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P. UEBEL
BORING AND BREAKING HAMMER WITH COMBUSTION
ENGINE OR ELECTROMOTOR DRIVE

3,323,601

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2 Sheets-Sheet 1

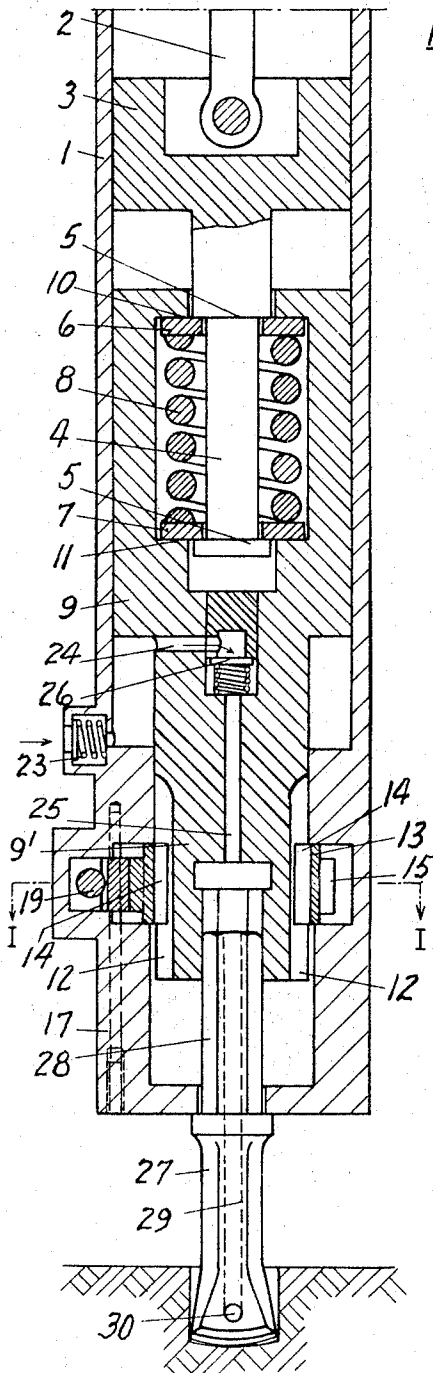


Fig. 1

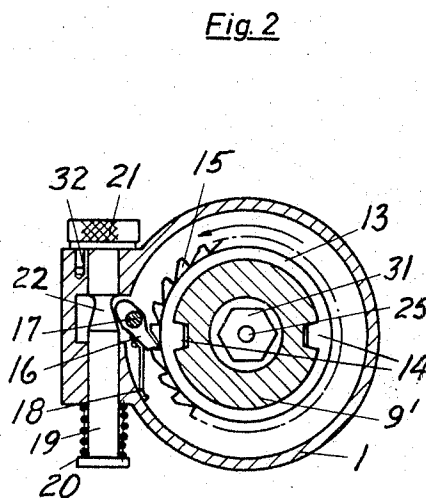


Fig. 2

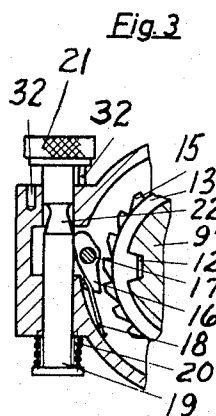


Fig. 3

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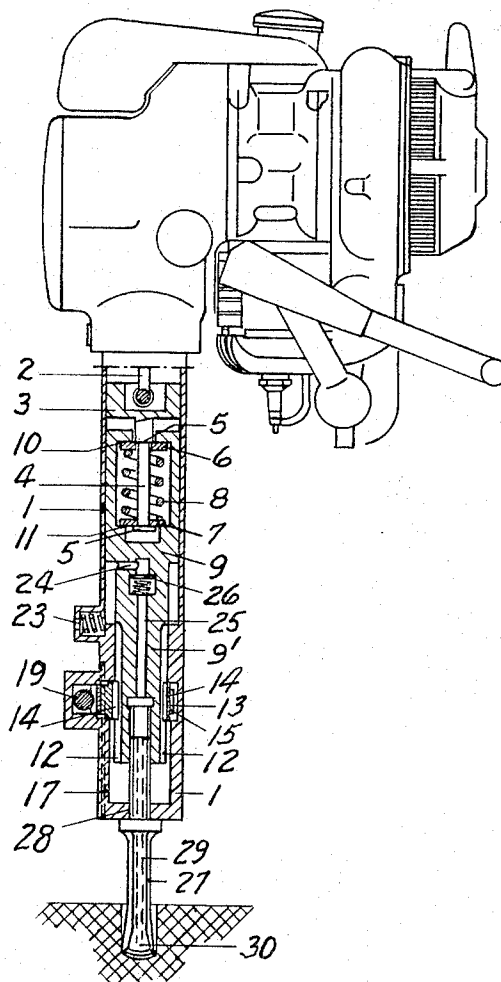
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Fig. 4



