April 7, 1959 A. E. BLOUNT 2,880,967

APPARATUS FOR PLANTING EXPLOSIVE CHARGES AT SUBMARINE LOCATIONS

Filed Aug. 9, 1957

FIG. 2.

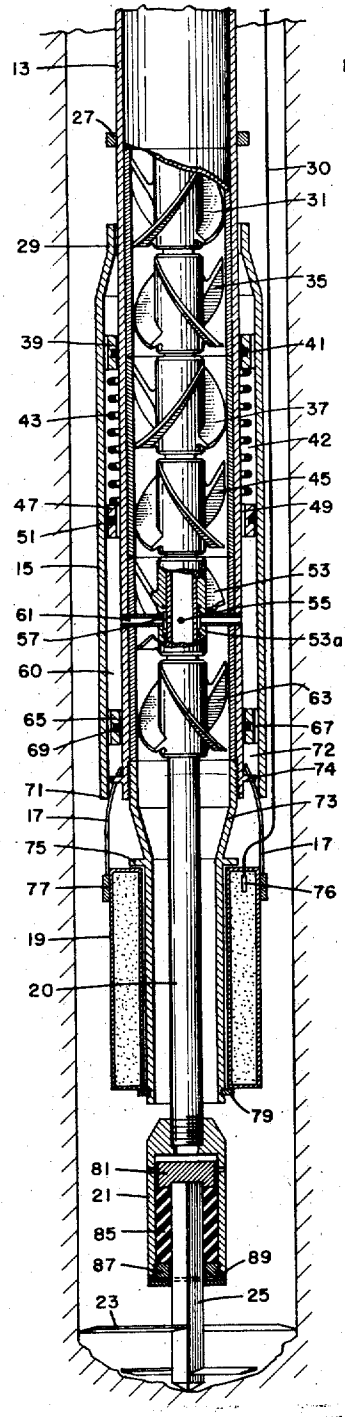


FIG. 3.

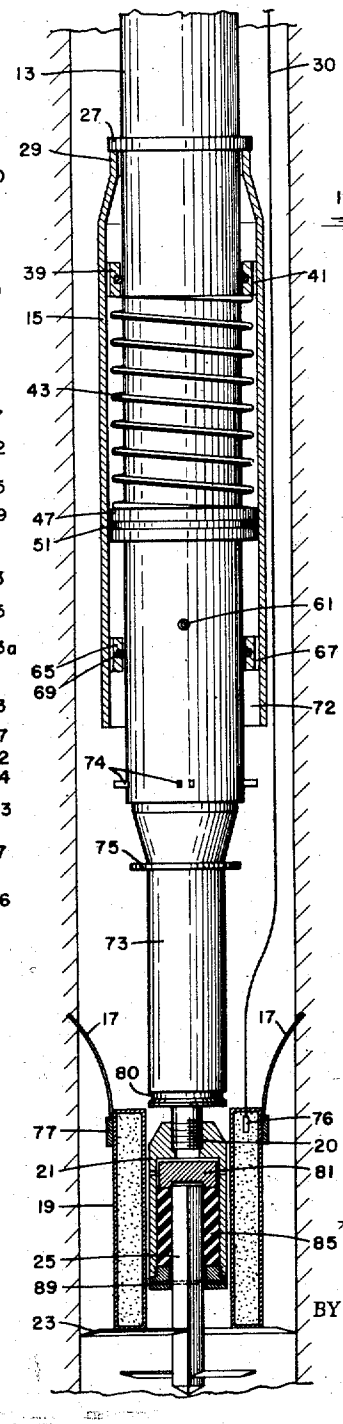
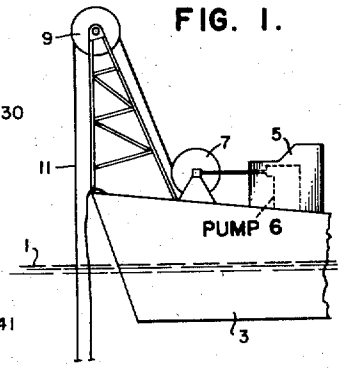
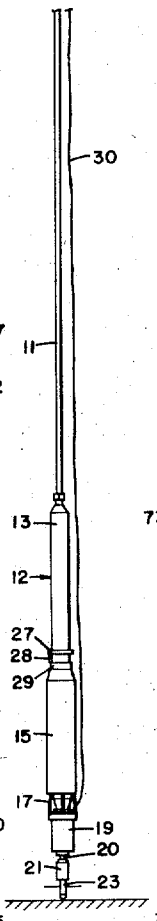


