Oct. 4, 1932. R. P. SIMMONS 1,880,215

DRILL HEAD FOR CORE BARRELS

Filed June 8, 1928 2 Sheets-Sheet 1

Fig. 1.

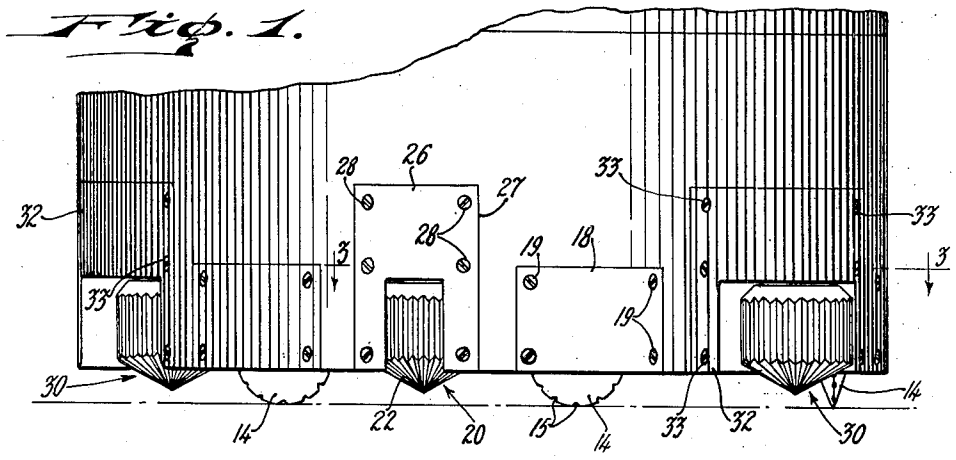
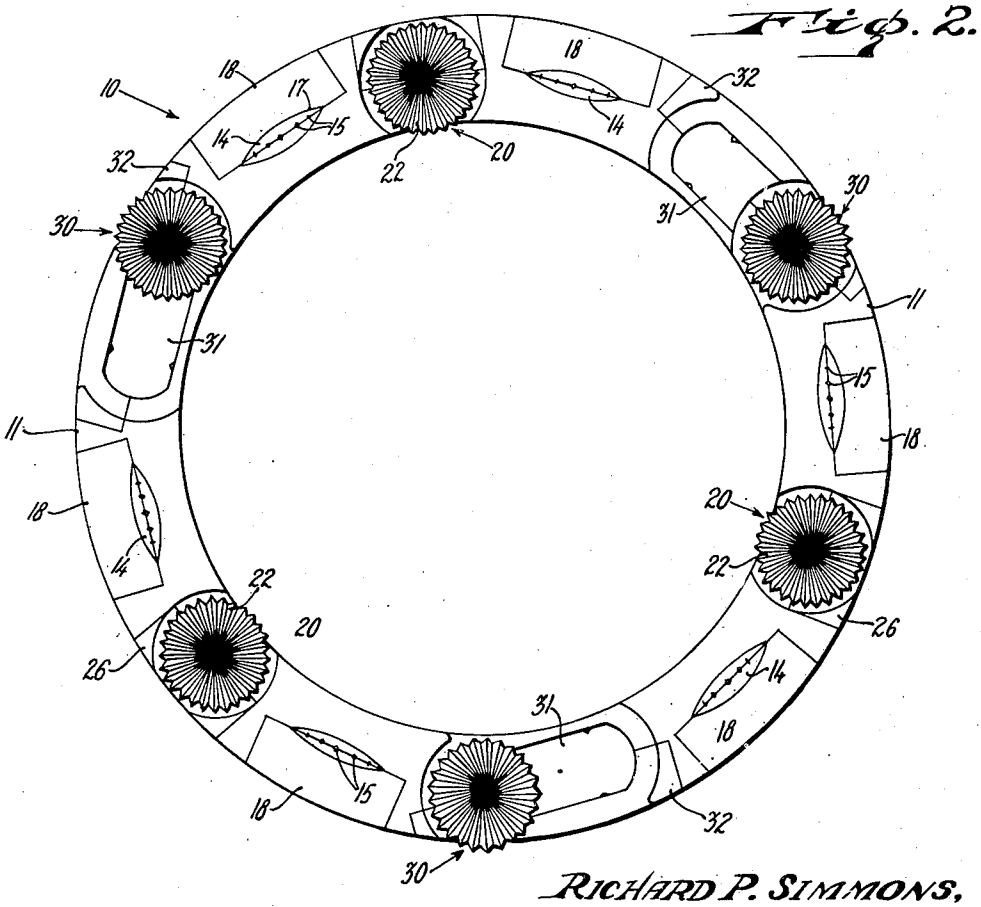


