United States Patent

Brinkman

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[54] OPERABLY ALIGNED AND CLAMPED EARTH BORING MACHINE

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[52] **U.S. Cl.** **175/122,** 175/62, 175/220

[51] **Int. Cl.**.....**E21b 3/02,** E01g 3/00

[58] **Field of Search**.....175/53, 62, 122, 162, 203, 175/220

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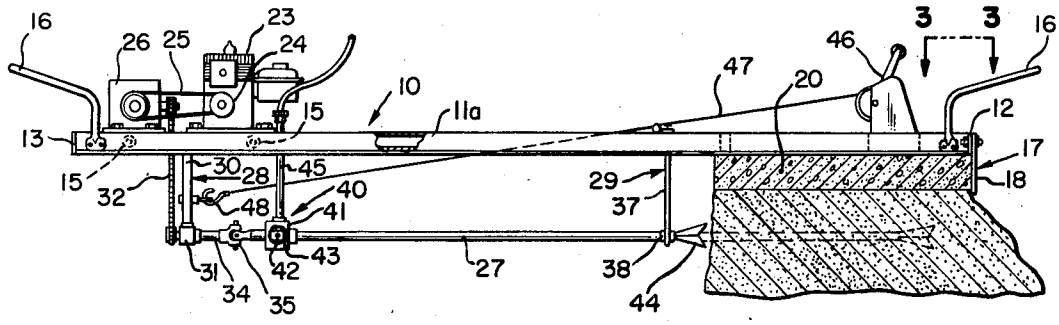
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Attorney—I. Robert Mednick

[57] **ABSTRACT**

The earth boring machine includes a stationary horizontally disposed frame with guide tracks to straddle a trench next to a pavement. A shaft for a drill bit, supported under the frame, is driven by a motor mounted on a carriage riding on the guide tracks. A pavement aligning member connects to one end of the frame to extend downward over the side of the pavement under which the earth is to be bored. A carriage driver pulls the carriage towards the pavement aligning member and pulls the frame against the side of the pavement in order to enable the drill bit to bore a hole in the earth under the pavement while aligning and clamping the boring machine during the boring operation.