FIG. 1.





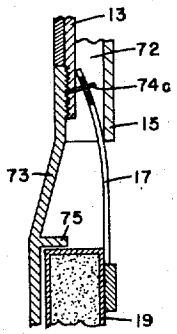


FIG. 4.

INVENTOR.
Alvie E. Blount,
BY
John B. Davidson
ATTORNEY

United States Patent Office 2,880,967 Patented Apr. 7, 1959

2,880,967

APPARATUS FOR PLANTING EXPLOSIVE CHARGES AT SUBMARINE LOCATIONS

Alvie E. Blount, Houston, Tex., assignor, by mesne assignments, to Jersey Production Research Company, Tulsa, Okla., a corporation of Delaware

Application August 9, 1957, Serial No. 677,352

8 Claims. (Cl. 255—4)

This invention relates to apparatus for drilling into water-submerged earth formations, and more particularly to apparatus for planting explosive charges in the earth in connection with seismic prospecting operations at marine locations.

In co-pending application Ser. No. 633,955, "Charge Planting Motor Bit Drill," filled January 14, 1957, by Alvie E. Blount and assigned to the assignee of the present invention, there is described apparatus for drilling into the earth from a barge or other craft at the surface of a body of water. The apparatus described therein utilizes a drill bit, preferably driven by a hydraulic motor, that is detachable from the remainder of the apparatus by withdrawing the apparatus upwardly from the earth after the desired depth within the earth has been reached. Connected to an explosive charge is flexible resilient barb means extending upwardly so as to offer a minimum of resistance to downward movement of the charge through the earth, but which can offer a maximum resistance to upward movement after the charge has been lowered into the earth. While the apparatus has been notably successful in marshes, lakes, and at off-shore locations, it has presented certain problems when operations are attempted when surface conditions are not relatively calm. As a result of rolling and pitching of the craft from which drilling operations are conducted, to prevent premature separation of the explosive charge container from the remainder of the apparatus, it is necessary to exercise considerable care and skill in order to avert upward movement of the drilling apparatus before the desired drilling depth is attained. Inasmuch as marine seismic operations are exceedingly expensive, it is imperative that seismic operations be conducted whenever possible and with a minimum amount of interruption due to rough seas. Furthermore, at times it is desirable to retract the drill assembly with dynamite attached. It is obvious that such an operation is not feasible when using the apparatus described in patent application Serial No. 633,955.

Accordingly, one object of this invention is to provide apparatus for planting explosive charges in the earth at submarine locales wherein the explosive charge will not become detached from the drill until a desired depth has been reached.

Another object is to provide apparatus for planting explosive charges in the earth under a body of water, the apparatus being particularly adapted for use in rough seas and at considerable distances from shore.

Still another object is to provide apparatus for drilling in the earth at submarine locations for the purpose of planting seismic explosive charges in the earth, which apparatus is not affected by rolling and pitching of the craft from which drilling operations are being conducted.

Other objects and features of the invention will become apparent upon consideration of the following description thereof, wherein:

Fig. 1 is a schematic representation showing the relationship between the underwater drilling apparatus and a ship from which operations are conducted.

Fig. 2 is an elevation view, partially in cross-section, of a preferred embodiment of the invention showing the explosive charge in its normal position during drilling operations.

Fig. 3 is an elevation view, partially in cross-section, showing the explosive charge in the position that will obtain during retraction of the drilling apparatus immediately before breaking away of the drilling bit from the apparatus.

