

United States Patent

[19]

Hornsten

[11] 3,722,610

[45] Mar. 27, 1973

[54] DRILLING EQUIPMENT, ESPECIALLY FOR DRILLING IN EARTH OR LOOSE ROCK

[75] Inventor: Karl Harald Hornsten, Sollentuna, Sweden

[73] Assignee: Nya Asfalt AB, Stockholm, Sweden

[22] Filed: Feb. 17, 1970

[21] Appl. No.: 11,955

[30] Foreign Application Priority Data

Feb. 28, 1969 Sweden 2841/69

[52] U.S. Cl. 175/386, 175/412

[51] Int. Cl. E21b 9/35, E21b 17/04

[58] Field of Search 175/171, 285, 286, 412, 173, 175/385-392, 413

[56] References Cited

UNITED STATES PATENTS

2,203,216	6/1940	Hokanson 175/413
3,139,149	6/1964	Dionisotti 175/413
3,429,387	2/1969	Brown 175/412
2,673,717	3/1954	Bacon 175/386
3,231,032	1/1956	Genberg et al. 175/171

3,540,536 11/1970 Huszar 175/171

FOREIGN PATENTS OR APPLICATIONS

200,419 10/1955 Sweden 175/173

202,607 10/1955 Sweden 175/173

464,093 11/1968 Switzerland 175/173

1,203,199 10/1965 Germany 175/173

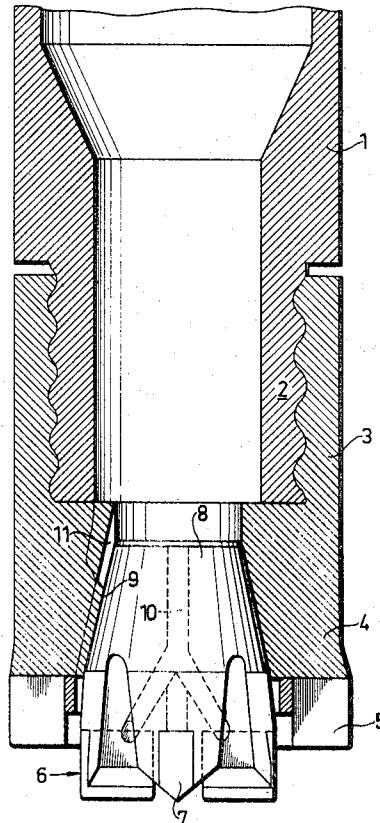
Primary Examiner—James A. Leppink

Attorney—Fred C. Philpitt

[57] ABSTRACT

A compound drill bit consisting of an outer ring-shaped drill bit and an inner central drill bit which is detachably connected to the outer drill bit in a manner to permit simultaneous operation when impact and rotational forces are applied. The impact and rotational forces are transmitted to them both through a casing which is attached to the outer ring-shaped drill bit. The two drill bits are so interconnected as to make it possible to expel the inner drill bit from the outer drill bit while both drill bits and the casing are positioned in the bore hole produced by them. Means are provided for passage of flushing fluid between the inner and outer drill bits.

