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[54] **REVERSIBLE PERCUSSION DEVICE**

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[58] **Field of Search** 173/91

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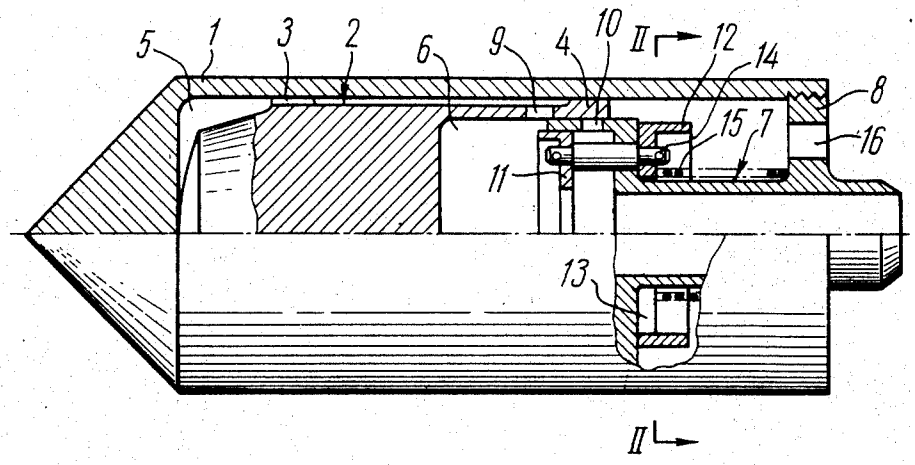
[57] **ABSTRACT**

Pneumatic reversible percussion device used for making holes in the ground.

The device is characterized in that under the action of compressed air the striker reciprocates in a hollow housing and delivers percussions upon the latter, thereby making the device move in to the ground. The compressed air is supplied into working chambers of the housing along an air-supplying bushing having ports provided on its portion interacting with the striker, overlapped by a slide valve during the forward movement of the device and used to outstrip the supply of compressed air into a front chamber during the reverse movement of the device. The slide valve is rigidly connected with a spring-loaded sleeve that is loosely mounted on the bushing and is actuated by a spring when the device is switched over to a reverse movement by way of dropping the pressure, as compared to the nominal one.

2 Claims, 2 Drawing Figures



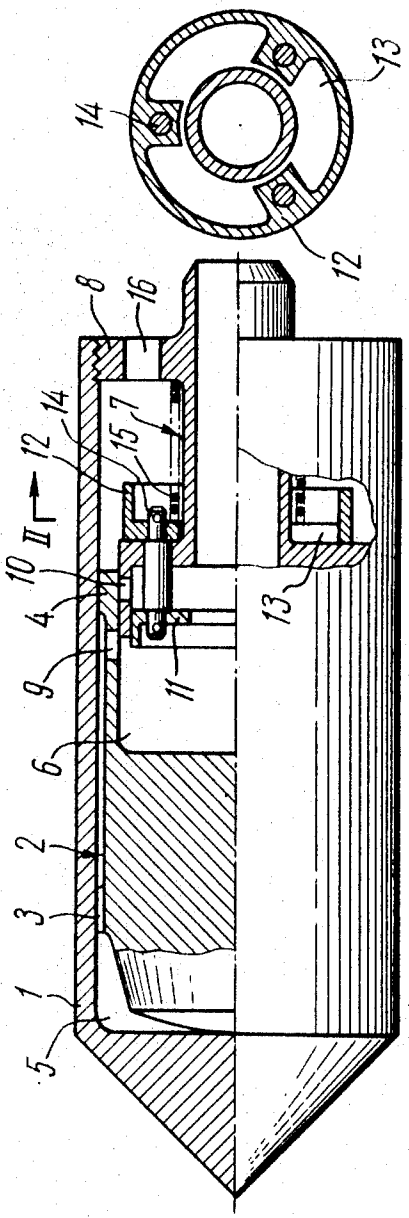


FIG. 2

FIG. 1

REVERSIBLE PERCUSSION DEVICE

The present invention relates to pneumatic reversible percussion devices for making holes in the ground by way of compacting the latter, and can be used, for example, for constructing underground communications by the closed trench-less method.

Known in the prior art are pneumatic reversible percussion devices having a housing pointed at its one side and accommodating a striker forming two chambers, a front and a rear one, of a variable volume. The front chamber disposed between the housing and the outer surface of the striker alternately communicates with a source of compressed air and with the atmosphere. The rear chamber disposed inside the striker in the tail portion thereof constantly communicates with a source of compressed air.

