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J. D. WORTHINGTON ET AL

3,169,591

DUAL DRILL BIT APPARATUS

Filed Nov. 21, 1961

2 Sheets-Sheet 1

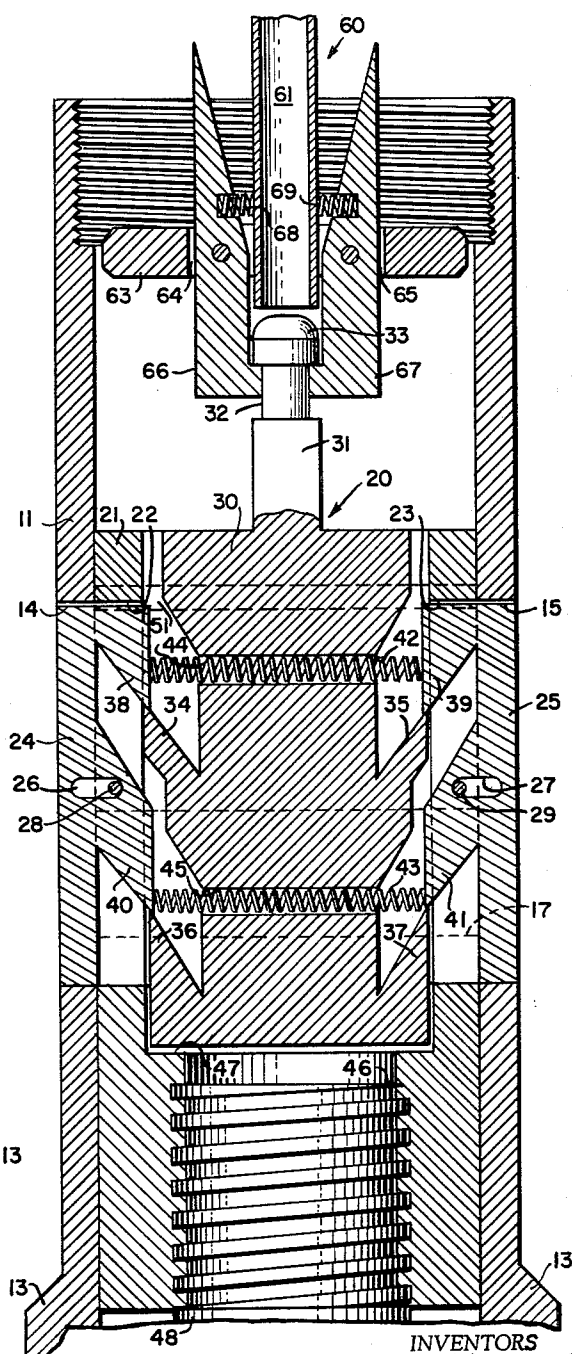
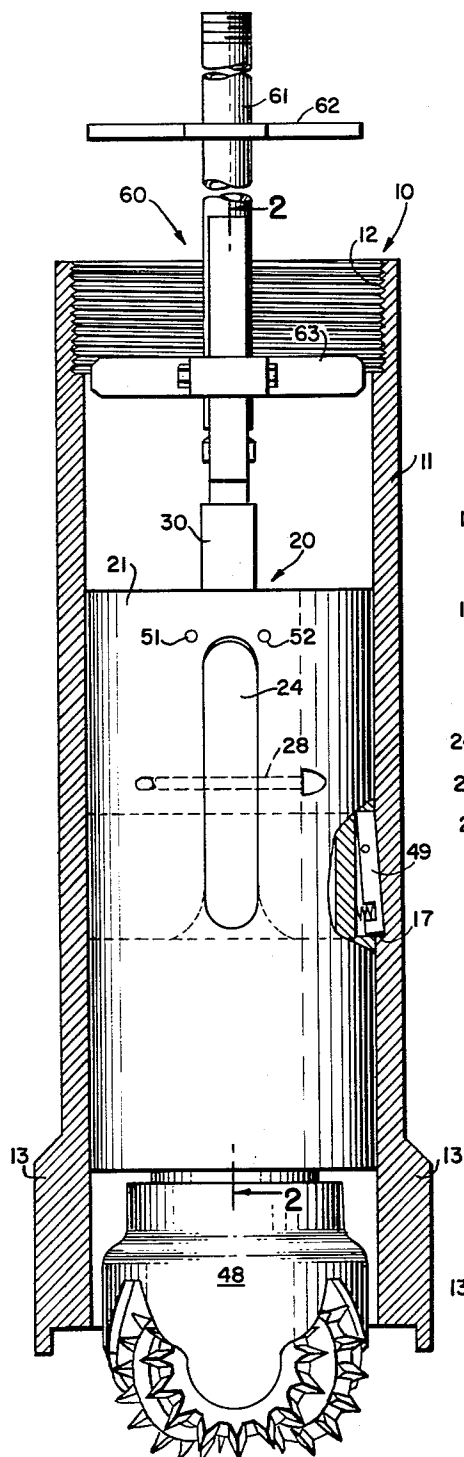


