March 24, 1959 E. C. EDWARDS ET AL 2,879,033

PORTABLE HORIZONTAL EARTH DRILLING TOOL

Filed April 12, 1955 3 Sheets-Sheet 1

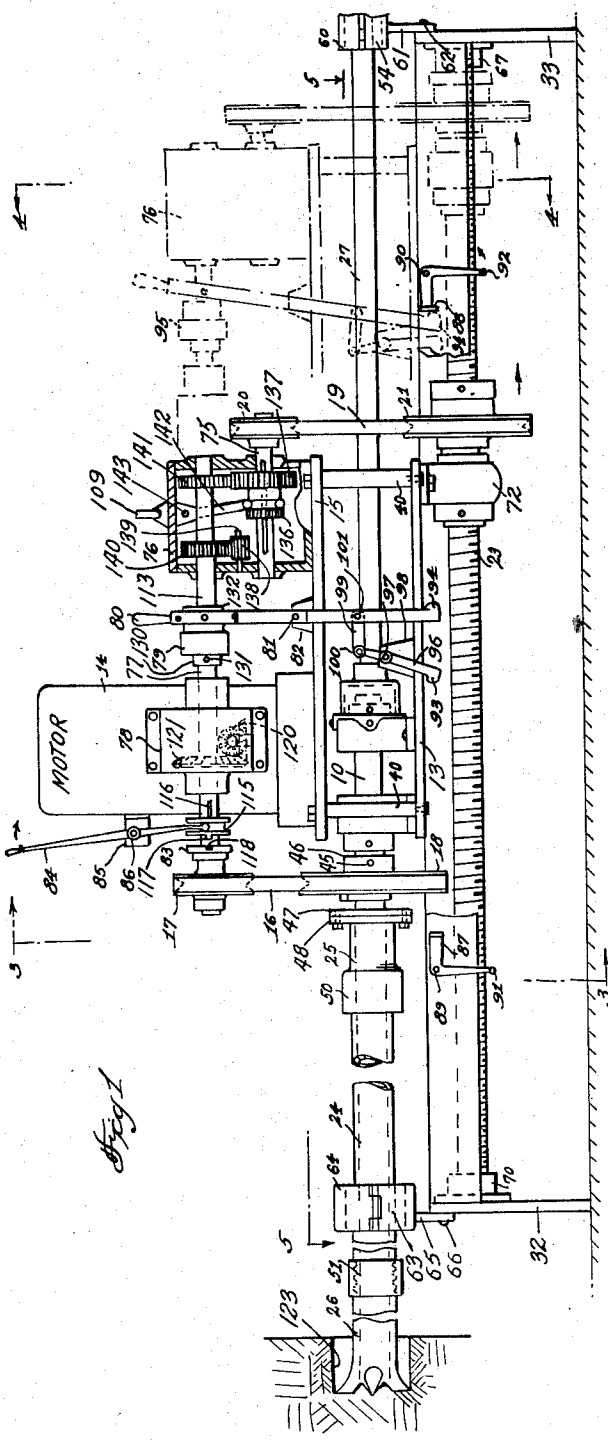


Fig. 1

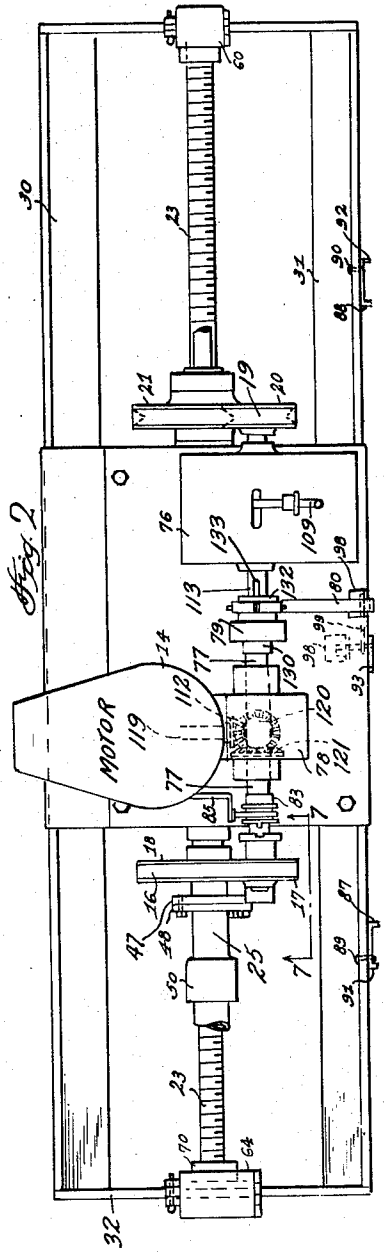


