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W. J. MITCHELL

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CORE DRILL

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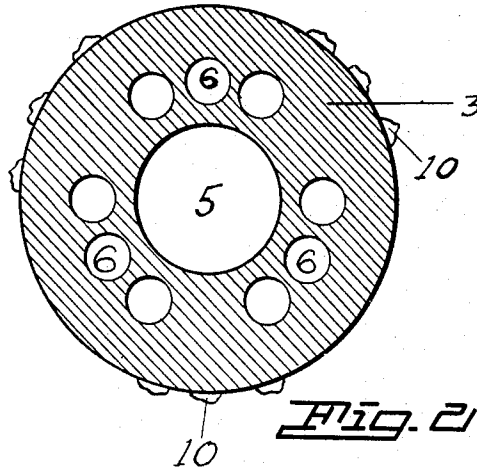
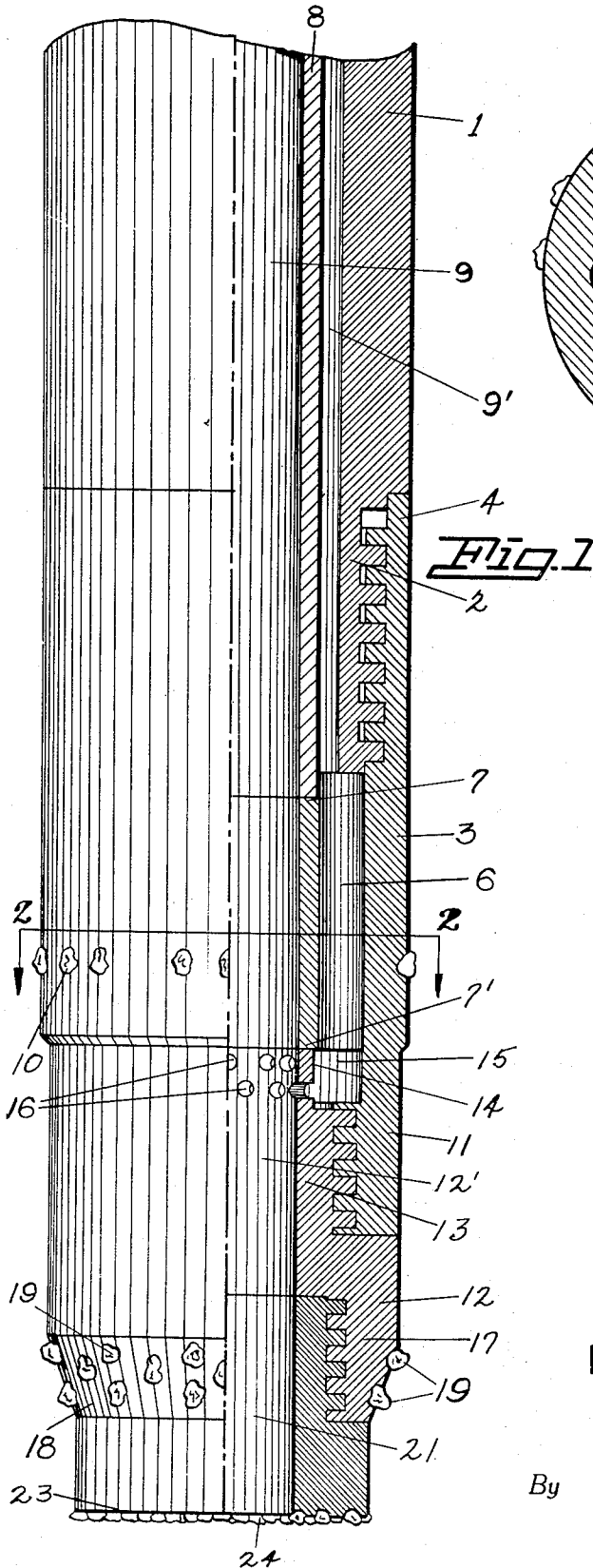
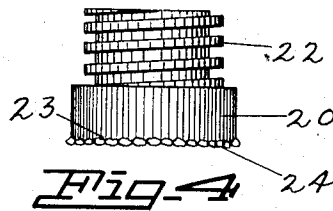
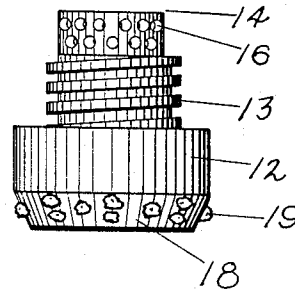


Fig. 3



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## UNITED STATES PATENT OFFICE

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## CORE DRILL

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My present invention relates to improvements in core drills of the type employed by miners, prospectors, and others, for obtaining a core or sample of the geological structure or strata through which a drill passes, to be used in determining the probable mining, or other values of the earth through which the drill passes.