FIG. 2. John D. Worthington &
BY John L. Owen

Irvin A. Lavine
ATTORNEY

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2 Sheets-Sheet 2

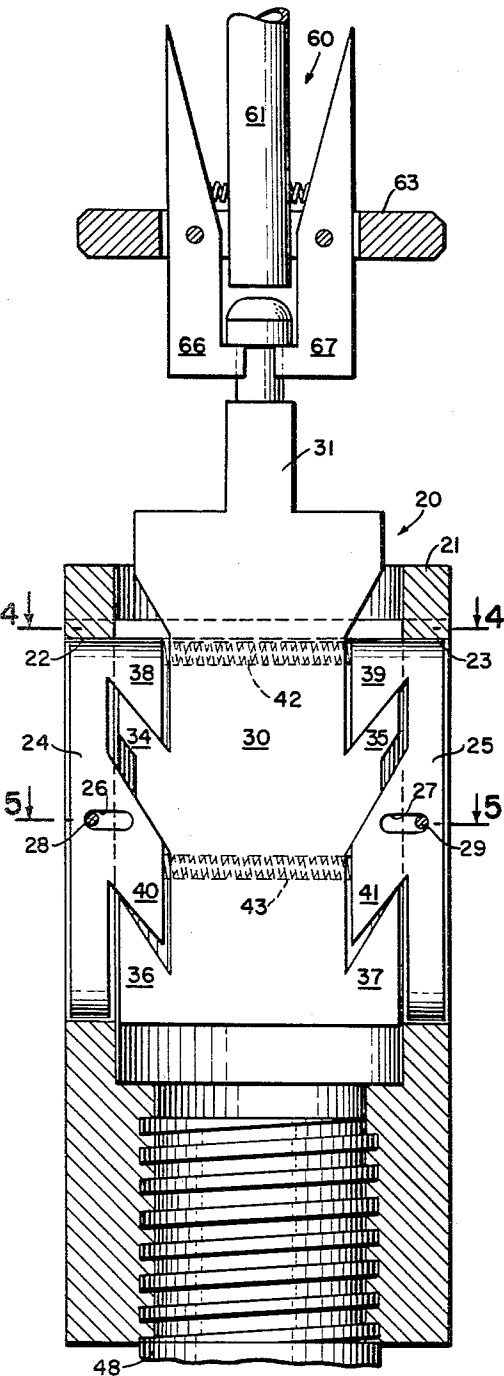


FIG. 3.

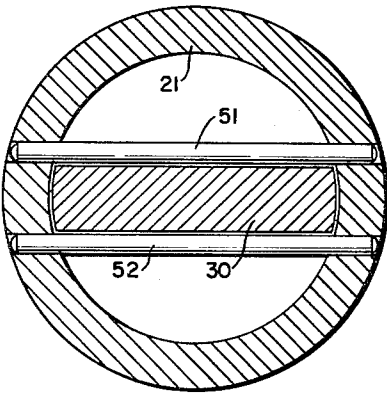


FIG. 4.

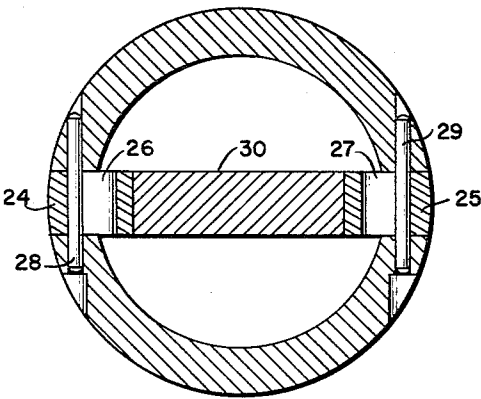


FIG. 5.

