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54 **Percussion drill with interchangeable downhole or sideways discharging cutting or drilling head.**

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EP-A- 0 005 384
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US-A- 4 530 408

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Description

This invention covers a percussion drill, equipped at its lower end with interchangeable downhole or sideways discharging cutting heads to drill and remove rubble and spoil after compressed air drilling.

It is known that the drills used for the drilling of wells are usually of two types, according to whether the head is drilling and discharging downhole or sideways. The choice of the drill depends on the type of soil and a downhole discharging cutting head is mostly used for very hard, compact or rocky soils while sideways discharging is used in sandy or crumbly soil.

Nowadays, drills with either head types are designed in different ways with different functions.

The downhole discharging drill is consisting of an external tubular rotating jacket at the upper end of which pipe sections, transmitting the rotary movement to the drills, are progressively fitted as the drill penetrates into the soil, while supplying compressed air to the drill.

The percussion device, with its up- and downward reciprocating movement, is located inside this jacket, acting on the lower cutting head. In this configuration, the percussion device has a central duct fed by a fixed central upper air distribution sleeve and is provided with a number of chambers and ducts located according to the position of the percussion device, the compressed air being either located below or above the percussion device, to lift or push it downward to ram the cutting head.

The discharged air is conveyed to the cutting head to facilitate lifting of the drilled spoil.

In the downhole approach, the cutting head too has a central axial duct, receiving discharged compressed air, as explained before; this air is discharged at the bottom through two raking branch lines.

This known solution of the downhole discharging cutting head is for instance explained in the Italian Patent Application n. 12440 A/88 and in US-A-4 530 408.

The percussion drill with sideways discharging cutting head has a different configuration. The rotary drill jacket has two hollow spaces, one to discharge the air, the air outlet being located in the upper compression chamber, and the other outlet at the bottom of the percussion device, at the center of the extreme stroke positions of the percussion device. Thus discharge is ensured when the percussion device is in its top or bottom position. The other hollow space has a lower orifice through which the compressed air below the percussion device is let in so that it can push the percussion device upwards. Proper valves, usually of the membrane type, convey the air above and

below the percussion device. In this solution, the percussion device has no axial internal channel, it does not adjust the air flow, but only the discharge at the two ends of the stroke. The sideways discharging cutting head has no central axial duct and compressed air is only let out peripherally.

This known solution of the sideways discharging cutting head is for instance explained in EP-A-0 005 384.

This means that the Firms in charge of drilling operations must have two complete drills, one of which with downhole discharging head and the other with sideways discharging head to be used according to the soil in which drilling is to be performed.

This Invention has the aim to use only one drill, and in particular a drill with downhole cutting head, even when sideways discharging cutting heads are required. This objective is met through the fact that a second sideways discharging cutting head has been devised interchangeable with the downhole discharging cutting head, i.e. a sideways discharging cutting head provided with a central duct receiving the discharged air, as required for operation of the drill in question.

The metal rings supporting the downhole and sideways discharging cutting heads are also interchangeable and have the same external thread so that they can be mounted on the drill jacket.

According to the scope of this Invention, it follows that one single percussion drill, fitted with two cutting heads, can perform any drilling operation, thus saving in equipment, accessories and maintenance costs.

In the background of the drilling it is known also US-A- 3 339 649 which treats only of a rock drill bit and US-A-4 043 409 which presents a particular cutting head formed in three separated elements.

This invention is explained in its practical and exemplifying implementation in the enclosed drawing, in which:

Fig. 1 shows the axial central section of the percussion drill with downhole discharging cutting head

Fig. 2 shows the axial central section of the sideways discharging cutting head interchangeable with the downhole discharging cutting head illustrated in Fig. 1

Fig. 3 shows the axial central section of the percussion drill fitted with sideways discharging cutting head.

With reference to these figures, the well known percussion drill with downhole discharging cutting head has an rotating external jacket 1 provided at its upper end with an element 2, connecting it to the rotary tubes through which compressed air flows, containing a shut-off valve to prevent the

return of water from the water bearing stratum (not shown on the drawing) and the compressed air distribution sleeve 3.

This external jacket 1 is equipped at its lower end with a cutting head 4, supported by a threaded ring 5. The cutting head 4 is internally provided with an axial duct 6, the upper end of which is connected to the pipe section 7 and it has at its lower end a bifurcation 8 in at least two raking directions.

The percussion device 9 is located in the center of the jacket 1, this percussion device being provided with an internal axial duct 10 in which the distributor sleeve 3 is fitted, while the pipe section 7 of the cutting head 4 may be fitted or not according to the position of the percussion device 9.

The central duct 10 of the percussion device 9 has two chambers 11 and 12 communicating with the upper and lower chambers 15, 15', by means of the ducts 13 and peripheral grooves 14 around the percussion device.

The percussion drill as here described is operating like all known drills of this type with downhole discharging cutting head and this operation is described in detail in the Italian Patent n° 12440 A/88 registered to the name of this patentee.

According to this invention, a second cutting head 16 with a central duct 17 is fitted with an upper pipe section 18 which may enter the central duct 10 of the percussion device 9 and is provided at the lower end with at least one bifurcation 19 leaving the cutting head sideways.

The locking ring 20 supporting the sideways discharging cutting head 16 is interchangeable with the locking ring 5 of the downhole discharging cutting head 4. However, at the outlets 19, this ring has two recesses 21 discharging at their lower end through small run channels 22. In this way, the compressed air when discharged flows through the central channel 17 of the cutting head 16, the bifurcation 19, thus reaching through the recesses 21 and the small channels 22, the peripheral space around the cutting head 16 provided with suitable recesses 23 through which the discharged air can reach the downhole drilling zone from which to remove the spoil.