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BORING AND BREAKING HAMMER WITH COMBUSTION ENGINE OR ELECTROMOTOR DRIVE

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2 Claims. (Cl. 173-76)

The invention relates to percussion or drilling tools of the type having a source of power or prime mover attached to the housing. More in particular, the invention concerns a boring and breaking hammer having a combustion engine or electromotor drive and where the transmission of power from the prime mover to the tool is effected by way of a driving piston, a spring system and a working piston. Tools of this type are known.

The invention is concerned with the problem of achieving in such apparatus the turning of the tool in the simplest manner possible as soon as the tool raises itself from the working area. It is furthermore intended to provide the possibility of disconnecting the turning operation as desired, i.e., to permit the hammer to operate without turning movement of the tool, and finally, it is also intended to obtain simultaneously the cooling of the tool as well as blowing out or clearing of the bottom of the hole being bored.

Boring hammers driven by electromotors or combustion engines are known where the rotating movement for the turning of the drill is effected by a special separately driven machine element. In such an embodiment the rational and tool protecting timing of an ideal machine, first blow, then rotation of the drill, while simultaneously releasing the load, is not provided for.

Boring hammers are furthermore known where the hammer ram is connected with the crank drive by an oscillating spring. Besides the known shortcomings of such an oscillating spring which is subjected to changing loads, the hammer ram is not able to cause the rotation of the tool because this imposes an unfavorable load on the oscillating spring. Consequently, an intermediate piston has been arranged in this known form of construction between the actual hammer ram and the tool. This, however, involved a decrease in the percussion force and an increase in the necessary machine components.

The subject of the invention avoids the foregoing shortcomings. In accordance with the invention the working piston is only caused to operate by a pressure loaded spring which permits the turning of the operating piston with respect to the driving piston, and between the lower part of the working piston and the housing of the hammer a turning means is provided which can be activated or released and which, when activated, causes a turning of the working piston during its return stroke. The turning movement takes place at the moment that the load is removed from the tool.

In order to obtain the turning movement of the work piston with respect to the driving piston the invention provides spring disks or plates below and above the spring which is responsive only to pressure, which disks or plates are axially displaceable with respect to the driving piston and which can support themselves against abutments on the driving piston and also against abutments on the work piston.

In accordance with the invention the turning or twisting means comprise grooves extending along helical lines provided in the lower part of the working piston, a ratchet wheel which is not axially displaceable in the housing and which is provided with lugs that engage the grooves in the work piston, and finally a ratchet for the ratchet wheel provided in the housing.

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The ratchet for the ratchet wheel can be moved into and out of locking or latching position by means of a latch that can be secured in fixed position on the housing with a locking means that is accessible from the outside.

This provides that in the latched position during the upward movement of the working piston the tool is always turned, and with the latch of the working piston disengaged the tool merely moves back and forth in axial direction.

In the simplest form of construction the tool has a polygonal member, such as a square or hexagonal shaft, which may enter the lower part of the working piston and is interchangeable. In this manner tools of different configuration and for different working operations may be inserted.

Finally there is also the possibility of constructing the work piston at the same time as the piston for a pump so that the housing draws in air by way of a release or check valve, which air is compressed and can be forced to the tool through a channel in the work piston which is provided with a check valve.

Besides avoiding the aforementioned shortcomings the invention provides a substantial simplification of the entire turning or reversing system. The apparatus may also be of very short structural length. The insertion and removal of the tool can be effected rapidly. It is not necessary in order to blow the dust or particles out of the bore hole to use a separate or special machine component. The work piston together with the surrounding housing are utilized as a pump or compressor. An auxiliary source of power and special conduits for introducing the blow air are not required.

