of each other to suit the need of the particular drilling problem at hand.
9. The length of the cutting edge can be regulated without affecting the gauge of the bit.
10. The cutting edge can be made to cut ahead of, in the same plane with, or follow the reaming edge of the bit, by merely changing the length of the auxiliary portion of the bit.

Another object is to provide a novel method of sharpening the improved bit.

Other objects and advantages of the invention will appear in the following description thereof.

Referring now to the accompanying drawings, forming part of this application, and wherein like reference characters indicate like parts:

Figure 1 is a central vertical section of a bit head embodying the invention.

Figure 2 is a similar view taken at right angles to Figure 1.

Figure 3 is a plan view of the cutting face of the bit illustrated in Figures 1 and 2.

Figure 4 is a central vertical section of a modified form of auxiliary portion of the bit, and is illustrative of a common cross-bit.

Figure 5 is a face view of Figure 4, illustrating how such an auxiliary cutting portion of the bit head may be made in separable sections.

Figure 6 is a central vertical section of a modified form of separable bit.

Figure 7 is a plan view of the cutting face of the bit shown in Figure 6.

Figure 8 is a plan view of the cutting face of a bit such as shown in Figures 1, 2, and 3 but with the auxiliary portion thereof made in two separable halves.

Figure 9 is an elevation of one of the divisions of the auxiliary portions as viewed on the plane of its division.

Figure 10 is a central vertical sectional view of a modified form of the invention showing a plurality of auxiliary bits.

Figure 11 is a face view of the cutting edge of Figure 10.

Figure 12 is an elevation of one of the auxiliary members.

Figure 13 is a similar view at right angles to Figure 12.

Figure 14 is a plan view of the cutting face of the member shown in Figure 12.

Figure 15 is a central vertical section of a still further modified form of bit, particularly in respect to that type illustrated in Figure 6, and showing a sharpening wheel as applied thereto.

Figure 16 is a similar view of the bit taken at right angles to Figure 15.

Figure 17 is a plan view of the cutting face of the bit illustrated in Figures 15 and 16.

In Figures 1, 2 and 3, the body portion of the bit head is shown at 1, it being hollow and having an axial bore entirely therethrough, said bore being tapered from opposite ends and decreasing in diameter from the ends to the center, and said bit head having a substantially cylindrical shank portion 2 formed integral therewith, and the tapered bore therein being for reception of the correspondingly tapered end of the bit rod 3. The lower end of the bit head, opposite to the shank portion, is enlarged on opposite sides as indicated in Figure 1, and flattened upon the diametrically opposite sides, as will be apparent from Figures 2 and 3. Axially disposed within this enlarged end of the bit head is a depression, preferably conical in shape, the walls of which depression extend inwardly to the axial tapered bore and outwardly to the outer walls of the enlargements, and which results in a pair of opposite arcuate reaming cutting edges indicated at 4 which lie in the same circle and in the same plane at right angles to the longitudinal axis of the bit. Any form of depression which will produce this result, whether it be conical, spherical, or otherwise, will suffice. Obviously the depression, being formed in the end of the bit which is flattened on opposite sides, results in the lower end of the flattened sides being cut away arcuately on an axis which

is at right angles to the bit axis, as is apparent from Figure 1 of the drawings.

Within the tapered bore of the enlarged end of the bit head is installed the auxiliary cutter portion 5 of the bit, it having a shank which is correspondingly tapered and frictionally held within the bore. This cutter portion projects from the bit head within the depression and beyond the plane of the reaming edges and terminates in opposed straight cutting edges 7—7 formed by plane surfaces intersecting each other at right angles, and leads in the cutting operation. In plan view this cutter portion 5 of the bit head is illustrated as being of generally elliptical shape, although this is not essential.