Fig. 2.



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Fig. 3.

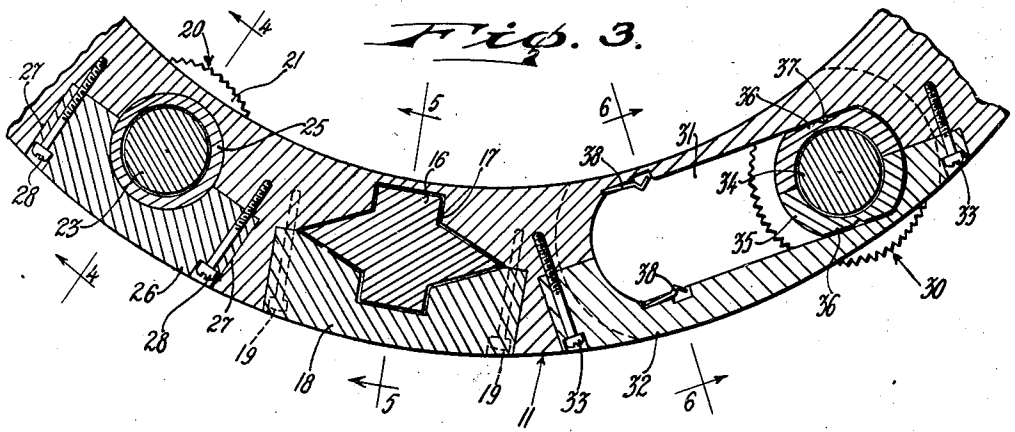


Fig. 4.

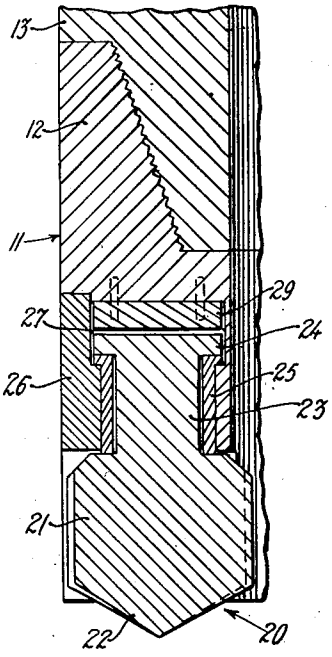


Fig. 5.

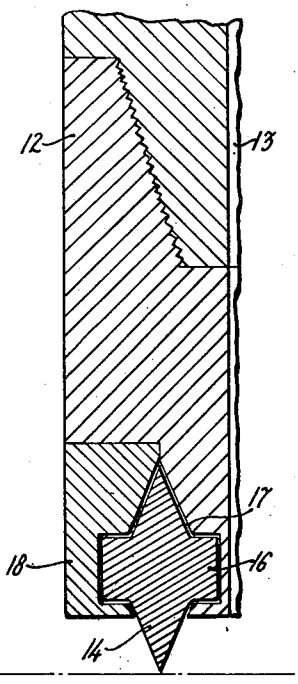


Fig. 6.

