

Aug. 10, 1965

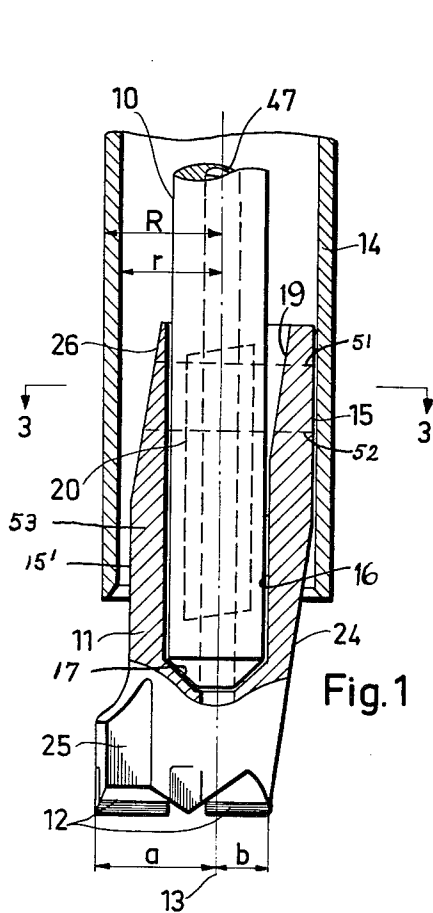
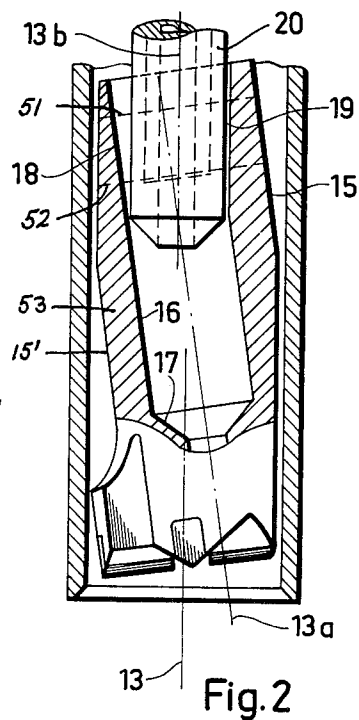
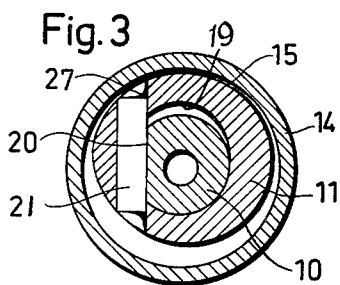
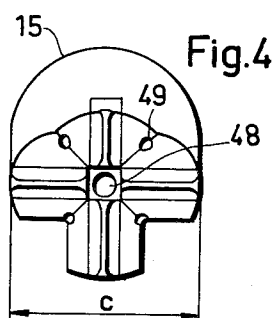
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DRILL FOR ROTARY PERCUSSION DRILLING

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2 Sheets-Sheet 1



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Fig. 6a

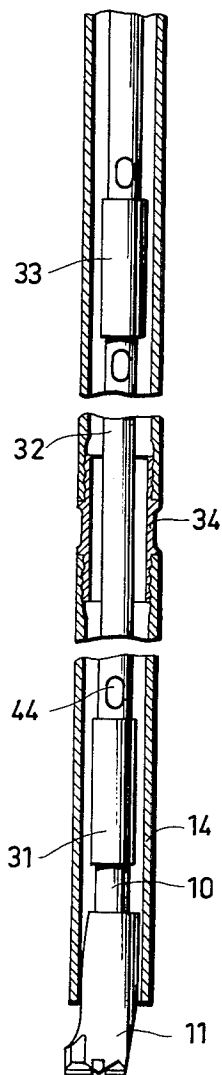


Fig. 6b

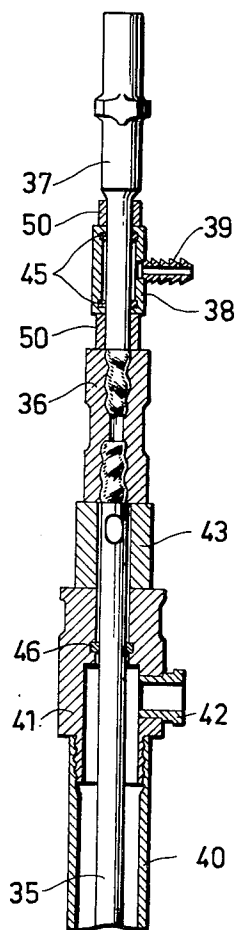


Fig. 5

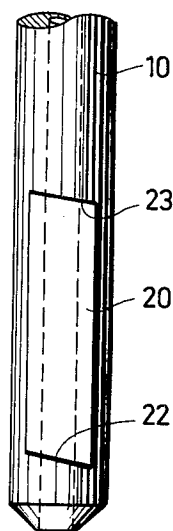
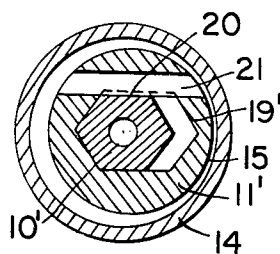


