March 17, 1953 G. ANNESLEY 2,631,824

DETACHABLE ROCK DRILL BIT

Filed Dec. 28, 1949

FIG. 1

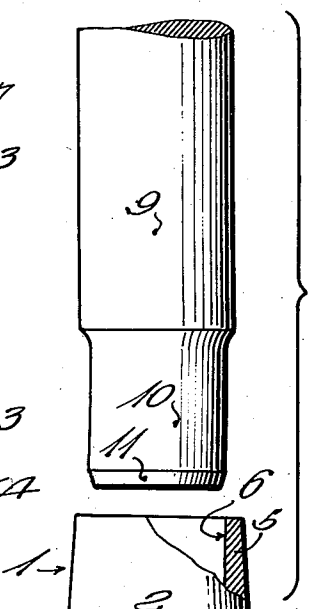


FIG. 2

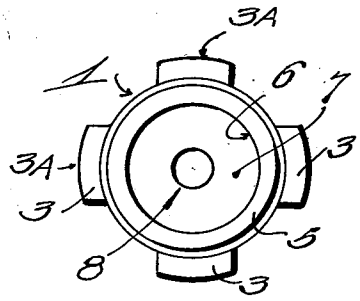


FIG. 3

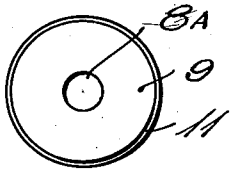


FIG. 5

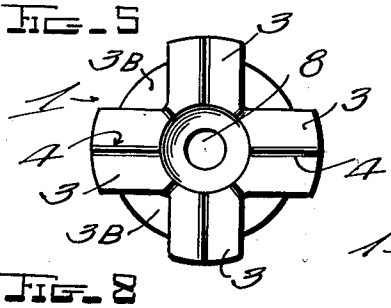


FIG. 6

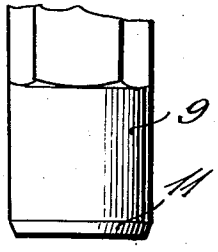


FIG. 8

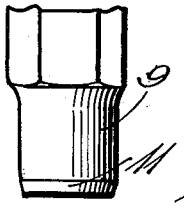


FIG. 9

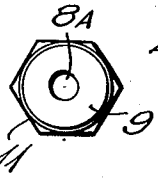


FIG. 7

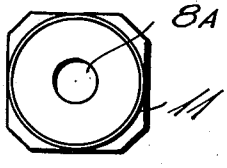


FIG. 10

FIG. 11

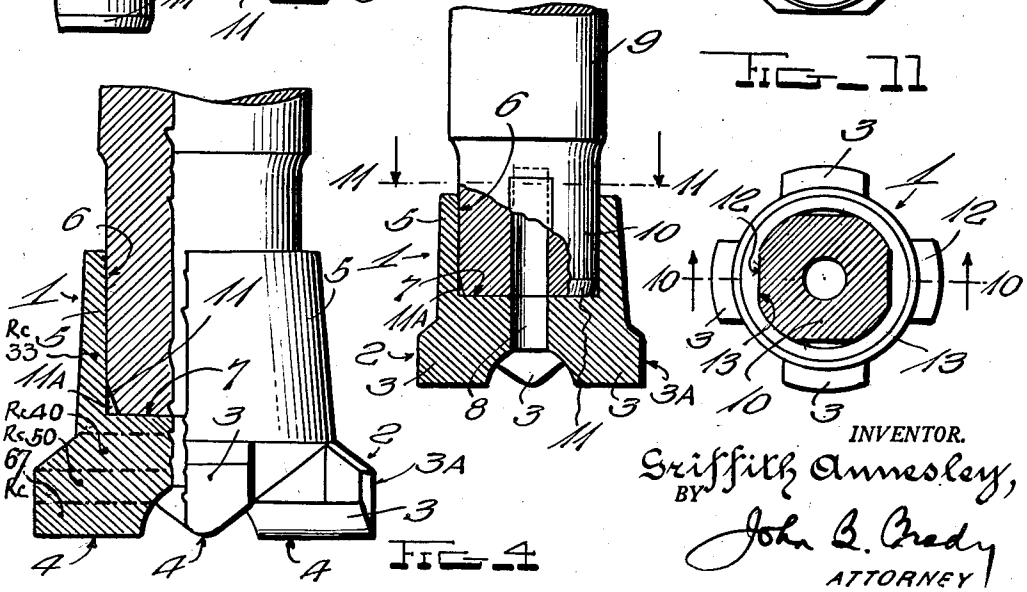


FIG. 4

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DETACHABLE ROCK DRILL BIT

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3 Claims. (Cl. 255—64)

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This invention is a continuation-in-part of my application Serial No. 5,853, filed February 2, 1948, for Detachable Rock Drill Bits.