Fig. 2

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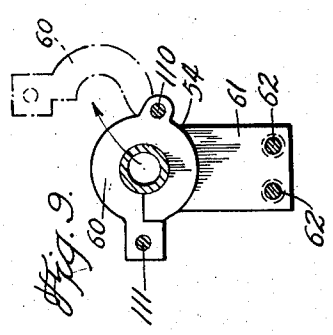


Fig. 9.

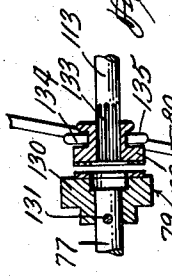


Fig. 10.

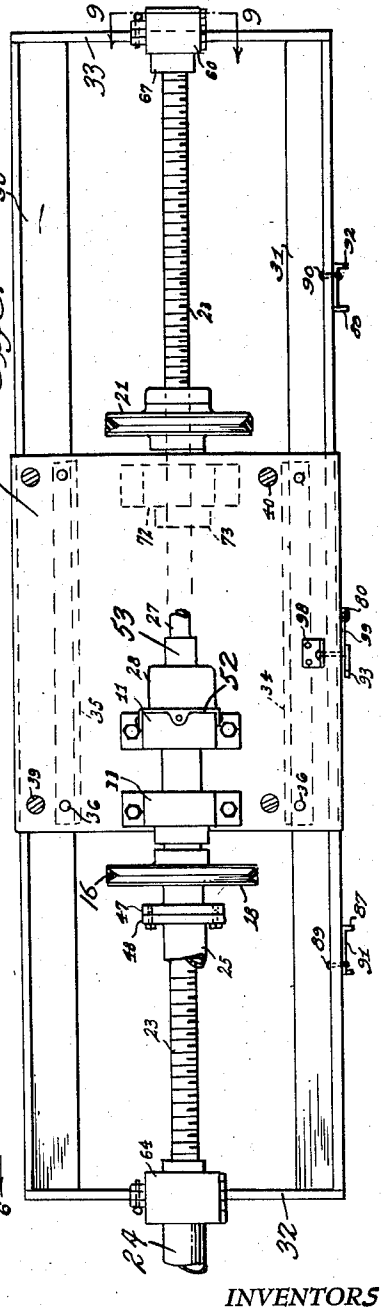


Fig. 5.