An air-supplying bushing is fixed in the tail portion of the housing by means of a nut so that it can move in the axial direction with respect to the latter. From the rear chamber the compressed air is supplied into the front one through ports made in the tail portion of the striker in the course of interaction of the latter with the air-supplying bushing.

While reciprocating under the action of the compressed air, the striker imparts percussions to the housing, which displaces the latter in the ground in the forward and reverse directions depending on the direction of the percussions.

To extract it from the well, the device is reversed by way of rotating a hose communicating with the air-supplying bushing and displacing the latter relative to the nut, which results in a change in the rate of supply of the compressed air into the chambers and, consequently, in a change in the direction of the percussions delivered by the striker upon the housing of the device.

The practice of use of such reversible percussion devices has shown, however, that there may take place a spontaneous stoppage of the air-supplying bushing in the nut during the forward movement of the device, which makes it difficult and sometimes impossible to reverse the movement of the device by way of rotating the hose.

The main object of the present invention is to provide a reversible percussion device whose movement would be reversed by varying the working pressure of the compressed air.

In accordance with the present invention this object is accomplished in that the air-supplying bushing is rigidly fixed in the tail portion of the housing and its portion interacting with the striker is provided with ports overlapped by a slide valve disposed inside the bushing and rigidly connected with a spring-loaded sleeve made movable along the air-supplying bushing.

It is expedient to connect the slide valve with the sleeve by means of pins passed through the face wall of the bushing.

This constructive embodiment of the air-supplying bushing attributes to a more reliable operation of the device as a whole and simplifies its servicing.

Other objects and advantages of the present invention will become apparent from the following detailed description of the invention, given with reference to the accompanying drawings, in which:

FIG. 1 shows a side view with a partial longitudinal section of a reversible percussion device for making holes in ground, according to the invention;

FIG. 2 is a section taken along line II—II in FIG. 1.

The device comprises a hollow cylindrical housing 1 (FIG. 1) pointed in its front portion and accommodating striker 2 resting upon the inner surface of a bushing 7 with two belts 3 and 4.

The space confined by the inner surface of the housing 1 and the outer surface of the striker 2 forms a front working chamber 5 of a variable volume, and the inner tail portion of the striker 2 has a space forming a rear working chamber 6. The chamber 6 accommodates the front portion of the air-supplying bushing 7 interacting with the striker 2, stationary fixed by a flange 8 in the tail portion of the housing 1 and connected with a hose coming from a compressor.

The walls of the tail portion of the striker 2 are provided with ports 9 which, depending on the position of the striker 2, periodically communicate the front working chamber 5 either with the rear working chamber 6 that is under constant pressure, or with the atmosphere.

The walls of the front portion of the air-supplying bushing 7, interacting with the striker 2, are provided with ports 10 used for supplying compressed air into the front chamber 5 during the reverse movement of the device. Mounted inside the front portion of the bushing 7 is a hollow slide valve 11 overlapping the ports 10 during the forward movement of the device.

Mounted on the bushing 7 at the side of the flange 8 is sleeve 12 (FIGS. 1 and 2) having ports 13, made movable in the axial direction and rigidly connected with the slide valve 11 by means of pins 14 passed through the face wall of the bushing 7. Installed between the flange 8 of the bushing 7 and the sleeve 12 is a spring 15 used to displace the slide valve 11 and the sleeve 12 during the reversing of the device.

The sizes and arrangements of the ports 9 and 10 are chosen so as to provide for a constant value of their passage sections irrespective of the position of the striker.

The device functions as follows:

With the device operating under the conditions of the "forward movement," the slide valve 11 and the sleeve 12, preferably connected to the former by means of the pins 14, are moved under the action of the compressed air supplied into the rear working chamber 6 along the air-supplying bushing 7 to the extreme position, as shown, whereby the ports 10 of the bushing 7 are overlapped by the slide valve 11, and the spring 15 is compressed.

Concurrently, under the action of the compressed air supplied into the chamber 6, the striker 2 is moved to the left and delivers percussions upon the inner wall of the front portion of the housing 1, as a result of which the whole device will move in the ground in the direction of the percussion, i.e., forward (in the drawing — to the left).

