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(54) Rock breaking method and tool.

(57) A method of breaking rock and a rock breaking tool for use therein in which a hole (8) is drilled in the rock, and substantially filled with water, and a barrel (1) of a rock breaking tool is inserted into the hole, the tool being operable to discharge a cartridge from a firing chamber (4) down the barrel, and discharging the cartridge down the barrel to cause an impulsive energy shock in the water to break up the rock, the barrel being short so as to be inserted in the entrance portion only of the hole and a blast absorbing mat is located over the tool to retain it substantially in position in the hole during discharge of the cartridge.

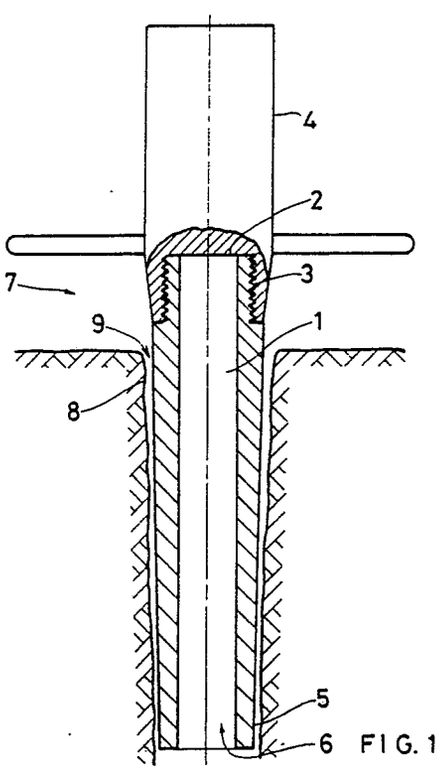

FIG. 1

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ROCK BREAKING METHOD AND TOOL

This invention relates to a rock breaking method and tool.

One type of rock breaking tool utilises a firing chamber to discharge a cartridge into the barrel. The tool is used by inserting the barrel into a pre-drilled hole in the rock, the hole being filled with water prior to firing. On discharging the cartridge, the expansion of gases from the firing causes water pressure in the form of a shock wave, which splits and cracks up the rock.

Rock breaking tools of this type known to the applicant have an extended barrel which is located in the length of the pre-drilled hole, with the tip of the barrel having a radially expandable seal. This seal expands by reason of lateral openings in the barrel directing discharge gases against the inner radial surface of the seal, and the expanding seal grips the surrounding rock to hold the tool within the hole sufficiently long for the discharge shock to break up the rocks. Without such a device for holding the tool within the hole, the tool is inclined to shoot out under blow back forces and the energy intended for breaking up the rock, is to a large extent lost.

The barrel of this type of tool also has lateral discharge outlets along its length to allow lateral impulsive discharge forces to operate on the rock surrounding the hole. The tip itself apart from the lateral discharge outlets for expanding the seal, is closed off.

The above rock breaking tool and method of using it also requires that a fairly long hole be drilled to accommodate the length of the barrel and the lateral discharge outlet. This hole must also be fairly accurately dimensioned and not be of too wide a diameter, since this can also serve to disperse and waste the energy shock. The hole must also be relatively water-tight and the longer the hole that is drilled, the greater is the chance of a leakage.

In accordance with this invention there is provided a method of breaking up rock including drilling a hole in the rock, substantially filling the hole with water, and inserting a barrel of a rock breaking tool into the hole, the tool being operable to discharge a cartridge from a firing chamber down the barrel, and, discharging the cartridge down the barrel to cause an impulsive energy shock in the water to break up the rock, characterised in that the barrel used is short so as to be inserted in the entrance portion only of the hole, and a blast absorbing mat is located over the tool to retain it substantially in position in the hole during discharge.

Preferably the method involves the use of a rock breaking tool which has its barrel exterior tapered towards the discharge end and the barrel is secured in the hole with the hole periphery in contact around the firing chamber end of the barrel.

Further the mat may be provided with a central opening with reinforced periphery, and is placed to have the firing chamber end of the tool protruding through the mat hole, leaving the hole periphery resting on transverse handles provided on the tool.

In accordance with a further aspect of the invention, there is provided a rock breaking tool comprising a firing chamber, a tubular barrel connected at one end to said firing chamber to enable the discharge of a cartridge in said firing chamber to pass through said barrel, into a water filled, pre-drilled hole in a rock to be broken up, a discharge outlet at the other end of the barrel, being substantially the only outlet from said barrel, the barrel length being only sufficient for it to be inserted part way into a water filled hole, in use.

