METHOD OF ROCK DRILLING
GESTEINSBOHRVERFAHREN
PROCEDE DE FORAGE DE ROCHES

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References cited:
EP-A1- 0 389 454
GB-A- 1 468 387
US-A- 3 561 542
EP-A1- 0 648 915

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The present invention relates to a method of rock drilling. More specifically, the invention relates to a method where the impact device is activated only after rock contact has been achieved.

According to previously known technique drilling (see EP-A-0 648 915) is initiated through starting of rotation of the rock drilling tool and flushing. After that the impact device is started with collaring pressure and the rock drilling machine is fed forward toward the rock with low speed. When the rock drilling tool reaches the rock drilling starts with low values on impact pressure and feed pressure. In order to get good collaring the forward feed must occur with low speed which means that it takes comparatively long time and that the drilling tool is exerted to empty blows, with resulting risks for damage, during this time. Since detection of rock contact occurs through sensing of the feed pressure difficulties with safe detection arise because of friction between the rock drilling machine slide and the feed beam.

The present invention, which is defined in the subsequent claims, aims at achieving a method of rock drilling where the forward feed of the rock drilling machine to rock contact can occur much quicker without exerting the equipment to unnecessary and harmful empty blows.

An embodiment of the invention is described below with reference to the accompanying drawing in which fig 1 schematically shows a rock drilling machine. Fig 2 shows schematically a control system for the rock drilling machine.

The rock drilling device shown in fig 1 comprises a machine housing 3 on which a front part 11 is fastened. The drilling device comprises a drill string including a set of tubes 1, which in fig 1 is represented by the drill sleeve 1 which is the rear part, and a set of rods 2, which in fig 1 is represented by an adapter 2 arranged in the machine. In the front part of the drill string a drill bit 31 is arranged. The drill bit 31 is rotated by means of the set of tubes which is rotated by a rotation motor 12 via a gear wheel 13 which meshes with cogs 14 on the drill sleeve 1. A hammer piston 4 is movable to-and-fro in the machine housing 3 in the usual way. The hammer piston transfers its energy to the adapter 2 in the set of rods. This energy is then transferred from rod to rod in the set of rods and from the set of rods to the drill bit 31. A sleeve 15 and a piston 8 are slidably arranged in the machine housing 3. These transfer a force determined by the pressure in a first chamber 5 to the adapter 2. This pressure acts forward on a surface 17. This force is during drilling used to hold the rods in the set of rods together. Chamber 5 is connected to an accumulator 6 which is supplied with pressure liquid from a pressure liquid source 16 via a control device 26 and a conduit 22. Piston 8 is with close fit insertable into a second chamber 7. This means that the recoil from the rock is effectively dampened because liquid is pressed out through the narrow slot between piston 8 and the machine housing. In order to avoid cavitation when piston 8 moves out from chamber 7 a check valve 9 is arranged between the first and second chambers and directed such that liquid flow is allowed from the first chamber 5 to the second chamber 7. Chambers 5 and 7 together form a recoil damper 21. The rock drilling machine is in the usual way movable to-and-fro along a feed beam 32 by a not shown feed motor. In the shown example the drill tool comprises a set of tubes and a set of rods arranged therein. The drill tool can of course be a drill rod of the normal kind.

The control system for the rock drilling method shown in fig 2 comprises a control unit 34 provided with a memory 44 for storing drilling values. To the control unit 34 are connected a sensor 35 for the pressure in the recoil damper 21, a sensor 36 for the pressure in the not shown feed motor which moves the rock drilling machine 3 along the feed beam 32, a sensor 37 for the pressure to the rotation motor 12 and a sensor for the pressure which drives the hammer piston 4 to-and-fro, the impact pressure. The control unit 34 is arranged to control a number of valves, e.g. the valve 39 for reducing the flow through the recoil damper 21, the valve 40 which controls the flow to the feed motor, the valve 41 which controls the pressure to the feed motor, the valve 42 which controls the flow through the rotation motor and the valve 43 which controls the pressure to the impact device for controlling the to-and-fro movement of the hammer piston 4.

The method of rock drilling is performed in the following way with the shown rock drilling device. The pressure in the recoil damper 21 is read by the sensor 35 and stored in memory 44 in the control unit 34. This is the idle damper pressure which is used as reference value.

Then the rock drilling machine 3 is fed along the feed beam 32 toward the rock 33 through opening the valves 40 for feed flow and 41 for feed pressure somewhat by the control unit 34. No other functions are activated at this time. The essential thing is however that the impact device remains inactive during this feed movement. Rotation may occur during this forward feed toward the rock. In this condition the reaching of the rock 33 by the drill bit 31 is awaited. The feeding toward the rock is interrupted when the pressure in the recoil damper 21 exceeds the reference value with a predetermined amount, for instance 10 bar. Through decreasing the damper flow by valve 39 one can obtain detection of rock contact at a smaller pressure increase than otherwise. When rock contact is detected the position of the rock drilling machine along the feed beam 32 is stored in the memory 44. After that the rock drilling machine is backed a short distance so that the drill bit 31 is free from the rock. Rotation and flushing are activated. Valves 40, 41 and 42 are opened so that the impact device is activated with low pressure, collaring pressure, and feed forward is started with low speed. This drilling occurs for a short distance in front of the position stored in memory 44. After that impact pressure and feed pressure are increased during a certain time to those values which are used for
normal drilling. Then the hole is drilled completely.

