

Dec. 10, 1957

N. E. WOLFRAM

2,815,932

RETRACTABLE ROCK DRILL BIT APPARATUS

Filed Feb. 29, 1956

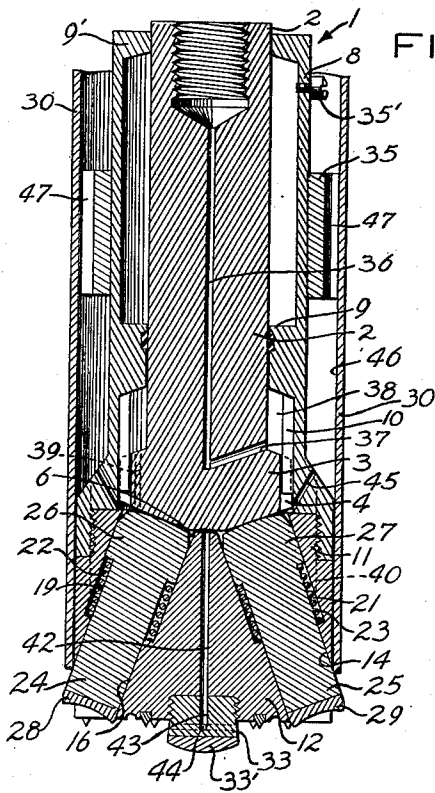


FIG. 1.

FIG. 2.

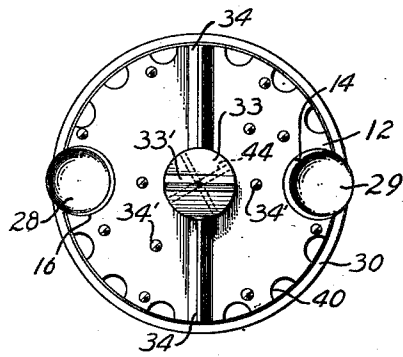
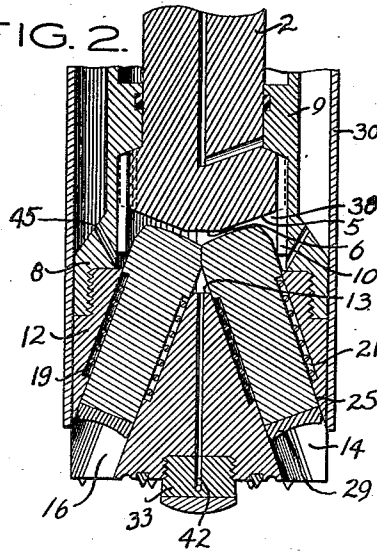


FIG. 3.

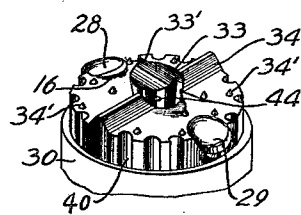


FIG. 4.

INVENTOR.
NORMAN E. WOLFRAM
BY
Chapman & Neale
ATTORNEYS

1

2,815,932

RETRACTABLE ROCK DRILL BIT APPARATUS

Norman E. Wolfram, South Deerfield, Mass.

Application February 29, 1956, Serial No. 568,608

8 Claims. (Cl. 255—41)

This invention relates to retractable drill bits and more specifically to retractable drill bits of the type which may be used in sinking a sleeve or casing while drilling a blind hole in various earth formations particularly stone or rock.

The operation of sinking a casing sleeve into the earth and through rock formations and the like is accomplished with the bit immediately preceding the forward end of the casing through which the drill steel is extended, the casing being thrust into the hole being drilled along with the bit as the latter advances. Accordingly, upon completing the sinking of a casing or whenever the bit needs to be replaced, the problem arises of extracting the bit from the end of the casing, the bit by necessity having an outside diameter greater than the diameter of the casing. Various and sundry types of special bit construction have been devised to provide a retractable bit. A principal object of the present invention is to provide a retractable bit of simplified yet sturdy and rugged construction for the purpose of sinking a casing into the rock formation so that drillings dislodged by the bit can be readily removed, and finally when the hole is drilled the casing can be left in the bore without loss of the bit.

Another object of the present invention is to provide a retractable drill bit which will automatically assume a retractable position upon the simple act of withdrawing the drill steel outwardly of the casing.

Another object is to provide a retractable bit of relatively simple construction which may be operated by the standard types of pneumatic drill hammer mechanism and will serve to efficiently drill a hole through solid stone or rock formations to sink a casing without the necessity of a usual reaming operation.