Fig. 4 is a fragmentary cross-sectional view illustrating a modification of the apparatus of Figs. 2 and 3.

With reference now to Fig. 1, there is shown a drilling barge 3 at the surface of a body of water 1, supporting a drilling mechanism 12 by means of a cable and hose 11. The cable and hose are wound upon a reel 7 and are suspended over the side or end of the vessel 3 by means of a sheave assembly 9. A prime mover within housing 5, such as a gasoline engine, serves to drive the reel 7. A hydraulic pump 6 may be included in housing 5 for supplying hydraulic pressure to hose 11. The drilling assembly 12 includes a housing 13 for a motor, preferably a hydraulic motor, for driving a bit 23 through a shaft 20 and a coupling section 21. An explosive charge 19 is detachably connected to the motor housing by means to be described. One or more barbs 17 are affixed to explosive charge container 19 for the purpose of preventing upward movement of the charge after it has reached the desired depth within the earth. Barb restraining device 15 is slidably connected on the motor housing 13.

As shown most perspicuously in Fig. 2, the hydraulic motor comprises a plurality of stator members affixed to the motor housing, and a plurality of rotor members affixed to shaft 20. While the motor may be an electric motor, the hydraulic motor shown is preferred. Pressurized water is fed to the motor by means of hose 11, which is coupled to the motor housing 13 at the upper end thereof. Three stator blading sections 31, 37, and 53, and three rotor sections 35, 45, and 63 are shown in Fig. 2, but it is to be understood that any convenient number of rotor sections and stator sections may be utilized.

At the bottom end of motor housing 13 and screw-threaded therewith so as to form an integral part thereof is housing section 73 for supporting an explosive charge container 19. An annular groove 80 is cut into the bottom of housing section 73 into which a snap ring 79 is fitted, the function of the snap ring being to support the weight of explosive charge container 19 while drilling operations are being conducted. Housing section 73 includes an annular ring 75 for the purpose of preventing upward movement of the charge container while drilling operations are under way. Upwardly-extending resilient barbs 17 are preferably affixed to the explosive charge container 19 by an annular clamping ring 77. If convenient, however, the barbs may be welded or otherwise affixed to the container. The barbs normally extend upwardly and outwardly so as to dig into the earth when an attempt is made to move the explosive charge container in an upward direction. Snap ring 79, which may be frangible, should have only sufficient strength to support the weight of explosive charge container 19 and should readily give way under the opsition of barbs 17 so that the explosive charge container 19 will slide off of housing section 73 when the drilling apparatus is retracted from the borehole.

The shaft 25 of bit 23 is coupled to shaft 20 by coupling apparatus including a compressible, deformable member 85, a piston 81 which bears against the top of

deformable member 85, and an end member 87 threadedly engaging the lower end of member 21 so as to support deformable member 85 and piston 81. Preferably, deformable member 85 is of rubber or rubber-like material. Shaft 20 is coupled to member 21 by screw threads so that member 21 threadedly engages the lower end of shaft 20. Deformable member 85 surrounds bit shaft 25, which is preferably rectangular in cross-section, but is in very loose engagement therewith so that bit shaft 25 may slide readily out of the coupling member when deformable member 85 is not under compression by piston 81. A very weak shear pin 89 is provided to hold shaft 25 in the assembly as the assembly is lowered to the initial drilling position. The shear pin 89 should shear easily when the bit is struck by charge container 19 after it slips off the lower end of member 73. Water pressure exerted on the upper face of piston 81 causes the piston to bear against deformable member 85 so that it squeezes against shaft 25 to provide a substantially rigid connection between shaft 25 and housing 21.

At this point, it should be noted that the interior of shaft 20 should be in fluid communication with hose 11 at the upper end of housing 13 so that the fluid pressure exerted on piston 81 is substantially the same as the pressure in hose 11.

