

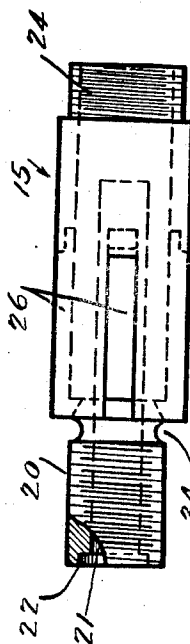
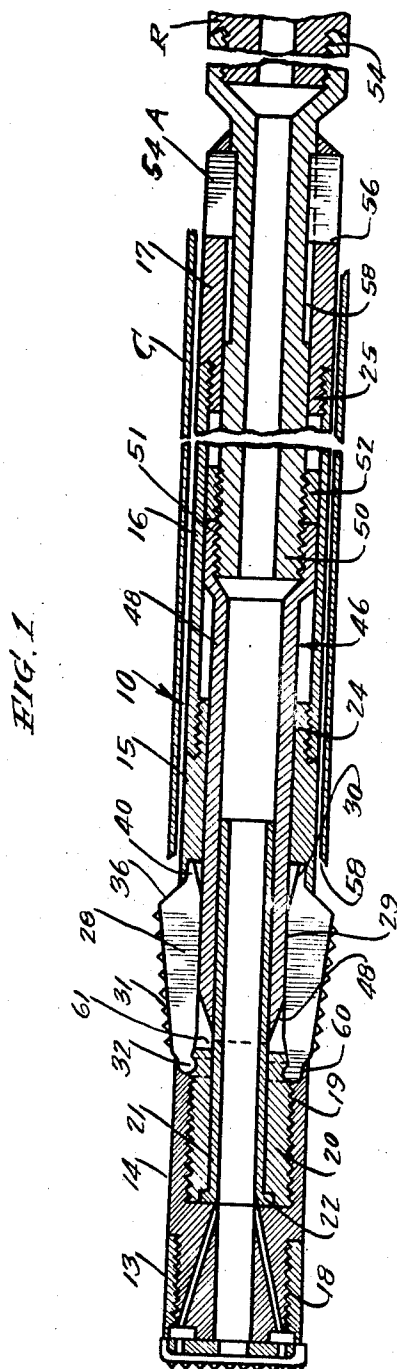
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ROCK DRILLING APPARATUS

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ROCK DRILLING APPARATUS

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2 Claims. (Cl. 255—72)

This invention relates to a diamond drill with expansion shell or reamers which renders possible the drilling from the surface of the earth to solid bed rock in whatever thickness or diversified strata there may be, and in such a manner that the hole is made to just the right size to allow the casing pipe to follow immediately behind it either through earth, ground, stone, boulders, hard-pan or whatever may be the interlying material between the surface and the solid rock to be reached and to whatever distance into the bed rock is necessary to seal the casing into the bed rock.

A further object of the invention is the provision of an improved method of and apparatus for operating pilot bit and expansion shell directly from the end of a regular diamond drill rod which is directly connected to suitable machinery at the surface and as the operation proceeds downward the casing pipe follows the pilot bit and expansion shell, thus preventing to a maximum degree the hole from deviating or offsetting from its straight course.

Another object of this invention is the provision of a method and apparatus whereby no rope or guide or instrument is necessary to lower the pilot bit and expanding shell other than its own drive shaft which is a regular drill rod operating inside of the pipe casing which remains stationary, that is without rotating, it being held fast in every respect except for a downward straight movement following the advancement of the pilot bit and expansion shell.

Various other methods have been employed for drilling and reaming holes with casing pipes from the surface to the solid bed rock which have employed and used a rope or cable or harpoon to lower the pilot bit and expanding shell with subsequent trouble in pulling up the cable that lowered the bit and expanding shell, which could not be used with the present method as the regular diamond drill rod only can be used as a drive shaft to actually operate same.

Other methods have also been devised whereby it is necessary to rotate the casing pipe using it as a drive shaft causing innumerable difficulties in gradually enlarging the size of the hole, wearing off the casing pipe, causing the casing to become loose in its hole, thus making it deviate from the straight line with the fatal consequences of often losing a hole and numerous other inconveniences appertaining to methods which have to rely on any tool or apparatus which is not self-contained and directly connected to the drill rod as in the present instance,

A further novel feature of this invention is that the casing pipe remains stationary, that is to say, does not rotate and is not used as a drive shaft for the pilot bit and expanding shell and its only movement is downward on being pushed down by a proper mechanical device so as to have the casing just follow the expanding shell, thus eliminating wear of the casing and minimizing to the largest possible extent the loss of holes.