Further advantages and objects of the invention will become apparent with reference to the accompanying drawings, in which:

FIG. 1 is an axial section through the boring and breaking hammer;

FIG. 2 is a section taken along the line I—I in FIG. 1 as the turning means becomes operative;

FIG. 3 is a partial section similar to FIG. 2 with the turning means disconnected; and

FIG. 4 shows the complete apparatus with the motor attached.

The boring or breaking hammer has a cylinder or housing 1 which at its upper end may be provided with an internal combustion engine or electromotor. The forces are transmitted by way of connecting rod 2 to the driving piston 3 which has imparted to it in the housing an axially reciprocating movement. The driving piston 3 has a reduced piston or shaft portion 4 with enlarged portions 5 at the ends thereof which serve as abutments. An upper spring disk 6 and a lower spring disk 7 are guided along the reduced piston portion 4. Between the spring disks 6 and 7 a compression spring 8 of helical form is provided which presses the spring disks 6 and 7 against the abutments 5 on the driving pistons 3, 4.

The work piston 9 is mounted around the driving piston and comprises an upper abutment portion or shoulder 10 for the upper spring disk 6 and a lower abutment portion or shoulder 11 for the lower spring disk 7. The spring disks 6 and 7 thus can simultaneously engage the abutment members 5 and 10 or 5 and 11. However, they may also disengage the abutments during the operation of the device.

The lower part 9' of the work piston 9 is provided with grooves 12 along the circumference thereof, which grooves extend helically along the outer periphery of the lower part 9'. For the sake of simplicity these grooves are shown in the drawings as grooves extending parallel to the axis. Actually, however, they extend helically as explained above. In the housing 1 a ratchet wheel 13 is provided which is rotatable but not axially movable. This

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ratchet wheel is provided with two inwardly extending lugs or noses 14 which engage the lower part 9' of the working piston and which extend likewise along a helical path.

The outer periphery of the ratchet wheel 13 is provided with teeth 15. A latch or pawl 16 is adapted to engage teeth 15 and is mounted for rotation in the housing upon a pin 17. This latch is biased by a spring 18 which presses the latch 16 into engagement with the teeth 15 of the ratchet wheel 13.

In order to move the latch 16 from the latched or closed position in accordance with FIG. 2 into the released position in accordance with FIG. 3, a bolt 19 is mounted in the housing where it is axially displaceable. This bolt is biased by a spring 20 and is provided with a head portion 21 and a conical recessed portion 22. If the bolt 19 is in the position shown in FIG. 2, then the latch 16 is adapted to enter with its rearward portion the conical recess 22 in the bolt and thus lock the ratchet wheel 13.

If the bolt 19 is moved outwardly as shown in FIG. 3, then the latch 16 is turned against the effect of spring 18 into release position so that the latch 16 does not engage the teeth 15.

The work piston 9 is simultaneously adapted as a pump piston. In the space about lower part 9' of the work piston within the housing 1 a quantity of air may be enclosed which, as the work piston 9 moves downwardly, reaches the tool. For this purpose a release valve or check valve 23 is provided in the housing 1. The work piston 9 has a transverse bore 24 and a longitudinal bore 25 which are connected with each other. Between the bores 24 and 25 a further check valve 26 is provided. The tool 27 has a shaft 28 with a bore 29, which at the lower end of the tool 27 ends in an aperture 30.

The shaft 28 of the tool is of polygonal configuration, for example, square or hexagonal. It may be inserted into a corresponding bore 31 of the lower part 9' of the work piston 9.

The operation is as follows. In operation the drive motor imparts a reciprocating movement to the connecting rod 2. This movement and the force are transmitted to the drive piston 3. As the drive piston 3 moves downwardly the upper spring disk 6 is carried along and compresses the spring 8. The compression spring 8 presses against the spring disk 7 and that in turn against the abutment surface 11 of the work piston 9. This moves the work piston 9 downwardly. When the drive piston 3 moves again in the upward direction, then its lower abutment surface 5 carries along the lower spring disk 7 again compressing the compression spring 8 which presses against the upper spring disk 6, and thus the working piston 9 is carried along in the upward direction.