For the purpose of holding barbs 17 against, or very close to, housing 13 until the apparatus has reached the desired depth for planting of the explosive charge, there is provided a latching apparatus including an elongated member 15 of substantially cylindrical construction and having an inner diameter somewhat greater than the outer diameter of housing 13, so as to provide an annular recess therebetween within which barbs 17 may be inserted. Latching member 15 may be of somewhat reduced diameter at the upper end 29 thereof so as to bear against an annular ring 27 affixed to motor housing member 13. The function of annular member 27 is to limit upward movement of latching member 15 and further to provide a shoulder against which a wedge may abut to keep latching means 15 in engagement with barbs 17, as will be described. Affixed to the interior of cylindrical latching member 15 and in sliding engagement with the outer shell of motor housing 13 are annular rings 39 and 65 positioned at or near opposite ends of latching member 15. A similar annular member 47 is affixed to the outer surface of the shell of motor housing 13. A coil spring 43 is positioned between annular members 39 and 47 so as to bias latching member 15 upwardly, as shown, to abut against annular shoulder 27. Manifestly, latching member 15, the outer shell of housing member 13, and annular members 47 and 65 define an expansible chamber that increases in volume as latching member 15 is moved downwardly. Manifestly, the volume of the chamber will increase when fluid presure is exerted against annular member 65, which in effect, serves as a piston under this circumstance.

For the purpose of exerting the fluid pressure within shaft 20 on annular member 65, there is provided a rotary fluid coupling between chamber 60 and the interior of shaft 20. In the preferred embodiment, this rotary fluid chamber comprises one or more conduits 61 which may be coupled between the interior of chamber 60 and a separate collar surrounding shaft 20, or as shown in the drawing, the conduits may be connected to the collar supporting the vanes of one of the stator members 53. A number of ports 55 are provided in shaft 20 to afford a path for fluid egress from the interior of the shaft. The ports 55 open into an annular recess 57 in collar 53*a* which supports vanes 53. The function of recess 57 is to provide continuous fluid pressure into each of the conduits 61, rather than intermittent fluid pressure, as would be the case if ports 55 opened directly into conduits 61.

It is to be noted that the stator members 31, 37, and 53 preferably are friction-fitted inside of the outer shell of the motor housing. The lower end of the stator and

rotor sections of the hydraulic motor abuts against the upper edge of housing member 73. By removing member 73, access may be gained to the interior of the motor housing for maintenance of the rotor and stator members whenever necessary.

Note further that small channels 41, 49, and 67 are provided through annular members 39, 47, and 65. The function of these channels is to allow enough water through to flush out sand and other fine matter which may find their way through conduits 61 into the space between housing 13 and latching member 15 so as to allow the moving parts of the latching mechanism to function freely. Passage 41 should be larger than passage 49 so that the pressure in chamber 60 will exceed the pressure in chamber 42. Small O-rings 51 and 69 provide a fluid seal with a minimum of frictional resistance to relative movement between the annular members and the surfaces along which the annular members must move.

For the purpose of detonating the explosive charge, there is provided within the explosive charge container 29 a cap 76 which is connected to a suitable source of electrical current on the craft 3 by means of an electrical conductor 30, which is suitably insulated in the usual manner. Conductor 30 also functions to permit the operator to keep a check on the downward progress of the drilling apparatus by monitoring the tension or slack in the electrical conductor.

Barbs 17 may snap out of annular recess 72 during drilling operations as a result of rotation of charge container 19. A number of smal pins 74 secured to the outer surface of housing 13 below annular member 65 serve to hold the barbs 17 within recess 72 until latching member 15 snaps upwardly into the position shown in Fig. 3. In the embodiment of Fig. 4, each of the barbs 17 may have a small hole drilled therethrough into which a pin 74*a* affixed to housing 13 may fit to aid snap ring 79 in supporting the charge container during drilling operations.