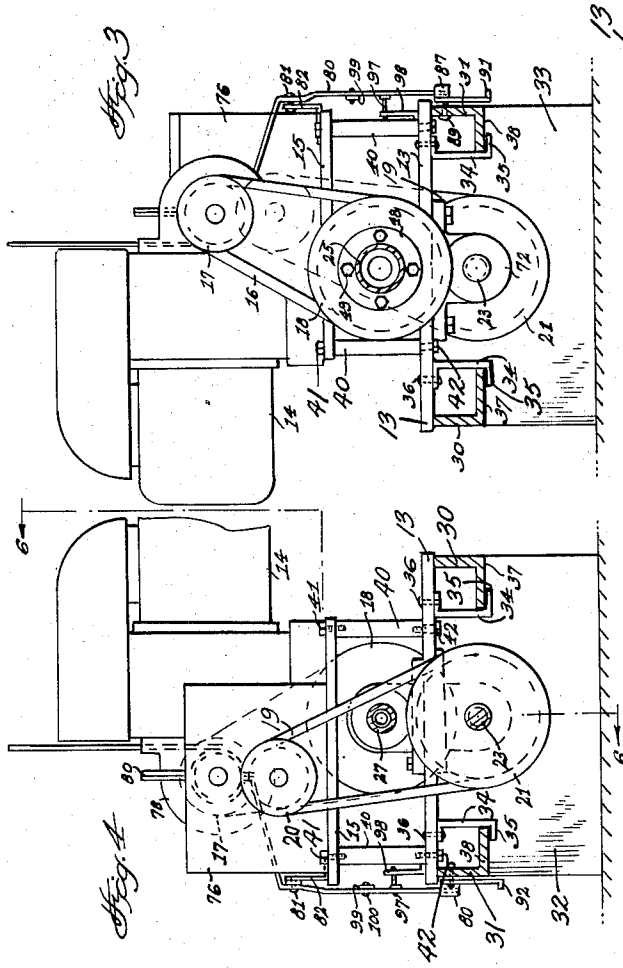


Fig. 3

Fig. 4

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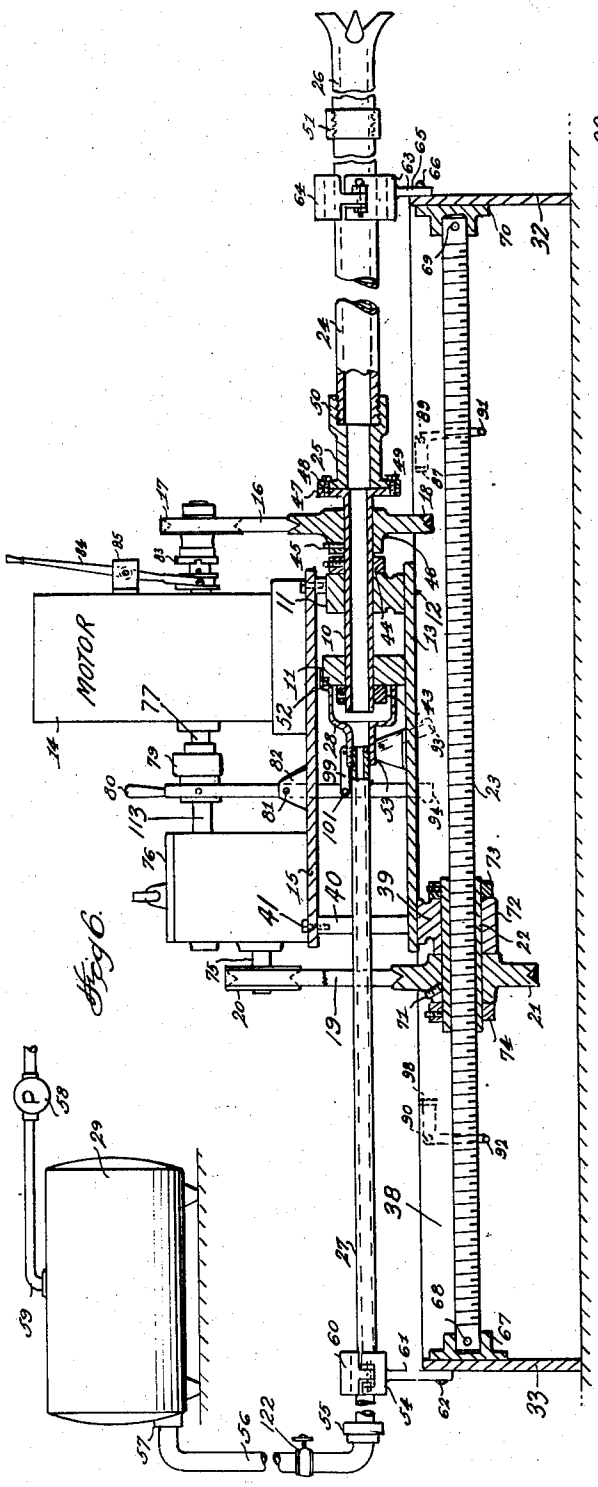


Fig. 6.