Another effective and novel feature of my invention is that the expanding shell is held in place by a lug on each cutter fitting into a groove in shell body and interlocking by means of an adaptor screwed on the end of expanding shell body so that no clogging takes place in the expansion shell whilst in operation and same is always fully protected in its operation with the further provision that the expanding cutters cannot become loosened or displaced by any interfering material whilst the drilling operation is going on.

Other novel features are that the cutters of the expanding shell at the top are faced with a cam plunger, thus providing immediate operation from the drive shaft or regular drill rod the moment the pressure is applied to the face of the pilot bit and causing the cutters to expand to the required size to allow the casing pipe to follow down as the drilling or boring goes down.

Furthermore the same cam effect is at the top of the expanding cutters so that when the drive shaft or drill rod is pulled up it causes the cutters to retract in the slots provided for same in shell body but always remaining fixed in body by means already explained, thus making it an automatic operation of expanding when downward pressure is applied and contracting when pulling up without additional mechanism whatever.

Other novel features and further objects of the invention appear from the description to follow.

In the drawing, wherein like numerals of reference indicate corresponding parts in the various figures;

Figure 1 is a fragmentary longitudinal cross section of a drill made in accordance with this invention;

Figure 2 is a side elevation, on a slightly enlarged scale, of a part of the drill.

Referring now by numerals to the drawing, 10 is a tubular member or barrel, being adapted at its lower or operative end to removably receive a conventional diamond pilot drill bit 13, so that

the bit is secured in operative position to the lower end of the barrel.

For manufacturing convenience or expediency, the barrel is preferably made of four assembled parts which may be termed, for convenience, an adaptor 14, a reamer or cutter holding body 15 (best shown in Figure 2), a tubular extension 16, and a barrel top member or connection 17.

The member or adaptor 14 is provided at the lower end with a reduced portion 18 threaded to removably receive the conventional pilot bit 13. The adaptor is formed with a flange 19 threaded on its inside face to removably receive the reduced lower threaded end 20 of the cutter-holding body 15. The reduced portion 20 carries in its longitudinal axis a tubular member or pipe 21 which may be termed a pilot core tube, the lower end of the tube being formed with a flange or shoulder 22 countersunk into the lower transverse end face of the adaptor and, preferably, secured therein as by welding (not shown) or otherwise, so that in effect the tube 21 is preferably an integral part of the cutter-holding body 15. The upper end of the body 15 is formed with a reduced threaded portion 24 adapted to be removably secured to the adjacent or lower end of the tubular extension or member 16. The upper end of the extension 16 is internally threaded to removably receive the adjacent or lower reduced threaded end 25 of the barrel top connection 17.

The cutter or reamer-holding body 15 is provided with a number of longitudinal slots 26, preferably equally spaced around the periphery of the body, adapted to receive the diamond cutters or reamers 28.

The cutter 28 may be formed substantially as shown in Figure 1, having an inner face or edge 29 terminating at the upper end in an outwardly directed face or cam portion 30, and an outer diamond-studded cutting face 31. The lower end of the cutter is formed with a circular or substantially circular portion 32 forming a hinge which is journaled in a substantially semi-circular shaped recess 34 formed into the outer face of the reduced end 20 of the cutter-holding body 15 and in a similarly formed semi-circular shaped recess 60 formed into the upper end or edge of the wall of the adaptor 14, all as best shown in Figure 1. The cutters will then turn on the axes of the hinge portions 32, respectively, to the extent to which they are permitted to turn. The upper end of the cutter is provided with an upper cam face 36 terminating in a lug or limiting stop 40 adapted to determine the outward swinging movement of the cutter by the engagement of the lug with the inside face of the wall of the body 15, at a point adjacent the lower end of the associated slot 26.

The cutters or reamers 28 are actuated outwardly into their intended operative or effective position (shown in Figure 1) by the action of a plunger 46 axially movable in the longitudinal axis of the barrel 10, more particularly by the engagement of the bevelled or cam end 48 of the plunger with the cam face 30 of the cutter as the plunger is moved toward the lower end of the barrel.