Prior to lowering the drilling apparatus into the water, a small wedge 28 is inserted between the upper end of section 29 of the latching mechanism and annular shoulder 27 as illustrated in Fig. 1. Barbs 17 are held against the motor housing 13 so that the lower edge 71 of the latching member 15 rides over the barbs and holds them against the motor housing. The apparatus may then be lowered into the water until solid earth is contacted by the bit. At this point, appropriate valves are closed or opened so that hose 11 is brought under fluid pressure from pumps on craft 3 to energize the hydraulic motor. Simultaneously, fluid pressure is exerted on the upper face of piston 81 so that deformable member 85 squeezes against shaft 25 to provide rigid coupling between shaft 25 and shaft 20. Fluid pressure within chamber 60 will cause latching member 15 to move downward slightly so that the wedge between annular shoulder 27 and the upper edge of the latching member will fall out. Drilling operations may then proceed until the desired depth is reached. Fluid pressure will then be cut off by closing appropriate valves or by stopping the pump, and latching member 15 will snap upwardly against shoulder 27, as is shown in Fig. 3. Barbs 17 will be released and will snap outwardly. When the drilling apparatus is retracted, barb 17 will dig into the sides of the borehole, snap ring 79 will give way, the explosive charge container 19 will be driven against bit 23 to break shear pin 89 so that explosive charge container 19 and the bit remain at the bottom of the borehole. The remainder of the drilling apparatus may then be removed. The charge thereupon may be detonated by energizing electrical conductor 30.

The invention has been found to provide a simple, fool-proof means for preventing detachment of the explosive charge container and the drilling bit from the

remainder of the drilling apparatus by the motion of the craft from which drilling operations are conducted. Operations may be conducted in relatively heavy seas, the drilling apparatus having been found to present no problems that would lead to discontinuance of drilling operations due to inclement surface conditions.

This invention is not to be restricted to the specific structural details or arrangement of parts herein set forth, as various modifications thereof may be effected without departing from the spirit and scope of this invention.

What is claimed is:

1. In a hydraulically-actuated apparatus for planting explosive charges in the earth, said apparatus including: a hydraulic motor including an elongated housing, said motor having an inlet end adapted to be coupled to a source of fluid pressure for energization of said motor; an earth drilling bit operatively coupled to said motor so as to be driven thereby; an explosive charge container supported by and adapted to slide longitudinally along the exterior of said housing, normally upwardly and outwardly extending flexible barb means affixed to the exterior of said container, said barb means when unrestrained being adapted to engage the sides of a borehole drilled by said bit to permit substantially unimpeded downward movement of said container as said container is lowered into the borehole on said housing, and to dig into earth formations around the borehole on attempted upward movement of said container to oppose upward movement of said container, and means for retaining said container on said housing while said container is being lowered into the borehole on said housing but yieldable under opposition of said barb means to permit said container to slide off of said housing when said housing is withdrawn upwardly through the borehole; means on said housing hydraulically coupled to the inlet end of said motor, responsive to fluid pressure from said inlet end to hold said barb means against said housing to permit upward movement of said container through the earth with said housing and responsive to lack of fluid pressure from said inlet end to release said barb means.

2. In a hydraulically-actuated apparatus for planting explosive charges in the earth, said apparatus including: a hydraulic motor including an elongated housing having an inlet end adapted to be coupled to a source of fluid pressure for energization of said motor and an exhaust end; an earth drilling bit operatively coupled to said motor so as to be rotated thereby; an explosive charge container supported by and adapted to slide longitudinally along the exterior of said housing, normally upwardly and outwardly extending flexible barb means affixed to the exterior of said container, said barb means when unrestrained being adapted to engage the sides of a borehole drilled by said bit to permit substantially unimpeded downward movement of said container as said container is lowered into the borehole on said housing, and to dig into earth formations around the housing on attempted upward movement of said container to oppose upward movement of said container, and means for retaining said container on said housing while said container is being lowered into the borehole on said housing but yieldable under opposition of said barb means to permit said container to slide off of said housing when said housing is withdrawn upwardly through the borehole; an elongated latching member for said barb means, longitudinally slidable along said housing and adapted to latch said barb means against said housing, spring-energized biasing means for holding said latching member away from said barb means to release said barb means, and means including piston means affixed to said latching member hydraulically coupled to said inlet end of said housing, responsive to fluid pressure at said inlet end to oppose the force exerted by said biasing means on said latching means to hold said latching means in position to latch said barb means against said housing.