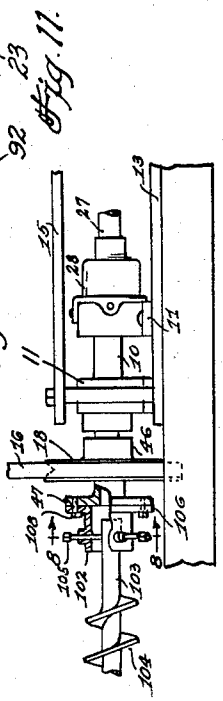


Fig. 7.

Fig. 11.

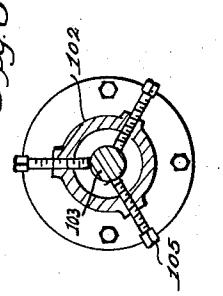


Fig. 8.

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PORTABLE HORIZONTAL EARTH DRILLING TOOL

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Application April 12, 1955, Serial No. 500,834

3 Claims. (Cl. 255—20)

This invention relates to horizontal earth drilling machines particularly designed for drilling horizontal openings under streets, highways, railroads, and the like for small pipes, such as used in service lines, and in particular a tool in which the operating instrumentalities are mounted on a traveling carriage designed to slide on a base frame with the carriage actuated by a feed screw fixedly mounted in the frame and with a drill bit carried on an extended end of a tube, and in which the tube on which the drill bit is carried and a collar positioned on the feed screw are rotated by power means on the carriage with limit switches and other controls mounted on the frame and positioned to be engaged by elements extended from the carriage.

The purpose of this invention is to provide a portable horizontally disposed earth drilling tool that is designed to be readily set up for use for drilling service lines below streets, highways, railroads and the like and wherein the tool is so designed that it may readiiy be moved from one position to another.

Various attempts have been made to drill openings below streets, highways, railroad beds and the like, particularly for culverts, service lines, and the like, however, such machines use conventional augers and it has been found difficult, and substantially impossible to drill an open hole through relatively loose dirt with a conventional auger. With this thought in mind this invention contemplates an earth boring tool having a drill bit or head on the extended end of a tube wherein with the drill bit having carbide cutting edges it will drill a hole for a service line such as a pipe for gas, water, sewerage, and the like through the ground, through rock, concrete walls, and other obstructions whereby with one operation, an opening is provided for a service line from one side of a street to another and below foundations of the paving of highways and the like.

The object of this invention is, therefore, to provide an earth drilling tool that drills a hole for a service line through earth and substantially all obstructions therein from one side of a street or highway to another and wherein the service line or pipe is installed in the opening or hole immediately.

Another object of the invention is to provide a portable drill for extending service lines below streets, highways, railroads and the like in which the speed of the cutting bit or head and also of the feed therefor are readily adjustable.

A further object of the invention is to provide a portable device for extending service lines below streets, highways, and the like in which the device is of a simple and economical construction.

With these and other objects and advantages in view, the invention embodies a substantially rectangular-shaped frame having bearings for rotatably mounting a screw feed therein, a carriage mounted on the frame and adapted to travel longitudinally thereof, a tubular shaft rotatably mounted on the carriage, a pipe extended from the tubular shaft and having a drill bit or head on the extended end, a supply tube for fluid under pressure extended from the tube rotatably mounted on the carriage and connected through said tube to the pipe and drill head, a power unit positioned on the carriage, and transmission elements having clutches and reduction gears therein for operatively connecting the tubular shaft and screw feed to the power unit.

Other features and advantages of the invention will appear from the following description, taken in connection with the drawings, wherein:

Figure 1 is a side elevational view illustrating the improved portable drill with parts of a side element broken away to show the mounting of the screw feed in the frame of the device.

Figure 2 is a plan view of the improved portable drill.

Figure 3 is a cross section through the drill, taken on line 3—3 of Figure 1, illustrating the drive for the tubular shaft.

Figure 4 is a cross section through the machine, taken on line 4—4 of Figure 1, showing the drive for the screw feed of the carriage.

Figure 5 is a plan view showing the upper part of the mounting frame of the drill, taken substantially on line 5—5 of Figure 1, the power unit and other elements of the drill being omitted.