INVENTORS
John D. Worthington &
John L. Owen

BY

Irvin. A. Levine
ATTORNEY

1

3,169,591

DUAL DRILL BIT APPARATUS

John D. Worthington, Box 608, Somerset, Pa., and John L. Owen, 9235 SW. 43rd Terrace, Miami, Fla.

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17 Claims. (Cl. 175-257)

The present invention relates to dual drill bit apparatus, and more particularly to a drill bit in which a casing member has teeth at its lower end, and a removable cone bit or the like within the casing member, and retractable dogs to permit removal of the cones bit from the casing member.

In drilling holes into the earth, it is usual to sink a casing as far as possible, and then to lengthen the hole by utilizing a roller cone bit or other type bit which is passed downwardly through the casing. Sediment and debris are removed as the drilling proceeds by a fluid, either air, water or drilling mud.

In order to enable the hole to be drilled deeper, and to have the casing reach to the bottom of the hole, it has been proposed heretofore to provide a special terminal casing member having teeth thereon so that as the casing is rotated and lowered the teeth on the terminal casing member will cut away the earth in an annular pattern; there was combined with this terminal casing member a supplementary bit, which was located within the casing member and at its lower end, this bit being secured to the casing member for rotation with and by it. The supplementary bit was secured to a body which was engageable by retractable dogs with the casing member, so as to be turned by the casing member as it rotated to thereby rotate the bit. The retractable dogs were provided in order that the supplementary bit could be withdrawn. Withdrawal of the supplementary bit was effected by an auxiliary tool so as to leave in the earth an unobstructed casing member extending from the bottom of the hole to the surface.

The prior apparatus of the nature generally described above were of several configurations and these configurations were deficient and undesirable. In one such apparatus, the casing member was provided with a plurality of grooves parallel to its axis, and the supplementary bit body had on it a plurality of dogs which were spring urged outwardly into the grooves; these dogs had at their upper ends spring fingers which were inwardly inclined and over which a conical member was lowered for the purpose of retracting the dogs. This would inherently cant the dogs out of their intended vertical alignment, thereby tending to jam them in the body in which they were carried. Further, the conical member was part of a tool which engaged in an eccentric manner with interior screw threads of the body, so that when the tool was raised an eccentric force was applied to the body, thereby tending to cant the body and to jam it in the casing member. This prior apparatus was expensive to manufacture, was erratic in operation due to its inherent canting of the dogs and of the main body, and also provided a connection between the withdrawal tool and the body which was liable to rupture, since the entire weight of the supplementary bit and its supporting body were borne by a small arc of a screw thread.

In another construction, a pivoted locking plate was provided, this locking plate being pin-connected to the main body which supported the supplementary bit, and having a triangular opening in it. A movable plunger was located in the main body, with furcations thereof on either side of the locking plate and with a pin secured to the furcations of the plunger and passing through the triangular opening in the locking plate. By withdrawal of the plunger upwardly, the last mentioned pin engaged

2

with a side of the triangular opening to thereby rotate the locking plate and withdraw a projection thereon from a slot in an insert provided in the casing member. This construction was such that substantial forces were exerted on the pins so that these pins were liable to bending and breaking with attendant failure of recovery of the supplementary bit. Also, the drive between the casing member and the supplementary bit could be effected only through the projection of the locking plate which would thereby tend to bend or shear under heavy loads.

An object of the present invention is to provide a dual drill bit apparatus characterized by great strength and ruggedness.

Another object of the present invention is the provision of a dual drill bit apparatus in which a supplementary bit may be withdrawn and lifted readily from the outer casing.

Yet another object of the present invention is to provide a dual drill bit apparatus in which the lifting forces on the supplementary bit body are balanced during lifting.

A further object of the present invention is the provision of a dual drill bit apparatus in which the interengaging dogs are positively and effectively withdrawn.

A still further object of the present invention is to provide a dual drill bit apparatus which may be readily and economically manufactured.

Other objects and many of the attendant advantages of the instant invention will be apparent from the following specification and drawings, within:

FIG. 1 is an elevational view of the dual drill bit apparatus of the present invention, with parts thereof removed and in section.

FIG. 2 is cross-sectional view taken on the line 2-2 of FIG. 1.

