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DRILL AND TUBE ARRANGEMENT WITH KNOCK-OFF DRILL PORTION

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FIG. 1

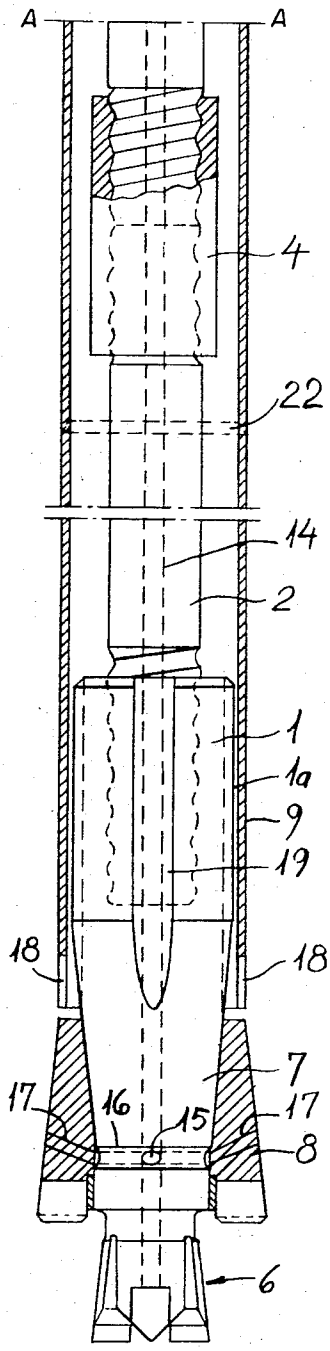
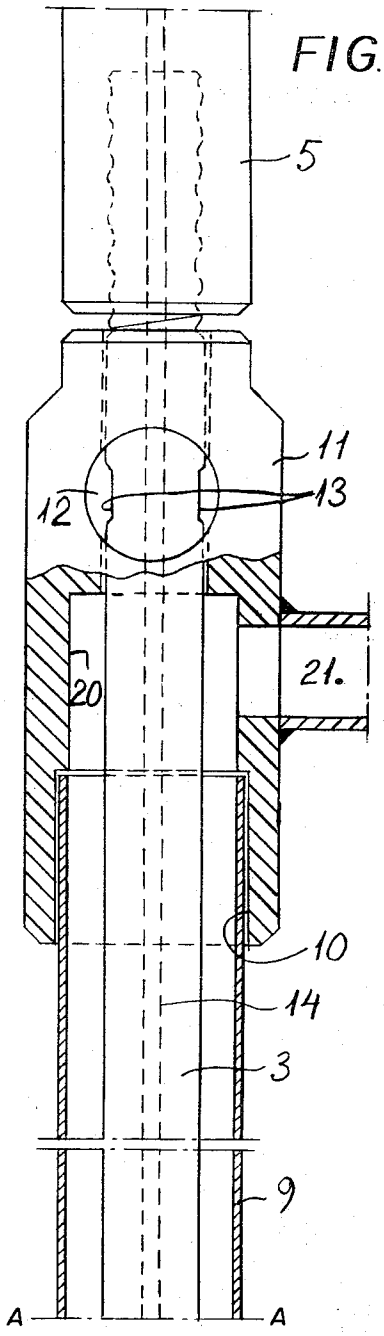


FIG. 2



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DRILL AND TUBE ARRANGEMENT WITH KNOCK-OFF DRILL PORTION

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ABSTRACT OF THE DISCLOSURE

A drill is provided, for drilling substantially elongated cylindrical holes in the earth and like substances, comprising a drill rod having a drill head portion and a drill crown portion, both the head portion and the crown portions having cutting edges. A tube is provided, disposed about the drill rod, the tube being longitudinally movable a predetermined distance along the drill rod, and being adapted to knock the drill crown portion off the drill head portion, when the drilling operation is completed, by pulling the drill rod and drill head out of the drilled hole. Rinsing means are provided whereby fluid may be delivered to the drill head and extracted through the tube.

The present invention relates to a drill and more especially to a drill for drilling in earth or loose species of stone, e.g. for performing so-called grouting, the drill rod being surrounded by a tube.

Grouting in the pressing of that tightening or reinforcing material, such as cement or concrete blends, into holes and cracks in rocks and earth.

The known drills of the indicated type have a drawback in that the drills and the tubes are very likely to stick in the hole being drilled because of earth materials which have been worked loose by the boring or drilling action. Bad difficulties also occurring when the drill and the tube are removed from the hole after a finished drilling action.