In Figure 5 I have illustrated a plan view of a cross-bit type of removable auxiliary portion of bit head and in this instance having illustrated the same as being composed of four like or similar portions, divided as on the radially disposed lines 8, and it will be obvious that the cutting edges may be installed within the socket in any relation to each other as for instance they may be all in one plane at right angles to the axis of the bit or any opposed two of these portions may be installed within the socket so that they will lead in the cutting operation, while the remaining two portions follow, etc. However, when these portions are nested together with their shank portions registering they will fit within the socket in the outer portion of the bit, as a solid unit. In this connection I wish to call attention to the convenience in such a compound bit of removal of the auxiliary cutting portion. For example when the compound bit head is removed from the rod 3, access is readily had through the tapered bore of the outer portion for driving the auxiliary cutter from its socket either for sharpening, renewal, or adjustment as desired.

It is obvious that such a compound bit as herein illustrated and described is in no respect confined to the specific form of the cutting edges here illustrated or to any particular kind of bit, as the advantages of such a novel compound bit in adapting it to specific kinds of drilling are obvious.

In Figure 6 is illustrated a modified form of separable bit, the outermost or major portion of which, indicated at 9, is shown as provided with the tapered friction socket 10 for reception of the similarly tapered terminal 11 of the bit rod, and which major portion in its drilling effect is similar to that shown in Figure 1 of the drawings in that it forms the reaming portion of the bit, and, in this instance, is provided with an externally tapered axial plug 12 for reception of the auxiliary portion 13, it being provided with a similarly tapered socket 14 for frictional engagement externally of the plug 12, as illustrated. It is obvious, of course, that these tapered frictional connections as here illustrated, may be the common screw threaded connections, without departing from the spirit of the invention. And it is also obvious that while I have illustrated the auxiliary portion 13 of the bit as of the chisel type, that a cross, rose, or any type of bit may be used with equally good results.

In Figure 8 is illustrated a slightly modified form of auxiliary portion of the bit in that it is made of two separable halves divided upon the line 15; this being to illustrate how, if so desired, the two different halves of the auxiliary portion may have unequal angles of the cutting edge, as more clearly illustrated in Figure 9. In all of the views it will be noted that the cutting edge of the bit is formed by the intersection of plane surfaces at right angles to each other, but in Figures 8 and 9 it will be noted that the cutting edge is formed by the intersection of plane surfaces one of which is 30° from the plane of the axis of the bit, and the other 60° therefrom, and this would bring the direction of the blow, as far as cutting is concerned, 15° off from the vertical. This is quite an advantage so far as wear on the bit is concerned when the functioning of the bit in drilling is considered, in that the bit is subjected not only to vertical blows but also to rotation as well, and therefore the cutting edge strikes the surface to be cut on an angle that may be around 45° with the vertical. Consequently with the bit sharpened as in Figure 9 there has been eliminated some of the wear and introduced more cutting of the cutting edge. Now, if we want the cutting edge of the bit to be formed of unequal angles, as above described, it has to be different on one side of the center of the bit than on the other, and therefore the auxiliary bit is formed in two halves at right angles to the cutting edge and along its longitudinal axis, providing two pieces just alike, simpler to manufacture, simpler to grind, and lending themselves perfectly to mechanical arrangements of grinding. The two pieces when driven in the bit will make just as solid a connection as if they were of one piece, and if it should be desired that one side lead or work ahead of the other side all that is necessary is to drive them in a little unevenly. This arrangement of cutting edges is also applicable to the bit shown in Figure 5.

In Figure 10 is illustrated a bit having two opposed auxiliary members 16 frictionally held within the major member 17, and it is obvious that there may be any desired number of such auxiliary members depending largely upon the size of the bit being used, and may be of chisel, cross, rose or any other type and so installed as to lead in the cutting operation or follow in respect to the reaming portion of the bit as desired. In this modification I have shown the reaming edge as being slightly different in form from that of the other embodiments of the invention.