3. In a hydraulically-driven apparatus for planting explosive charges in the earth, comprising: a housing having an inlet end adapted to be coupled to a source of fluid pressure, and an exhaust end; a hollow rotatable shaft; a hydraulic turbine assembly including a plurality of stator members affixed to said housing along the longitudinal axis of said shaft alternating with rotor turbine members affixed to said shaft, said shaft being journalled within said stator members, said turbine assembly being responsive to hydraulic pressure from said source to rotate said shaft; a drilling bit; a shaft of rectangular cross-section for supporting said bit; means for coupling said shaft of rectangular cross-section to said hollow rotatable shaft adapted to release said shaft of rectangular cross-section when hydraulic pressure within said hollow rotatable shaft falls below a given magnitude; a container for an explosive charge, said container having normally upwardly and outwardly extending flexible barbs affixed thereto, said barbs when unrestrained being adapted to engage the sides of a borehole drilled by said bit to permit substantially unimpeded downward movement of said container as said container is lowered into the earth on said housing, and to dig into the earth formations around the borehole upon attempted upward movement of said container to oppose upward movement of said container, said container being slidably mounted on said housing and adapted to slide longitudinally therealong; an annular groove in said housing for receiving a snap ring; a releasable snap ring for supporting the weight of said container while said container is being lowered into the earth but yieldable under opposition of said barb means to prevent said container from sliding off of said housing when said housing is withdrawn upwardly from the earth; an elongated generally cylindrical latching member longitudinally slidable along said housing, said latching member at one end thereof being adapted to engage said barbs to hold said barbs against said housing; first and second annular rings respectively affixed to the interior of said latching member, and a third annular ring affixed to the exterior of said housing between said first and second annular rings; said housing, said latching member, and said first and third annular rings defining a substantially closed chamber adapted to increase in volume as said latching member is slid toward said barbs; a compression spring member positioned between and engaging said second and third annular rings to bias said latching member away from said barbs; rotary fluid coupling means for coupling the interior of said hollow rotatable shaft to said substantially closed chamber to subject said substantially closed chamber to fluid pressure within said hollow rotatable shaft so as to bias said latching member toward said barbs against the force exerted by said spring.

4. Apparatus for driving an earth drilling bit and for carrying an explosive charge receptacle during drilling operations, said apparatus comprising: a bit-drive shaft hollow along its length adapted to be coupled to a quick-detachable bit; a hydraulic motor, said hydraulic motor having a housing with an inlet end adapted to be coupled to a source of fluid pressure for energization of said motor, and an exhaust end; said motor being operatively coupled to said bit-drive shaft for rotation thereof, one end of said bit-drive shaft being hydraulically coupled to said inlet end of said housing so that fluid pressure at said inlet end is exerted within said shaft, the end of said shaft adapted to be coupled to a bit extending through said exhaust end of said housing; an explosive charge container supported by said housing and adapted to slide longitudinally along the exterior of said housing and off of the exhaust end thereof; normally upwardly and outwardly extending flexible barb means affixed to the exterior of said container, said barb means

when unrestrained extending outwardly from said container a distance sufficient to engage the earth that surrounds said housing during drilling operations when said housing is beneath the earth's surface, said barb means being adapted to oppose upward movement of said container with said housing after said housing is below the earth's surface; yieldable retaining means on said housing adapted to retain said container on said housing, said retaining means being further adapted to yield under opposition of said barb means to permit said container to slide off of said housing when said housing moves upwardly through the earth; coupling means on said shaft adapted to couple a quick-detachable bit to said shaft responsive to fluid pressure exerted through said shaft from said inlet end and responsive to lack of fluid pressure at said nlet end to release the bit; means on said housing hydraulically coupled to said inlet end and responsive to fluid pressure from said inlet end to hold said barb means against said housing to permit upward movement of said container through the earth with said housing, and responsive to lack of fluid pressure at said inlet end to release said barb means.