FIG. 3 is an elevational view, with parts in section, of the attachment member of the drill bit apparatus of the present invention, with the dogs in the withdrawn position.

FIG. 4 is a cross-sectional view taken on the line 4-4 of FIG. 3.

FIG. 5 is a cross-sectional view taken on the line 5-5 of FIG. 3.

Referring now to the drawings, wherein like or corresponding reference numerals designate like or corresponding parts throughout the several views, there is shown in FIG. 1 a dual drill bit apparatus 10 comprising an outer casing member 11 having screw threads 12 at its upper end whereby it may be attached in conventional fashion to and may form a part of a casing string. At its lower end, casing member 11 is provided with cutting teeth 13 to enable it to cut an annular hole in the earth. A pair of slots 14 and 15 (see FIG. 2) extend vertically in the casing member 11 and parallel to the longitudinal axis thereof, the slots 14 and 15 being diametrically opposed. The slots 14 and 15 receive retractable dogs as will be hereinafter described. In the inner face of the casing member 11 is an annular groove 17 which enlarges as shown in dashed lines on FIGURE 1 in the vicinity of slots 14 and 15.

Within the casing member 11, as is shown in FIGS. 1 and 2, there is an attachment member generally designated 20 and comprising a cylindrical body 21. A pair of slots 22 and 23 are provided in cylindrical body 21, these slots generally corresponding in size and orientation to the slots 14 and 15 in the casing member 11.

A pair of dogs 24 and 25 extend through the slots 22 and 23 in the cylindrical body 21 and also through the slots 14 and 15 in casing member 11, and in the position of the parts shown in FIGS. 1 and 2. The dogs 24 and 25 have generally horizontal slots 26 and 27 therein (see FIGS. 2 and 5) through which extend pins 28 and 29 which are carried by the cylindrical body 21. As will be

understood, pins 28 and 29 serve as guides for the dogs 24 and 25 through their association with the slots 26 and 27.

An actuator plate 30 is carried in the cylindrical body 21, and extends generally between the slots 22 and 23 therein. Plate 30 has at its upper end a centrally disposed upstanding post 31 which is provided with a groove 32 beneath a mushroom head 33.

The actuator plate 30 has upwardly sloping teeth 34, 35, 36 and 37, and the dogs 24 and 25 have downwardly sloping teeth 38, 39, 40 and 41 which engage with the teeth of the actuator plate 30. Springs 42 and 43 extend through holes 44 and 45, respectively, in actuator plate 30 to thereby urge the dogs 24 and 25 to the outward positions thereof shown in FIG. 2, due to the engagement of the ends of these springs with the dogs.

At its lower end, cylindrical body 21 is provided with a reduced, screw threaded bore 46, and an upwardly facing annular shoulder 47, which latter serves as a stop for the actuator plate 30. The screw threaded bore 46 receives the upper end of a roller cone bit 48 of known construction.

A spring pressed detent 49 is carried by the cylindrical body 21 to thereby halt the downward movement of attachment member 20 as it is being lowered through the casing member 11, due to the engagement of the spring pressed detent 49 in the groove 17, this construction being shown in FIG. 1. Cylindrical body 21 also carries a pair of parallel transversely extending guide pins 51 and 52, these being on either side of actuator plate 30 as is clearly shown in FIG. 4, and thereby serving to guide the actuator plate 30 in its vertical movements in cylindrical body 21.

In assembling the dual drill bit apparatus 10, the parts are positioned initially with the actuator plate 30 in an upper position so that the dogs 24 and 25 are thereby retracted. The attachment member 20 is then lowered partially into the casing, and the spring detent 49 depressed, after which the attachment member 20 may continue to be lowered through the casing. When the attachment member 20 has descended sufficiently so that spring detent 49 is at groove 17, detent 49 will move outwardly to the position shown in FIG. 1 and thereby prevent further downward movement of attachment member 20. Should the attachment member 20 be so oriented that detent 49 is in alignment with one or the other of the slots 14 and 15, rotation of the attachment member 20 will be permitted by the enlargement of the groove 17 at the slots 14 and 15, which will thereby permit the detent 49 to be cammed out of the slot 14 or 15. Thereafter, by releasing any upward force on actuator plate 30, and by rotating attachment member 20, the dogs 24 and 25 will become aligned with the slots 14 and 15 in casing member 11 and will be urged therethrough by springs 42 and 43, so that the position of FIG. 2 is obtained. Thereafter, drilling may proceed due to rotational forces applied to the casing string, with the dual drill bit apparatus 10 at the lower end thereof, and with the drive being through casing member 11 and the dogs 24 and 25 to the cylindrical body 20 and the conical roller bit 48. This connection is extremely rugged and strong.