3 Claims, 4 Drawing Figures



PATENTED MAR 27 1973

3,722,610

SHEET 1 OF 2

Fig.1

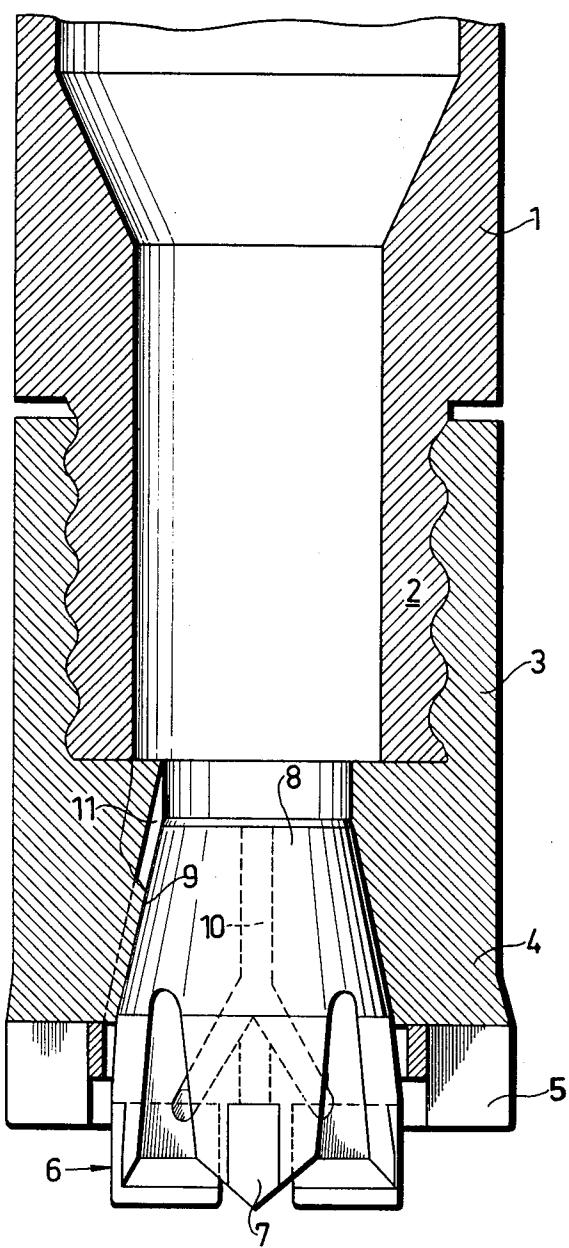


Fig.2

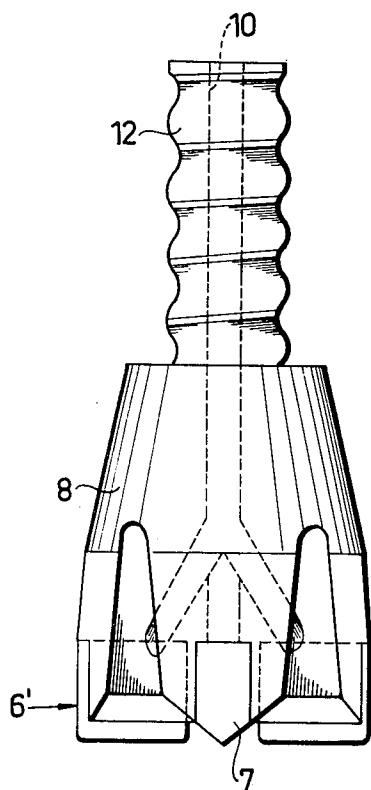


Fig.3

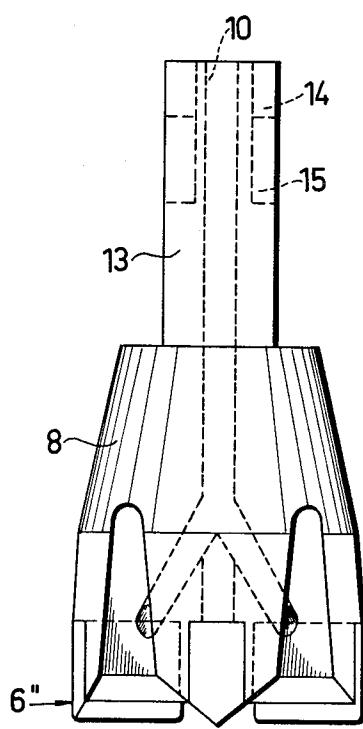
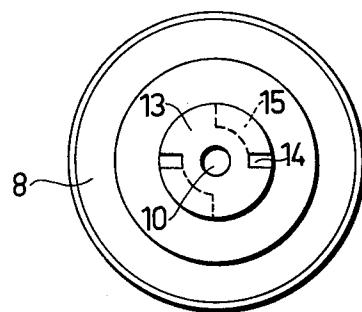


Fig.4



DRILLING EQUIPMENT, ESPECIALLY FOR DRILLING IN EARTH OR LOOSE ROCK

The present invention relates to a drilling equipment, especially for drilling in earth or loose rock, comprising an inner central drill bit, an outer ring-shaped drill bit, and a casing pipe connected to the outer drill bit, said equipment being arranged to permit simultaneous driving of the two drill bits by means of a common boring machine.