5. Apparatus for driving an earth drilling bit and for carrying an explosive charge receptacle during drilling operations, said apparatus comprising: a bit-drive shaft adapted to be coupled to a quick-detachable bit; a hydraulic motor, said hydraulic motor having a housing with an inlet end adapted to be coupled to a source of fluid pressure for energization of said motor, and an exhaust end; said motor being operatively coupled to said bit-drive shaft for rotation thereof, the end of said shaft adapted to be coupled to a bit extending through said exhaust end of said housing; an explosive charge container supported by said housing and adapted to slide longitudinally along the exterior of said housing and off of the exhaust end thereof; normaly upwardly and outwardly extending flexible barb means affixed to the exterior of said container, said barb means when unrestrained extending outwardly from said container a distance sufficient to engage the earth that surrounds said housing during drilling operations when said housing is beneath the earth's surface, said barb means being adapted to oppose upward movement of said container with said housing after said housing is below the earth's surface; yieldable retaining means on said housing adapted to retain said container on said housing, said retaining means being further adapted to yield under opposition of said barb means to permit said container to slide off of said housing when said housing moves upwardly through the earth; means on said housing hydraulically coupled to said inlet end responsive to fluid pressure from said inlet end to hold said barb means against said housing to permit upward movement of said container through the earth with said housing, and responsive to lack of fluid pressure at said inlet end to release said barb means.

6. Apparatus for driving an earth drilling bit and for carrying an explosive charge receptacle during drilling operations, said apparatus comprising: a bit-drive shaft adapted to be coupled to a quick-detachable bit; a hydraulic motor, said hydraulic motor having a housing with an inlet end adapted to be coupled to a source of fluid pressure for energization of said motor, and an exhaust end; said motor being operatively coupled to said bit-drive shaft for rotation thereof, the end of said shaft adapted to be coupled to a bit extending through said exhaust end of said housing; an explosive charge container supported by said housing and adapted to slide longitudinally along the exterior of said housing and off of the exhaust end thereof; normaly upwardly and outwardly extending flexible barb means affixed to the exterior of said container, said barb means when unrestrained extending outwardly from said container a distance sufficient to engage the earth that surrounds said housing during drilling operations when said housing is beneath the earth's surface, said barb means being

adapted to oppose upward movement of said container with said housing after said housing is below the earth's surface: yieldable retaining means on said housing adapted to retain said container on said housing, said retaining means being further adapted to yield under opposition of said barb means to permit said container to slide off of said housing when said housing moves upwardly through the earth; an elongated latching member for said barb means, longitudinally slidable along said housing and adapted to latch said barb means against said housing; spring energized biasing means for holding said latching member away from said barb means to release said barb means; means including piston means affixed to said latching member hydraulically coupled to said inlet end of said housing, responsive to fluid pressure at said inlet end of said housing exerted on said piston to oppose the force exerted by said biasing means on said latching means to hold said latching means in position to latch said barb means against said housing.