It follows that by replacing the downhole discharging cutting head 4 and its locking ring 5 by the sideways discharging cutting head 16 and its related locking ring 20 or vice-versa, the same percussion drill can be used for drilling and excavation in different operating conditions and especially in any kind of soil.

In conclusion, when using these interchangeable cutting heads 4 and 16, the discharged air coming from the chambers driving the percussion device 9 or directly from the distribution sleeve 3,

flows through the central ducts respectively 6, 7, 17, 18 towards the downhole (bifurcation 8) or sideways outlet 19, recesses 21 and small channels 22.

Claims

1. Percussion drill with downhole discharging cutting head equipped with a cutting head (4) provided with a central duct (6) terminating at its lower end in lateral discharge openings (8), provided with a locking ring (5) presenting at its upper end an external thread for the mounting of this locking ring (5) on the external jacket (1) and supporting the cutting head (4) and provided with the percussion device (9) presenting a central duct (10) connected by means of a pipe section (7) to the central duct (6) of the head (4), **characterized** by the fact that the same percussion drill is equipped with a second sideways discharging cutting head (16) provided with a central duct (17) connected by means of a pipe section (18) to the central duct (10) of the percussion device (9) and terminating at its lower end in lateral discharge openings (19) and also provided with a locking ring (20) supporting the cutting head (16), the external thread of the ring (20) being identical to the thread of the locking ring (5) of the downhole discharging cutting head (4) and having chambers (21) tallying the lateral discharge openings (19) when the cutting head (16) is in retracted position and small downwards directed run channels (22), conveying the air from the chambers (21) to recesses (23) at the periphery of the cutting head (16), the latter together with its locking ring (20) being interchangeable with the downhole discharging cutting head (4) and with its locking ring (5), so that the same percussion drill can perform drilling operations in different soils and in various operating conditions by choosing the most suitable cutting head (4 or 16).

Revendications

1. Foreuse à percussion avec tête de forage et refoulement de fond de puits équipée d'une tête de forage (4) comportant un conduit central (6) qui se termine à son extrémité inférieure par des ouvertures de décharge latérales (8), équipée d'une bague de verrouillage (5) présentant à son extrémité supérieure un filet extérieur pour le montage de cette bague de verrouillage (5) sur l'enveloppe extérieure (1) et supportant la tête de forage (4) et équipée du dispositif à percussion (9) présentant un conduit central (10) relié au moyen d'un tron-

çon de tube (7) au conduit central (6) de la tête (4), caractérisée par le fait que la même foreuse à percussion est équipée d'une seconde tête de forage à décharge latérale (16) équipée d'un conduit central (17) relié au moyen d'un tronçon de tube (18) au conduit central (10) du dispositif à percussion (9) et se termine à son extrémité inférieure par des ouvertures de décharge latérales (19) et se trouve également équipée d'une bague de verrouillage (20) supportant la tête de forage (16), le filet extérieur de la bague (20) étant identique au filet de la bague de verrouillage (5) de la tête de forage (4) et refoulement de fond de puits et comportant des chambres (21) communiquant avec les ouvertures de décharge latérales (19) lorsque la tête de forage (16) est en position rentrée et des canaux (22) de courte longueur orientés vers le bas, acheminant l'air depuis les chambres (21) jusqu'aux logements (23) à la périphérie de la tête de forage (16), cette dernière en même temps que sa bague de verrouillage (20) étant interchangeable avec la tête de forage (4) et refoulement de fond de puits et avec sa bague de verrouillage (5), de manière que la même foreuse à percussion puisse effectuer des opérations de forage dans différents sols et dans différentes conditions de fonctionnement en choisissant la tête de forage la mieux appropriée (4 ou 16).

(21) vorgesehen sind, die in der zurückgezogenen Stellung des Schneidkopfes (10) zu den seitlichen Spülöffnungen (19) passen, sowie weiters kleine, nach unten gerichtete Ablaufkanäle (22) angeordnet sind, die die Luft von den Kammern (21) zu Einschnitten (23) am Umfang des Schneidkopfes (16) leiten, wobei letzterer zusammen mit seinem Verriegelungsring (20) gegen den nach unten spülenden Schneidkopf (4) und seinem Verriegelungsring (5) austauschbar ist, sodaß der gleiche Schlagbohrer Bohrungen in verschiedenen Böden und unter verschiedenen Arbeitsbedingungen durch Auswahl des am meisten geeigneten Schneidkopfes (4 oder 16) durchführen kann.

Patentansprüche

1. Schlagbohrer mit einem nach unten spülenden Schneidkopf (4), der mit einem zentralem Kanal (6) versehen ist, der an seinem unteren Ende in seitlichen Auslaßöffnungen (8) endet, wobei ein Verriegelungsring (5) vorgesehen ist, der zur Befestigung am äußeren Hüllrohr (1) an seinem oberen Ende ein Außengewinde besitzt und den Schneidkopf (4) lagert, sowie ferner die Schlagvorrichtung (9) angeordnet ist, die einen zentralen Kanal (10) aufweist, der durch einen Rohrteil (7) mit dem zentralen Kanal (6) des Kopfes (4) verbunden ist, **dadurch gekennzeichnet**, daß der gleiche Schlagbohrer mit einem zweiten, seitwärts spülenden Schneidkopf (16) ausgestattet ist, der einen zentralen Kanal (17) aufweist, der durch einen Rohrteil (18) mit dem zentralen Kanal (10) der Schlagvorrichtung (9) verbunden ist und an seinem unteren Ende in seitlichen Spülöffnungen (19) endet, wobei ebenfalls ein den Schneidkopf (16) lagernder Verriegelungsring (20) vorgesehen ist, dessen Außengewinde gleich dem Außengewinde des Verriegelungsringes (5) des nach unten spülenden Schneidkopfes (4) ist, und ferner Kammern