Thus I have provided a bit wherein consideration is given to the fact that the reaming and the cutting work performed by the bit are two separate functions thereof, and, as a consequence, the bits thus far described are provided with reaming and cutting edges which are separate and distinct from one another and therefore adjustable in relation to each other to suit the need of the particular drilling problem at hand. For instance it may be desired for a particular drilling operation that the reaming edges of the bit rotate in immediate advance of the cutting edge when drilling. In Figure 3 it will be noticed that the two elliptical portions of the bit have their longest diameters at right angles to each other, and therefore the cutting edge is exactly midway between the reaming edges as the bit rotated in drilling. Thus, if, as before stated, it is desired that the reaming edge rotate immediately in advance of the cutting edge, the cutting edge could be loosened and rotated upon its axis, or within the socket, anticlockwise about 45°, there tightened, and thus provide a bit to meet the needs of this particular drilling problem. If, however, there is a question of the efficient and quick discharge of the material cut, it may be found that the reaming edge should follow the cutting edge, in which event the cutting edge would be rotated clockwise in its socket about

45°, and there tightened. It is thus apparent that the drilling operator is provided with a bit having heretofore unheard of flexibility, making research possible for any drilling problem, and with the consequent lessening of the cost thereof.

In Figures 15, 16 and 17 is illustrated a type of bit, comprising a body portion **25**, attached at one end to a drill rod indicated at **26**, said bit embodying a somewhat modified form to that shown in Figure 6 of the drawings, and wherein the axial portion **20** thereof is extended beyond the plane of the reaming edges **21** forming the integral central cutting portion, and the straight cutting edge **22** of which is preferably only in length equal to the distance transverse the opposed corners of one of the reaming edges **21**, this being particularly convenient in sharpening said reaming edges with a hollow conical grinding wheel such as illustrated at **23**.

It is to be noted that the axially disposed cutter **20** is of straight cylindrical form which is of advantage in maintaining the sturdiest possible cutting edge of that portion of the bit, it being well known that where such a chisel shaped bit is formed with the side walls tapered inwardly, the arcuate edges adjacent the corners of such chisel shaped bit do not support the corners of the cutting edge in an equally efficient manner and permits of greater grinding area of the hollow conically shaped grinder for the reaming edges.

This integral form of head obviously provides means for modifications in the discharge of fluid to remove the bit cuttings, in that such discharge may consist of the axial hole **24** through the central cutter or it may consist of a plurality of diagonal openings, such as indicated at **25**, bringing the discharge of the fluid, whatever it may be, well above the danger zone of plugging, which, normally occurs under some instances in drilling.

It is to be noted too that while I have illustrated in all of the accompanying drawings that form of uniting the separable parts of the bit and operating rod as employing tapered friction joint connections, it is to be understood that other forms of connecting said parts may be resorted to without departing from the spirit of the invention.

Furthermore it will be noticed in the several views that the cutting edge is working deeper in the hole drilled than the reaming edges, and also that the length of the cutting edge is not as long as the diameter of the hole drilled. This increases the speed of cutting since a smaller bit cuts faster than a larger one of the same design, all things being equal. So that with this arrangement we are cutting a hole of smaller diameter than desired and then reaming the hole to size with the reaming edges. Thus the reaming edges do more than merely ream the hole, but since the cutting edge is working in a plane lower than the plane of the reaming edges, the latter are breaking loose the outside ring not covered by the cutting edge, but which gives way easily as soon as the reaming edge starts to penetrate. There is much less work connected with reaming this outer part than would be required to cut the hole to its full diameter in the first instance.

It is also conceivable that in certain kinds of material drilled in, it may be desirable to have the reaming edge lead in the drilling, and, if so, the drill operator would simply remove the central cutting portion and replace it with one shorter in axial length so that when installed the cutting face thereof would not reach to the same plane as that of the reaming edge. In this type of bit the reaming edge is cutting a depression all around the perifery of the hole, leaving a central core which is cut by the cutting edge and as a result it breaks up in larger pieces on account of the cut on the perifery which results in faster cutting.