7 Claims, 4 Drawing Figures



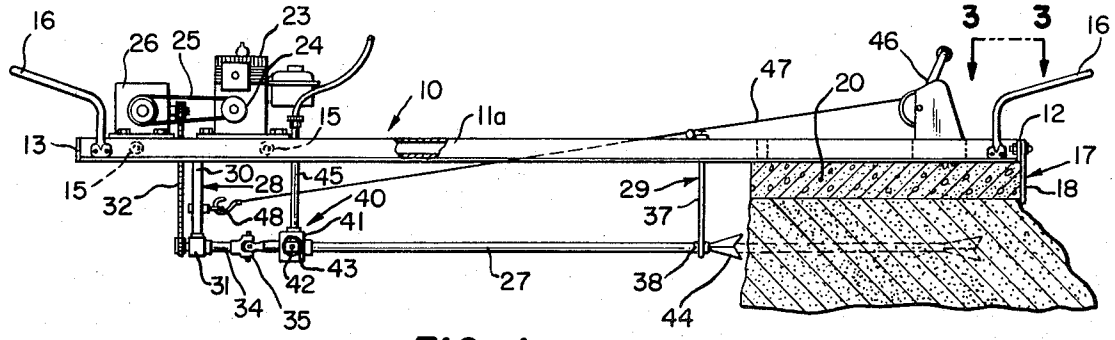


FIG. 1

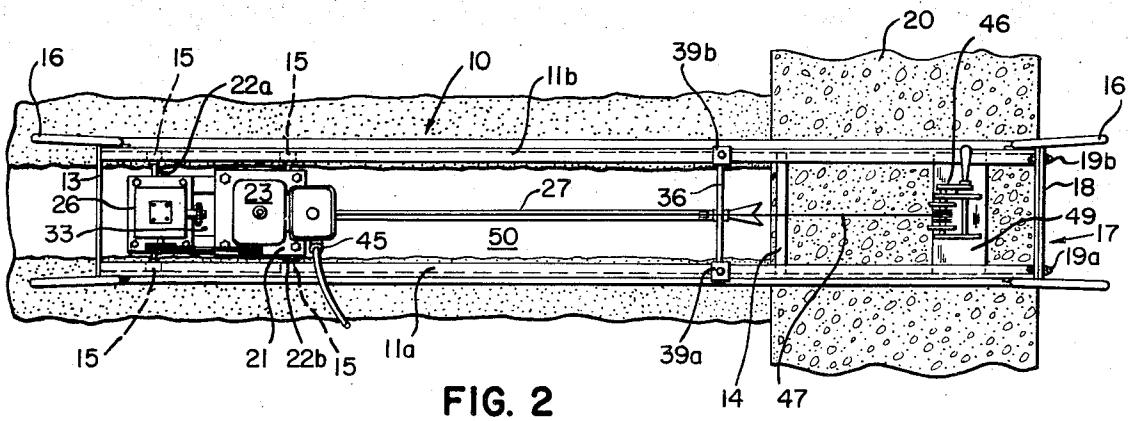


FIG. 2

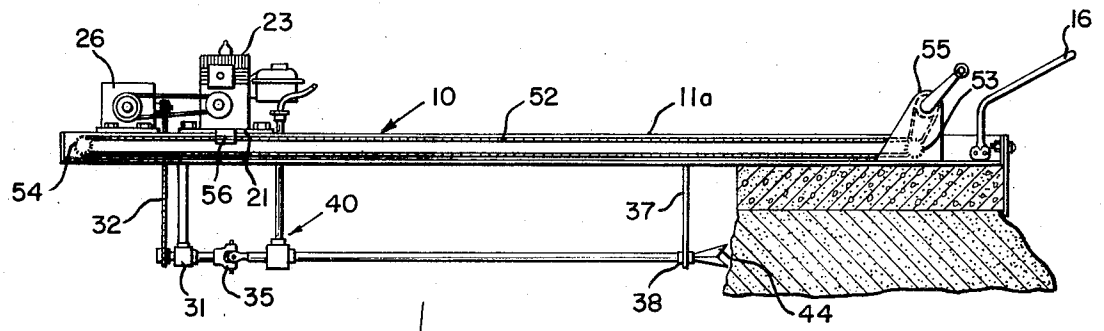


FIG. 4

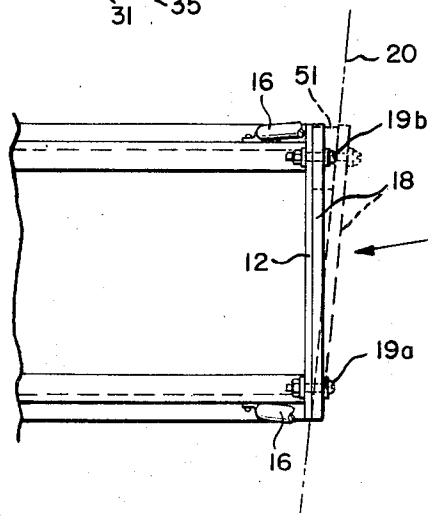


FIG. 3

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OPERABLY ALIGNED AND CLAMPED EARTH BORING MACHINE

AN OPERABLY ALIGNED AND CLAMPED EARTH BORING MACHINE

The present invention relates to an earth boring machine, and more particularly relates to an earth boring machine for boring horizontal holes in earth under pavement.

In installing earth covered conduits such as water pipes, trenches or ditches are generally dug in the earth. After the conduit is installed in the trenches, the trenches are then filled with earth. At times, it is desirable or necessary that the conduit extend under a pavement such as a concrete walk. In that event, it is not practical to break up the pavement to enable a trench to be dug so as to place a section of the conduit therein, and to thereafter refill the trench and rebuild the pavement. For this purpose, it is customary to bore a hole under the pavement within which a section of the conduit is placed and connected to the sections of the conduit installed in the trenches. Various types of earth boring machines have been built to accomplish this purpose.

