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 [31] 1307966

[54] **PNEUMATIC PERCUSSION DEVICE FOR MAKING HOLES IN THE GROUND BY PACKING THE LATTER**
 4 Claims, 4 Drawing Figs.

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 173/137, 175/19
 [51] Int. Cl. E21b 1/06
 [50] Field of Search 175/19, 92;
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[56]

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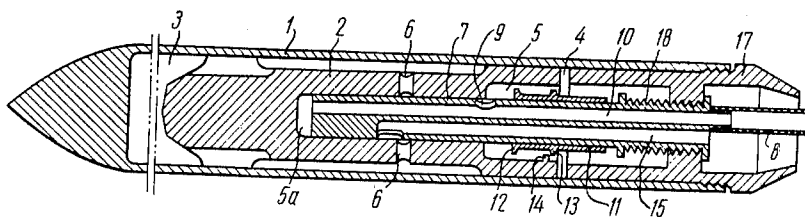
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ABSTRACT: The invention consists in a pneumatic percussion device for making holes in the ground by packing the latter, comprising a striker accommodated in a tapered housing and adapted to deliver impacts upon the housing in the course of its reciprocation under the effect of compressed air intermittently supplied to working chambers of the device by a distributing mechanism formed by an air-supply pipe secured in the shank portion of the housing, on which pipe there is set a movable sleeve adapted to overlap one of the inlet apertures of the pipe, and openings in the shank portion of the striker, said openings being overlapped by the pipe during the striker movement.