Figure 6 is a longitudinal section through the drill with parts shown in elevation, taken on line 6—6 of Figure 4.

Figure 7 is a longitudinal section through the intermediate part of the drill taken on line 7—7 of Figure 2, with parts broken away, illustrating a method of mounting an auger in a chuck at one end of the tubular shaft of the drill.

Figure 8 is a cross section through the chuck taken on line 8—8 of Figure 7.

Figure 9 is a section taken on line 9—9 of Figure 5 showing a bearing which forms a guide for a lubricant supplying tube at the end of the frame of the machine.

Figure 10 is a longitudinal section through a clutch positioned between a gear housing of the motor and a reduction gear illustrating the shift lever connection of the clutch.

Figure 11 is a longitudinal section through the machine showing a manually actuated trip lever for releasing the clutch operating lever, other parts of the machine being broken away.

Referring now to the drawings wherein like reference characters denote corresponding parts the improved portable earth drilling tool of this invention includes a longitudinally disposed tubular shaft **10** rotatably mounted in bearings **11** of a traveling carriage **12** mounted on a frame and having a base plate **13**, an engine or motor **14**, an upper plate **15** spaced above and parallel to the base plate **13** and on which the engine or motor is mounted, a belt **16** trained over a pulley **17** on the motor shaft and also over a pulley **18** on the tubular shaft **10** for rotating the shaft by the motor, a belt **19** trained over a pulley **20** of a reduction gear operated by the motor and also over a pulley **21** on an internally threaded sleeve **22** positioned on a longitudinally disposed screw **23** and connected to the carriage, a pipe **24** connected to the tubular shaft **10** by a coupling **25**, a drill bit or head **26** carried by the extended end of the pipe or tube **24**, and a supply tube **27** connected to the opposite end of the tubular shaft **10** by a bell fitting **28** and extended to a reservoir for water or other fluid under pressure, as indicated by the numeral **29**.

The carriage is mounted whereby the base plate **13** slides longitudinally on upper edges of vertically disposed legs of angle bars **30** and **31** which extend longitudinally of the frame and which are connected by end plates **32** and **33**. The base plate **13** is retained in position for sliding on the upper edges of the legs of the

angle bars by channel bars 34 mounted inside of the angle bars with flanges 35 on the lower edges and the channel bars are secured in position by rivets 36 extended through flanges on upper edges thereof and also through the base plate 13. The flanges 35 on the lower edges extend below horizontally disposed arms 37 and 38 of the angle bars 30 and 31 as shown in Figures 3 and 4.

The sleeve 22 is connected to the base plate 13 by a bearing 39 whereby upon rotation of the sleeve by the belt 19 which is trained over the pulley 21 on the sleeve, the sleeve follows the threads of the screw 23 actuating the carriage longitudinally of the machine.

The upper plate 15 is mounted on the base plate 13 by supports 40, upper ends of which are secured to the plate 15 by bolts 41 and lower ends of which are secured to the base plate 13 by bolts 42.

The tubular shaft 10 is retained in position in the bearings 11 with a set collar 43, at one end, and a similar collar 44 at the opposite end and the pulley 18 is secured in position on the shaft 10 with a set screw 45 which is threaded in the hub 46 of the pulley. The extended end of the shaft 10 is provided with a flange 47 to which a similar flange 48 of the coupling 25 is connected with bolts 49. The extended end of the coupling is provided with an internally threaded collar 50 and the pipe 24 is threaded into the collar 50 as shown in Figure 6. The drilling bit or head 26 is mounted on the end of the pipe 24 with a collar or other fastener, as indicated by the numeral 51.

The opposite end of the tubular shaft 10 opens into the bell fitting 28 which is mounted on the side of the bearing 11 with a flange, such as the flange 52, and the opposite end of the fitting is provided with an internally threaded nipple 53 into which the tube 27 is threaded, also as shown in Figure 6. The extended end of the tube 27 is retained in position with a bearing or guide 54 and the end of the tube extended through the guide is connected by a coupling 55 to a tube 56 that is secured to a boss 57 on the reservoir 29. Pressure may be retained in the reservoir with a pump 58 that is connected to the reservoir with a connection 59.

