Nov. 2, 1965 C. J. IRVING 3,215,443

PERCUSSION ROCK DRILLING MACHINES

Filed Dec. 3, 1962 2 Sheets-Sheet 1

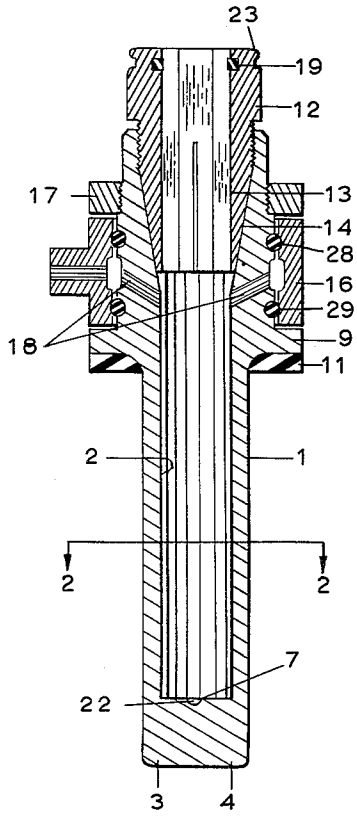


FIG 1

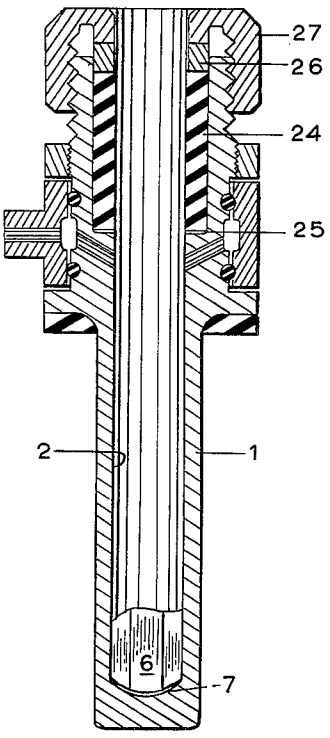


FIG 4

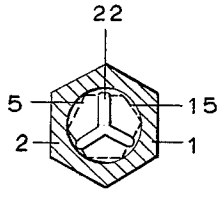


FIG 2

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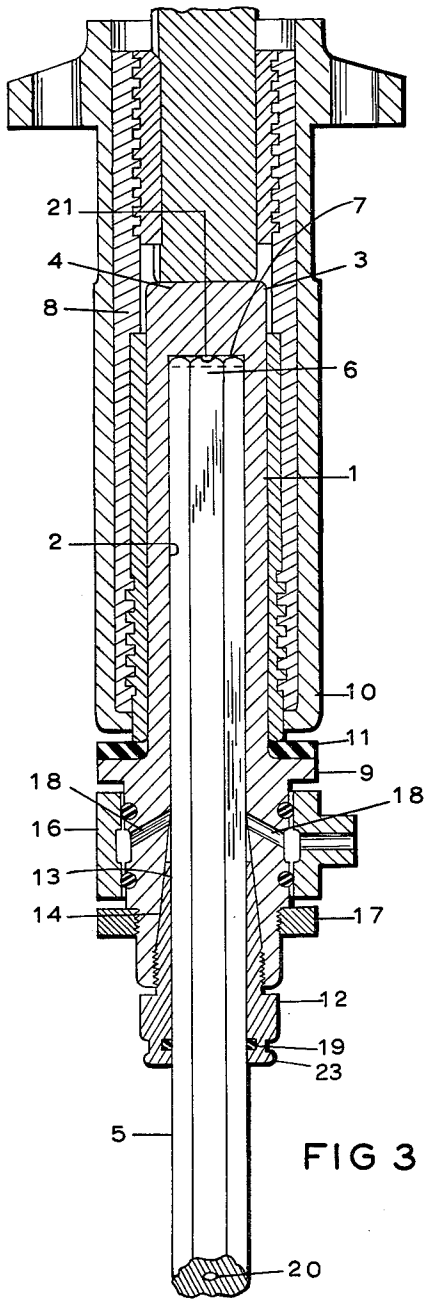


FIG 3

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PERCUSSION ROCK DRILLING MACHINES

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13 Claims. (Cl. 279—20)

This invention relates to pneumatic percussion rock drilling machines for wet drilling, and in particular to the front head portion of such machines.