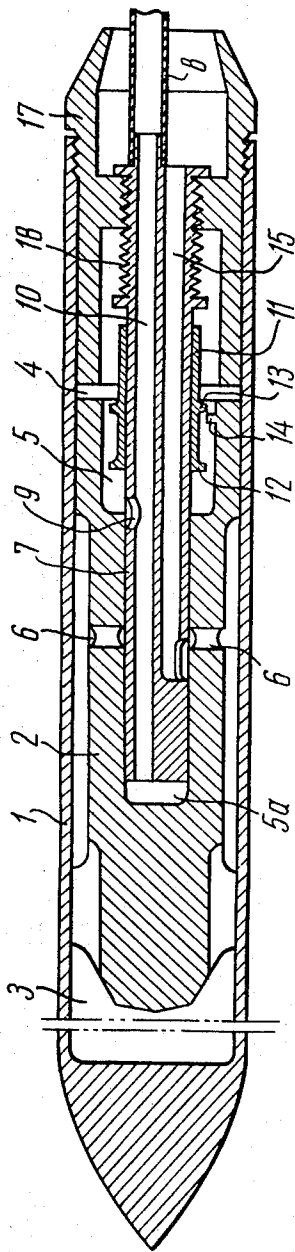


FIG. 1

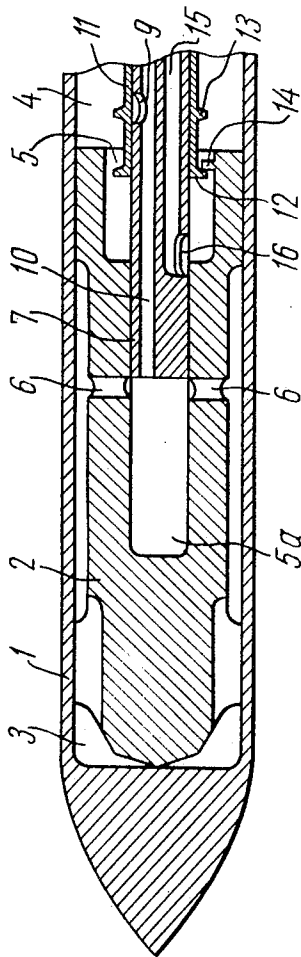


FIG. 2

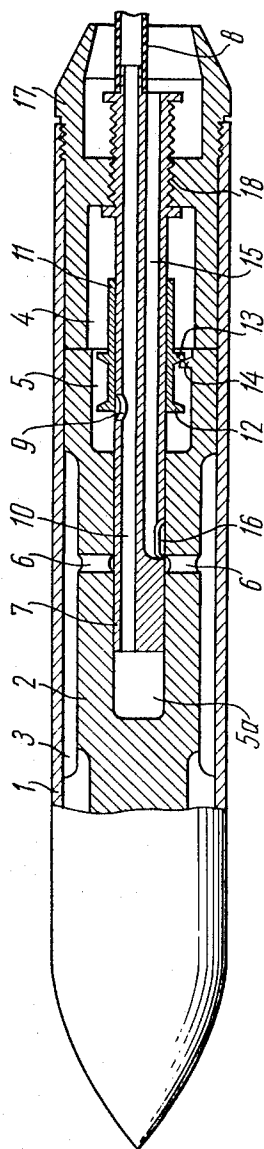


FIG. 3

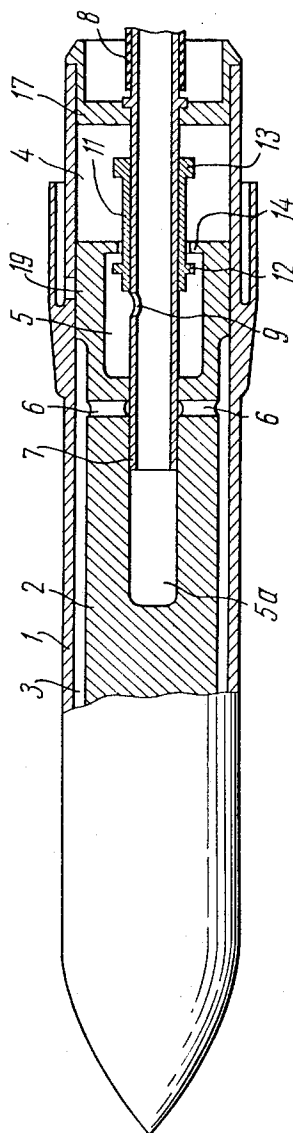


FIG. 4

PNEUMATIC PERCUSSION DEVICE FOR MAKING HOLES IN THE GROUND BY PACKING THE LATTER

This invention relates to pneumatic percussion devices for making holes in the ground by packing the latter and can be used to advantage in trenchless laying of pipes, electric and telephone cables, etc.

There are already known prior art devices, in particular, those described in French Pat. No. 1,515,348 and Belgian Pat. No. 695,405, featuring a cylindrical housing with a pointed front port on accommodating a striker with a space in the shank portion thereof, said striker dividing the inside of the housing into front and rear working chambers to which compressed air is intermittently supplied by a distributing mechanism for imparting reciprocation to the striker which is delivering impacts upon the housing.

The air-distributing mechanism in said known devices comprises an air-supply pipe secured in the shank portion of the housing and openings in the shank portion of the striker, said openings being intermittently overlapped by the pipe when the striker advances thereupon with its space.

The air-distributing mechanism has been adapted to reverse the device stroke owing to axial displacement of the air-supply pipe, making for such a variation in the striker of the housing.

The percussion energy of the known devices, at preset overall dimensions thereof, is relatively low, for the pressure of compressed air in the forward stroke does not act upon the total cross-sectional area of the striker but upon the cross-sectional area of its space.

It is an object of the present invention to provide a more powerful and efficient device, without changing its overall dimensions, by improving the air-distributing mechanism.

The present specification discloses such a device. In accordance with the present invention, the pipe mounts a sleeve connected with the striker and movable with respect to the latter and the pipe, while in the sidewall of the pipe provision is made of an aperture connecting the air conduit of the pipe with the rear working chamber, said aperture being overlapped by the sleeve during the striker stroke towards the front working chamber.

The sleeve mobility relative the pipe and the striker is attained due to the provision on the sleeve of two outer ribs spaced from each other, between which ribs is arranged a pin secured to the striker and adapted to alternately cooperate with said ribs.

Exhausted air can be alternately removed from the working chambers of the device during the striker movement, either via channel and exhaust hole in the air-supply pipe or through an opening in the housing.