The bearing or guide 54, which is mounted on the end plate 33, is provided with a hinged cap 60 and a depending plate 61 extended downwardly from the guide is secured to the end plate 33 with bolts or other fasteners as indicated by the numeral 62. The cap 60 is pivotally connected to the base of the bearing with a pin 110, as shown in Figure 9, and the parts are connected at the opposite sides with a latch having a pin 111.

A similar guide 63 that is positioned on the end plate 32 at the opposite end of the frame and which is provided with a hinged cap 64 is mounted by a depending plate 65 and bolts or other fasteners 66 upon the plate 32. It will be understood that any suitable open ring or other type of guide may be provided at the ends of the frame.

The end plate 33 is provided with a socket 67 in which one end of the screw 23 is secured with a pin 68 and the opposite end of the screw is secured by a similar pin 69 in a socket 70 on the end plate 32. The pulley 21 is secured on the internally threaded bushing 22 with a set screw 71 and the bushing is secured in a bearing 72 depending from the base plate 13 with a set collar 73. A similar set collar 74 is provided at the opposite end of the bushing for retaining the pulley 21 in position. The pulley 20 is secured on a shaft 75 extended from a gear reduction 76 from which a clutch shaft 113 extends and, as shown in Figure 2, the clutch shaft is connected to a countershaft 77 through a coupling 79 and, as shown in Figure 2, the countershaft extends from a gear housing 78 in which a pinion 112 and gears 120 and 121 are positioned.

The pinion 112 on the motor shaft 119 meshes with the beveled gear 120 in the gear housing 78 and the gear 120 meshes with the beveled gear 121 on the countershaft 77 whereby the countershaft is directly connected to the motor; and one end of the countershaft is connected by the belt 16 to the tubular shaft 10 and the other by the gear reduction 76 and belt 19 to the threaded rod 23.

The clutch 79 is formed with a stationary collar 130 which is secured to the countershaft 77 with a pin 131 and a sliding collar 132 which is splined to the shaft 113 such as by the splines 133 and the collar 132 is actuated by the lever 80, pins 134 of which extend into a groove 135 of the collar, as shown in Figure 10.

The end of the counter shaft 77 at the opposite side of the gear housing is provided with a clutch 83 that is actuated by a hand lever 84 pivotally mounted on a bracket 85 by a pin 86.

The clutch collar 115 of the clutch 83 is slidable on the shaft 77 and the lever 84 is provided with a yoke having pins that extend into an annular groove of the clutch collar. The clutch collar 115 is keyed to the shaft 77 by a key 116 and one end of the clutch collar 115 is provided with teeth 117 that mesh with notches 118 in one end of the hub of the pulley 17 whereby with the pulley freely rotatable on the shaft the drill bit is stationary until the clutch elements are engaged by the lever 84.

The counter shaft 77 is driven by the motor 14 through a pinion 112 on the motor shaft 119, the pinion meshing with a beveled gear 120, in the gear housing 78 and the gear 120 meshing with a beveled gear 121 on the shaft 77. By this means the counter shaft 77 is directly connected to the motor and one end of the shaft drives the drill bit through the tubular shaft 24 and belt 16 through the clutch 83, and the opposite end drives the feed sleeve 22 on the screw 23 through the reduction gear unit 76 and belt 19, the reduction gear unit being connected to the counter shaft 17 through the clutch 79 and shaft 113.

The drill is also provided with stops 87 and 88 which are pivotally mounted on the frame member 31 with pins 89 and 90 respectively, and the stops are provided with handles 91 and 92 by which the engaging portions thereof may be moved into or out of engagement with ends 93 and 94 of arm 96 pivotally mounted by pins 97 on bearing 98, and upper ends of which are connected to a link 99 that actuated the clutch lever 80, and the stops are positioned whereby in forward movement of the drill bit 26 the end 93 will engage the stop 87 actuating the lever 80 from the position shown in full lines in Figure 1 to the position shown in dotted or broken lines, whereby with the lever 80 pivotally mounted on the pin 81 the upper end of the lever will move rearwardly disengaging the clutch 79, the parts being actuated to the position shown by dotted lines 95 in Figure 1.