It is apparent that in all of the modifications illustrated, the inner wall of the cutting edge of the reaming portion is formed by the walls of a conical depression within the face of the bit, this being true even where a plurality of removable auxiliary bits are employed, as in Figures 10 and 11, such conical depressions being illustrated at **18** in these figures, the axis of said cones being coincident with the axis of the removable bits. This as is obvious provides most convenient means for resharpening the inside of the cones by the use of a cone shaped grinder.

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

1. A drill bit consisting of a hollow head flattened on opposite sides, the outermost lower portions of which are formed with a pair of cutting edges lying substantially in the same circle, and a central removable cutting portion having a cutting edge extendable entirely across from one of the flattened sides to the other.

2. A drill bit consisting of a hollow head flattened on opposite sides, the outermost portions of which are formed with a pair of arcuate cutting edges lying in the same circuit, a conical depression intermediate of said cutting edges, and a cutting portion removably installed within said depression and having a cutting edge less in length than the distance between said arcuate cutting edges.

3. A drill bit consisting of a unitary conically concaved head portion flattened upon two opposite sides and the other more remote opposite sides being formed with substantially V-shaped arcuate cutting edges lying in the same plane, and a removable auxiliary cutting portion mounted within the concavity of said head portion.

4. A drill bit consisting of a unitary concaved head portion flattened upon two opposite sides to provide clearance for the bit cuttings, with the other more remote opposite sides being formed with arcuate cutting edges, said edges being formed by a conical depression in said concavity, and a removable auxiliary cutting portion mounted within said conical depression.

5. A drill bit consisting of a unitary hollow head portion flattened on opposite sides and having a conical depression therein forming the outermost portions of said head into diametrically opposite arcuate reaming edges lying in the same circle, and a cutter portion removably installed axially within said conical depression.

6. A drill bit consisting of a unitary hollow head portion comprising a substantially cylindrical shank with an enlargement upon two opposite sides adjacent the working face of the bit, a conical depression within said bit, the opposite walls of said depression extending to and intersecting the outer walls of said enlargement and resulting in a pair of opposite arcuate cutting edges lying in the same circle and in a plane at right angles to the bit axis and the other opposite walls of said depression being arcuately cut-away on an axis at right angles to said bit

axis, and a cutting portion projecting from said depression.

7. A drill bit consisting of a hollow head flattened upon opposite sides, a conical depression within one end of said head resulting in the outermost lower portions thereof being formed with a pair of cutting edges lying in substantially the same circle and the opposite flattened sides being cut-away to provide clearance for the bit cuttings, and a cutting portion having a cutting edge extending in a direction from one flattened side to the other.

8. A drill bit consisting of a relatively short unitary hollow head portion comprising a substantially cylindrical shank portion at one end with an enlargement upon two opposite sides of the other end, said enlargements resulting in said other end being substantially elliptical in plan view, a conical depression within said other end resulting in the outermost portions thereof being formed with a pair of arcuate cutting edges and the remainder of said other end being cut-away to provide clearance for the bit cuttings, and a central cutting portion having a straight cutting edge extending in a direction from one of the flattened sides to the other.

9. A rock drill bit consisting of a head portion which constitutes the working end of the bit, said head portion having a major axis and a minor axis, the major axis being the full diameter of the hole to be drilled and the minor axis being of lesser diameter, said head portion having a depression in said working end forming the working portions of said head into diametrically opposite arcuate reaming edges, the portions of the lower edge of the bit between the arcuate reaming edges being cut-away to permit lateral escape of the bit cuttings, and a central cutting portion within said depression and having a cutting edge less in length than the major axis, the walls of said depression being an element of a solid of revolution the axis of which is coincident with the longitudinal axis of said bit, whereby said arcuate cutting edges may be sharpened by a suitably shaped end grinder revolving about an axis coincident with the longitudinal axis of the bit.

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