The water for wet drilling is normally conveyed through an axial hole in the drill steel for discharge at the bit end of the steel. In internal water feed drilling machines the water supply is conveyed through a pipe extending through an axial hole in the rifle bar and piston, whence the water flows in an axial direction into the water hole at the shank end of the drill steel. Due to design considerations it has hitherto not been found practically possible to avoid air being entrained in the water flowing into the water hole in the drill steel. This entrained air, when discharged at the bit end of the drill steel during drilling results in the formation of bubbles of dust laden air, the dust content of which is released to atmosphere at the collar of the hole being drilled. This dust discharge, if not the primary cause of silicosis, is at least an important contributory factor.

The air entrainment in the water used for wet drilling and the attendant disadvantages can be substantially avoided by the use of an external water feed. This type of feed also enables simplification of the design of the drilling machine and improved operation thereof due to elimination of the condition where lubricant is washed away by water which normally flows over working parts of the internal water feed machines.

With an external water feed the shank end of the drill steel is blocked and the water flows into the axial hole in the drill steel through a side or radially extending hole in the steel. This side hole introduces a weakness in all normal drill steels for percussion operation, which leads to such premature breakage of the drill steel that it has hitherto generally proved uneconomical to use an external water feed. The use of special external water feed drill steels strong enough to withstand fracture has also generally proved uneconomical.

One basic object of this invention is to provide a rock drilling assembly which will avoid the disadvantages associated with both internal and external water feed drilling.

All normal drill steels embody a collar of some form to limit penetration of the shank end of the drill steel into the rock drill chuck. The three main forms of collar are those formed by forging the drill steel shank, those formed by machining a cylindrical end on the shank ends of drill steels of normal hexagonal shape, and those in the form of a rubber collar.

All these collars have certain disadvantages. For example, the forged collars cause changes in the metallurgical structure of the drill steel resulting in premature breakage in the vicinity of the collar. The machined type of collar reduces and thus weakens the shank end which is struck by the piston, only provides a relatively small collar area, and reduces the available length of steel of hexagonal section in the chuck bush which results in increase of wear of the chuck bush and shank. The rubber collar has the chief disadvantage that in use it becomes damaged and often shifts in position with consequent possible damage to the water tube and short-stroking of the piston with resulting loss of efficiency.

It is accordingly a further object of this invention to

provide means whereby the disadvantages associated with presently known drill steel collars may be at least to a large extent obviated, while still enabling the use of conventional rolled drill steels of normal hexagonal section.

In accordance with this invention there is provided a rock drilling machine having a front end embodying an auxiliary chuck to engage a normal drill steel and be engaged by the rock drill machine chuck, the bore of said auxiliary chuck being shaped to form at least one longitudinally extending passageway between the bore of the auxiliary chuck and a drill steel inserted therein, and an external water box mounted on the auxiliary chuck and communicating with the bore of the chuck, the said bore being blanked off at the inner end which is adapted to be struck by the rock drill piston.

According to further features of the invention the inner blanked off end of the auxiliary chuck may comprise a radially grooved structure to form one or more radially extending passageways between the shank end of a drill steel inserted in the auxiliary chuck and the blanked off end of said chuck. Alternatively there may be provided a drill steel with radially extending grooves at the shank end thereof.

Still further features of the invention provide for the auxiliary chuck to have an external flange to form a collar limiting the penetration of the auxiliary chuck into the rock drill machine chuck; for the bore of the auxiliary chuck to be of non-complementary shape to the drill steel; for the auxiliary chuck to embody a collet to hold the shank end of a drill steel in position therein; for the outer end of the collet to embody or form a water seal; for the outer end of the collet or chuck to embody a circumferentially extending ring and for the inner blanked off end of the auxiliary chuck to be of concave shape.