In order to bore a hole under a pavement at a desired location, direction, and depth, a boring machine may have to be stabilized in a suitable position. Then the selected position of the boring machine should be maintained during the boring operation. In that event, suitable stabilizing equipment is required. Otherwise, the operator may have to readjust the position of the boring machine from time to time. Further, during the operation of the boring machine, the drilling mechanism will at times encounter obstacles or impediments such as rocks. Thereupon, the speed of the boring operation will have to be slowed down or otherwise temporarily adjusted. In order to take care of factors involved, more than one person may be required to operate the earth boring machine, or else one person will have to take more time in completing the boring operation. Conventional earth boring machines for drilling holes under pavement are usually large in size and expensive. Some of these earth boring machines operate in enlarged trenches or dugouts to accomodate the large sized machines. As a result, additional earth digging will have to be performed. Others require considerable time to bring the machines to the site, and arrange them in position to drill the desired horizontal holes in the earth under the pavement. Additionally, other earth boring machines require a lot of attention in operating the machines and to maintain them in the desired positions during the boring operations.

It is therefore an object of this invention to provide a machine for boring holes in earth under a pavement or the like.

Another object of this invention is to provide an earth boring machine that can be quickly and easily installed and operated to bore holes in earth under a pavement.

Still another object of this invention is to provide an earth boring machine which can utilize the conduit trenches already formed in the earth next to a pavement in order to bore a hole under the pavement.

A further object of this invention is to provide an earth boring machine which is aligned and clamped to a pavement to be maintained in its desired position while operating to bore a hole under the pavement.

A still further object of this invention is to provide an earth boring machine which can be economically manufactured and maintained, and which only required one person to operate the machine.

Another object of this invention is to provide an earth boring machine having a frame with a pair of guide tracks that is positioned on top of a pavement, and which has a rotatable shaft and drill bit positioned in a conduit trench previously formed in the earth next to the pavement in order to bore a horizontal hole under the pavement.

Still another object of this invention is to provide an earth boring machine that may be quickly and readily moved from one place to another in order to bore holes under pavement or the like.

Still another object of this invention is to provide an earth boring machine wherein the rate of drilling may be easily adjust-d when encountering obstacles or impediments during the boring operation.

The novel features which are believed to be characteristic of the invention, both as to its organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawings in which an embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only and are not intended as a definition of the limits of the present invention.

FIG. 1 is a side view of the earth boring machine of this invention showing it in use.

FIG. 2 is a top view of the earth boring machine seen in FIG. 1.

FIG. 3 is an enlarged view of the pavement aligning member seen along lines 3—3 of FIG. 1, and showing by dotted lines an alternate position thereof.

FIG. 4 is another side view of an earth boring machine of this invention showing a modified carriage driver that may be utilized therewith.

Referring now to the figures, there is seen in FIGS. 1 and 2 a side and top view, respectively, of the earth boring machine of this invention. A frame generally designated by numeral **10** includes a pair of parallel disposed channels **11***a* and **11***b* positioned on their edges with their open sides facing each other. End bars **12** and **13** connected at the ends of channels **11***a* and **11***b* make a rectangular shaped frame thereof. In order to provide additional structural support, an intermediate cross bar **14** is also seen connected to channels **11***a* and **11***b*. Channels **11***a* and **11***b*, and end bars **12** and **13** are preferably made of iron, steel, or the like, to form a rigid structure. End bars **12** and **13** may be welded or otherwise fixedly connected to the ends of channels **11***a* and **11***b*. Channels **11***a* and **11***b* form longitudinally extending laterally spaced guide tracks for rolling members such as wheels **15** disposed within the open sides of channels **11***a* and **11***b*. A pair of handles **16** are fixedly connected near each end of frame **10** and extend upwards to enable the earth boring machine to be carried to a site to perform the boring operation.

Pavement aligning member **17** includes a flat plate **18** secured by bolts **19***a* and **19***b* to end bar **12**. Plate **18** extends downward to rest on one side of a pavement **20** being a sidewalk formed by a concrete slab. A carriage with wheels is formed by a platform **21** with fixed axles

22*a* and 22*b* connected to the bottom side thereof to carry four rotatable wheels 15 positioned within the open sides of channels 11*a* and 11*b*. A motor 23 such as a gasoline engine, with a centrifugal clutch 24, is mounted on platform 21 in any convenient manner. An endless belt 25 connects centrifugal clutch 24 to drive a reduction gear assembly 26 also mounted on platform 21.