7. Apparatus for driving an earth drilling bit and for carrying an explosixe charge receptacle during drilling operations, said apparatus comprising: a bit-drive shaft hollow along its length adapted to be coupled to a quick-detachable bit; a hydraulic motor, said hydraulic motor having a housing with an inlet end adapted to be coupled to a source of fluid pressure for energization of said motor, and an exhaust end; said motor being operatively coupled to said bit-drive shaft for rotation thereof, one end of said bit-drive shaft being hydraulically coupled to said inlet end of said housing so that fluid pressure at said inlet end is exerted within said shaft, the end of said shaft adapted to be coupled to a bit extending through said exhaust end of said housing; an explosive charge container supported by said housing and adapted to slide longitudinally along the exterior of said housing and off of the exhaust end thereof; normally upwardly and outwardly extending flexible barb means affixed to the exterior of said container, said barb means when unrestrained extending outwardly from said container a distance sufficient to engage the earth that surrounds said housing during drilling operations when said housing is beneath the earth's surface, said barb means being adapted to oppose upward movement of said container with said housing after said housing is below the earth's surface; yieldable retaining means on said housing adapted to retain said container on said housing, said retaining means being further adapted to yield under opposition of said barb means to permit said container to slide off of said housing when said housing moves upwardly through the earth; coupling means on said shaft adapted to couple a quick-detachable bit to said shaft responsive to fluid pressure exerted through said shaft from said inlet end and responsive to lack of fluid pressure at said inlet end to release the bit; an elongated generally cylindrical latching member longitudinally slidable along said housing, said latching member at one end thereof being adapted to engage said barbs to hold said barbs against said housing; first and second annular rings respectively affixed to the interior of said latching member, and a third annular ring affixed to the exterior of said housing between said first and second annular rings; said housing, said latching member, and said first and third annular rings defining a substantially closed chamber adapted to increase in volume as said latching member is slid toward said barbs; a compression spring member positioned between and engaging said second and third annular rings to bias said latching member away from said barbs; rotary fluid coupling means for coupling the interior of said shaft to said substantially closed chamber to subject said substantially closed chamber to fluid pressure within said shaft so as to bias said latching member toward said barbs against the force exerted by said spring.

8. Apparatus for driving an earth drilling bit and for carrying an explosive charge receptacle during drilling operations, said apparatus comprising: a bit-drive shaft

hollow along its length adapted to be coupled to a quick-detachable bit; a hydraulic motor, said hydraulic motor having a housing with an inlet end adapted to be coupled to a source of fluid pressure for energization of said motor, and an exhaust end; said motor being operatively coupled to said bit-drive shaft for rotation thereof, one end of said bit-drive shaft being hydraulically coupled to said inlet end of said housing so that fluid pressure at said inlet end is exerted within said shaft, the end of said shaft adapted to be coupled to a bit extending through said exhaust end of said housing; an explosive charge container supported by said housing and adapted to slide longitudinally along the exterior of said housing and off of the exhaust end thereof; normally upwardly and outwardly extending flexible barb means affixed to the exterior of said container, said barb means when unrestrained extending outwardly from said container a distance sufficient to engage the earth that surrounds said housing during drilling operations when said housing is beneath the earth's surface, said barb means being adapted to oppose upward movement of said container with said housing after said housing is below the earth's surface; yieldable retaining means on said housing adapted to retain said container on said housing, said retaining means being further adapted to yield under opposition of said barb means to permit said container to slide off of said housing when said housing moves upwardly through the earth; coupling means on said shaft adapted to couple a quick-detachable bit to said shaft responsive to fluid pressure exerted through said shaft from said inlet end

and responsive to lack of fluid pressure at said inlet end to release the bit; an elongated generally cylindrical latching member longitudinally slidable along said housing, said latching member at one end thereof being adapted to engage said barbs to hold said barbs against said housing; first and second annular rings respectively affixed to the interior of said latching member, and a third annular ring affixed to the exterior of said housing between said first and second annular rings; said housing, said latching member, and said first and third annular rings defining a substantially closed chamber adapted to increase in volume as said latching member is slid toward said barbs; a compression spring member positioned between and engaging said second and third annular rings to bias said latching member away from said barbs; rotary fluid coupling means for coupling the interior of said shaft to said substantially closed chamber to subject said substantially closed chamber to fluid pressure within said shaft so as to bias said latching member toward said barbs against the force exerted by said spring; and an annular shoulder on said housing between said inlet end of said housing and the end of said latching member opposite the end that engages said barbs, said shoulder being adapted to engage a wedge for holding said latching means in engagement with said barbs until hydraulic pressure is applied to said inlet end, said latching member being thereupon movable a short distance toward said barbs to release the wedge.

No references cited.