The invention is illustrated in the accompanying drawings in which:

FIG. 1 is a sectional side elevation of the auxiliary chuck,

FIG. 2 is a section on the line 2—2 in FIG. 1,

FIG. 3 is a sectional side elevation of the front end of the rock drilling machine and auxiliary chuck with a non-sectionalized drill steel normally positioned therein, and

FIG. 4 is a sectional side elevation of a modified form of chuck with a fragment of the shank end of a drill steel positioned therein and shown not sectionalized.

As shown in FIGS. 1 to 3 the auxiliary chuck **1** is generally a tubular structure with a cylindrical internal bore **2** terminating some distance from the inner end **3** thereof which is thus solid, and provides a face **4** which is struck by the piston of the rock drill machine. The diameter of the bore **2** is such that a drill steel **5** of conventional hexagonal shape will be as far as is possible, a sliding fit in the chuck **1** (see FIG. 3). It is held therein with the shank end **6** of the drill steel **5** butting against the inner surface **7** of the blanked off or solid end **3** of the auxiliary chuck so that the blows from the piston are transmitted to the drill steel. Should there be any objectionable play at the area where the shank end **6** of the drill steel **5** abuts the blanked off end **3** of the auxiliary chuck, these parts may be mutually shaped to avoid this, as more fully described below.

The auxiliary chuck **1** is externally of non-circular and preferably of hexagonal shape and is engaged and rotated by the drilling machine main chuck or machine chuck **8**, which may consist of the conventional rotation sleeve, chuck nut and chuck bushing, the parts being, however, of somewhat larger than normal dimensions to accommodate the larger dimensions of the auxiliary chuck as compared to the shank end of a drill steel.

The penetration of the auxiliary chuck **1** into the main chuck **8** is limited by an external collar **9** thereon of substantial size and which bears on the faec of the front

head cover **10** of the rock drill. The inner face of this collar **9** and/or the face of the front head cover may be faced with any suitable shock absorbing material **11**.

The drill steel **5** may be held in position in the auxiliary chuck by a collet **12** screwed into the outer end of the auxiliary chuck **1**. The collet **12** is preferably of a one-piece split tapered type, the tapered end **13** fitting into a complementary tapered portion **14** of the bore of the chuck **1** and the inner surface of the collet **12** being of complementary shape to that of the drill steel engaged thereby and normally of hexagonal shape. With this arrangement the drill steel may be firmly held in the auxiliary chuck with the shank end **6** of the drill **5** butted against the inner solid end **3** of said chuck **1**.

External water feeding is effected by making use of the segmental longitudinally extending water passageways between the drill steel **5** and the bore of the chuck **1** and which are formed due to the non-complementary shape of these parts. This is illustrated in FIG. 2 in which the drill steel is shown in dotted outline and the segmental passageways indicated by numeral **15**.

An external water feed box **16** of any suitable type is fitted on the auxiliary chuck. It is conveniently moulded against the outer face of the collar **9** on the auxiliary chuck and retained in position by a ring **17** screwed onto an externally threaded portion of said chuck. Holes **18** comprising subsidiary pasageways are drilled through the auxiliary chuck to connect the water box **16** with the segmental passageways **15** between the drill steel **5** and chuck bore. Suite sealing rings **28** and **29** are mounted on the exterior of chuck **1** above and below holes **18** respectively to prevent escape of water between the chuck **1** and box **16**. Outward flow of water from the outer end of the auxiliary chuck bore **2** is prevented by a suitable seal or seals **19** which may conveniently be incorporated in the collet **12**.

Subsidiary passageways in addition to those connecting the segmental passageways **15** to the water box **16** are provided for conveying the water from the segmental passageways to the water hole **20** at the shank end **6** of the drill **5**. These are formed either by forming radially extending grooves **21** on the shank end of the drill steel as shown in FIG. 3 or by forming grooves **22** on the inner face of the blanked off end of the auxiliary chuck as shown in FIG. 2. It will be seen that the former involves only a very minor operation on the drill steel which will not weaken it unduly, and the latter enables a conventional drill steel to be used without alteration. It will also be appreciated that with the structure described above the formation of collars on the drill steel may be avoided altogther since the function of the collar is taken over by the collar **9** and the auxiliary chuck **1**.