Hollow shaft 27 is supported under frame 10 by a first support member 28 and a second support member 29. First support member 28 includes a vertical rod 30 with its top end fixedly connected to platform 21, and with its bottom end connected to support bearing member 31. A chain 32 extends through opening 33 in platform 21 to engage a sprocket on the output shaft of reduction gear assembly 26, and to engage a sprocket on coupling shaft 34 carried by bearing member 31. A universal coupling 35 connects coupling shaft 34 to hollow shaft 27. Second support member 29 includes a cross bar 36 with an attached plate 37 having a bearing member 38. Hollow shaft 27 extends through bearing member 38 to be supported and guided as it is moved therethrough. Fastening members 39*a* and 39*b* on the ends of cross bar 36 can be secured to channels 11a and 11b to hold second support member 29 in a selected position.

As seen in the partial broken away view in FIG. 1, a water applicator 40 surrounds hollow shaft 27 near universal coupling 35. Water applicator 40 comprises a non-rotatable casing 41 forming a water jacket surrounding several small circumferential openings 42 in rotatable hollow shaft 27. A couple of sealing rings 43 at each end of casing 41 provide a water seal between casing 41 and hollow shaft 27. A drill bit 44 with a centrally extending orifice is secured to the end of hollow shaft 27. Water can flow from inlet pipe 45 inside casing 41 into hollow shaft 27 through its openings 42, and then escape through the central orifice in drill bit 44.

As realized from the above, motor 23 is coupled to hollow shaft 27 to drive hollow shaft 27 and drill bit 44. The coupling means connecting motor 23 to shaft 27 includes centrifugal clutch 24, belt 25, reduction gear assembly 26, chain 32, bearing member 31, and universal coupling 35. When motor 23 is operating, hollow shaft 27 with its drill bit 44 will thereupon be rotated. A carriage driver is also provided in order to enable drill bit 44 to bore a horizontal hole under pavement 17. The carriage driver includes winch 46 with a cable 47 connected to the carriage by a hook and eye bolt 48 secured to rod 30 which in turn connects to platform 21. Winch 46 is mounted on a plate 49 connected to channels 11a and 11b. Cable 47 rides on a pulley attached to the top of cross bar 36. Winch 46 may be turned to pull the movable carriage towards pavement aligning member 17. When drill bit 44 engages the earth under pavement 20, frame 10 will be pulled so that flat plate 18 will press against the side of pavement 20, and the contacting force of drill bit 44 with the earth will clamp the boring machine in this position.

In order to operate this machine, the earth boring machine is carried to the sidewalk 20 or other type of pavement under which a hole is to be bored. Of course, prior to the use of the machine, regular sized trenches for laying conduit are initially dug on both sides of sidewalk 20. Frame 10 is positioned on top of sidewalk 20 with pavement aligning member 17 resting against the side of sidewalk. Channels 11*a* and 11*b* are spaced apart to straddle trench 50. Support members 28 and 29, and also shaft 27 with its drill bit 44 fit within trench 50. By means of a water hose connected to inlet pipe 45, water under pressure flows through water applicator 40 into hollow shaft 27 and out of drill bit 44. With motor 23 running, shaft 27 and drill bit 44 will thereupon rotate. Then, hand winch 46 will be turned to pull platform 21, and the carriage will move on the tracks of frame 10 towards pavement aligning member 17. When drill bit 44 engages the earth under pavement 20, plate 18 will press against the side of pavement 20 to align frame 10 will pavement 20. The engaging force of the plate 18 against pavement 20 together with the engaging force of drill bit 44 with the earth will act as a clamp to hold the earth boring machine in this position. Accordingly, the drill bit will then bore a hole under the pavement while the earth boring machine is aligned and clamped during the boring operation.

In case it is desired to bore a hole in an angular direction with respect to a pavement, the pavement aligning member may then be correspondingly positioned with respect to frame 10. FIG. 3 is an enlarged view of pavement aligning member 17, showing by dotted lines such an alternate position thereof. In that event, by the simple use of a spacer 51 on bolt 19*a*, pavement aligning member 17 will then be quickly and easily positioned to enable a hole to be bored in a desired angular direction. It will be realized that in case the pavement or sidewalk is curved or has an irregular shape, then the pavement aligning member may be shaped and positioned to accomodate the shape of the pavement. In either case, the operation of this earth boring machine will be the same as previously described.