Other objects and advantages of the invention will be apparent from the following description read in conjunction with the drawings, wherein like numbers designate the same elements in the several views and in which,

Fig. 1 is a transverse sectional view of the bit assembly showing the same in an operative position for drilling;

Fig. 2 is a similar partial view of the assembly of Fig. 1 with the parts thereof in retracted condition for withdrawal of the bit from the casing sleeve;

Fig. 3 is a plan view of the bit face as seen from the bottom of Fig. 1; and

Fig. 4 is a perspective of the bit face to better illustrate the detail thereof.

Referring to Fig. 1 the drill bit assembly designated generally by numeral 1 is encased in a tubular sleeve casing 30 at the lower end thereof. A reciprocable and rotatable hammer member 2 having a threaded socket at its upper end is adapted for connection to the drill steel (not shown) of a pneumatic hammer device having a pulsating stroke and imparting a rotary motion thereto between strokes. The member 2 at its lower end has an enlarged head 3. The head is formed with a plurality of longitudinally grooved keyways 4 at the periphery thereof and an annularly beveled face with a flat central

2

section at 6. The hammer member is held concentrically within a sleeve extension 8 of the bit body, the extension being provided with an inwardly directed collar 9 forming a bearing for the member 2 upwardly of the head 3 and the sleeve at its upper end having a collar portion at 9'. The extension 8 below the collar 9 is provided with a plurality of longitudinally disposed keys 10 received in the grooves 4 of the head 3. At its lower end the extension 8 is fixed by a threaded connection to the body member 12 of the bit. The bit body as shown is largely encased in casing 30 and at its rear face has a saucer shaped anvil surface in opposed relation to the beveled lower end of the hammer head 3. The body 12 is spaced from the collar 9 of the extension to form a chamber for the reciprocation of the head 3 and retraction of bit "gauging" plungers as will be described.

The lower end of the extension 8 and the cylindrical bit body are in slidable bearing relation with the sleeve 30, the outer end of the body projecting beyond the end of the sleeve. Upwardly of the bit a "floating" spacer ring 35 also provides a concentric bearing relation for the extension 8 with respect to the sleeve 30. As will be explained a stop screw 35' prevents ring 35 from riding off the extension 8.

The bit 12 is also formed with outwardly angled opposed sockets as the pair of sockets 14 and 16, each extending from the inner face thereof to intersect the outer edges at diametrically opposite positions on the forward working face of the bit. The sockets as at 19 and 21 provide enlarged inner portions for receiving springs 22 and 23, respectively. The springs are seated between the shoulders of the portions 19 and 21 and the shouldered anvil portions of plungers 24 and 25 as at 26 and 27. As shown by the operative drilling position of Fig. 1 the outer tip ends of the plungers extend outwardly of the diameter of the casing sleeve 30 and provide the members for gauging the diameter of the bore into which the casing is being thrust.

Preferably the tip ends of the plungers are surfaced with a hardened drilling material such as carbide or diamond impregnated carbide for durability and more efficient drilling action on rock formations. At the leading face of the bit body a centrally projecting pilot cutter post 33 is located with a carbide blade insert at 33'. Radially extending cutter blades 34 (Figs. 3 and 4) are disposed on opposite sides of the post 33 and a plurality of tipped carbide inserts 34' are also set into the face of the body to assist the action of the blades 34.

The arrangement of cutters and tips at the working face of the bit body may be varied. Preferably, the tips of the small inserts 34' are set back from the tip edge of the blades 34 so that at each rotational advance of the bit the several tips will chip off the higher spots on the surface which have been left by the preceding radial cutter blades. Thus the blades 34 are able to strike a more solid blow by reason of a more even surface at each successive blow and larger fragments can be knocked loose. The particular bit face arrangement as indicated by Figs. 3 and 4 is designed for clockwise movement, the clusters of tips 34' being more or less concentrated in the clockwise path of each of the radial cutters 34.

It will be noted also that the outermost edges of the tips 28 and 29 of the plungers are spaced rearwardly of the leading face of the body 12 and outwardly of the outside diameter of the casing 30. By reason of their extension beyond the casing 30 the bore being drilled will be gauged by the plungers which will progressively chip the rock edges in a circular path. Thus the casing can be thrust into the bore as the bit advances. By reason of the disposition of the plunger edges rearwardly of the bit face the rock chipped from these edges will be spalled

inwardly and below the plungers and thus the chips will be more easily broken off. The force required for this type of spalling action (i. e. into void spaces) is such as to eliminate any tendency of the plungers to become damaged or the tips 28 and 29 to become subjected to excessive wear.