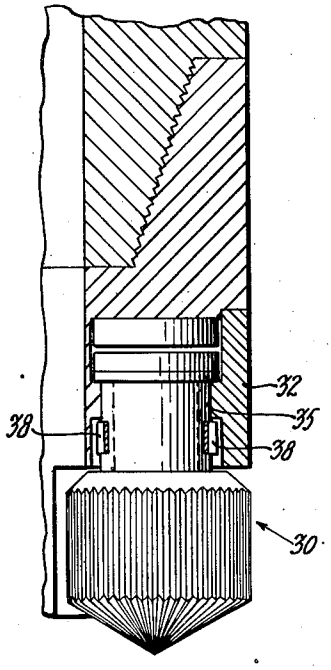
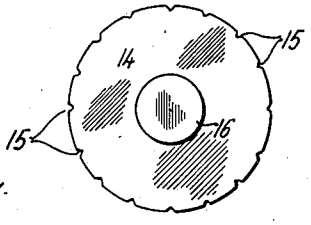


Fig. 7.



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UNITED STATES PATENT OFFICE

RICHARD P. SIMMONS, OF NEW YORK, N. Y.

DRILL HEAD FOR CORE BARRELS

Application filed June 8, 1928. Serial No. 283,847.

This invention relates to improvements in drill heads for attachment to core barrels of well drillling apparatus of the type shown in my prior Patent No. 1,717,271, issued June 11, 1929.

The primary object of the invention is to provide a drill head for cutting a circular hole in well drilling to form a central core and a path, for the free vertical movement of the drilling apparatus, when lowered during the gradual increase in depth of the well, and when removed therefrom to empty the preformed core from the core barrel.

Another object is to provide a drill head which includes an annular ring-like body adapted to be threadedly connected to the lower end of a rotatable core barrel, in which head extensible rotary bits are mounted for cutting beyond the periphery of the annular body to facilitate the lowering of a follower casing into the well during drilling thereof, and which bits are automatically extended upon rotation of said body in a clockwise direction and automatically retracted upon the reverse rotation of said body, or upon counter-clockwise rotation thereof.

A further object is the provision of a rotary drill head including an annular ring-like body having rotary bits for cutting inwardly of the inner and outwardly of the outer peripheries of said body, and cutter disks extending below the underside of said body to form a circular cut in the bottom of the well to initially provide a path for the drill bits, the cutting disks and rotary drill bits being alternately arranged in said body.

With these and other objects in view, the invention resides in a certain novel construction and combination and arrangement of parts, the essential features of which are hereinafter fully described, are particularly pointed out in the appended claims, and are illustrated in the accompanying drawings in which:—

Figure 1 is a fragmentary side elevation of my improved drill head for well drilling apparatus.

Figure 2 is a bottom plan view.

Figure 3 is a horizontal sectional view on the line 3—3 of Figure 1.

Figures 4, 5 and 6 are vertical transverse sectional views on the line 4—4, 5—5 and 6—6 respectively of Figure 3.

Figure 7 is a detail side elevation of one of the rotary cutter disks.

Referring to the drawings by reference characters, the numeral 10 designates my improved drill head in its entirety which includes an annular ring-like body 11 having an internally threaded portion 12 for threaded engagement with the lower end of a rotary core barrel 13 of a well drilling machine which is more clearly shown and described in the above mentioned co-pending application.

Mounted in the body and angularly spaced are rotary cutter disks 14 having their outer cutting edges notched as at 15, while trunnions 16 extend axially from opposite sides thereof. The cutter disks snugly fit in recesses 17, formed partially in the body and partially in removable, shaped blocks or plates 18 set into the body where cut away on the outer sides and bottom thereof. The inner trunnions have their bearings in the body. Each plate 18 is bolted to the body as at 19 and serves as a bearing for the outer trunnion of each cutter disk. The cutter disks project beyond the bottom of the body to cut a cross-sectionally V-shaped groove in the bottom of the well during a rotary drilling operation.