It will be understood, therefore, that with the clutch lever 80 pivotally mounted by the pin 81 in a bearing 82 a projection 94 on the lower end of the lever actuates the lever to the position shown in broken lines in Figure 1 disengaging the clutch 79 as the projection 94 engages the end of stop 88 thereby stopping the machine and as the machine moves in the opposite direction the projection 93 on the lower end of the arm 96 engages the end of the stop 87 and with the arm 96 pivotally mounted by the pin 97 the upper end thereof, being connected to the lever 80 by the link 99, draws the lower end of the lever 80 to the left from the position shown in Figure 1, also disengaging the clutch 79.

The drilling operation and also the feeding means stops when the lever 80 reaches the broken line position in Figure 1 and with the bell crank lever 92 manually actuated from the position shown in Figure 1 to the position shown in Figure 11 the lower end of the lever is released whereby the clutch lever is manually moved forwardly to engage the clutch elements.

The end 93 forms part of an arm 96 that is pivotally mounted with a pin 97 on a bearing 98 and the upper end of the arm is pivotally connected with a link 99 by a pin 100, the opposite end of the link being pivotally connected to the lower part of the lever 80 with a pin 101. By this means the stops may be set whereby the carriage stops before the parts thereof engage the end of the frame of the drill.

In the assembly illustrated in Figures 7 and 8, the coupling 25 is replaced with a chuck 102 in which a shank 103 of a drill or auger 104 is secured by adjusting screws 105 and the chuck is provided with a flange 106, similar to the flange 48, whereby the flange is adapted to be secured to the flange 47 of the tubular shaft 10 with bolts or other fasteners, as indicated by the numeral 108. In this assembly, as illustrated in Figures 7 and 8, the machine functions as an earth boring tool drilling only to form openings through a bank or the like, and the valve 122 in the tube 56 which connects the tube 27 to the reservoir 29 is closed, however, the valve may be opened and water flushed through the supply tube 27 and tubular shaft 10 to wash material away from the outer end of the opening if desired.

With the parts assembled as illustrated in the drawings, the device is adapted to be set up for operation in a pit or opening at the side of a street, highway, or the like and with a suitable drill bit, such as the bit 26, secured on the end of a pipe 24, the engine is started whereby the drill bit is fed into soil or other material below a street or highway with the pipe 24 following the drill head or bit until the pipe extends completely through the street or highway. It will be understood that sections of pipe may be added to the pipe 24 and the drilling operation continued through the foundation of a street or highway of substantially any width. With the cutting edges of the drill bit formed of carbide or other similar material, the device is adapted to cut through stone, rock, cement or other foundations and with the device adapted to cut straight through deflection and binding in the parts are substantially eliminated.

The machine is adapted to install a pipe, such as the pipe 24, or, after the pipe is forced through the foundation of a street or highway, pipe units of different materials or the like may readily be drawn through the foundation.

After drilling an opening or installing a section of pipe therein the drill is withdrawn by shifting the gears in the gear housing 76 by the lever 109 whereby a gear 136 keyed on the shaft 75 on which the gear 137 is positioned meshes with a back gear 138 on an idler shaft 139. The gear 138 meshes with a gear 140 on the shaft 113 on which the gear 141 that meshes with the gear 137 is positioned. The gears 136 and 137 are keyed to the shaft 75 and these gears are shifted to disengage the gear 137 from the gear 141 and engage the gear 136 with the back gear 138 by a yoke 142 actuated by the lever 109 that is pivotally mounted in the gear housing by a pin 143.

By this means a row of buildings, such as new residences, may readily be provided with service pipes with the machine set up from one building to another and by this means service pipes for a group of buildings may be run through the foundation of a street or highway in a comparatively short time.

With the parts connected, particularly as illustrated in Figure 6, water and other fluid under pressure forced through the tubular shaft and pipe 24 to the drill head flushes material cut by the drill bit through a return passage 123 around the pipe or tube.