When it is desired to withdraw the supplementary bit including attachment member 20 and cone bit 48, a suitable tool (described herein below) is lowered through the casing string and engaged with the underside of head 33, and is then moved upwardly. The parts initially being in the position shown in FIG. 2, the upwardly sloping teeth 34, 35, 36 and 37 of the actuator plate 30 will engage with the downwardly sloping teeth 38, 39, 40 and 41 respectively of the dogs 24 and 26 to thereby cause the withdrawal of the dogs 24 and 25 against the urging of the springs 42 and 43. Dogs 24 and 25 will thereby be moved inwardly in a positive and effective manner, guided somewhat by the boundaries of the slots 22 and 23 and also by the guide pins 28 and 29 as may be seen from FIGS. 2, 3 and 5. When the dog 24 and 25 have been

withdrawn from the slots 14 and 15 in casing member 11 into the position shown in FIG. 3, the upward force will effect the removal of the cylindrical body 21 and roller cone bit 48, so that the entire attachment member 20 will be withdrawn from casing member 11 upwardly there-through. The lifting force will be at and along the axis of the attachment member 20, and will pass through the center of gravity thereof.

To effect manipulation of the attachment member 20, there is provided a tool 60 comprising an upstanding rod 61 with a cruciform guide 62 near its upper end and a second cruciform guide 63 near its lower end. As may be seen from FIGS. 2 and 3, the guide 63 has a pair of apertures 64 and 65 therethrough, with grip fingers 66 and 67 pivotally secured to the guide 63 and extending through the apertures 64 and 65 respectively. Springs 68 and 69 abut against the rod 61 and the fingers 66 and 67, respectively to thereby urge these fingers to a closed condition, and to permit them to open. The fingers 66 and 67 will be caused to open by the head 33 as the tool 60 is lowered, and then will snap closed beneath head 33 to firmly grip the post 31.

As will be understood, the tool 60 is merely illustrative of one form of tool that could be used for the manipulation of the actuator plate 30, and other forms of tools could be used.

There has been provided a dual drill bit apparatus which is relatively easily and inexpensively manufactured and which is of great strength throughout. With the apparatus herein disclosed, it is relatively easy to place the attachment member within the casing member and to lock it in driving relationship therewith. Further, the apparatus of the present invention provides for the positive retraction of the dogs and for the lifting of the entire attachment with the roller cone bit, thus insuring that the roller cone bit positively will be removed from the bore hole as will also be understood. There is provided a very strong and positive driving connection between the two bit portions of the present dual drill bit apparatus.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. Drilling apparatus comprising a casing member having screw threads at its upper end for connection to a casing, said casing member having teeth at the lower end thereof and a pair of generally vertically extending diametrically opposed slots therethrough, an attachment member in said casing member comprising a generally cylindrical body having a pair of slots corresponding to said slots in said casing member, a pair of dogs in the slots of said attachment member and extending into the slots of said casing member, horizontal slots in said dogs and pins carried by said body and extending through the slots of said dog, an actuator plate in said body extending generally between said slots in said body, said plate having at its upper end a centrally disposed upstanding post having a recess near its upper end, springs extending through said actuator plate and engaging said dogs to thereby urge said dogs outwardly, said dogs having downwardly sloping teeth thereon and said actuator plate having upwardly sloping teeth in engagement therewith to thereby retract said dogs and remove them from the slots in said casing member, guide pins in said cylindrical body for guiding said plate in a generally vertical path, detent means in said cylindrical body to limit the downward movement of said plate, groove means in the interior surface of said casing member for receiving said detent means, and a roller cone bit carried by said attachment member, whereby a tool may grip said post at the recess thereof and pull said plate upwardly to retract said dogs and remove said attachment member and bit from said casing member.