My invention is an applied improvement on double-tube drills, i. e. tools wherein an inner tube or core barrel is arranged concentrically with, but spaced apart from an outer tube or casing, and the core barrel is adapted to receive the core as it is cut by the drill bits. Cutting stones or diamonds are mounted on the drill at its working end, and during the drilling operation a stream of water is passed downwardly through passages in the tool to the cutting bits, and some of this water then passes around the face bit and returns upwardly between the exterior of the tool and the wall of the drilled hole. Other portions of the water return upwardly through the core barrel, or inside tube, and thereby assist in floating or lifting the core within the barrel.

In actual practice, the diamonds or cutting stones employed on the drill bits, are comparatively expensive in first cost, as well as costly in the time consumed and labor expended in first setting the cutters, and then in replacing the cutters or diamonds after they have become broken, destroyed, or otherwise rendered inoperative. Repairs and replacements of the bits are also necessary at frequent intervals, because of the wear of the cutting tools, which result in loss of time and heavy expenditures for labor.

In carrying out my invention I provide a drilling tool that eliminates many of the difficulties in present day practice, which tool at the same time is more durable than those now in use with which I am familiar; and the drilling tool of my invention is less expensive in cost and in repairs, and requires less time for changing worn parts than is the practice with tools of this character.

The drill is so constructed and fashioned that I am enabled to so direct and guide the tool to insure a true, straight hole through

the earth, irrespective of the character of the geological structure, and regardless of the depth to which the hole is drilled. By the combination and arrangement of parts at the working end of the tool the core barrel directly behind or above the bits is protected against most of the wear to which it is usually subjected, and therefore the life of the core barrel is prolonged, and expenses incident to frequent renewals of the core barrel are avoided.

In the boring operations I employ one and the same tool for completing the full size hole, in lieu of the usual practice in which two tools are successively employed for this purpose, thereby avoiding the expense, difficulties, and delays incident to present day practices. By the utilization of a set of bits, and interchangeable parts, necessary changes may be made with facility and without material loss of time.

The invention consists in certain novel combinations and arrangements of parts involving the use of a face bit and an enlarging bit as will hereinafter be more fully set forth and claimed. In the accompanying drawing I have illustrated one complete example of the physical embodiment of my invention wherein the parts are combined and arranged according to one mode I have thus far devised for the practical application of the principles of my invention. While I have shown one exemplifying structure that is successful in actual practice in carrying out the principles of my invention, it will be understood that changes and alterations may be made therein, within the scope of my claims, without departing from the principles involved.

Figure 1 is a view at the lower end of a tubular drill rod, one half in section, showing the embodiment of my invention.

Figure 2 is a transverse sectional view through the drill coupling at line 2—2 of Figure 1.

Figure 3 is an elevation, detached, of the enlarging bit, and Figure 4 is a similar view of the face bit, employed in carrying out my invention.

In order that the general arrangement and relation of parts may readily be understood

I have illustrated in Figure 1 a portion of the lower, or lowest, drill rod section 1, which is of tubular construction and provided with a reduced extension 2 that is externally threaded to receive the drill rod coupling 3 having a shank 4 that is internally threaded for co-action with the threaded extension 2 of the tubular rod.

The coupling 3 has a reduced, central bore 5, and in Figure 2 it will be seen that three groups of holes 6, arranged three to a group, are spaced at intervals in the wall of the coupling, about the central bore. On its upper and lower edges the wall of the intermediate or central portion of the coupling is fashioned as with two shoulders 7 and 7' that form annular, interior ledges, and the lower end of the core barrel 8 rests upon the upper shoulder 7 of the coupling.

The core barrel 8 is provided with a central bore 9 of the same diameter as the bore 5 of the coupling 3, and these two bores register as indicated in Figure 1.

Between the wall of the tubular drill rod 1 and the inner tube or core barrel 8, an annular space 9' is fashioned by these parts through which the water descends, past the substantially water-tight joint between the lower end of the core barrel and the annular shoulder or ledge 7 of the coupling, and thence down through the groups of holes 6 in the coupling, 3.

The coupling, as shown in Figures 1 and 2 is provided with one or more annular series of reaming stones or diamond cutters 10 that project laterally from the face of the body of the coupling, and these reaming cutters operate, as the drill descends, to ream out the wall of the hole. These reaming cutters are instrumental in cutting the wall of the drilled hole, as the work progresses, to provide the necessary clearance space between the wall of the hole and the exterior of the drill rod, for freedom in the turning movement of the drill, and to insure sufficient space for the debris or cuttings that are carried, upwardly, by the water, from the lower end of the drill.

Below its central body portion, the coupling 3 is fashioned with a slightly reduced, annular shank 11 that is internally screw threaded for connection with the enlarging bit 12 forming an essential feature of my invention. The bit 12 is fashioned with a reduced extension 13 that is threaded, externally, and screwed into the shank 11 of the coupling, and as best seen in Figure 3 the enlarging bit is fashioned with an integral, annular flange 14 that contacts with the lower annular ledge or shoulder 7' of the body of the coupling to insure a water tight joint between the coupling and the bit. As best shown in Figure 1, an annular water chamber 15 is fashioned within the upper end of the shank 11 of the coupling, below the thick

body wall of the coupling, and the annular flange 14 of the bit forms the inner wall of this chamber. Holes 16 in the flange 14 permit water to flow from the chamber into the bore 12' of the enlarging bit, which bore is alined with the bore of the coupling to accommodate the geological core that is formed by the drill.