Preferably the barrel exterior tapers down towards the discharge end by an amount arranged to facilitate insertion of the barrel in a hole drilled in rock by standard drill bit size, so as to leave the firing chamber end of the barrel in contact with the periphery of the hole in operative location.

Advantageously a blast absorbing mat is locatable over the rock breaking tool in use and arranged to prevent the tool being blown back out of a hole during discharge of the tool.

Desirably, the mat has a central opening, which has a reinforced periphery, adapted to be located over the rock breaking tool, and the rock breaking tool has transverse handles so that the tool protrudes partly through the hole and the mat rests on the handles, the reinforcing being adapted to prevent the periphery of the mat opening from expanding on discharge of the cartridge, and so allowing the tool to blow back through the central opening.

Preferably the mat reinforcing is wire, and the mat is woven of strip rubber-dash type vehicle tyre material, being approximately 2.3 m^2 in area. The mat may be square and measure l.5 m x l.5 m, and be approximately l5 mm thick.

A preferred embodiment of the invention is described below by way of example only, and with reference to the accompanying drawings, in which:-

Figure l is a cross-section through a barrel according to the invention located in a rock hole; and

Figure 2 is an isometric illustrative view of a blasting mat according to the invention.

Referring to Figure I, a barrel (I) for a rock breaking tool is tubular, having an end (2) which is diametrically rebated and threaded at (3) in order to be screw fitted to a firing chamber (4). The opposite discharge end (5) of the barrel carries the sole discharge outlet (6) of the barrel opening which runs axially through the barrel. The barrel exterior is tapered down smoothly from the firing chamber end (2) to the discharge end (5).

In use, the barrel, operatively connected to a firing chamber to form a tool (7), is inserted in a pre-drilled rock hole (8), which is filled with water. The hole (8) is drilled to a diameter which will allow the barrel (I) to close off the entrance (9) of the hole when the barrel is inserted, and preferably this closing off will occur when the barrel rests in the hole with the periphery of the hole entrance at the firing chamber end of the barrel. The majority of the length of the barrel should thus be inserted in the hole.

The taper of the barrel is arranged to allow easy but relatively close fitting insertion of the inserted barrel length in a hole having a diameter within tolerances to be expected from drilling with standard size drill bit.

It has been found in practice that a taper from an outside diameter of 38 mm to 34 mm end to end over a barrel shaft length of I40 mm is suitable for a 36 mm drill bit drilling a 38 mm hole.

Since the barrel has no gripping mechanism, an additional restraining means is provided, to prevent a tool fitted with the barrel from blowing back out of the hole on discharge.

Referring now to Figure 2, a mat (I0) is shown which is of square configuration, having sides of approximately I.5 × I.5 metres in length. The mat is of woven rubber tyre strip material, and of approximately I5 mm thickness. It has a central opening (II) which is round and has wire reinforcing around it to restrict its expandability.

In use, the mat is located over a rock breaking tool (I2), with the upper firing chamber portion (I3) of the tool protruding through the hole and the periphery of the hole resting on transverse handles (I4) of the tool. It has been found in practice that the mat serves to contain the blow back forces to good effect.

Variations may be made to be above embodiment without departing from the scope of the invention. For example, the extent of taper on the barrel will depend on the size of the tool and the hole which is to be drilled, and the dimensions and shape of the mat may vary widely. They may also be round, but this is not a convenient shape for folding and carrying.

Claims

I. A method of breaking up rock including drilling a hole in the rock, substantially filling the hole with water, and inserting a barrel of a rock breaking tool into the hole, the tool being operable to discharge a cartridge from a firing chamber down the barrel, and, discharging the cartridge down the barrel to cause an impulsive energy shock in the water to break up the rock, characterised in that the barrel used is short so as to be inserted in the entrance portion only of the hole, and a blast absorbing mat is located over the tool to retain it substantially in position in the hole during discharge of the cartridge.

2. A method as claimed in claim I, in which a rock breaking tool is used which has a barrel exterior tapered towards a discharge end and the barrel is inserted to be seated in the hole with the hole periphery in contact around the firing chamber end of the barrel.

3. A method as claimed in claim I in which the mat is provided with a central opening with a reinforced periphery, and is placed to have the firing chamber end of the tool protruding through the mat hole, leaving the periphery of the hole resting on transverse handles provided on the rock breaking tool.

4. A rock breaking tool comprising a firing chamber, a tubular barrel connected at one end to said firing chamber to enable the discharge of a cartridge in said firing chamber to pass through said barrel, into a water filled, pre-drilled hole in a rock to be broken up, a discharge outlet at the other end of the barrel, being substantially the only outlet from said barrel, the barrel length being only sufficient for it to be inserted part way into a water filled hole, in use.