Mounted in the body and interposed between each alternate set of cutter disks 14 are rotary drill bits 20 for cutting within the inner peripheral edge of the body. Each of the drill bits 20 includes a toothed head 21 having its underside pointed as at 22 and provided with centrally converging teeth, the pointed ends of the heads being in a common circle with the cutting edges of the cutting disks. A reduced shank 23 having an annular flange 24 at its upper end rises from said head 21 and is journaled in a bearing sleeve 25 mounted in the body 11 and in a removable closure plate 26 fitting into a recess 27 in the body and held by removable bolts 28. The recess 27 opens at the sides and bottom of the body to allow the periphery of the head 21 to extend within the inner peripheral edge of the body to cut inward

thereof during drilling operation. A removable bearing plate 29 is mounted on the top wall of the recess 27 to strike against the top of the bit during the hammering or pounding of the apparatus when drilling.

Interposed between the other alternate pairs of cutter disks 14 are expansible and retractible rotary drill bits 30 or cutters of barrel form, exactly like the bits 20 just described, so that a detailed description of the former is not believed necessary. These bits 30 are slidably mounted in elongated slots 31 formed in the body and in removable plates 32 bolted to the body as at 33. The slots are arranged at a tangent with respect to the circumferential axis of the body and may be termed cam slots. The shanks 34 of the bits 30 are enclosed in bearing collars 35 having flat sides 36 engaging the opposed side walls of the slots 31, and which flat sides are provided with notches 37 for receiving spring catches 38 mounted in the side walls of the slots adjacent their inner ends, whereby the drill bits 30 may be locked in retracted positions against accidental movement. The heads of the drill bits 30 extend below the plane of the underside of the body and lie in the horizontal plane of the drill bits 20, and cut beyond the outer periphery of the body when in extended positions to facilitate the lowering of a follower casing into the well hole as the depth increases.

In practice, rotary movement is imparted to the drill head 10 by reason of its connection to the rotary core barrel 13, and when in position within a well hole, the cutters 14 cut a circular cross-sectionally V-shaped path in the bottom thereof, the opposed side walls of the V-shaped groove being attacked by the following rotary bits 20 and 30. The bits 20 cut inwardly of the inner periphery of the ring-like body 11 to form a core to be received in the core barrel, while the bits 30 during clockwise rotation of the drill head, move to extended positions to cut beyond the exterior periphery of the ring-like body for the lowering of the follower casing. The bits 30 are extended during clockwise rotation of the drill head by centrifugal force and by the friction between the bits and the walls of the well. However, when it becomes necessary to remove the drilling apparatus and drill head as a unit from the well hole to empty the core barrel of a core of earth, a slight reverse or counter clock-wise rotation is imparted to the rotary core barrel and drill head, which slides the drill bits 30 toward the inner walls of the slots 31, so that the drill bits lie within the confines of the ring-like body, leaving no obstruction which would interfere with the withdrawal of the apparatus from the well. The drill bits 30 lock in the retracted position by reason of the spring catches snapping into the notches 37 to prevent accidental shifting of the bits during lifting of the drill head, but the tension between the catches and the notches is such that the centrifugal force and friction upon rotation of the drill head in a clockwise direction will automatically overcome the same to free said drill bits and allow them to move to an extended position.

As shown in Fig. 3, the rotary drill bits are adapted to project inwardly of the inner periphery of the core barrel, due to the inclination of the slot 31, and thus cut the rock core which is crowded into the core barrel, when the core barrel is turned in the direction of the arrows 6.

Although I have shown the expansible bits for cutting beyond the outer periphery of the body, it will be appreciated that similar bits may be arranged for cutting inwardly of the inner periphery thereof in lieu of the stationary rotary drill bits 20, if desired. Furthermore, a drill head may be constructed of all expansible bits, either for cutting an inner or outer path, or both, without departing from the spirit of my invention.

While the cutter ring or head herein disclosed is particularly adapted for use where the core barrel is rotary, it is also adapted for use where the core barrel is operated by percussive action. Under the latter condition of operation, the cutter ring or head is forced against the earth intermittently by the hammering or pounding attending percussive operation.