On its lower end the enlarging bit is fashioned with an annular flange 17, threaded internally, and on its exterior this flange is fashioned with a tapering or conical face 18 in which the diamonds or cutting stones 19 are imbedded, and the diameter of the cutting face 18 decreases from that of the body of the enlarging bit to the exterior diameter of the face bit 20 forming the working terminal of the drilling tool.

The face bit is also a tubular structure with a bore 21 alined with the bore 12' of the enlarging bit, and the face bit is fashioned with an integral, externally threaded extension 22 that screws into the threaded flange 17 of the enlarging bit.

On its lower, annular, flat face 23 are provided diamonds or cutting stones 24, which follow a circular path with the longitudinal center of the drill as the axis of rotation, in the drilling operations for the formation of the core.

Thus, with a smaller area of cutters on the face bit than is customarily employed and with the enlarging cutters on the tapered face 18 a standard size hole may be drilled with accuracy, more rapidly than is usual, and at less expense.

It will be apparent that the cutters of the face bit advance into the earth, cutting out a comparatively small hole and the usual size core, and as the tool advances the cutters of the enlarging bit wear away the wall of the hole produced by the face-bit cutters, and finally, the reaming cutters 10 enlarge the hole for the drill rod.

It will be noted that the stones or diamonds 24 are smaller in size than the stones 19, and of course the smaller diamonds are less expensive than the larger ones, thus permitting the manufacture of the face bits at an extremely low cost compared with the cost of the enlarging bits, and as the face bits wear more quickly than the enlarging bits, I provide a number or set of face bits, for replacements, with a single enlarging bit. In as much as the face bits are comparatively inexpensive, I can replace worn ones when necessary and thus maintain the highest efficiency of the face bit on the drill tool. These face bits may readily be unscrewed from the enlarging bit and the worn face bit may quickly be replaced with a fresh one.

Due to the longitudinal advancing movement of the drill and the setting of the diamonds 19 in the tapering or angular enlarging face 18, pressure or resistance is imposed

against the diamonds 19 which tends to maintain them firmly in their settings, and these more expensive diamonds are therefore less liable to become misplaced or broken in the drilling operations. Therefore the durability of the enlarging bit, as compared with the face bit, is materially enhanced and the enlarging bit requires replacement, at much less frequent intervals, thus conserving time, and consequent expense due to labor costs in the changing operations.

Through the employment of the face bit and the enlarging bit, I find that greater footage may be drilled in a given period of time than can be accomplished by the usual face bit, thus materially lowering the costs per foot for drilling. By this arrangement of the two bits fewer stones are lost or destroyed, and the operator, by maintaining a supply of the face bits may replace them as needed without disturbing the enlarging bit. Inasmuch as the amount of money invested in stones or cutting diamonds in a complete drilling tool represents quite an investment, it will be apparent that by the combination and arrangement of parts herein shown I am enabled to materially reduce the drilling costs to a minimum.

By the use of the smaller face bit, as it penetrates the earth, the drilling tool is guided accurately to form a straight hole, and the enlarging bit prevents drifting and maintains the face bit in such position as to insure a straight hole, regardless of the rock structure, faults, or other obstacles.

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

1. In a drilling tool having an interior bore, the combination of a coupling having an interiorly threaded attaching shank, an interior, annular shoulder on the coupling below the shank, a core barrel seated on said shoulder and forming an annular space within the tool, said coupling having holes therein communicating with said space, a detachable bit secured to the coupling, and an inner perforated flange on said bit engaging the coupling to form a water space below said holes.

2. In a tubular drilling tool, the combination with an enlarging bit having an annular flange and an exterior conical face on said flange, of a face bit having an integral extension threaded in said flange and having a diameter approximately the minimum diameter of the conical face, an annular series of cutters on the conical face, and an annular series of cutters on said face bit.

3. In a tubular drilling tool, the combination with a threaded drill rod, of a coupling having a shank threaded on the rod, said coupling having upper and lower annular shoulders and an internally threaded lower shank, a core barrel supported on the upper

shoulder, an enlarging bit having an exterior threaded extension engaging said shank and an interior perforated flange on the bit engaging the lower shoulder, said bit having a lower internally threaded shank and a tapered exterior face on the shank, a face bit threaded in the bit-shank, cutters on the tapered face and the face bit, said perforated flange forming a water chamber in the coupling, and said coupling having holes therein affording communication between said space and an annular space between the core barrel and drill rod.

In testimony whereof I affix my signature.

WILLIAM J. MITCHELL.