2. Drilling apparatus comprising a casing member hav-

4. Drilling apparatus comprising a casing member having screw threads at its upper end for connection to a casing, said casing member having teeth at the lower end thereof and a pair of generally vertically extending diametrically opposed slots therethrough, an attachment member in said casing member comprising a generally cylindrical body having a pair of slots corresponding to said slots in said casing member, a pair of dogs in the slots of said attachment member and extending into the slots of said casing member, horizontal slots in said dogs and pins carried by said body and extending through the slots of said dog, an actuator plate in said body and extending generally between said slots in said body, said plate having at its upper end a centrally disposed upstanding post having a recess near its upper end, spring means engaging said dogs and urging said dogs outwardly, said dogs having downwardly sloping teeth thereon and said actuator plate having upwardly sloping teeth in engagement therewith to thereby retract said dogs and remove them from the slots in said casing member, and a roller

8. Drilling apparatus comprising a casing member having a pair of generally vertically extending diametrically opposed slots therethrough, an attachment member in said casing member comprising a body having a pair of slots

corresponding to said slots in said casing member, a pair of dogs in said slots of said attachment member and extending into the slots of said casing member, means for guiding said dogs in horizontal inward and outward motion, an actuator plate in said body and extending generally between said slots in said body, said plate having at its upper end a centrally disposed upstanding post having a recess near its upper end, spring means engaging said dogs and urging said dogs outwardly, said dogs having downwardly sloping teeth thereon and said actuator plate having upwardly sloping teeth in engagement therewith to thereby retract said dogs and remove them from the slots in said casing member, and a bit carried by said attachment member, whereby a tool may grip said post at the recess thereof and pull said plate upwardly to retract said dogs and remove said attachment member and bit from said casing member.

9. Drilling apparatus comprising a casing member having a pair of generally vertically extending diametrically opposed slots therethrough, an attachment member in said casing member comprising a body having a pair of slots corresponding to said slots in said casing member, a pair of dogs in said slots of said attachment member and extending into the slots of said casing member, means for guiding said dogs in horizontal inward and outward motion, an actuator plate in said body, said dogs having downwardly sloping teeth thereon and said actuator plate having upwardly sloping teeth in engagement therewith to thereby retract said dogs and remove them from the slots in said casing member when said actuator plate is raised, spring means engaging said dogs and urging said dogs outwardly, and a bit carried by said attachment member.

10. The drilling apparatus of claim 9, said attachment member having a spring pressed detent on the outer surface thereof and said casing member having an annular groove in the interior surface thereof.

11. Drilling apparatus comprising a casing member having means therein for receiving dog means, an attachment member in said casing member comprising a body, opening defining means in said body, dog means in said body extending through said opening defining means and into said receiving means, teeth means on said dog means, actuator means in said body having teeth means in engagement with the teeth means of said dog means for moving said dog means inwardly upon axial movement of said teeth actuator means, spring means urging said dog means outwardly, and a bit secured to the said attachment member, whereby said attachment member may be driven from said casing member and removed therefrom.

12. Drilling apparatus comprising a casing member

having means therein for receiving dog means, an attachment member in said casing member comprising a body, opening defining means in said body, dog means in said body extending through said opening defining means and into said receiving means, downwardly directed teeth means on said dog means, actuator means in said body having upwardly directed teeth means in engagement with the teeth means of said dog means for moving said dog means inwardly upon axial movement of said teeth actuator means, and a bit secured to the said attachment member, whereby said attachment member may be driven from said casing member and removed therefrom.

13. Drilling apparatus comprising a casing member having means therein for receiving dog means, an attachment member in said casing member comprising a body, opening defining means in said body, dog means in said body extending through said opening defining means and into said receiving means, actuator means in said body adapted to be translated longitudinally therein, interengaging means on said actuator means and said dog means for moving said dog means inwardly upon longitudinal movement of said actuator means, said interengaging means having progressively increasing contact areas as said actuator means is moved longitudinally to move said dog means inwardly, said attachment member adapted to have a bit secured thereto.

14. The drilling apparatus of claim 13, and spring means urging said dog means outwardly.

15. The drilling apparatus of claim 13, and teeth on said casing member.

16. The drilling apparatus of claim 13, said casing member being circular in cross section and having on an internal groove, and said body having a spring-pressed detent thereon for engagement in said groove.

17. The apparatus of claim 13, wherein there are a plurality of said dog means.

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CHARLES E. O'CONNELL, *Primary Examiner*,