In prior art equipments of the kind above described the required forces for driving the inner drill bit have usually been transmitted to said bit by means of a drilling rod passing through the casing pipe and having its lower end connected to the inner drill bit. The impact forces and rotating forces from the boring machine have been transmitted to the outer drill bit in two different ways. Thus, said transmission has taken place either through the casing pipe or through the central drilling rod and an adapter connecting the lower end of the drilling rod to the outer drill bit. In the latter case, where the casing pipe does not serve to transmit any forces to the outer drill bit, it is however not possible to eliminate the casing pipe as said pipe is required to ensure a free passage to the bottom of the bore hole. Thus, the known equipments above described require a casing pipe as well as a boring rod passing therethrough.

The invention has for its object to provide a drilling equipment of the kind described, in which the central drilling rod can be omitted, at least as long as the two drill bits are simultaneously driven. A similar equipment is previously known through German patent specification No. 925,101. In this known equipment the drill bits are interconnectable in such a manner as to permit the required forces for their simultaneous operation to be transmitted to them both through the casing pipe. This equipment in which the drilling rod has been omitted has, however, not found any substantial use due to the fact that the bottom of the bore hole 40 cannot be reached without a preceding removal of the casing pipe and the two drill bits and that a similar step usually involves that the bore hole will be at least partially filled with material coming down from the walls of the hole.

The purpose of the invention is to provide an improved drilling equipment which utilizes the advantages of the previously known equipments above described but eliminates their drawbacks.

More particularly, the invention relates to a drilling equipment, especially for drilling in earth or loose rock, comprising an inner central drill bit, an outer ring-shaped drill bit, and a casing pipe connected to the outer drill bit, the two drill bits being detachably interconnected so as to permit the required impact and rotation forces for their simultaneous operation to be transmitted to them both through the casing pipe.

The drilling equipment according to the invention is primarily characterized in that the inner drill bit is designed and arranged so as to make it possible to expel the inner drill bit from the outer drill bit when the drill bits and the casing pipe are positioned in a bore hole produced thereby.

Through the above arrangement of the drilling equipment according to the invention there is obtained not only a reduction of the material costs but also a reduction of the time required for drilling to a certain

depth, as any time will not be consumed for connecting successive length of a boring rod. This time saving can be calculated to about 60 percent of the total time consumed for the successive lengthening of the drill rod and the casing pipe when using prior art equipments.

Furthermore the invention makes it possible to use increased impact forces and a reduced impact frequency as the buckling tendency of the casing pipe is lower than that of the central drilling rod of the known equipments.

The equipment according to the invention is especially suited for drilling in earth or loose rock, for instance for drilling holes for anchor rods or for grout injection. However, as will be explained more in detail below, the equipment can also be designed so as to permit drilling in solid rock.

According to a preferred embodiment of the invention the inner drill bit is provided with a tapered neck adapted to be received in a correspondingly shaped central passage in the outer drill bit, the inner drill bit being arranged to be detachably retained in the outer drill bit through frictional engagement therewith.

In cases where it is desired, after having penetrated an earth-layer, to continue drilling in the underlying solid rock by means of the inner drill bit only, the equipment according to the invention can be provided with coupling means for connecting the inner drill bit to a drilling rod which is inserted through the casing pipe when the preceding drilling step has been completed. Such an embodiment will make it possible, after the termination of a drilling operation using both drill bits to continue the drilling with the inner drill bit while driving this drill bit by means of a central drilling rod. According to the invention such a drilling rod is, however, required only in this special case, where it is needed only during the later boring step i.e. not during the step when both drill bits are simultaneously driven through the earth. This means that also when it is not possible to eliminate the drilling rod entirely, the time for using said rod and the wear thereof will be substantially reduced.