Fig. 7



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DRILL FOR ROTARY PERCUSSION DRILLING
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7,694/62

2 Claims. (Cl. 175—284)

The present invention resides in a drill bit for rotary percussion drilling having an eccentric cutting edge portion, said bit being adapted to be positioned at the fore end of a drill rod situated in a casing tube in such a way that the cutting edge portion protrudes in front of the fore opening of the casing tube, and the radially most protruding part of the cutting edge portion is situated at a distance from the rotary axis of the drill bit greater than the outer radius of the casing tube.

Drill equipment of this kind has for its purpose to make possible drilling through loose material and fissured rock, where a casing tube is necessary in order to protect the drill rod and prevent the earth material from filling up the hole when the rod is extracted. After extraction of the rod the casing tube can be used for grouting with a binder for strengthening the surrounding ground.

The drill hole must of course have a larger diameter than the casing tube. The radius of action of the drill bit must thus extend beyond the outer radius of the tube. At the same time it is necessary that the drill bit can be extracted through the tube, the latter being left in the ground. This has been achieved in different ways such as by the use of radially expandible drill bits, which during drilling have a greater diameter than during extraction. It is also known to use eccentric drill bits, which during the drilling are forced to protrude radially and during extraction are withdrawn closer to the centre of the tube in order to pass the tube freely. In order to obtain the necessary protrusion in radial direction it has been suggested to use movable pawls which during drilling are directed outwardly from the drill rod or bit and are supported against the wall of the casing tube or drill hole, so that the bit is held in an eccentric position with a part of the cutting portion protruding radially beyond the tube. During the rotation of the drill a hole is made that is larger than the tube. During the extraction of the drill the pawl is turned toward the drill axis, so that the drill bit can assume a position within the extension of the inner surface of the tube and can be extracted through the tube. It is also known to use guiding elements which are pressed by a spring outwardly in a radial direction and under influence of the spring hold the bit in an eccentric position in relation to the tube. The extraction is accomplished by pressing the guiding element inwardly against the spring pressure.

All such devices which comprise movable elements have the disadvantage that they are easily clogged by the cuttings and therefore their functional reliability is doubtful. It has been proposed to operate certain of these devices by means of a rod between the drill bit and an operating device above the ground level, which, however, in no appreciable degree increases the reliability of operation and besides substantially complicates the drilling apparatus and its operation.

A purpose of the present invention is to avoid all use of movable expanding and locking means on the drill bit or the drill rod. This is accomplished by making the whole drill bit adjustable so that, in drilling position it protrudes radially with the cutting portion beyond the extension of the tube and at the same time is supported at its rear part against the casing tube, while in extraction position it is

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inclined in relation to the drilling position, so that the cutting portion is withdrawn within the extension of the tube.

The invention is characterized in that a rear part of the drill bit has a peripheral supporting surface comprising one or more surface portions integral with the drill bit and situated in a radial direction opposite to the radially most protruding part of the cutting portion and shaped to rest against the inner surface of the tube casing during drilling, when the rotation axis of the drill bit coincides with the axis of the casing tube, and that the drill bit is so shaped that during extraction through the tube it is placed in a position where the axis of the drill bit is inclined in relation to the axis of the tube, all parts of the drill bit being at a distance from the axis of the tube which is less than the inner radius of the casing tube. In other words the drill bit is so shaped that it is tiltable about an axis perpendicular to the casing tube axis from a drilling position in which the cutting portion protrudes beyond the casing tube wall to a position permitting its extraction through the casing tube, in which latter position all parts of the drill bit are within the inner surface of the casing tube and its extension.