In operating the boring machine previously described, the operator rotates the crank of the winch to pull the carriage to move it on the tracks of the frame towards the pavement aligning member. After the boring operation is completed, the carriage may be easily pushed by hand to return it to the position shown in FIG. 1. However, with one person operating the earth boring machine, it may be convenient if the operator can turn the winch for returning the carriage as well. FIG. 4 shows a side view of the earth boring machine in which a modified carriage driver is shown wherein the winch can be used for advancing and returning the carriage. Therein, an endless chain 52 on a pair of pulleys 53 and 54 are provided to be turned by winch 55 to move the carriage in either direction. Chain 52 is seen disposed on the outside of channel 11a so that it will not interfere with the operation of the boring machine. A bracket 56 connects chain 52 to platform 21 to enable the carriage to be moved along frame 10 in either longitudinal direction as winch 55 is turned accordingly. Except for the modified carriage driver as described, all the other parts of the earth boring machine shown in the other figures are included in the earth boring machine shown in FIG. 4, and therefore the same reference numbers are shown therein.

Having herein described the invention, what is claimed as new is:

1. An operably aligned and clamped earth boring machine for boring horizontal holes in earth under a pavement, said boring machine comprising:

a. a stationary horizontally disposed frame having longitudinally extending laterally spaced guide tracks;
b. a pavement aligning member connected to the frame at one end thereof to extend downward over one side of the pavement while a portion of said frame is positioned on top of the pavement;
c. a carriage having wheels rotatably disposed on the guide tracks;
d. a motor mounted on the carriage;
e. a rotatable hollow shaft disposed on the underside of the frame;
f. a drill bit fixedly connected to one end of the hollow shaft;
g. a first shaft support member suspended from the carriage to rotatably support the shaft and to move the shaft with the carriage;
h. a second shaft support member suspended from the frame on the other side of the pavement between the first shaft support member and the pavement aligning member to support and guide the shaft;
i. coupling means connecting the shaft and the motor to enable the motor to rotate the shaft and the drill bit; and
j. a carriage driver connected to the frame and to the carriage to pull the frame so that the pavement aligning member presses against the side of the pavement, and to pull the carriage to move it on the tracks of the frame towards the pavement aligning member in order to enable the drill bit to bore a hole in the earth under the pavement while aligning and clamping the boring machine during the boring operation.

2. The earth boring machine in accordance with claim **1** wherein said carriage driver includes a winch fixedly connected to the frame, and a cable driven by the winch and being connected to move the carriage towards the pavement aligning member.

3. The earth boring machine in accordance with claim **2** wherein said drill bit has an orifice, wherein said shaft has openings in a portion thereof, and which additionally includes a non-rotatable water applicator connected to the shaft with a water jacket surrounding the openings therein and being in sealed engagement therewith to allow water into the rotating shaft and out of the orifice during operation of the boring machine.

4. The earth boring machine in accordance with claim **1** wherein said carriage driver includes connecting means operable to move the carriage on the tracks in either direction, wherein said drill bit has an orifice, and which additionally includes a non-rotatable water applicator connected to the shaft to allow water into the hollow shaft and out of said orifice during operation of the boring machine.

5. An operably aligned and clamped earth boring machine for boring horizontal holes in earth under a pavement, said boring machine comprising:
a. a stationary horizontally disposed frame having guide tracks;
b. a pavement aligning member connected to the frame at one end thereof to extend downward over one side of the pavement while a portion of said frame is positioned on top of the pavement;
c. a carriage capable of moving on the guide tracks;
d. a motor mounted on the carriage;
e. a rotatable shaft disposed on the underside of the frame;
f. a drill bit fixedly connected to one end of the shaft;
g. shaft support means to support the shaft under the frame;
h. coupling means including a universal joint connecting the shaft and the motor to enable the motor to rotate the shaft and the drill bit; and
i. a carriage driver connected to the frame and to the carriage to pull the carriage to move it on the guide tracks of the frame towards the pavement aligning member, and to pull the frame so that the pavement aligning member presses against the side of the pavement in order to enable the drill bit to bore a hole in the earth under the pavement while aligning and clamping the boring machine during the boring operation.

6. The earth boring machine in accordance with claim **5** wherein said carriage driver includes a winch fixedly connected to the frame, and a cable driven by the winch and being connected to move the carriage towards the pavement aligning member, and wherein said coupling means includes a reduction gear assembly to rotate the shaft at a reduced rate of speed.

7. The earth boring machine in accordance with claim **5** wherein said carriage driver includes connecting means operable to move the carriage on the guide tracks of the frame in either direction.

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