**Claims**

1. Method of rock drilling comprising forward feeding of a percussive rock drilling machine (3) provided with a recoil damper (21) towards a rock (33), drilling a short distance in the rock with reduced values on impact pressure (38) and feed pressure (36) and after that transition to full impact pressure and feed pressure with which a bore hole is finished, characterized in that the pressure in the recoil damper (21) at the percussive rock drilling machine (3) is read and stored in a memory (44), that the percussive rock drilling machine (3) is fed towards the rock (33) with inactive impact device until a rock drilling tool (2) connected to the percussive rock drilling machine reaches the rock, that the feeding toward the rock is interrupted when the pressure (35) in the recoil damper (21) exceeds the value stored in the memory (44) with a predetermined amount and that the bore hole after that is drilled with impact device and feeding active.

2. Method according to claim 1, characterized in that the position of the rock drilling machine (3) along a feed beam (32) is stored in the memory (44) at rock contact, that the percussive rock drilling machine (3) is backed a short distance and that a bore hole is drilled after that.

3. A percussive rock drilling machine arranged to perform the method according to claim 1 or 2.

**Patentansprüche**

1. Gesteinsbohrverfahren umfassend das Vorwärtsführen einer schlagenden Gesteinsbohrmaschine (3) versehen mit einem Rückstoßdämpfer (21), in Richtung eines Gesteins (33), das Bohren einer kurzen Distanz im Gestein mit reduzierten Werten von Schlagdruck (38) und Führungsdruk (36) und anschließender Änderung auf vollen Schlagdruck und Führungsdruk, mit welchem ein Bohrloch beendet wird, dadurch gekennzeichnet, dass der Druck im Rückstoßdämpfer (21) an der schlagenden Gesteinsbohrmaschine (3) ausgelesen wird und in einem Speicher (44) gespeichert wird, dass die schlagende Gesteinsbohrmaschine (3) in Richtung des Gesteins (33) mit inaktiver Schlagvorrichtung geführt wird, bis ein Gesteinsbohrwerkzeug (2) verbunden mit der schlagenden Gesteinsbohrmaschine, das Gestein erreicht, dass das Führen in Richtung des Gesteins unterbrochen wird, wenn der Druck (35) im Rückstoßdämpfer (21) den im Speicher (44) gespeicherten Wert um einen vorherbestimmten Wert übersteigt, und dass danach das Bohrloch mit aktiver Schlagvorrichtung und aktiver Zuführung gebohrt wird.

2. Verfahren gemäß Anspruch 1, dadurch gekennzeichnet, dass die Position der Gesteinsbohrmaschine (3) entlang des Führungs balkens (32) im Speicher (44) bei Gesteinkontakt gespeichert wird, dass die schlagende Gesteinsbohrmaschine (3) eine kurze Distanz zurückgesetzt wird und dass danach ein Bohrloch gebohrt wird.

3. Eine schlagende Gesteinsbohrmaschine angeordnet um das Verfahren gemäß der Ansprüche 1 oder 2 durchzuführen.

**Revendications**

1. Procédé de forage de roches comprenant l’avance vers l’avant d’une foreuse de roches (3) pourvue d’un amortisseur de recul (21) en direction d’une roche (33), le forage d’une distance courte dans la roche avec des valeurs réduites de la pression d’impact (38) et de la pression d’avance (36) et ensuite la transition pour la pression d’impact totale et la pression d’avance avec quelles une forure est accomplie, caractérisé en ce que la pression dans l’amortisseur de recul (21) de la foreuse de roches à percussion (3) est lue et stockée dans une mémoire (44), en ce que la foreuse de roches à percussion (3) est avancée en direction de la roche (33) avec un dispositif d’impact inactif jusqu’à ce qu’un outil de forage de roches (2) connecté à la foreuse de roches atteigne la roche, en ce que l’avance en direction de la roche est interrompue lorsque la pression (35) dans l’amortisseur de recul (21) excède la valeur stockée dans la mémoire (44) avec une quantité prédéterminée et en ce que la forure est ensuite forée avec un dispositif d’impact et une avance active.

2. Procédé selon la revendication 1, caractérisé en ce que la position de la foreuse de roches (3) le long d’une glissière d’alimentation (32) est stockée dans la mémoire (44) au contact de la roche, en ce que la foreuse de roches à percussion (3) est reculée à une distance courte et en ce qu’une forure est forée après cela.

3. Foreuse de roches à percussion prévue pour réaliser le procédé conformément à la revendication 1 ou 2.