The invention will be described with reference to the accompanying drawings in which:

FIG. 1 is a longitudinal sectional view of the lower part of a drill with a casing tube belonging thereto, the drill bit being in drilling position,

FIG. 2 is a sectional view of the same parts of the drill as are shown in FIG. 1 but the bit being in the extraction position,

FIG. 3 is a cross section through the drill and the casing tube along the line 3—3 in FIG. 1, but rotated counter-clockwise 90° to the position shown in FIG. 1,

FIG. 4 is a front elevational view of the drill bit cutting portion but rotated counter clockwise 90° to the position shown in FIG. 1,

FIG. 5 is a side elevational view at an angle of 180° to the position shown in FIG. 1 of the drill rod with the drill bit removed,

FIGS. 6a and 6b are longitudinal sectional views partly in elevation of the drill and the casing tube including the devices for connection to the drilling machine, and

FIG. 7 is a cross-sectional view similar to that of FIG. 3 but rotated clockwise 90° relative to the position shown in FIG. 3, of a modified form of drill rod having a polygonal cross section.

The drill rod 10 in FIG. 1 carries at its fore end the drill bit 11. The drill bit 11 has at its fore end a cutting portion 12 which is situated eccentrically in relation to the axis 13 of the shank portion 53. The drill rod 10 and the rear part of the drill bit 11 are surrounded by a casing tube 14. The largest distance "a" of most protruding part 25 of the cutting portion 12 from the axis 13 of the tube is larger than the outer radius R of the tube 14, so that the drill bit during rotation drilling cuts a hole with larger diameter than the diameter of the tube. The tube 14 does not rotate during the drilling. In order to make possible the extraction of the drill bit through the tube the distance "b" from the least protruding part of the cutting portion 12 to the axis 13 must be so small that the total transversal dimension of the bit is smaller than the inner diameter of the tube, i.e. $a+b < 2R$. Besides the transversal dimension "c," shown in FIG. 4, in the direction at right angles to $a+b$ also must be smaller than the inner diameter of the tube, i.e. $c < 2R$. Both transversal dimensions can be equal, so that $a+b=c$.

In order that the drill bit during drilling is held with the part 25 at the constant distance "a" from the axis of the tube, the bit is at its upper part shaped to have contact with the inner surface of the tube. For this purpose the

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bit is shaped with cylindrical portions 15 and 15' which have approximately the same radius of curvature as the inner surface of the tube. When the bit 11 is in the position shown in FIG. 1 the cylindrical portions 15 and 15' will during the rotation of the drill slide around the inner wall of the tube and hold the outermost part 25 of the cutting portion 12 at the distance "a" from the rotation axis 13 of the drill. The axis 13 is thus not only the centre axis of the tube but also the rotation axis of the drill rod and also the drill bit.

In order to make possible the extraction of the drill bit 11 through the casing tube it is adjustably coupled to the drill rod 10. The fore part of the drill rod is fitted into a bore in the drill bit. During drilling the front surface of the drill rod abuts against the bottom 17 of said bore. The fore part 16 of the bore has the same shape as the drill rod, whereby the bit in drilling position is guided by the drill rod and is held with its rotation axis coincident with the longitudinal axis of the tube.

When extracting the bit it must be able to assume the position shown in FIG. 2, in which the rotation axis 13a of the drill bit is inclined in relation to the longitudinal axis 13 of the tube. The drill rod 10 is pulled upwards to a position above the part 16 of the bore in the drill bit. The part 18 of the bore is provided with an inclined beveling 19 directed outwardly, whereby the bit can be inclined to the position shown in FIGURE 2, the drill rod remaining inserted in the upper part 18 of the bore. The longitudinal axis 13b of the drill rod will then be displaced laterally from the position in which it coincides with the axis 13 of the tube.

In order that the drill bit will follow the rod when the latter is drawn upwards the rod is provided with a beveling or depression 20, which is most clearly shown in FIG. 5. A locking plate 21 in the drill bit fits in this depression 20. The depression is limited downwards by a shoulder 22 and upwards by a second shoulder 23. The upper edge of the locking plate 21 shall, when the drill rod is brought to the bottom 17 of the bore 16, 18, be situated below the shoulder 23. When the drill rod is lifted upwardly it slides along the bore 16, 18 till the shoulder 22 abuts against the lower edge of the locking plate 21, after which the drill bit follows the movement of the rod upwards. The locking plate 21 is situated in a recess in the drill bit so that it intermeshes with the lower part of the rod. The plate 21 can suitably be welded to the bit with weld joints 27. The position of the plate 21 is indicated by the broken lines 51 and 52 in FIGS. 1 and 2.

In order that there shall be room for the drill bit in its inclined extraction position within the tube 14 the bit is provided with an inclined beveling 24 situated at the fore part of the drill bit and in a radial direction opposite to the most eccentric part 25 of the drill bit, and a second inclined beveling 26 situated at the upper part of the bit in the same radial direction as the part 25. The bit is thus shaped in such a way that there is room for it within the tube 14 when it is placed in the inclined position shown in FIG. 2.