This invention relates to rock drills used in percussive drilling operations.

An object of the present invention is to provide a drill bit having a structure which results in substantially longer wear of the bit in operation.

Another object is to provide an efficient and durable bit capable of being manufactured inexpensively by quantity production methods and at such relatively low cost that it may be advantageously discarded after it becomes incapable of further profitable operation.

Another object is to provide a drill rod and bit which may be readily and securely united together while maintaining maximum efficiency of the drill in operation.

The invention will be described with reference to the accompanying drawing, in which:

Figure 1 is a side elevation of a drill rod and drill bit made in accordance with my invention and in positions to be united;

Fig. 2 is a top plan view of the drill bit;

Fig. 3 is a bottom plan view of the drill rod;

Fig. 4 is a view similar to Figure 1 showing the drill rod and bit securely united and with fragments broken away for convenience of illustration;

Fig. 5 is a bottom plan view of the drill bit;

Fig. 6 is a fragmentary side elevation of a drill rod of quarter-octagon formation turned at one of its ends to a diameter slightly greater than the inside diameter of the socket;

Fig. 7 is an end elevation of Fig. 6;

Fig. 8 is a fragmentary side elevation similar to Fig. 6 showing the drill rod made of hexagonal material;

Fig. 9 is an end elevation of Fig. 8;

Fig. 10 is an enlarged side elevation of the bit and drill rod united and with fragments broken away and indicating zones of hardness of the bit diminishing upwardly from the cutting head; and

Fig. 11 is a top plan view of a modified form of socket and correspondingly shaped drill rod (in section) united therewith.

Referring now more particularly to the drawing: The drill bit generally indicated at 1 is provided with a cutting head 2 formed with blunt cutting or linear impact surfaces 3 which have an effective width of less than three-thirty seconds of an inch as shown at 4. I have found this dimension to be critical in order to eliminate

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excess stresses which frequently cause cracking or checking during the hardening operation caused by the small mass of the extremity which is subject to much more rapid cooling than the more remote portions of the cutting edge approximately three-thirty seconds of an inch back from the intersection of planes coincident with the sides of the cutting faces. Furthermore, after fully hardening, sharp cutting edges are liable to break off or chip especially at the corners when in contact with hard rock, unless drawn back to approximately 62 RC, whereas, the blunt edges as set forth in the structure of my invention may be hardened to approximately 67 RC without fear of breaking under similar conditions without the necessity of being drawn back as the blunt cutting edges afford adequate mass both to insure against cracks or checks during hardening and breakage or chipping when in contact with hard rock. The blunt cutting edges may be formed on a small radius preferably under three-thirty seconds of an inch or by means of a small flat not wider than three-thirty seconds of an inch, nor narrower than one-thirty second of an inch. Extending upwardly from the cutting head is a tapered or cylindrical socket 5 having substantially cylindrical inside walls 6 and a flat bottom wall 7. During the manufacture of the inside socket a perfectly cylindrical straight sided punch is used to form a parallel walled hole. However, during the heat treatment of the cutting head of the bit a certain amount of shrinkage occurs in consequence of which the normally cylindrical walls of the hole may become very slightly tapered. This is not desired and is purely coincidental with the hardening of the bit and is only of the order of one or two thousandths of an inch for the very small bits increasing up to several thousandths with the larger bits whose cutting heads contract more than do those of the smaller bits. The bottom wall is normally formed with an opening 8 which extends through the cutting head and through which water and/or compressed air is blown in the conventional manner to remove dust and rock particles from the work being dealt with in the drilling operation, but this opening may be at the side for use in soft ground.

The cutting surfaces 3 of the cutting head terminate in arcuate side walls or reaming surfaces 3A which project outwardly for a distance of from one-sixty-fourth of an inch to three-eighths of an inch, the angle of said walls with respect to the vertical axis of the bit (known as

the reaming angle) lying within the range 0° to 2°. The reason for projecting these arcuate reaming surfaces outward for a distance of over one-sixty-fourth of an inch and under three-eighths of an inch is to enable the reaming surfaces to maintain a substantially constant area throughout the duration of their gauge reduction until such projections are finally worn off to the extent that they no longer protect the portion of the bit with or to which they are united with respect to the abrasive action of the hole. This permits an immediate or considerable extension of the reaming surfaces with consequently greatly increased rotational friction resulting in cessation of drilling within a few seconds.