5. A rock breaking tool according to claim 4, in which the barrel exterior tapers down towards to said other end by an amount arranged to facilitate insertion of the barrel in a hole drilled in a rock by a standard drill bit size, and arranged to leave the firing chamber end of the barrel in contact with the periphery of the hole in operative location.

6. A rock breaking tool according to claim 4 or 5, wherein a blast absorbing mat is provided and arranged to be placed over the rock breaking tool to prevent it being blown back out of the hole during discharge of the cartridge in use.

7. A rock breaking tool according to claim 6, wherein the mat has a central opening, which has a reinforced periphery, adapted to be located over the rock breaking tool, wherein the rock breaking tool has transverse I5 handles so that the tool protrudes partly through the hole and the mat rests on the handles, the reinforcing being adapted to prevent the periphery of the mat opening from

expanding on discharge of the cartridge, and so allowing the tool to blow back through the central opening.

8. A rock breaking tool according to claim 7, in which the reinforcing for the periphery of the hole is of wire.

9. A rock breaking tool according to claim 6, 7 or 8, in which the mat is woven of strips of vehicle tyre material.

10. A mat according to claim 6, 7, 8 or 9, in which the mat is approximately 2.3 m^2 in area.

11. A rock breaking tool according to any one of claims 6 to 10, in which the mat is approximately 15 mm in thickness.

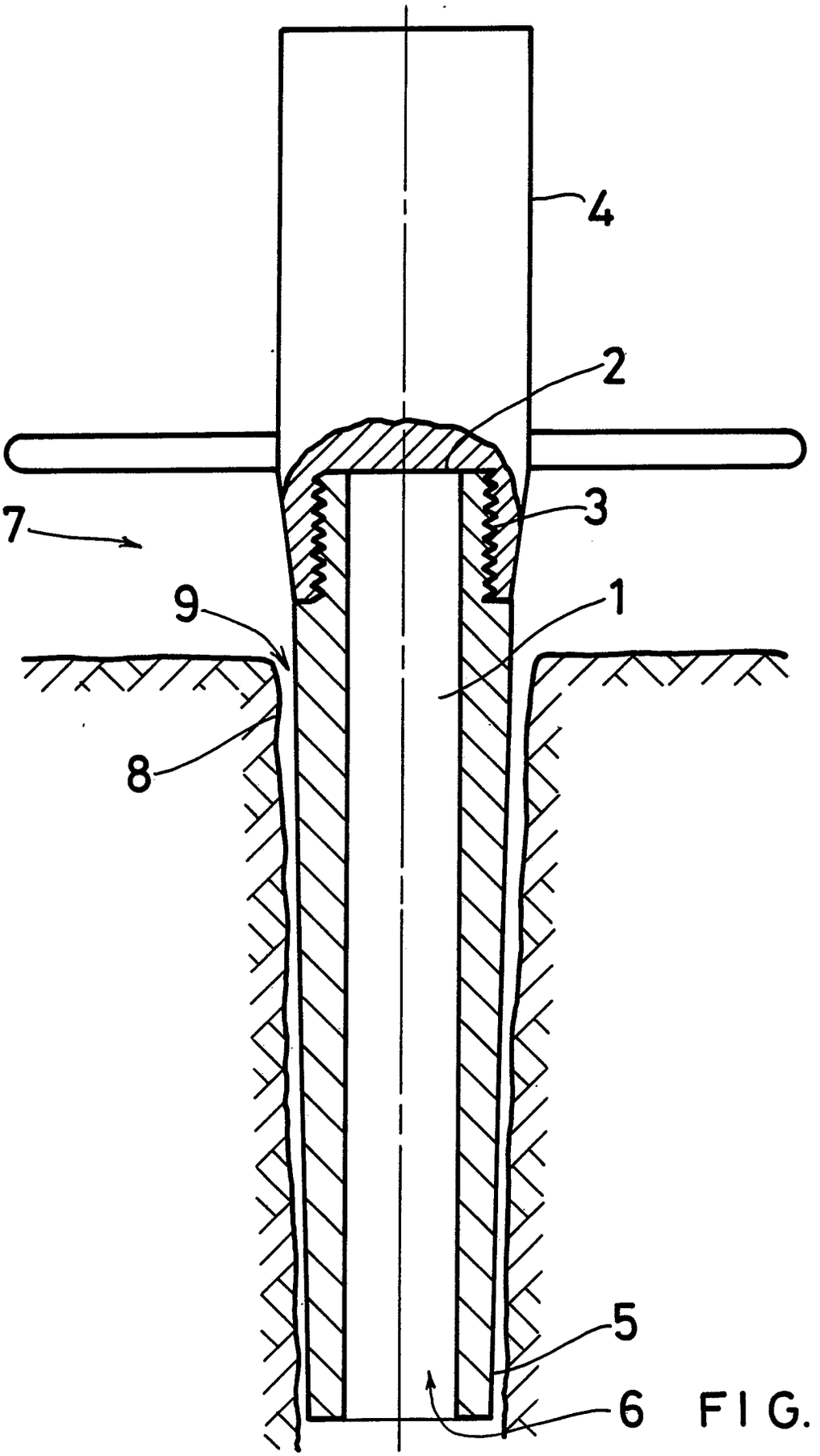

FIG. 1

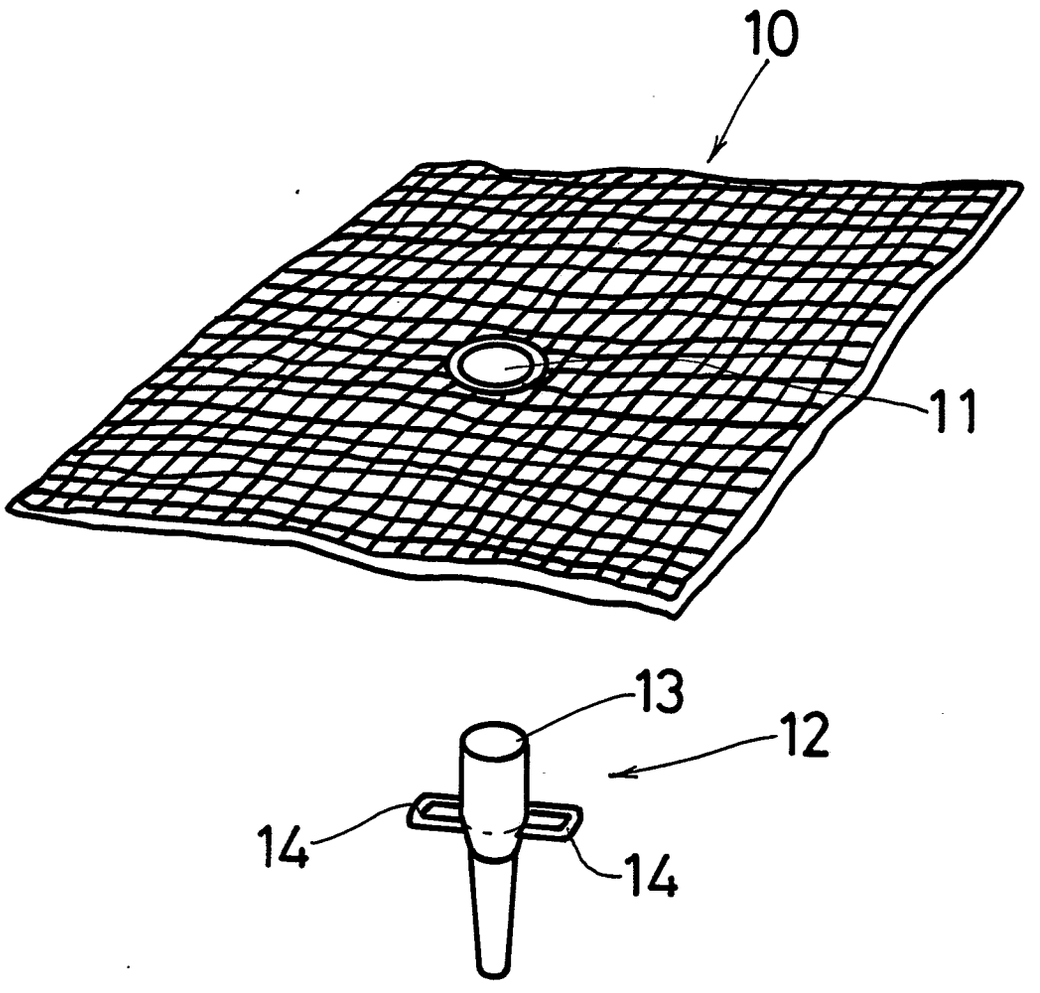

FIG. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 87 30 4794

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US-A-4 449 754 (ORLOV et al.) * Column 3, lines 23-68; figure 1 * ---	4,5	E 21 C 37/12
Y		1,2,6	
Y	CA-A-1 019 202 (ROBERTSON) * Claim 1 * ---	1,2,6	
A		9	
A	GB-A-1 408 541 (GIDROPROEKT) * Claim 1; figure * -----	1,4	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

E 21 C
F 42 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21-08-1987	RAMPELMANN J.

CATEGORY OF CITED DOCUMENTS

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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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