Method and apparatus for drilling overburden covered rock which may or may not be submerged. The apparatus comprising a first drilling machine having a rotary drill head with a hollow drive spindle to which is connected a sectional cylindrical outer casing having a ring bit at its free end. The hollow drive spindle being located between a pair of vertically disposed parallel guide members for axial movement therebetween. A second drilling machine independently operable and having a drill string mounted to the drilling machine above the hollow drive spindle and co-axial therewith so that the drill string can be put down through the hollow drive spindle and outer casing to drill bed rock.

3 Claims, 8 Drawing Figures
METHOD OF ROCK DRILLING AND APPARATUS FOR USE THEREIN

BACKGROUND OF THE INVENTION

This invention relates to an improved method of rock drilling and to apparatus for use in performing the method.

More particularly, the invention is directed to the drilling of overburden covered rock which may or may not be submerged. It has become standard practice to drill overburden covered rock without first removing the soil cap or overburden which often covers the rock and this technique requires an outer sectional cylindrical casing to be put down along with the drill rods. The casing is fitted at its extreme end with a ring bit and the casing is collared into the bed rock so that it stands substantially rigidly upright and provides a seal for the drill rods to prevent the rocks being fouled by the earth of the soil cap or the overburden which may be clay, moraine, sand, boulders, etc. This method allows for the removal of the overburden from within the cylindrical casing, all the way down to the underlying rock and the method may be applied for various purposes, e.g. charging the drilled hole for blasting the rock, taking out samples by coring, injecting stabilizing material and the like or taking undisturbed samples of soft materials below the casing at any desired level in the soil cap or overburden.

In one such method of drilling, the casing and the rods are put down simultaneously using the same rotary and percussive drill unit. In another method the casings and rods are put down separately using different drill units for the casing and the rods, the casing drill unit having to be replaced in due course by the rod drill unit. Both of these known techniques possess a serious disadvantage which becomes apparent when conditions require the casing to be put down further, e.g. when subsequent broken rock or sand is encountered by the drill rods and fouling occurs. In such a situation the drill rods have to be disconnected from the appropriate drill unit and the casing reconnected which is a time consuming and laborious procedure which considerably reduces the efficiency of the drilling operations.

It is an object of the present invention to provide a means of drilling whereby the casing and drill rods can be put down simultaneously but independently of each other thus obviating or mitigating the aforesaid disadvantage.

According to the present invention the casing and drill string are capable of being put down simultaneously and independently using separate drill units, by virtue of the casing drill unit including a rotary drill head provided with a hollow drive spindle and the drill unit for the drill string being mounted above said rotary drill head in such manner that the drill string can be put down through the hollow drive spindle.

It is thus possible by the method and apparatus of the invention to advance and withdraw the casing and at the same time advance and withdraw the drill string independently of one another by means of their respective drill units. In this manner faster and more secure penetration into the bed rock is obtained.

According to the invention, the rock drilling apparatus comprises a first drilling unit including a drilling machine, a rotary drill head having a hollow drive spindle operatively connected to the drilling machine, a sectional cylindrical outer casing connected by coupling means to the drive spindle and having a ring bit provided at its free end, a second drilling unit including a second drilling machine and a drill string operatively connected to the second drilling machine, the drill head and the drill string mounted intermediate a pair of vertically disposed parallel guide members for movement therebetween and axially of the guide members, the second drilling unit is mounted above the first drilling unit for independent operation and the drill string is coaxial with the outer casing and adapted to be put down through the outer casing.

The casing may be coupled to its associated drill head either by bolting or by means of an adapter incorporating a quick action coupling.

The drill string may consist of a train of interconnected rods or tubes.

The auxiliary drill unit for the string may be rotary, percussive, rotary/percussive or "in the hole" hammer means.

Embodiments of the invention will now be described simply by way of example with reference to the accompanying drawings in which:

FIG. 1 illustrates a centrally apertured rotary drill head according to the invention putting down a sectional cylindrical outer casing;

FIG. 2 shows a train of drill rods or steels fitted with a drill bit about to be pushed through the drill head and outer casing illustrated in FIG. 1;

FIG. 3 shows the outer casing and drill steels in position during drilling;

FIG. 4 is similar to FIG. 3 but illustrates an alternative coupling for the outer casing to the hollow drive spindle;

FIG. 5 is an enlarged sectional elevation of the flanged coupling adapter shown in FIGS. 1 to 3;

FIG. 6 is a plan view of the adapter of FIG. 5;

FIG. 7 is an enlarged sectional elevation of the alternative coupling adapter shown in FIG. 4;

FIG. 8 illustrates a flushing swivel unit for the outer casing.