When using known drills it has been necessary to withdraw the drill as well as the tube after the completed drilling operation and to insert, instead, another tube through which the grouting material shall be introduced and pressed into the earth. However, the introduction of this final tube is often extremely difficult or quite impossible due to the circumstance that the rock or the earth material is falling down or is being cracked, thus preventing the introduction of the tube. A drawback is also that the final tube must have a relatively small diameter.

An object of the present invention is to eliminate the above indicated drawbacks and to provide a drill through which the earth material worked loose by the drilling action will be positively removed, whereby the drill will be completely free from any tendency to stick in the hole, and through which the introduction of the second or final tube is possible in connection with the drilling operation itself. The said final tube may, due to the removal of the earth material, have a maximum diameter, that is a diameter which is approximately the same as the diameter of the drilled hole.

These objects of the invention are made possible through the fact that the tube, preferably at or near its leading end adjacent to the drill head, is provided with openings through which rinsing water supplied to the drill head will be conducted into the tube, the outer or rear end of which is provided with an outlet for the rinsing water.

According to the invention the tube surrounds a portion of the drill head which is provided with external recesses, preferably longitudinal grooves or canals, for the rinsing liquid, and the tube is mounted with a considerable play in the longitudinal direction of the drill.

It has been proven that the drill according to the present invention needs only very reasonable impact impulses in order to be able to follow the drill crown in the hole being actually drilled. Trials have also proved that there is absolutely no blocking of either the drill or the tube even in spite of the most brittle rocks or "smeary" earths.

The maximum effective diameter of the drill is determined through a drill crown mounted on a conical portion of the drill head. This drill crown shall be knocked off the drill head by means of the inner or forward end of the tube when the drill rod and the drill head are pulled out of the drilled hole.

Because thus the drill crown or at least some portion of the drill crown will be left in the hole, drill bits of hard metal or any other expensive material may be dimensioned rather sparingly in order to save costs for such material. The driving impacts against the tube may be performed by a drilling machine adapter which is arranged to transmit impact impulses for a drilling machine not only to the drill or the drill rod but also to the tube. A special member may transmit the impact impulses from the adapter to the tube.

In the drawing:

FIGURES 1 and 2 are longitudinal views with major portions illustrated in section of the lower and upper halves of the drill of this invention, respectively, broken along the line A—A of the figures.

The invention will now be declared more in detail, reference being had to the accompanying drawing which shows an embodiment presented as a non-limiting example.

The said embodiment comprises a drill head **1**, which may comprise of several parts **2** and **3** coupled together by means of a coupling sleeve **4**, and a drilling machine adapter **5** mountable on the rear, specially threaded end of the drill or rod.

The drill head **1** has a central portion **6** provided with drill bits and a conical or tapered portion **7** situated at the rear of the said central portion in respect to the driling direction. Upon this conical portion which has a relatively small cone angle or taper angle, e.g. only 1–5°, is mounted a drill crown **8** which is correspondingly conical and has a circumferential character.

The connection of the drill head **1** to the drill rod **2** as well as the connection between the drill rod parts **2** and **3** with the connecting sleeve **4** may have a special thread which also forms the connection between the rear end of the drill rod **3** and the adapter **5**.

The drill rod **2**, **3**, **4** is surrounded by a tube **9** which is to be introduced into the drill hole, and which has an outer diameter which is substantially equal to or slightly less than the maximum effective diameter of the drill, such maximum diameter being determined by the drill crown **8**.

The tube **9** is guided in co-axial relation to the drill crown and the drill rod **2**, **3** by means of a cylindrical surface **1***a* on the drill head **1** and a boring **10** in a member **11** between the adapter **5** and the tube **9**. The said boring **10** is co-axial with the drill rod part **33**. The member **11** transmits the impacts received from drilling machine (not shown) to the adapter **5** to the tube **9**. Through the impacts transmitted by the member **11** the tube **9** will be forced to follow the drill head **1** and the drilling portions **6** and **8** of the drill head in a most positive way.

The play of the tube **9** relative to the surface **1***a* of the

drill head **1** and the surface of the preferably internal boring or socket **10** of the member **11** may be only about one or a few millimeters in radial direction. This play is clearly indicated in the drawing. However the play of the tube in axial direction is preferably quite considerable.

The drill crown **8** shall be knocked off, after a completed drilling operation by the inner end of tube **9** when the drill rod and the drill head are being pulled out of the drilled hole the tube **9** likewise remaining in this hole. Because the drill crown **8** is thus to be discarded the same should not, of economical reasons be provided with greater or more expensive bits than what is to be consumed in the individual drilling operations. The central drill portion **6** may however, be stronger since the same should be used several times.

Instead of two separate drill crowns, namely the central drill portion **6** and the circumferential or ring-shaped drill crown **8**, it is possible to use only one single drill crown mounted upon the conical or tapered portion **7**.