The provision of the movable sleeve and the air-supply aperture in the pipe to be overlapped by this sleeve has made it possible to supply compressed air throughout the total cross-sectional area of the striker during the forward stroke from the rear chamber and, during the reverse stroke, to cut off the supply of compressed air to said chamber.

Presented hereinbelow is a detailed description of exemplary embodiments of the present invention with reference to the accompanying drawings, wherein:

FIG. 1 shows the proposed device with a reversing air-distributing mechanism, the striker being in its position prior to the beginning of the forward stroke during the device advance;

FIG. 2 shows the same device at the moment of the striker impact, that is, in the position prior to its reverse stroke;

FIG. 3 shows the same device, the striker being in the position of delivering an impact upon the shank portion of the housing during the device retreat; and

FIG. 4 shows one of the possible embodiments of the proposed device having a nonreversing air-distributing mechanism.

Now, referring to FIGS. 1-4, a cylindrical housing 1, pointed in its front portion, accommodates a striker 2 dividing the inside of the housing 1 into front, 3, and rear, 4, working chambers to which compressed air is intermittently supplied

for imparting reciprocation to the striker 2 which is delivering impacts upon the housing 1.

The striker 2 in its shank portion has a space 5 open from the butt end side, a space 5a of smaller diameter and radial openings 6, while in the shank portion of the housing 1 is secured an air-supply pipe 7 connected to an air-supply main 8. During the movement of the striker 2, its radial openings 6 are intermittently overlapped by the pipe 7 entering the space 5a, whereby intermittent air supply is attained to the front 3 and rear 4 chambers.

In the sidewall of the pipe 7 provision is made of aperture 9 serving to connect the rear chamber 4 with air conduit 10 of the pipe 7. This latter aperture can only be overlapped during the movement of the striker 2 towards the front chamber 3 by a sleeve 11 mounted outside the pipe 7 and connected with the striker 2 so as to be movable with respect to the striker 2 and pipe 7.

To this end, the sleeve 11 is provided with two ribs 12 and 13 spaced from each other, between which ribs is arranged a pin 14 of the striker 2, said pin alternately cooperating with the ribs 12 and 13 during the striker reciprocation, whereby the sleeve 11 is caused to move and close or open the aperture 9.

Thus, the pipe 7, the sleeve 11, the openings 6 and the aperture 9, when taken in combination, form an air-distributing mechanism. Thanks to the provision of the aperture 9, compressed air acts throughout the total cross-sectional area of the striker 2 from the side of the rear chamber 4, which results in an increase of the percussion energy of the striker during the forward stroke.

According to the embodiment of the present invention shown in FIGS. 1-3, the above-mentioned pipe 7 is provided with a channel 15 designed for removal of exhausted air to the atmosphere and alternately communicating, during the movement of the striker 2, with the chamber 3 and 4 via exhaust hole 16 provided in the pipe 7. As seen from FIGS. 1 and 3, the pipe 7 is secured in the shank portion of the housing 1 by means of a nut 17 relative which it can be moved along thread 18.

By changing the position of the pipe 7 relative the nut 17, the moment of air supply to the working chambers 3 and 4 can be regulated so that the striker 2 will strike against the nut 17, thereby causing the retreat of the device. Reversing the device movement may be required when making vertical or blind horizontal holes, or for removing the device from the hole when encountering an obstacle (for example, a boulder), or in case the device has considerably deviated from a preset direction.

The device shown in FIG. 4 only differs in that the discharge of exhausted air is effected via opening 19 in the housing 1, while the pipe 7 is rigidly fixed in the nut 17. This device has a simpler design, however, its air-distributing mechanism is not adapted for reversing the movement of the device.

Presented hereinbelow is a description of the principle of operation of the proposed device during the forward and reverse strokes.

Let us consider the forward stroke of the device from the moment the striker 2 and the sleeve 11 are in the extreme rear position, the aperture 9 of the pipe 7 is open, and the openings 6 of the striker 2 are overlapped by the pipe 7, as shown in FIG. 1.