In order that the turning of the tool may take place during the raising of the working piston, it is possible in accordance with the invention to rotate the working piston as it rises. If the ratchet 16 is in the locking position in accordance with FIG. 2 and if the working piston 9 moves downwardly, then the ratchet wheel 13 can rotate in counterclockwise direction in that the lugs 14 slide in the grooves 12 of the working piston 9. Therefore the working piston 9 and the tool 27 do not effect any rotary movement as the working piston 9 moves downwardly.

When the working piston 9 moves upwardly, then the ratchet wheel 13 is latched, i.e., it cannot effect any rotational movement in counterclockwise direction because the latch 16 is in engagement with the teeth 15. Since the ratchet wheel 13 is now fixed in position, the working piston 9 is forced to move counterclockwise as it moves upwardly.

If the ratchet 16 is turned by moving the bolt 19 into the position shown in FIG. 3 so that it disengages the teeth 15 of the ratchet wheel 13, then the ratchet wheel 13 can move clockwise and counterclockwise. In that event

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the working piston 9 is not turned during any stroke movement.

The outward position of the bolt 19 (top position as shown in FIG. 3) can be secured by a pin 32 which is seated on the housing as the bolt 19 is moved outwardly and rotated so that the bolt is held in the raised position by the pressure of spring 20.

As the working piston 9 moves upwardly air is drawn into the cylinder 1 through the release valve 23, and as the working piston 9 moves downwardly, the air is conducted through channels 24 and 25 and the check valve 26 into the tool 27 whence it arrives at the aperture 30. In this manner the air reaches the bottom of the bore hole.

Having now described my invention with reference to the embodiment illustrated in the drawings, I do not wish to be limited thereto, but what I desire to protect by Letters Patent of the United States is set forth in the appended claims.

I claim:

1. Boring and breaking hammer including a motor, a housing supporting said motor, a driving piston connected to said motor and a working piston mounted in said housing, and means connecting said driving piston for force transmission from said motor to said working piston including spring means comprising a compression spring subjected solely to compression operative to reciprocate said working piston and disposed to permit the turning of said working piston relative to said driving piston, and releasable turning means disposed intermediate the lower part of said working piston and said housing and operative during the return stroke of said working piston to effect rotary movement of said working piston relative to said driving piston, said driving piston and said working piston having portions presenting abutments within said working piston proximate the upper and lower end of said spring, said spring means including two spring disks one intermediate each end of said spring and the adjacent abutments movable axially relative to said driving piston and to said working piston and alternately into engagement with the abutments on said driving piston and the abutments on said working piston, said turning means comprising grooves extending helically along the lower portion of said working piston, a ratchet wheel mounted around the lower portion of said working piston and having a portion supported for rotary movement in said housing, said ratchet wheel having lugs extending into said grooves, a latch pivotally supported in said housing operative to engage the teeth of said ratchet wheel, and a tool having a polygonal shaft for engagement with the lower portion of said working piston and having an air passage extending therethrough, said working piston having a reduced portion defining a part of a pump including a channel having an axially extending portion and a radially extending portion in said piston, a release valve being arranged on said housing operative to admit air around said reduced portion to said channel, said channel being connected with the air passage in said tool to supply air through said tool, and a check valve being provided in said channel within said working piston.

2. Boring and breaking hammer including a motor, a housing supporting said motor, a driving piston connected to said motor and a working piston mounted in said housing, means connecting said driving piston for force transmission from said motor to said working piston including spring means comprising a compression spring subjected solely to compression operative to reciprocate said working piston and disposed to permit the turning of said working piston relative to said driving piston, and releasable turning means disposed intermediate the lower part of said working piston and said housing and operative during the return stroke of said working piston to effect rotary movement of said working piston relative to said driving piston, said driving piston and said working piston having portions presenting abutments within said working

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piston proximate the upper and lower end of said spring, said spring means including two spring disks one intermediate each end of said spring and the adjacent abutments movable axially relative to said driving piston and to said working piston and alternately into engagement with the abutments on said driving piston and the abutments on said working piston, said turning means comprising grooves extending helically along the lower portion of said working piston, a ratchet wheel mounted around the lower portion of said working piston and having a portion supported for rotary movement in said housing, said ratchet wheel having lugs extending into said grooves, and a latch pivotally supported in said housing operative to engage the teeth of said ratchet wheel, said latch being associated with a spring biased bolt mounted externally of said housing, said bolt having a recessed portion for en-

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gement by the rear portion of said latch when in operative position and a portion operative to move said latch out of engagement with said ratchet wheel.

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