The coupling means of the inner drill bit may have the form of a projecting threaded bolt or consist of a threaded bore in said drill bit. Alternatively, said coupling means may be arranged to form a bayonet coupling with co-operating means at the lower end of the drilling rod.

Below the invention will be described in greater detail, reference being had to the accompanying drawings, in which:

FIG. 1 shows a longitudinal section through the lower portion of a drill equipment according to one embodiment of the invention;

FIGS. 2 and 3 are lateral views illustrating two alternative designs of the inner drill bit; and

FIG. 4 is a top plan view of the inner drill bit shown in FIG. 3.

Reference numeral 1 designates a casing pipe which may consist of one or more interconnected sections. At its upper end (not shown in the drawing) the casing pipe 1 is arranged to be connected to a boring machine, while at its lower end it is provided with an externally threaded end portion 2 of reduced diameter on which an internally threaded socket 3 is mounted, said socket forming the upper portion of a ring-shaped outer drill

bit 4 having a set of hard metal cutting edges 5. Reference numeral 6 designates an inner central drill bit having at its lower end a set of hard metal cutting edges 7 and at its upper end a tapered neck 8 which has its smallest diameter at the end thereof remote from the cutting edges 7 and which is received in a correspondingly shaped central passage 9 in the outer drill bit 4. The inner drill bit 6 is arranged to be secured concentrically in the outer drill bit 4 through frictional engagement between the neck 8 and the inner wall of drill bit 4 defining the conical passage 9.

Reference numeral 10 designates flushing fluid passages provided in known manner in the inner drill bit 6, while reference numeral 11 refers to corresponding passages or channels having the shape of grooves 15 provided in the inner wall of the outer drill bit 4. When, after the termination of a boring operation, it is desired to expel the inner drill bit 6 from the outer drill bit 4 this can be done either by means of a rod or mandrel inserted through the casing pipe 1 or by establishing an 20 overpressure in the casing pipe.

The inner drill bit 6' shown in FIG. 2 differs from the corresponding drill bit according to FIG. 1 only in that it is provided with an upwardly projecting threaded bolt 12 adapted to facilitate an interconnection between 25 drill bit 6' and a drilling rod inserted through casing pipe 1 in such cases where it is desired to continue the drilling operation with only the inner drill bit.

Also the inner drill bit 6'' shown in FIGS. 3 and 4 is provided with a projecting bolt 13 serving to enable an 30 interconnection with a drilling rod. Bolt 13 is, however, provided with axially and circumferentially extending grooves 14 and 15, respectively, which form bayonet coupling means.

Naturally, the invention is not restricted to the embodiment above described but includes a number of modifications and alternative embodiments. For instance, the interconnection between the inner and the outer drill bit can be obtained by designing them for threaded engagement with each other, or the drill bits 40

may be provided with bayonet coupling means.

What is claimed is:

1. A drilling device that is especially useful for drilling in earth or loose rock, comprising in combination:
- a. a casing pipe,
- b. an outer drill bit means connected to the lower end of said casing pipe in such a manner that rotation of said casing pipe will cause rotation of said outer drill bit,
- c. a central opening in the lower portion of said outer drill bit, said central opening having tapered side walls that form a frusto-conical section that diverges outwardly in a downward direction,
- d. an inner drill bit,
- e. said inner drill bit having a tapered neck section that is shaped so that it will only frictionally engage the inner surface of the central opening in said outer drill bit,
- f. said inner drill bit being provided with coupling means for connecting the same to a drill rod inserted through the casing pipe so as to permit continued drilling by only the inner drill bit after termination of the simultaneous drilling with both drill bits,

whereby

1. rotational and impact forces applied to said casing means will be transmitted to both said outer drill bit and said inner drill bit and
2. said inner drill bit can be expelled from engagement with said outer drill bit by the application of a rod inserted through the interior of the casing pipe.
2. A drilling device according to claim 1 characterized in that said coupling means include a threaded bolt projecting upwardly from the inner drill bit.
3. A drilling device according to claim 1 characterized in that said coupling means is in the form of a bayonet coupling means.

* * * * *