The drillings removed by the bit are carried away from the lower end of the bore by fluid under pressure, a "jet" stream being fed to the end of the bore and conducted back out through the casing. The hammer member 2, as shown, may be provided with a central passage 36 suitably fed from a similar passage in the drill steel. Passage 36 terminates in the head 3 and leads into a branch line at 37. Thus the fluid is fed into the chamber 38 in which the head 3 reciprocates. From the chamber 38 back of the head the fluid passes through passages as at 39 to the front of the head at the rear face of the bit. In the bit a central passage 42 leads from the anvil surface to the central post 33 in which a plurality of radial exit passages 44 are located to direct streams of air or water radially across the face of the bit.

Thus drillings removed by the bit will be forced by the stream of air or water from the passages 44 to pass to the periphery of the bit. As shown by Figs. 3 and 4 at the edge of the bit body longitudinal grooves or openings 40 are formed to receive and conduct the drillings rearwardly to the annular space between the hammer sleeve extension 8 and casing 30. It will be noted as at 45 that rearwardly directed passages lead from the chamber 38 at the front end thereof diagonally through sleeve 8 into the annular space at 46. Such passages provide auxiliary jets to assist the rearward travel of the drillings back through the casing 30. At suitably spaced intervals upwardly of the sleeve the drill steel (not shown) may, of course, also be provided with diagonal passages to carry the drillings to the extreme outer end of the casing for suitable disposition.

From the annular space indicated at 46 the drillings are conveyed through openings 47 in the spacer collar 35 to the annular passage beyond the same. The stop pin 35' will prevent movement of the collar 35 along with the drillings beyond its supporting position relative to the sleeve extension 8.

It will be noted that the particular arrangement for the passage of fluid to the chamber 38 and to the anvil surface of the bit insures that the chamber 38 and plunger sockets will be kept relatively clean and free of grit, dust, and chips. The pulsating beat of the hammer head against the anvil surface permits fluid communication with the bit passage 42 and the passages 45. By leakage into the sockets 14 and 16 the pressure fluid will also maintain the plungers free of grit.

It will also be realized that the hammer head during its pulsating beat is positioned in the lower end of the chamber 38. In actual operation the reciprocation of the hammer is rapid enough to maintain the plungers substantially in their extended position as in Fig. 1 at all times. In other words the blows of head 3 are delivered in such rapid succession that the reaction of the springs 19 and 21 is insufficient to carry the plungers back with the head 3 at each blow. In boring through solid rock the entire bit of course rebounds to some extent so that the rotative motion of the hammer rig will be effective to turn the bit as the drilling proceeds. The keyed relation of head 3 with the extension 8 thus turns the bit and causes the progressive chipping away at the edges of the bore by the gauging plunger tips. As will be obvious the plungers may turn in their sockets and with the slightly dished formation of the striking tips 28 and 29 the outer edges in any rotative position will effectively spall the rock from the edges of the bore. The plungers are free to rotate in the sockets during the drilling and this contributes to an even wearing action all around the edges of the plunger tips.

From the above, the operation of the bit, as it advances

with the casing along with it, will be apparent. In Fig. 2 the withdrawing operation is illustrated. Assuming the drilling to be completed or that the bit needs replacing, the drill steel may be raised in any suitable manner to withdraw the hammer member 2 upwardly. When the head 3 abuts the collar 9, springs 19 and 21 force the plungers inwardly of the axis of the bit to the retracted position shown and the tips 28 and 29 are recessed in the sockets. Thus the withdrawal of the head 3 automatically permits the retraction of the plungers whereupon the bit body with the entire bit assembly may be withdrawn outwardly through the casing 30.

What is claimed is:

1. Retractable drill bit construction for sinking casings in rock formations comprising a bit body member having a plurality of sockets opening at the front edges of the forward cutting end of said body member, said sockets extending rearwardly thereof and being angled toward the center of the body member, reciprocable plungers slidably mounted in said sockets with means normally urging the plungers rearwardly, said plungers having bladed tips lying in extended position radially outwardly of the outer wall of the body, and a reciprocable and rotatable hammer member engageable against the inner ends of said plungers and said body member for extension of said plungers on reciprocation of said hammer, said hammer and body being fixed against rotation relative to each other for rotative movement of the body as the hammer is turned, and means limiting movement of said hammer rearwardly of said body member away from the rock formation being cut for withdrawal of both said members together from a casing.