The reason for holding the reaming surfaces at an angle less than 2° is to eliminate excessive reduction in gauge diameter as it will be realized that the more acute the angle of the reaming surface the greater will be the reduction in gauge diameter as there is correspondingly less metal to be removed with the acute angle than would be from an angle that is almost parallel. The improved construction increases the strength of the corner of the bit over that which would be possible with bits having reaming edges of over 2° and especially with bits having the normal reaming surface angle of 5° or 7°.

It is important, in order to achieve the long-wearing qualities of the bit in accordance with the invention, to provide such reaming surfaces with dimensions within clearly defined limits, in combination with the reaming angle referred to above. Thus, the height of each reaming surface should not exceed a maximum dimension of one-half of an inch, and the width of such reaming surface should not exceed a maximum dimension of nine-sixteenths of an inch. Each cutting face tapers inwardly from the top of its reaming surface, as indicated at 3B. The angle of such tapered surface 3B should be more than 45° but less than 90°, and is preferably 60°, with respect to the vertical axis of the bit. In other words the reaming surface merges into the body of the bit at a sharply sloping angle.

I have found by extended research that the short and narrow reaming surfaces described joined by a flat sharply sloping buttress to the body of the bit allows further penetration without binding in a hole than can be obtained by bits of conventional design heretofore known in the art. Thus, the reason for holding the height of the projecting reaming surfaces below one-half of an inch and for having said reaming surface slope sharply towards the body, is to insure that when the reaming edges and cutting faces wear during use the reaming edges can never exceed their original height, thus precluding the possibility of binding in the drilled hole, which in turn prevents rotation and stops drilling before the bit is actually worn out and the full useful life obtained therefrom, as is the case with conventional design. During drilling gauge wear is approximately six times as rapid as cutting face wear, so that with a shoulder angles of less than 45° with the vertical axis of the drill, the height of the reaming surface becomes rapidly greater, thus causing binding in the drilled hole with stoppage of rotation and cessation of drilling upon the height of the reaming surface exceeding one-half of an inch.

The reason for restricting the effective width of the reaming edges below nine-sixteenths of an inch is to allow maximum space for the cuttings to be discharged and to prevent excessive contact area with the walls of the hole thus minimizing rotational friction and allowing smaller machines to be used with larger bits than they would be normally capable of rotating.

The drill rod in any of the forms shown, and generally indicated at 9 in Figs. 1 and 4, is of a diameter, as at 10, slightly greater than the inside diameter of the socket 5, and the lowermost end of the drill rod is slightly reduced or tapered as at 11 to a lesser diameter to facilitate the initial introduction of the drill rod into the socket preparatory to forcibly uniting the drill bit with the drill rod.

In accordance with a further feature of the invention, the drill bit is hardened in its entirety in varying degrees ranging, from a maximum of 67 Rockwell C at the cutting head diminishing to approximately 40 Rockwell C in the proximity of the mergence of the cutting head with the base portion of the socket, then further and gradually diminishing to approximately 33 Rockwell C at the open end of the socket. These blending zones of hardness have been calculated and located to render the socket walls radially deformable within critical limits into cylindrical zones of unlike diameters upon the forcible entry of the drill rod. This limited deformation causes the walls of the socket to adhere in parallel relationship throughout the major portion of their length to the drill rod above the said tapered end thereof, and flare outwardly to a slight degree only at their upper or open end in the lesser hardened area.

The zones of hardness are illustrated diagrammatically in the bit shown in Fig. 10. This hardening procedure makes it possible to utilize maximum hardness from the steel and at the same time maintain sufficient toughness in the cutting or impact surfaces of the bit to prevent breakage, chipping or other mutilation which would normally occur under the severe conditions of shock and vibration to which the bit is continuously subjected. The bit is heat treated to produce a straight zone of Martensite laterally within the impact surface and approximately three-sixteenths of an inch from their extremities. This is entirely different from customary practice of allowing the hardness zone to curve up the outside reaming surfaces so that the said reaming surface is as hard as the cutting faces of the bit. Indeed, with customary methods of hardening used it is impossible not to obtain this characteristic, as adequate control cannot be exercised. The reason that I desire this stratification of hardened zones, as clearly shown in Fig. 10, is to secure an extremely hard, unyielding cutting face averaging 67 Rockwell C for a predetermined depth to resist wear and abrasion. Immediately adjacent the cutting faces of the bit I obtain a zone of secondary hardness due to the prolonging of the hardening time curve. This secondary zone approximates 50 Rockwell C in hardness and is designed to provide a reasonably hard and tough backing for the primary zone described hereinbefore. As will be seen from Fig. 10, the primary and secondary zones extend for approximately the full heighth of the projecting reaming surface, each zone occupying approximately one-half of said heighth. Upon wear taking place on each of the said reaming surfaces, the corners are subjected to the greatest amount of wear and abrasion, and with a conventionally heat treated bit this results in the gradual formation of a tapered reaming surface which before long prevents the continuation of