The chamber 3 is communicated with the atmosphere via the openings 6 of the striker 2, exhaust hole 16 in the pipe 7 and the air-discharge channel 15 of the latter. Under the action of compressed air supplied via the conduit 10 into the spaces 5 and 5a of the striker 2 and through the aperture 9 into the chamber 4, the striker 2 moves forward. When so doing, the pin 14 of the striker 2 acts upon the rib 12 of the sleeve 11, displacing the latter along the pipe 7 so as to overlap the aperture 9, thereby ceasing the supply of air into the chamber 4. Further advance of the striker 2 takes place under the effect of the energy of air expanding in the chamber 4. At the end of the stroke the striker 2 delivers an impact upon the

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front portion of the housing 1, causing the latter to intrude into the ground.

Almost simultaneously with the impact, the exhaust hole 16 gets connected with the space 5 of the striker 2, as shown in FIG. 2, as a result of which exhausted air is discharged into the atmosphere from the chamber 4 via the channel 15 of the pipe 7, while the openings 6 get opened, and compressed air from the space 5a enters the chamber 3, causing the reverse motion of the striker 2.

The sleeve 11 remains in the extreme front position, i.e., the aperture 9 is overlapped by this sleeve. During further movement of the striker 2, its openings 6 are overlapped by the pipe 7 entering the space 5a, and the supply of air to the chamber 3 is ceased. The striker 2 moves on owing to the energy of air expanding in the chamber 3.

As soon as the openings 6 of the striker 2 coincide with the exhaust hole 16, there takes place the discharge of exhausted air to the atmosphere from the chamber 3 via the channel 15 of the pipe 7. The striker 2, moving on by inertia, acts with its pin 14 upon the rib 13 of the sleeve 11 which displaces to its initial position leaving the aperture 9 open for the subsequent air intake to the chamber 4. Thereupon, the cycle is repeated.

In order to switch the device over to the reverse stroke, the pipe 7 should be displaced relative the nut 17 from the front to rear position, for example, by turning the main 8 until the pipe 7 is screwed into the nut 17 up to the stop, as shown in FIG. 3.

With the new position of the pipe 7, the openings 6 of the striker 2 during the latter's advance will open earlier and, consequently, the intake of compressed air to the chamber 3 will take place earlier, therefore, the striker 2 will brake without having struck against the front portion of the housing 1 and start moving in the opposite direction. During this latter movement of the striker 2, the exhaust hole 16 and the aperture 9 will open later, that is, the exhaust of exhausted air from the chamber 3 and the intake of compressed air to the chamber 4 will take place later, and the striker 2, having no time for braking, will deliver an impact upon the nut 17, as a result of which

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the housing 1 of the device will move in the opposite direction. Thereupon, the cycle is repeated.

The device shown in FIG. 4 operates analogously during the forward stroke, however, the discharge of exhausted air from the chambers 3 and 4 takes place via exhaust opening 18 in the housing 1.

We claim:

1. A pneumatic percussion device for making holes in the ground by packing the latter, comprising: a cylindrical housing pointed in its front portion; a striker having openings and a space in the shank portion, said striker dividing the inside of said housing into front and rear working chambers and adapted to deliver impacts upon said housing in the course of its reciprocation under the effect of compressed air; a pipe for the delivery of compressed air to said chambers, secured in the shank portion of said housing and overlapping the openings of the striker when the latter advances with its space upon said pipe; a sleeve mounted on the pipe and connected with the striker and movable with respect to the latter and the pipe; said pipe having in its sidewall an aperture communicating the air conduit of the pipe with the rear working chamber and adapted to be overlapped by said sleeve during the striker stroke towards the front working chamber.

2. A pneumatic percussion device according to claim 1, wherein the sleeve has two outer ribs spaced from each other, between which ribs is arranged a pin secured to the striker.

3. A pneumatic percussion device according to claim 1, wherein the air-supply pipe is provided with a channel designed for the removal of exhausted air to the atmosphere and alternately communicating, during the striker movement, with the front and rear chambers via an exhaust hole.

4. A pneumatic percussion device according to claim 1, in whose housing provision is made of an opening designed for the discharge of exhausted air to the atmosphere and alternately communicating, during the striker movement, with the front and rear chambers.

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