In drilling wells by percussive action the material in the path of the well bore is pounded by successive impacts into the adjacent mass of earth. This necessarily involves the condensing of the earth in advance of the well bore with the earth surrounding the same. As the well increases in depth the natural density of the earth also increases, so that the amount of earth, rock or other material which can be displaced by this pounding or percussive action, decreases. This requires a progressive reduction in the diameter of the well, as it is deepened. The larger the area of the percussive drill head the greater will be the mass of material which is displaced by the pounding, and if the density of the earth or material is too great for a given diameter of drill head, current practice requires that the drill head be reduced, which necessitates the use of a smaller diameter well casing within the larger diameter well casing previously installed in place.

By the use of the percussive core barrel, the area of resistance encountered approximately equals that met by the smallest diameter percussive drill now in general use. To make this drill head effective as a percussive tool, so that the core is not displaced by the percussive action or pounding, but can be extracted with the core barrel, it is necessary that the core barrel cut a path through the

ground which is larger than the barrel itself, and also cut a path around the core, so that the barrel may be freely actuated by the associated percussive unit.

By means of my improved core barrel cutting head I make this possible. The mass of material which is displaced by this core barrel will not be sufficient to prevent the maximum penetration of a core barrel through the ground, so that a large diameter well may be excavated from the ground to the oil zone.

By the use of my improved core barrel cutter head the body of the core of a well may be extracted, while only a minor portion of the obstructing mass is poured into what ultimately becomes the wall of the well.

While I have described what I deem to be the most desirable embodiment of my invention, it is obvious that many of the details may be varied without in any way departing from the spirit of my invention, and I therefore do not limit myself to the exact details of construction herein set forth nor to anything less than the whole of my invention limited only by the appended claims.

What is claimed as new is:—

1. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, the rotary cutting disks having their cutting edges cross-sectionally V-shaped with the angle of the V less than the angle of the tapered ends of the cylindrical bits.

2. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, the rotary cutting disks having their cutting edges cross-sectionally V-shaped with the angle of the V less than the angle of the tapered ends of the cylindrical bits, the cutting edges of the disks and the lower extremities of some of the cylindrical bits lying in a common circle.

3. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, the rotary cutting disks having their cutting edges cross-sectionally V-shaped with the angle of the V less than the angle of the tapered ends of the cylindrical bits, the cutting edges of the disks and the lower extremities of some of the cylindrical bits lying in a common circle, the cylindrical bits alternating with the cutting disks.

4. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, the rotary cutting disks having their cutting edges cross-sectionally V-shaped with the angle of the V less than the angle of the tapered ends of the cylindrical bits, certain of said cylindrical bits being bodily movable with respect to the head.

5. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, the rotary cutting disks having their cutting edges cross-sectionally V-shaped with the angle of the V less than the angle of the tapered ends of the cylindrical bits, certain of said cylindrical bits being bodily movable relative to the head in substantially tangential directions.

6. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, the rotary cutting disks having their cutting edges cross-sectionally V-shaped with the angle of the V less than the angle of the tapered ends of the cylindrical bits, certain of said cylindrical bits being bodily stationary with respect to the head while the remainder are bodily movable with respect to the head.

7. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, the rotary cutting disks having their cutting edges cross-sectionally V-shaped with the angle of the V less than the angle of the tapered ends of the cylindrical bits, certain of said cylindrical bits being bodily stationary with respect to the head while the remainder are bodily movable with re-

spect to the head, in directions substantially tangential of the latter.

8. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, said disks and said bits having their axes of rotation angularly related, said bits having teeth on their peripheries extended onto their lower tapered ends.

9. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, said disks and said bits having their axes of rotation angularly related, said bits having teeth on their peripheries extended onto their lower tapered ends, certain of said bits being bodily stationary with respect to the head while the remainder are bodily movable with respect thereto in substantially tangential directions.

10. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, said disks and said bits having their axes of rotation angularly related, said bits having teeth on their peripheries extended onto their lower tapered ends, certain of said bits being bodily stationary with respect to the head while the remainder are bodily movable with respect thereto in substantially tangential directions, the bodily stationary bits having their peripheries projecting within the inner periphery of the head.

11. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, rotary cutter disks journalled in said body and having a cutting edge projecting from the underface thereof, and rotary cylindrical bits also journalled in the body with their under ends projecting from the underface of said body and tapered to cutting points, said disks and said bits having their axes of rotation angularly related, said bits having teeth on their peripheries extended onto their lower tapered ends, certain of said bits being bodily stationary with respect to the head while the remainder are bodily movable with respect thereto in substantially tangential directions, the bodily stationary bits having their peripheries projecting within the inner periphery of the head, while the bodily movable bits have their peripheries projecting beyond the outer periphery of the head in certain positions with respect to the head.

12. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, cylindrical cutting bits mounted in said body with respect to which they are bodily movable to project beyond the periphery of the body if the latter be rotated in one direction but to recede within the periphery if the body be rotated in the opposite direction.

13. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, cylindrical cutting bits mounted in said body with respect to which they are bodily movable to project beyond the periphery of the body if the latter be rotated in one direction but to recede within the periphery if the body be rotated in the opposite direction, said bodily movement being in lines substantially tangential of the body.

14. A drill head attachment for the core barrel of a well drilling apparatus comprising an annular body, cylindrical cutting bits mounted in said body with respect to which they are bodily movable to project beyond the periphery of the body if the latter be rotated in one direction but to recede within the periphery if the body be rotated in the opposite direction, said bodily movement being in lines substantially tangential of the body, the body being provided with latching means to retain said bits in retracted position, said latching means being releasable upon rotation of the body in one direction by the centrifugal force to which said bits are then subjected.

15. A rotary drill head having a body, rotary cutters carried by the body and projecting from the underface thereof, certain of said cutters being of cylindrical form with teeth on their cylindrical surfaces, and slides mounted in said body for movement substantially tangentially thereof, said cylindrical cutters being rotatably mounted in said slides.

16. A cutter head for core barrels comprising an annular body, cutter disks rotatably mounted in said body and projecting from the under edge thereof, cylindrical cutting bits rotatably mounted in said body and projecting from the underface thereof, said bits having their under ends conically formed and being provided with peripheral cutting teeth extending onto said ends, certain of said bits projecting within the inner periphery of the body while the others are bodily movable with respect to the body to project beyond the outer periphery thereof or to recede within the outer periphery.

17. A drill head comprising an annular body, cylindrical bits journalled in the lower end of the body and projecting from the lower end, certain of said bits having their peripheries projecting within the inner periphery of the body and the others having their peripheries projecting beyond the outer periphery of the body, said latter bits being retractable within the outer periphery of the body but maintained in projecting position during rotation of the body in one direction.

18. A drill head comprising an annular body, cylindrical bits journalled in the lower end of the body and projecting from the lower end, certain of said bits having their peripheries projecting within the inner periphery of the body and the others having their peripheries projecting beyond the outer periphery of the body, said latter bits being retractable within the outer periphery of the body but maintained in projecting position during rotation of the body in one direction said bits being formed with teeth on their cylindrical surfaces and on their lower ends.

19. A drill head comprising an annular body, cylindrical bits journalled in the lower end of the body and projecting from the lower end, certain of said bits having their peripheries projecting within the inner periphery of the body and the others having their peripheries projecting beyond the outer periphery of the body, said latter bits being retractable within the outer periphery of the body but maintained in projecting position during rotation of the body, said bits being formed with teeth on their cylindrical surfaces and on their lower ends which are tapered to points.

20. A drill head comprising an annular body, cylindrical bits journalled in the lower end of the body with their lower extremities projecting beyond the lower end of the body and tapered to points, some of said cylindrical bits having their peripheries projecting within the inner periphery of the body and being provided with teeth on their cylindrical surfaces and on their tapered ends.

In testimony whereof I have affixed my signature.

RICHARD P. SIMMONS.