As will be apparent from the foregoing description the beveling surfaces 24, 26 and 19 and the part 25 are alined with the inner surface of the casing tube 14 when the bit is being inserted or removed and the surfaces 15 and 15' are alined with the inner surface of the tube 14 when the bit is in operation.

In the case shown in the drawings that the drill rod 10 is round, the beveling 20 and the locking plate 21 co-operating therewith also form coupling elements for causing the bit to rotate with the rod.

FIGS. 6a and 6b show an arrangement of the drilling equipment for a drill bit according to the invention. The bit 11 is applied to a drill rod 10. The drill rod is threaded at its rear end and joined by an internally threaded coupling sleeve 31 to an extension rod 32, which is threaded at both ends and at its rear end is connected to a second coupling sleeve 33, and so forth. For turning the

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rods when coupling them they are provided with wrench grips 44. The tube 14 is also jointed by threaded extension sleeves 34, so that the tube can be extended rearwardly in the same way as the drilling rod as the drilling proceeds. At the rear end the uppermost extension rod 35 is coupled by coupling sleeve 36 to a shank adapter 37 which is provided with a sleeve 38 having a connection piece 39 for the supply of flushing medium. Seal packings 45 and 50 are placed between the sleeve 38 and the shank adapter 37. The uppermost casing tube 40 is provided with a tube collar 41, which has a connection piece 42 for supply or possibly letting out of flushing medium. A packing 46 is applied between the tube collar 41 and the drill rod extension 35. If flushing medium is supplied at both connection pieces 39 and 42 the earth or rock surrounding the drill must be able to receive the flushing medium. Otherwise supply can be performed at only one of the connection pieces and outlet at the other.

Between the tube collar 41 and the coupling sleeve 36 can be applied a spacing sleeve 43 in order to compensate possible tolerance differences in the length of the tube and the drill rod, so that the drill bit is positioned at a suitable level in relation to the casing tube.

The flushing medium supplied at the sleeve 38 is transported along a flushing channel 47 through the drill rod and discharged at holes 48 and 49 in the drill bit. The drill bit illustrated is provided with four cutting inserts situated crosswise. A flushing hole 43 is situated at the intersection point between the inserts and the other flushing holes 49 are placed between the inserts. Other arrangements of the inserts and flushing holes can of course be used such as, for instance, a single chisel insert.

The invention is not restricted to the above mentioned embodiments. The coupling between the drill bit and the drill rod can be varied, maintaining the essential feature that the bit can be inclined in relation to the drilling direction. Instead of a round drill rod, a rod with polygonal cross section can be used as shown in FIG. 7, the parts 14, 15, 20 and 21 being the same as in FIG. 3 while the parts 10', 11' and 19' are modified as compared with the corresponding parts 10, 11 and 19 shown in FIG. 3. Also other variations obvious to the person skilled in the art can be made in the invention defined in the following claims.

I claim:

1. A drill bit and drill rod assembly, said drill bit having a lower cutting portion and an upper shank portion, a longitudinal bore in said shank portion, said drill rod extending into said bore, a depression having limiting end shoulders in the side of said drill rod at a distance from the lower end thereof, a locking member secured to said drill bit and extending into said bore and depression, said locking member having a substantially smaller dimension in the direction of the longitudinal axis of said drill bit than said depression and the distance between the lower end shoulder of said depression and the end of said drill rod being substantially smaller than the distance between said locking member and the bottom of said bore, the lower portion of said bore having a cross sectional size and shape corresponding to the size and shape of the lower end portion of said drill rod, said bore adjacent the upper end of said shank portion having a beveled inner surface that is inclined upwardly and outwardly relative to the axis of said shank portion, said shank portion having a lower outer cylindrical surface on one side thereof adjacent to the lower end thereof and an upper outer cylindrical surface on the opposite side thereof adjacent to the upper end thereof, said cylindrical surfaces being approximately concentric with the axis of said shank portion, said cutting portion having an eccentric cutting edge that extends radially beyond the extension of said lower cylindrical surface, said shank portion having also a first beveled outer surface adjacent to the upper end thereof opposite to said upper outer cylindrical surface and a second beveled outer surface adjacent to the lower end thereof

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radially opposite to said lower outer cylindrical surface, said outer beveled surfaces and said beveled inner surface all being substantially parallel to an axis that is inclined with respect to the axis of said shank portion and said first beveled outer surface adjacent to the upper end of said shank portion being substantially aligned with the outermost extension of said eccentric cutting edge.

2. A drill bit and drill rod assembly as defined in claim 1 in which the end portion of said drill rod and the lower portion of said bore have a polygonal cross sectional shape.

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