drilling. With my method of hardening, the corner with its approximate hardness of 67 Rockwell C wears in the normal way, but that portion of the reaming surface immediately above it being approximately 17 points (on the Rockwell C scale) lower in hardness and consequently proportionally in wear resistance, recedes inwardly in direct proportion to the recedence of the primary zone, thus tending to maintain at all times substantially parallel reaming surfaces which will continue to drill as their diameter becomes reduced until eventually they are no longer projected reaming surfaces, after which occurrence drilling ceases almost immediately.

Although the invention has been described by making a fully detailed reference to the certain presently preferred embodiments, such detail of description is to be understood in an instructive rather than a limiting sense, many changes being possible within the spirit and scope of the claims hereto appended.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A percussive drill bit comprising in combination a substantially cylindrical bit body, a socket formed in the upper portion of said body, a cutting head formed by a plurality of V-shaped wings having a maximum height of one-half an inch and a maximum width of nine-sixteenths of an inch and extending radially outwards from the lowest portion of said body for a distance not exceeding three-eighths of an inch, said wings terminating in arcuate peripheral end reaming surfaces, flattened impact cutting surfaces having a width of the order of three-thirty-seconds of an inch formed on the apex of each wing and extending transversely to the axis of the bit, said arcuate peripheral reaming surfaces sloping upwards and inwards from said flattened cutting surface at an angle of the order of 2° to the axis of the bit, and shoulders above said reaming surfaces extending from the top edge of each reaming surface to the external surface of said socket and sloping inwards at an angle lying within the range of 45° to 90° with respect to the vertical axis of the bit, said wings having a hardness varying in degrees ranging from a maximum of 67 Rockwell C at the impact cutting surfaces of the cutting head and diminishing to approximately 40 Rockwell C in the proximity of the mergence of the cutting head with the base portion of the socket and then further gradually diminishing to approximately 33 Rockwell C at the upper portion of the body of the socket.

2. A percussive drill bit comprising in combination a substantially cylindrical bit body, a socket formed in the upper portion of said body, a cutting head formed by a plurality of the V-shaped wings having a maximum radial projection from the cutting head not exceeding three-eighths of an inch and terminating in arcuate peripheral end reaming surfaces not exceeding a height of one-half inch and not exceeding a maximum width of nine-sixteenths of an inch, said wings terminating in flattened impact cutting surface having a width of the order of three-thirty-seconds of an inch and a hardness varying from a maximum of 67 Rockwell C at the impact cutting surfaces of the cutting head and gradually diminishing to approximately 40 Rockwell C in the proximity of the mergence of the cutting head with the base portion of the socket.

3. A percussive drill bit comprising in combination a substantially cylindrical bit body, a socket formed in the upper portion of said body, a cutting head formed by a plurality of V-shaped wings having a maximum height of one-half an inch and a maximum width of nine-sixteenths of an inch and extending radially outwards from the lowest portion from said body for a distance not exceeding three-eighths of an inch, said wings terminating in arcuate peripheral end reaming surfaces, flattened impact cutting surfaces having a width of the order of three-thirty-seconds of an inch formed on the apex of each wing and extending transversely to the axis of the bit, said arcuate peripheral reaming surfaces sloping upwards and inwards with respect to said flattened cutting surface, and shoulders disposed above said reaming surfaces and sloping inwards with respect to the vertical axis of the bit from the top edge of each reaming surface to the external surface of said socket on an angle lying within the range of 45° to 90° with respect to the vertical axis of the bit, said wings having a hardness varying in degrees ranging from a maximum of 67 Rockwell C at the impact cutting surfaces of the cutting head and diminishing to approximately 40 Rockwell C in the proximity of the mergence of the cutting head with the base portion of the socket and then further gradually diminishing to approximately 33 Rockwell C at the upper portion of the body of the socket.

GRIFFITH ANNESLEY.

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The following references are of record in the file of this patent:

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Number	Name	Date
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