A further feature of the invention provides for an outwardly projecting circumferential ring **23** preferably of V-section to be formed on the outer end of the collet extending from the auxiliary chuck. The function of this ring **23** is to throw off, mainly by centrifugal force, any sludge which may run down the drill steel when drilling upwardly inclined holes, and so keep the sludge away from working parts of the machine. The ring **23** need not be a separate item, but as illustrated may be formed on the end of the collet by a machining or other conventional operation. It could also be formed on the end of the chuck.

As an alternative to the form of collet illustrated, said collet may be made in the form of a rubber bushing **24** which fits over the drill steel **5** and grips said drill steel by a compressive action as shown in FIG. 4. The compression of the rubber bushing is achieved by compressing it between an internal collar or abutment **25** formed in the bore of the auxiliary chuck and a metal ring **26** held in the end of the chuck **1** by an end cap **27** screwed onto the end of chuck **1**. As a further alternative rubber bushing may be used in addition to a collet of the type illustrated in the drawings. In both cases the rubber bushing in addition to gripping the drill steel, acts as a seal and thus enables elimination of the seal **19**. Should it be desired the bushing **24** may be secured to the drill steel by bonding or an adhesive and/or an outer ferrule in the conventional manner.

If desired the auxiliary chuck may be prevented from dropping out of the main chuck by any conventional form of retainer (not shown).

Ideally the drill steel **5** should be a sliding fit in the bore **2** of chuck **1** to form the segmental passageways as stated above, but in many cases drill steels are not made to sufficiently close tolerances to ensure this. Should these conditions apply, bore **2** of chuck **1** may be made slightly undersize or the drill steel made slightly oversize and the shank portion of the drill steel ground to be a sliding fit in the bore **2**.

Alternatively the shank end **6** of the drill steel may be made of convex shape and the inner surface **7** of the auxiliary chuck **1** made of complementary concave shape as shown in FIG. 4 so that the drill steel will be centered between the end **7** and collet **12** or bushing **24**. It will also be appreciated that the bore **2** of the auxiliary chuck **1** may be of any suitable shape, provided that together with the drill steel inserted therein it forms at least one longitudinal passageway connecting the water box to the grooved shank end of the drill steel or grooves in the inner end of the auxiliary chuck.

What I claim as new and desire to secure by Letters Patent is:

1. In combination with a percussive rock drilling machine, a machine chuck, an auxiliary chuck held in the machine chuck, a bore in the said auxiliary chuck, a shank portion of a drill steel engaged in the said bore, a longitudinally extending water passageway between said bore and the said shank portion, an external water box associated with the auxiliary chuck, a blanked-off inner end to the bore of the auxiliary chuck, an axial water hole in the drill steel and subsidiary passageways connecting the said axial water hole to the longitudinally extending passageway, and the latter passageway to the water box.

2. In combination with a percussive rock drilling machine, a machine chuck, an auxiliary chuck held in the machine chuck, a cylindrical bore in the said auxiliary chuck, a hexagonal shank portion of a drill steel engaged in the said bore, segmental longitudinally extending pasageways formed thereby between the said bore and shank portion, an external water box associated with the auxiliary chuck, a blanked-off inner end to the bore of the auxiliary chuck, an axial water hole in the drill steel and subsidiary passageways connecting the said water hole to the longitudinally extending passageways, and the latter passageways to the water box.

3. In combination with a percussive rock drilling machine, a machine chuck, an auxiliary chuck held in the machine chuck, a cylindrical bore in the said auxiliary chuck, a hexagonal shank portion of a drill steel engaged in the said bore, segmental longitudinally extending passageways formed thereby between the said bore and shank portion, an external water box associated with the auxiliary chuck, a subsidiary passageway connecting the water box to the longitudinally extending passageways and a groove in the blanked-off inner end of the auxiliary chuck bore connecting the said water hole to the longitudinally extending passageways.

4. In combination with a percussive rock drilling machine, a machine chuck, an auxiliary chuck held in the machine chuck, a cylindrical bore in the said auxiliary chuck, a hexagonal shank portion of a drill steel engaged in the said bore, segmental longitudinally extending passageways formed thereby between the said bore and shank portion, an external water box associated with the auxiliary chuck, a blanked-off inner end to the auxiliary chuck bore, an axial water hole in the drill steel, a subsidiary passageway connecting the longitudinally extending pas-

sageways to the water box, and a groove in the end of the shank portion of the drill steel connecting the axial water hole to the longitudinally extending passageways.