The friction forces arising between the housing 1 and the walls of the well in the ground prevent the device from reverse displacement.

At the beginning of the forward stroke of the striker 2 the ports 9 in its tail portion connect the front working chamber 5 with atmosphere, and, as the striker 2 moves and interacts with the bushing 7 at a predetermined distance from the extreme front position thereof, the ports 9 connect the front chamber 5 with the rear chamber 6, and, consequently, with the source of compressed air. Due to the jumping of the striker 2 from the front wall of the housing 1 and under the ac-

tion of the pressure of the compressed air delivered into the front chamber **5**, the striker **2** starts moving in the reverse direction (to the right) since its working area at the side of the chamber **5** is greater than that at the side of the chamber **6**.

With the ports **9** overlapped by the side surface of the air-supplying bushing **7**, the striker **2**, by overcoming the resistance of the compressed air in the chamber **6**, continues moving in the reverse direction due to expansion of air in the chamber **5**.

At the end of the reverse stroke of the striker **2** its ports **9**, on having passed the stage of the great diameter of the bushing **7**, connect the front chamber **5**, through the intermediary of the exhaust apertures **13** of the sleeve **12** and exhaust apertures **16** provided in the flange **8**, with the atmosphere, thus providing an outlet for the used air.

Then, the cycle is repeated. The forward movement of the device is effected under the nominal pressure of the compressed air.

When the mechanism encounters an obstacle which it cannot overcome (boulders, remainders of a foundation, debris, etc.), or upon completion of the percussion drilling of a closed hole, there takes place reversing of the movement of the percussion device, as a result of which the latter, after it has been supplied with compressed air, comes onto the surface along the hole it has made before.

The reverse movement of the device takes place when the pressure of the compressed air is lower than the nominal one. The rigidity of the spring **15** is chosen in dependence on the value of the working pressure of the air of the reverse movement.

To make the device perform the reverse movement, the pressure of the air is to be dropped, whereby under the action of the spring **15** the sleeve **12** and the slide valve **11** connected therewith will move to the extreme left position shown in FIG. **1**. As a result of this, the ports **10** in the bushing **7** are opened, the sleeve **12** is pressed against the face wall of the bushing **7**, and the exhaust ports **13** of the sleeve **12** are closed.

With the striker **2** displacing to the left, there takes place outstripping of the supply of the compressed air (as compared with that during the forward movement) into the front chamber **5** from the air-supplying bushing **7** through its ports **10** and the ports **9** provided in the tail portion of the striker **2**. The latter will be stopped by the compressed air supplied into the chamber **5**, and will start moving to the right without having delivered any percussion upon the front portion of the housing **1**. Due to the increase in the volume of the front chamber **5** and delay in the exhaust, as compared to the normal one, during its reverse movement the striker **2** will deliver percussions upon the front face of the forward flange of the bushing **7** rigidly secured in the housing **1** of the device which in this case will move the device in the reverse direction along the hole it has made before.

To switch the device from the reverse movement over to the forward one, it is necessary to raise the pressure of the compressed air to the nominal one, whereby the pressure of the compressed air acting upon the slide valve **11** will exceed the force of the spring **15**, and the slide valve **11** with the sleeve **12** will move the extreme-right position so that the slide valve **11** will overlap the ports **10**.

Now, the supply of the air into the front chamber **5** will be controlled by the edges of the air-supplying bushing **7**, and the striker **2** will deliver percussions upon the front portion of the housing, e.i. the "forward movement" cycle of the device will take place again.

We claim:

1. A reversible percussion device for making holes in the ground by compaction, comprising a housing pointed at one end and defining an inner space; a striker accommodated in said space and forming therewith front and rear variable-volume working chambers which periodically communicate with each other, said striker imparting impacts to said housing as it reciprocates therein under the effect of compressed air supplied to said chambers; an air-supplying stepped bushing having a partition between the steps thereof and interacting by one of its ends with said striker, while the other end of said bushing is secured in a portion of said housing opposite to said pointed end, said one end of the bushing, which interacts with said striker, having ports therein for the supply of the compressed air into said front chamber; a slide valve located inside said bushing for moving along the axis thereof to close said ports in one of its end positions; and a spring-biased sleeve for moving along said bushing and rigidly coupled with said slide valve.

2. The reversible percussion device as defined in claim **1**, wherein said slide valve is coupled with said sleeve by means of pins extending through said partition between said steps of the bushing.

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