12 designates a hole drilled in the member **11**, through which a key may be introduced into engagement with surfaces **13** on the drill rod part **3** when the adapter **5** shall be mounted upon the rod **3** or removed therefrom.

14 designates a rinsing canal arranged in an old manner in the drill rod and leading centrally out of the drill portion **6**, and the tapered portion **7** of the drill head is provided with radial rinsing canals **15** and with a ring groove **16**, through which canals and through which groove rinsing liquid may be supplied to and through the canals **17** in the drill crown **8** into the drilled hole.

In accordance with the present arrangement the front end of the tube **9** in respect of the drilling direction is provided with recesses or openings **18** through which the rinsing liquid together with loose-drilled rock and earth material will pass to one or more longitudinal grooves **19** provided in the mantle surface of the drill head **1**. The rinsing or flushing liquid together with the said loose-drilled material is thereupon passing freely through the tube **9** to a boring arranged in the member **11** and communicating with the guiding boring **10**. An outlet **21** is leading out of the boring **20**.

The above mentioned rinsing away of the loose-worked material through the tube involves an astonishingly great and deciding improvement. Thus, neither the drill itself nor the tube shows any longer the slightest tendency of sticking in the drilled hole. This is due to the fact that drilling is always performed completely freely and without any obstructions in a very clean hole. Not even in clay-type or loamy earths there are any longer any difficulties. It follows that it is possible to obtain drill holes of a length of 150 metres and more. To this favorable result the rather big axial play of the tube is contributing as well as the influence of the adapter upon the tube.

The rinsing away of the loose-worked material and the knocking off of the drill crown **8** after completed drilling operation are thus, in combination, giving a very good drilling speed and eliminating all difficulties when the drill rod shall be removed out of the drilled hole, since the tube **9** simply remains in the hole.

When drilling long holes the drill rod may in a known manner be extended unlimitedly. Then also the tube **9** is extensible correspondingly, since the tube may be extended or made longer by means of special extension parts and coupling members or perhaps through welding or brazing as indicated at **22**.

The drill according to the invention functions very well also with the longest drill rods and tubes, respectively, and the outer diameter of the tube **9** may be approximately the same as the maximum effective diameter of the drill crown or the diameter of the drill hole without any sticking.

In the known drills, as indicated in the opening part of this description, the diameter of the final tube must be considerably smaller than the diameter of the drill

hole. Because in the drill according to the invention the tube **9** may have approximately the same diameter as the hole, it is possible, when using the drill according to the invention, to drill holes with a considerably smaller diameter than it was heretofore for the final tube diameter. This involves an enormously great saving, since every possible reduction of the hole diameter means a considerably increased drilling speed and less consumption of expensive drilling material.

The invention makes it possible to drill the hole and to introduce the final tube into this hole in one and the same operation.

The invention is not limited only to the embodiment here described and shown, since other embodiments are possible within the scope of the invention.

It is possible to construct the drilling machine adapter with a guide for the tube **9**, whereby the member **11** may be dispensed with, i.e. it is possible to combine the parts **5** and **11**.

In the embodiment shown it is assumed that impact or percussion drilling is concerned. It is however to be seen that the invention is applicable also for drills which are not impact drills.

A great advantage of the invention consists in that the tube **9**, due to the near correspondence between its outer diameter and the diameter of the drilled hole, already relatively soon after a finished drilling will stick surprising steady in the drilled hole and also tighten well against the walls of the hole, which circumstance very positively contributes to the good result when grouting rocks and earths. There is, however, no risk that the tube will stick during the drilling operation or even under short stops, e.g. for performing the necessary extensions of the drill rod and the tube.

Through the member **11** the impact impulses of the impact piston of the drilling machine are transmitted to the drill rod in a most positive manner, since the member **11** oscillating between the adapter **5** and the tube **9** consumes only a relatively small part of the impact energy. The member **11** shall together with the tube **9** have a considerable axial play or movement which, however, must be less than the length of the boring **10** guiding the tube **9**. A sufficient play must of course be present between the drill rod and the member **11** so that this member may be able to move easily in the axial direction.

What I claim is:

1. A drill adapted for drilling in earth or loose rocks and species of stone, in order to perform grouting, in which the rod of the drill is surrounded by a tube and includes a drill head at one end thereof, characterized in that the tube is provided at its lower end adjacent to the drill head with openings through which rinsing water supplied to the drill head will be conducted into the tube, the tube also being provided with an outlet for the rinsing water at its upper end, wherein the tube has a considerable play in the longitudinal direction of the drill in which a drilling machine adapter is disposed on the upper end of the drill rod, said adaptor being operable to transmit impact impulses from a percussion drilling machine to the drill rod and to the tube.