2. Retractable rock drill bit construction comprising a cylindrical body member having an inner anvil surface and a forward outer bladed bit face, a plurality of reciprocable plungers carried by said member in divergently angled relation to the bit axis means limiting movement of each plunger between an extended position in which the outer tip ends of the plungers extend beyond the side wall of the body member rearwardly adjacent said outer face and with the inner ends of said plungers flush with said anvil surface, and, a retracted position in which said tip ends are recessed within said member, means to urge said plungers to said retracted position, said body member having an extension disposed rearwardly thereof and a reciprocable hammer member slidably mounted in said extension for guided movement axially of said body member and striking engagement against the inner ends of said plungers and said anvil surface.

3. Retractable rock drill bit construction for sinking a casing into rock formations and comprising a cylindrical bit body member with an inner anvil surface and a forward outer bladed bit face and having a pair of blade tipped reciprocable plungers mounted within said body in divergently angled relation to the axis of the body, said plungers being normally urged to a rearwardly retracted position and movable to an extended position with said tips extending beyond the outer side wall of the body rearwardly adjacent said bit face and radially thereof for gauging the bore to be drilled for passage of a casing slidably embracing said body, a sleeved extension disposed rearwardly of the body and a hammer member mounted for reciprocation longitudinally thereof to engage said anvil surface and said plungers to extend the latter, said hammer being keyed to said sleeved extension for imparting rotary motion thereto, and said extension having means to limit rearward movement of the hammer relative to the body for longitudinal withdrawal of the body member with said plungers in retracted position.

4. A retractable drill bit having a body member adapted for rotatable mounting in a cylindrical casing and having a bit face for extending beyond the open end of the casing, a plurality of retractable plungers slidably mounted in said body with the outer ends of the plungers be-

5

ing extendible radially of the bit side wall for enlarging the bore of the hole formed by said face and maintaining said casing in surrounding relationship to said body member as the bit is advanced, said body member having an axially chambered extension rearwardly thereof and receiving in the chamber the inner ends of said plungers in a retracted position of the latter, yieldable means normally urging the plungers to said retracted position, a reciprocable hammer member extending into said chamber and having an enlarged head portion slidable longitudinally therein to engage said body and plungers for moving the latter to said extended positions, said head portion being keyed to said extension wall for rotation of the body as the hammer is turned, and said chamber having abutment means engaging said head in a retracted position thereof for withdrawing said body inwardly of the open end of a sleeve when the plungers are retracted.

5. The structure of claim 4 with said hammer member mounted in bearing relation to said chambered extension, the outer wall of the extension being of lesser diameter than said bit body to form an annular passage between the extension and the casing rearwardly of said body, and said body having inlet fluid passages communicating said chamber with the bit face and outlet passages for conducting drillings from the bit face to said annular space surrounding the extension.

6. The structure of claim 5 in which a supply passage for pressure fluid to said chamber is formed longitudinally of the hammer member and directed from the head portion thereof into the rearward section of said chamber, and said head is provided with a passage from the rear to the front face thereof for communicating with said inlet passage of the body, said latter inlet passage having at said bit face a plurality of outlet ports radially directed from the center thereof.

7. Retractable rock drill bit construction for sinking a cylindrical casing into rock formations comprising a bit body member for rotatable and slidable bearing relation with the casing, a forward outer bit face on said

6

body for extension beyond the casing end and an anvil face formed on said body rearwardly of said forward bit face with a fluid inlet passage between the faces, said bit body having a grooved outer side wall for passage of drillings rearwardly of the casing and a sleeved extension encasing said rear anvil surface, a rotatable and reciprocable hammer member mounted in the extension in fluid sealing relation therewith and having an enlarged hammer head portion adjacent said anvil surface, said hammer member having pressure fluid passages communicating with the interior of said extension and with said inlet passage of the body member and said extension having an inner abutment spaced rearwardly of the anvil surface forming a chamber for reciprocation of said head portion with said abutment being engageable by said enlarged head for retracting said body on withdrawal of said hammer, said bit body having sockets angularly directed from the anvil surface to the outer side wall of the body rearwardly adjacent said bit face, plungers in said sockets engageable by said hammer head for extending beyond the said side walls at their outer ends for enlarging a bore formed by said bit face whereby the casing may be advanced as the bit advances, said plungers having dished tip ends and being rotatably mounted in said sockets with spring means urging the same rearwardly in the sockets.

8. The structure of claim 7 in which a spaced collar having an outer grooved wall embraces said extension rearwardly of the bit body and said extension adjacent the body is formed with rearwardly angled fluid passages for conveying drillings rearwardly of said extension through the annular space around the same.

References Cited in the file of this patent

UNITED STATES PATENTS

1,613,555	Boyd	Jan. 4, 1927
1,767,474	Phipps	June 24, 1930
2,072,470	Thompson	Mar. 2, 1937
2,763,469	Burls	Sept. 18, 1956