It will be understood that other modifications, within the scope of the appended claims, may be made in the design and arrangement of the parts without departing from the spirit of the invention.

What is claimed is:

1. In an earth drilling tool, the combination which comprises an elongated frame having spaced parallel horizontally disposed rails connected at the ends with end plates, a stationary screw parallel to the rails and mounted in said end plates, a carriage slidably mounted on the rails and positioned to travel longitudinally of the frame thereon, a power unit mounted on the carriage, an internally threaded sleeve threaded on the screw, means for connecting the sleeve to the carriage whereby rotation of the sleeve on the screw moves the carriage, means for rotating the internally threaded sleeve by the power unit of the carriage for sliding the carriage longitudinally of the frame, a tubular shaft rotatably mounted in the carriage and positioned longitudinally thereof, guides positioned at opposite ends of the frame and aligned with the tubular shaft, a pipe connected to one end of the tubular shaft and extended through the guide at one end of the frame, a drill head carried by an extended end of the pipe, means for rotating the tubular shaft and pipe by the power unit of the carriage, means for stopping the rotation of the internally threaded sleeve for halting the travel of the carriage, and means for supplying fluid under pressure through the tubular shaft, pipe, and drill head.

2. In an earth drilling tool, the combination which comprises a frame having spaced parallel horizontally disposed rails connected at the ends with end plates, a stationary screw parallel to the rails and mounted in said end plates of the frame, a carriage slidably mounted on the rails and positioned to travel longitudinally of the frame, a motor mounted on the carriage, a reduction gear unit also mounted on the carriage, a manually actuated clutch positioned between the motor and reduction gear unit, an internally threaded sleeve mounted to rotate on the screw, means for connecting the sleeve to the carriage whereby rotation of the sleeve moves the carriage, transmission means for rotating the internally threaded sleeve by the reduction gear unit, a tubular shaft rotatably mounted in the carriage and extended longitudinally thereof, guides positioned at opposite ends of the frame and aligned with the tubular shaft, a pipe connected to one end of the tubular shaft and extended through the guide at one end of the frame, a drill head carried by the extended end of the pipe, means for rotating the tubular shaft, pipe, and drill head by the motor, a manually actuated clutch positioned between the motor and tubular shaft rotating elements, stops mounted in the frame and spaced from ends thereof, the clutch positioned between the motor and reduction gear unit having an extended lower end positioned to engage said stops for actuating the clutch to release the drive to the internally threaded sleeve as the carriage approaches an end of the frame, and means for supplying fluid under pressure through the tubular shaft and pipe to the drill head.

3. In an earth drilling tool, the combination which comprises a frame having spaced parallel horizontally disposed rails connected at the ends with end plates, a stationary screw parallel to the rails and mounted in said end plates of the frame, a carriage slidably mounted on the rails and positioned to travel longitudinally of the frame, a motor mounted on the carriage, a reduction gear unit also mounted on the carriage, a manually actuated clutch positioned between the motor and reduction gear unit, an internally threaded sleeve mounted to rotate on the screw, means for connecting the sleeve to the carriage whereby rotation of the sleeve moves the carriage, transmission means for rotating the internally threaded sleeve by the reduction gear unit, a tubular shaft rotatably mounted in the carriage and extended longitudinally thereof, guides positioned at opposite ends of the frame and aligned with the tubular shaft, a pipe connected to one end of the tubular shaft and extended through the guide at one end of the frame, a drill head carried by the extended end of the pipe, means for rotating the tubular shaft, pipe, and drill head by the motor, a manually actuated clutch positioned between the motor and tubular shaft rotating elements, stops mounted in the frame and

spaced from ends thereof, the clutch positioned between the motor and reduction gear unit having an extended lower end positioned to engage said stops for actuating the clutch to release the drive to the internally threaded sleeve as the carriage approaches an end of the frame, and a tube extended from the end of the tubular shaft opposite to the end from which the pipe extends through the guide on the end of the frame for supplying fluid under pressure through the tubular shaft and pipe to the drill head.

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