The plunger may be conveniently made of two parts, a lower tubular member or portion 48 and an upper member 50, preferably threaded together as at 51. Preferably, a suitable lock nut 52 is used as shown. The upper end of the plunger, more particularly, the upper end of the

component part 50, is formed with an enlarged inwardly threaded socket 54 adapted to removably receive the threaded end of a conventional rotatable drill rod R, so that the plunger may be imparted a rotary movement with the rotatable drill rod when in operation. To impart a rotary movement to the barrel 10 by and with the plunger 46, while permitting the latter to be moved axially in the barrel to either actuate the cutters outwardly or to enable the cutters to be retracted within the body 15 of the barrel, the plunger is suitably splined to the barrel. Conveniently, keys 54A may be inserted and locked in slots 56 made through the wall of the barrel top connection 17, to engage or ride in longitudinal keyways 58 made into the plunger member 50.

C is the casing, to be lowered to the solid rock through the overlying strata or overburden. As seen in Figure 1, the casing is of a slightly larger inside diameter than the outside diameter of the drill proper or more particularly, of the barrel and pilot bit, so that the casing will lower or follow the drill proper just behind the reamers or cutters, as the drill proper gradually lowers or sinks into the overburden. The lower end of the casing is formed with a bevelled edge or cam face 58 adapted to engage the cam edges 36 of the cutters to force same to be retracted or swung inwardly, when free to do so, that is when the plunger has been moved axially away from the pilot bit, as when the drill proper is being hoisted up or withdrawn from the drilled and reamed hole.

The axial movement of the plunger in the barrel is determined by the engagement of the lower end of the plunger with the adjacent upper face 61 of the adaptor 14 and (preferably) by the engagement of the upper end of the lock nut 52 with the lower or adjacent end of the barrel top connection 17. The maximum axial movement of the plunger in the barrel should be just sufficient to allow the cutters to be retracted to inoperative position within the holding body 15.

Operation

The drill (with casing C therearound) is operated to bore or drill into the overburden. The pressure exerted downwardly by the plunger 46 causes the reamers 28 to be swung outwardly to operative or cutting position. As the pilot bit 13 bores a hole and the reamers operate to enlarge the hole, the casing gradually sinks, or is gently forced down, in the reamed or enlarged hole. When the hole has been drilled to the required depth, say to solid rock, and partly thereinto if desired, the drill is hoisted or raised out of the hole. As the drill is being so raised, the casing remaining stationary, the lower bevelled edge 58 of the casing is engaged by the cam portions 36 of the reamers, and the reamers are swung inwardly to inoperative or retracted position within the cutter-holding body 15, thus allowing the drill to be removed out of the hole.

What I claim is:

1. In a device for making a hole and sinking a lining therein, the combination of a rotary drill including a plurality of reamers pivotally mounted in said drill to be actuated outwardly to operative reaming position to enlarge the hole bored by said drill and including a plunger operable to actuate said reamers outwardly to reaming position, said reamers being adapted to swing inwardly to inoperative position within said drill when said reamers are free of said

plunger, and a casing freely mounted around said drill operable when moved axially of said drill toward said reamers, as when lifting said drill in the hole, to engage said reamers and swing the same inwardly to inoperative position thereby allowing said casing to sink into the reamed hole while said drill is free to be lifted out of the hole, said drill having a longitudinal core bore and a tube in part defining said bore and forming a slide bearing for one end of said plunger.

2. In a device for making a hole and sinking a lining therein, the combination of a rotary drill including a plurality of reamers pivotally mounted in said drill to be actuated outwardly to operative reaming position to enlarge the hole bored by said drill and including a plunger operable

to actuate said reamers outwardly to reaming position, said reamers being adapted to swing inwardly to inoperative position within said drill when said reamers are free of said plunger, and a casing freely mounted around said drill operable when moved axially of said drill toward said reamers, as when lifting said drill in the hole, to engage said reamers and swing the same inwardly to inoperative position thereby allowing said casing to sink into the reamed hole while said drill is free to be lifted out of the hole, said drill including a tubular portion and a removable adaptor co-operating with said portion to form semi-circular recesses, said reamers having end semi-circular lugs removably journaled in said recesses.

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