Referring to the drawings 1 denotes a drilling machine mounted on parallel guides 2. A rotary drill head 3 is operatively connected to the drilling machine and moveable between the parallel guides 2. The drill head 3 is provided with a hollow drive spindle 4. A .coupling member 6 is provided with a flange 7 which is secured, as by bolts, to a flange 8 on the drive spindle 4.

The coupling member 6 has a hollow elongated body portion 9 externally screw threaded which can be screwed into a hollow sectional cylindrical outer casing 10 carrying at its free end a ring bit 11.

Referring to FIG. 2 the guides 2 also carry a second drilling machine 14 above the drilling machine 1 for the outer casing. The drilling machine 14 is operatively connected to a train of drill rods or steels 15 which is provided with a drill bit 16 at its free end. The drill unit for the rods is superimposed over the drill unit for the outer casing and so aligned that the rod or steels 15 can pass through the hollow drive spindle 4 and outer casing 10. Each of the drill units are independently driven by known means e.g. air power, hydraulic power or electric power.

FIG. 7 illustrates an alternative coupling 6a for the outer casing 10 and hollow drive spindle 4.
The coupling 6a consists of a male part 21 and a female part 22. The female part 22 is provided with a flange 23 at one end of a hollow body member 24. The flange 23 is secured to or integrally formed with the flange 8 on the drive spindle 4. The body member 24 adjacent the opposite end is provided with opposed substantially L shaped slots 25 each open at one end and opening at the other end into laterally formed opposed slots 26,27. The male part 21 is provided by an elongated tubular member 30 dimensioned to fit into the end of the female part 22 and having outwardly directed tongue members 31 adjacent one end thereof adapted to be located in the opposed slots 25 to form a bayonet coupling with the female part 22.

The opposite end of the male part is threaded to screw into the end of the outer casing 10.

A flushing swivel unit 35 is illustrated in FIG. 8 and comprises a barrel part 36 provided with a central passageway 37 extending axially therein. One end of the barrel part has rubber sealing rings 38 secured circumferentially thereto and adapted to fit into the hollow drive spindle 4 and metal sleeves 40 are interposed between the rings, a clamp member 39 mounted on the barrel part is screw threaded and engages with the drive spindle to clamp the barrel part to the drive spindle 4.

A swivel member 41 is rotatably mounted about the barrel part and provided with a port 42 which communicates with the passageway 37. A lifting hook 43 is attached to the end of the barrel remote from the drive spindle.

Fluid is supplied to the port 42 under pressure to flush the outer casing as drilling proceeds.

In operation of the apparatus according to the invention the second cylindrical outer casing 10 with the ring bit 11 at its extreme end is secured at one end by the coupling member to the drill head and the outer casing is put down until the casing is driven securely into the bed rock as illustrated in FIG. 1.

A train of drill rods or steels 15 with the drill bit 16 fitted to the end thereof is operatively connected to the drilling machine 14 and lowered through the hollow drive spindle 4 to commence drilling with the drill steels. A drilling hammer (not shown) may be used to put down the steels. FIG. 3 illustrates the drilling in progress. As the drill unit for the rods is superimposed over the drill unit for the outer casing and both units are mounted on the same guides and the drilling machines are independently operable separate operations can be carried out independently.

The coupling illustrated in FIGS. 5 or 7 may be used for coupling the outer casing to the hollow drive spindle 4 of the rotary drill head.

The flushing swivel unit 35 shown in FIG. 8 is placed into the top opening 4 on the drill head and secured by screwing the clamp member 39 down on to the metal sleeves, which in turn force the rubber rings 38 against the wall of the drill head. A water hose is connected to the port 42 on the swivel and water at high pressure is pumped into the casing as drilling proceeds. The swivel turns freely on the barrel of the unit and remains stationary as the unit revolves with the drilling line. The swivel unit may alternatively be supplied with air instead of water for flushing the casing.

The drill string need not be restricted to a train of rods and could comprise a second casing.

The action of drill units for the string could be purely rotary, purely percussive or rotary/percussive or alternatively it could be an "in-the-hole" hammer. The casing is put down mainly by rotary action although weight may be applied to the rotary drill head by means of a winch and rope arrangement known per se.