5. In combination with a percussive rock drilling machine, a machine chuck, an auxiliary chuck held in the machine chuck, an external collar on the auxiliary chuck located to limit the penetration thereof into the machine chuck, a bore in the said auxiliary chuck, a shank portion of the drill steel engaged in the said bore, a longitudinally extending water passageway between said bore and said shank portion, an external water box associated with the auxiliary chuck, a blanked-off inner end to the auxiliary chuck bore, an axial water hole in the drill steel and subsidiary passageways connecting the said axial water hole to the longitudinally extending passageway and the latter passageway to the water box.

6. The combination in accordance with claim **5** including a facing of shock absorbing material on said collar.

7. In combination with a percussive rock drilling machine, a machine chuck, an auxiliary chuck engaged by the machine chuck, a bore in said auxiliary chuck, a shank portion of a drill steel located in said bore, a collet fitted at the outer end of the auxiliary chuck bore and holding the drill steel in position in said auxiliary chuck, a longitudinally extending water passageway between said bore and said shank portion, an external water box mounted on the auxiliary chuck, a blanked-off inner end to the auxiliary chuck bore, an axial water hole in the drill steel and subsidiary passageways connecting the said axial water hole to the longitudinally extending passageway and the latter passageway to the water box.

8. The combination of claim **7** including an internal water seal fitted in the collet and bearing on the shank portion of the drill.

9. The combination of claim **7** including an outwardly projecting circumferentially extending ring on the outer end of the collet.

10. In combination with a percussive rock drilling machine, a machine chuck, an auxiliary chuck engaged by the machine chuck, a bore in said auxiliary chuck, a shank of a drill steel located in said bore, a resilient bushing fitted in the outer end of the auxiliary chuck bore, an end cap for retaining and compressing said bushing, a longitudinally extending water passageway between said bore and said shank portion, an external water box mounted on the auxiliary chuck, a blanked-off inner end to the auxiliary chuck bore, an axial water-hole in the drill steel and subsidiary passageways connecting the said water hole to the longitudinally extending passageway and the latter passageway to the water box.

11. In combination with a percussive rock drilling machine, a machine chuck, an auxiliary chuck engaged by the machine chuck, a bore in said auxiliary chuck, a shank portion of a drill steel located in said bore, a collar on the drill steel, a retaining cap positioned on the outer end of the auxiliary chuck to retain the collar and shank portion of the drill steel in position, a longitudinally extending water passageway between said bore and said shank portion, an external water box mounted on the auxiliary chuck, a blanked-off inner end to the auxiliary chuck bore, an axial water hole in the drill steel and subsidiary passageways connecting the said axial water hole to the longitudinally extending passageway and the latter passageway to the water box.

12. In combination with a percussive rock drilling machine, a machine chuck, an auxiliary chuck engaged by the machine chuck, a cylindrical bore in the said auxiliary chuck, a hexagonal shank portion of a drill steel located in said bore, means for retaining said shank portion in said bore, an external collar on the auxiliary chuck positioned to limit the penetration of said auxiliary chuck into the machine chuck, longitudinally extending water passageways between said bore and said shank portion, an external water box mounted on the auxiliary chuck, a blanked-off inner end to the auxiliary chuck bore, an axial water hole in the drill steel and subsidiary passageways connecting the said axial water hole to the longitudinally extending passageways and the latter passageways to the water box.

13. In combination with a percussive rock drilling machine, a machine chuck, an auxiliary chuck held in the machine chuck, a bore in said auxiliary chuck, a shank portion of a drill steel located in said bore, means for retaining said shank portion in said auxiliary chuck, a longitudinally extending water passageway between said bore and said shank portion, an external water box mounted on the auxiliary chuck, a blanked-off inner end to the auxiliary chuck bore, a concave inner surface to said blanked-off inner end, a complementary convex end to the shank portion of the drill steel bearing against said concave surface, an axial water hole in the drill steel and subsidiary passageways connecting the said axial water hole to the longitudinally extending passageway and the latter passageway to the water box.

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