2. A drill as claimed in claim **1**, in which a special member is adapted to transmit the impact impulses from the adapter to the tube, said special member including guide means for holding the tube in co-axial alignment with the drill rod, said special member being provided with a rinsing water outlet which communicates with the guide and the rinsing water outlet of the tube.

3. A drill as claimed in claim **2**, in which the guide means comprises a boring in the member.

4. A drill as claimed in claim **2**, in which the longitudinal or axial play of the tube allows the member to oscillate between the adapter and the tube and thereby impart axial movements to the tube.

5. A drill as claimed in claim **4**, in which the effective diameter of the drill is determined by a drill crown

mounted on a conical or tapered portion of the drill head, characterized in that the drill crown is capable of being knocked off the inner or forward end of the tube after a completed drilling operation by pulling the drill rod and the drill head out of the drilled hole.

6. A drill adapted for drilling in earth or loose rocks and species of stone, in order to perform grouting, in which the rod of the drill is surrounded by a tube and includes a drill head at one end thereof, characterized in that the tube is provided at its lower end adjacent to the drill head with openings through which rinsing water supplied to the drill head will be conducted into the tube, the tube also being provided with an outlet for the rinsing water at its upper end, in which the effective diameter of the drill is determined by a drill crown mounted on a conical or tapered portion of the drill head, characterized in that the drill crown is capable of being knocked off the inner or forward end of the head after a completed drilling operation by pulling the drill rod and the drill head out of the drilled hole.

7. A drill as claimed in claim 3, in which the longitudinal or axial play of the tube allows the member to oscillate between the adapter and the tube and thereby impart axial movements to the tube.

8. A drill as claimed in claim 2, in which the preferably cylindrical portion of the drill head, which is surrounded by the corresponding end of the tube, is adapted to guide the tube ends co-axially relative to the drill rod, the drill head and the drill crown.

9. A drill as claimed in claim 2, in which the effective diameter of the drill is determined by a drill crown mounted on a conical or tapered portion of the drill head, characterized in that the drill crown is capable of being knocked off the inner or forward end of the tube after a completed drilling operation by pulling the drill rod and the drill head out of the drilled hole.

10. A drill adapted for drilling in earth or loose rocks and species of stone, in order to perform grouting, in which the rod of the drill is surrounded by a tube and includes a drill head at one end thereof, characterized in that the tube is provided at its lower end adjacent to the drill head with openings through which rinsing water applied to the drill head will be conducted into the tube, the tube also being provided with an outlet for the rinsing water at its upper end, wherein the tube surrounds a portion of the drill head which is provided with external recesses, in the form of longitudinal channels for the rinsing liquid, in which the effective diameter of the drill is determined by a drill crown mounted on a conical or tapered portion of the drill head, characterized in that the drill crown is capable of being knocked off the inner or forward end of the head after a completed drilling operation by pulling the drill rod and the drill head out of the drilled hole.

11. A drill adapted for drilling in earth or loose rocks and species of stone, in order to perform grouting, in which the rod of the drill is surrounded by a tube and includes a drill head at one end thereof, characterized in that the tube is provided at its lower end adjacent to the drill head with openings through which rinsing water supplied to the drill head will be conducted into the tube, the tube also being provided with an outlet for the rinsing water at its upper end, wherein the tube has a considerable play in the longitudinal direction of the drill, in which the effective diameter of the drill is determined by a drill crown mounted on a conical or tapered portion of the drill head, characterized in that the drill crown is capable of being knocked off the inner or forward end of the head after a completed drilling operation by pulling the drill rod and the drill head out of the drilled hole.

12. A drill adapted for drilling in earth or loose rocks and species of stone, in order to perform grouting, in which the rod of the drill is surrounded by a tube and includes a drill head at one end thereof, characterized in that the tube is provided at its lower end adjacent to the drill head with openings through which rinsing water supplied to the drill head will be conducted into the tube, the tube also being provided with an outlet for the rinsing water at its upper end, wherein the drill head includes a cylindrical portion which is surrounded by the corresponding end of the tube, and is adapted to guide the tube end co-axially relative to the drill rod, the drill head and a drill crown which is disposed on the drill head, in which the effective diameter of the drill is determined by the drill crown mounted on a conical or tapered portion of the drill head, characterized in that the drill crown is capable of being knocked off the inner or forward end of the head after a completed drilling operation by pulling the drill rod and the drill head out of the drilled hole.

13. A drill adapted for drilling in earth and the like substances, comprising a rod, a drill head attached to said rod, a drill crown mounted on said drill head on a tapered portion thereof, and a tube disposed about said rod; the effective diameter of the drill being determined by the diameter of the drill crown; the tube comprising means for knocking the drill crown off the head after a completed drilling operation when the drill rod and drill head are pulled out of the drilled hole.

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