The method and apparatus of the invention can be used on land or for underwater drilling from a floating barge or fixed rig mounted on legs which stand on the sea or river bed. Furthermore, the method and apparatus may advantageously be used in the overburden method of drilling but it is emphasized that the invention is in no way restricted to the overburden method.

It will be seen that with the apparatus of the invention it is possible to advance and withdraw the casing and at the same time advance and withdraw the drill string independently of one another by means of their respective drill units.

What is claimed is:

1. Rock drilling apparatus comprising a first drilling unit and an independently operable second drilling unit said first drilling unit including a first drilling machine, a rotary drill head operatively connected to said drilling machine, said drill head having a hollow drive spindle, a sectional cylindrical outer casing operatively connected by coupling means to said hollow drive spindle, said coupling means comprising a flange on said hollow drive spindle and a flanged coupling member secured to said flange and adapted to be releasably secured to said outer casing, a ring bit connected to the free end of said outer casing, said second drilling unit including a second drilling machine and a drill string operatively connected to said drilling machine, said hollow drill head and drill string being mounted intermediate a pair of vertically disposed parallel guide members for movement between and axially of said guide members, said second drilling unit being mounted above said first drilling unit and said drill string co-axial with said outer casing, said drill string being adapted to be put down through said hollow drive spindle and outer casing, said coupling member comprising a male section and a female section, said female section having at least two open ended oppositely disposed slots at one end thereof and being secured at the opposite end to said hollow drive spindle, said open ended slots opening oppositely disposed lateral slots, said male section being adapted to be inserted into the female section and having radially disposed tongue members adjacent one end thereof for engagement in said slots, the opposite end of the male section being removably secured to said outer casing.

2. Rock drilling apparatus comprising a first drilling unit and an independently operable second drilling unit, said first drilling unit including a first drilling machine, a rotary drill head operatively connected to said drilling machine, said drill head having a hollow drive spindle, a sectional cylindrical outer casing operatively connected by coupling means to said hollow drive spindle, said coupling means comprising a flange on said hollow drive spindle and a flanged coupling member secured to said flange and adapted to be releasably secured to said outer casing, a ring bit connected to the free end of said outer casing, said second drilling unit including a second drilling machine and a drill string operatively connected to said drilling
machine, said hollow drill head and drill string being mounted intermediate a pair of vertically disposed parallel guide members for movement between and axially of said guide members, said second drilling unit being mounted above said first drilling unit and said drill string co-axial with said outer casing, said drill string being adapted to be put down through said hollow drive spindle and outer casing, said apparatus further including a flushing swivel unit connectible to said hollow drive spindle, said swivel unit comprising a barrel member, a clamp member mounted on said barrel for securing the barrel member to the hollow drive spindle, a swivel member rotatably mounted about said barrel member and provided with a port communicating internally of the drive spindle, said port being adapted to be connected to a source of pressure fluid.

3. A method of rock drilling utilizing a rock drilling apparatus comprising a first drilling unit and an independently operable second drilling unit, said first drilling unit including a first drilling machine, a rotary drill head operatively connected to said drilling machine, said drill head having a hollow drive spindle, a sectional cylindrical outer casing operatively connected by a coupling means to said hollow drive spindle, said coupling member comprising a male section and a female section, said female section having at least two open ended oppositely disposed slots at one end thereof and being secured at the opposite end to said hollow drive spindle, said open ended slots opening into oppositely disposed lateral slots, said male section being adapted to be inserted into the female section and having radially disposed tongue members adjacent one end thereof for engagement in said slots, the opposite end of the male section being removably secured to said outer casing, a ring bit connected to the free end of said outer casing, said second drilling unit including a second drilling machine, a drill string operatively connected to said drilling machine, said hollow drill head and drill string being mounted intermediate a pair of vertically disposed parallel guide members for movement independent of one another between and axially of said guide members, said second drilling unit being mounted above said first drilling unit, said drill string co-axial with said outer casing, said drill string being adapted to be put down through said hollow drive spindle and outer casing, said drill string and said outer casing being adapted to be advanced and withdrawn independent of one another, said method comprising the steps of securing said sectional cylindrical outer casing with an attached ring bit to said hollow drive spindle operatively connected to said first drilling machine and to drive means putting down said outer casing until the casing is driven securely into bed rock, securing said drill string, fitted with a drill bit at its extreme end, to driving means on said independently operable second drilling machine and putting down said drill string through said hollow drive spindle and outer casing to drill bed rock.

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