

April 11, 1961

C. W. KANDLE
EARTH BORING APPARATUS

2,979,141

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2 Sheets-Sheet 1

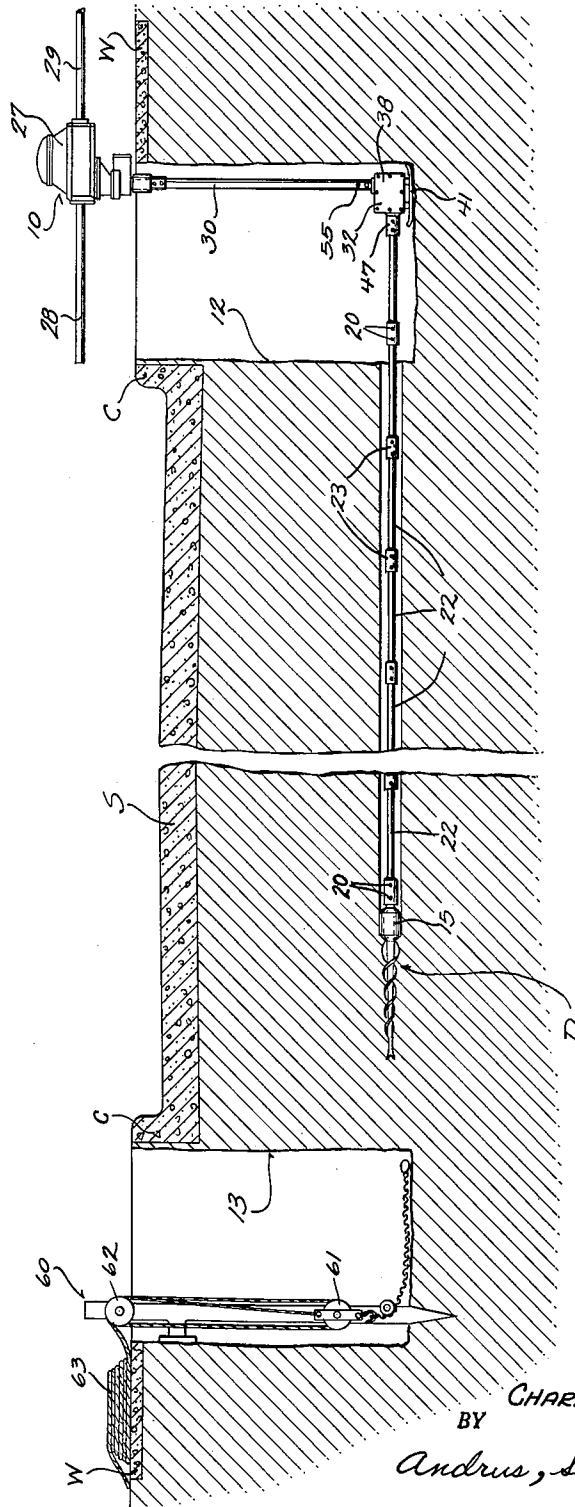


Fig. 1

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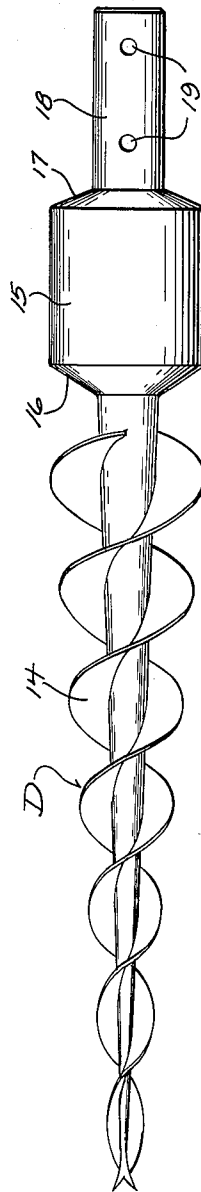
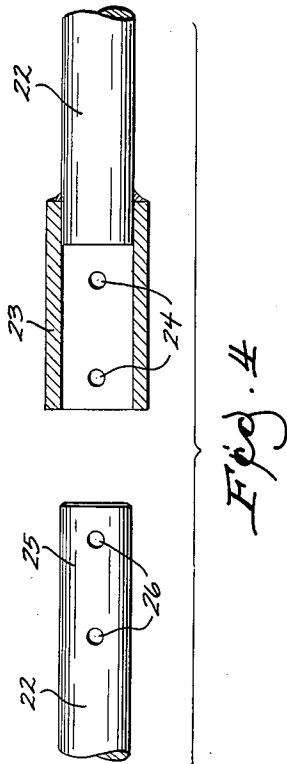
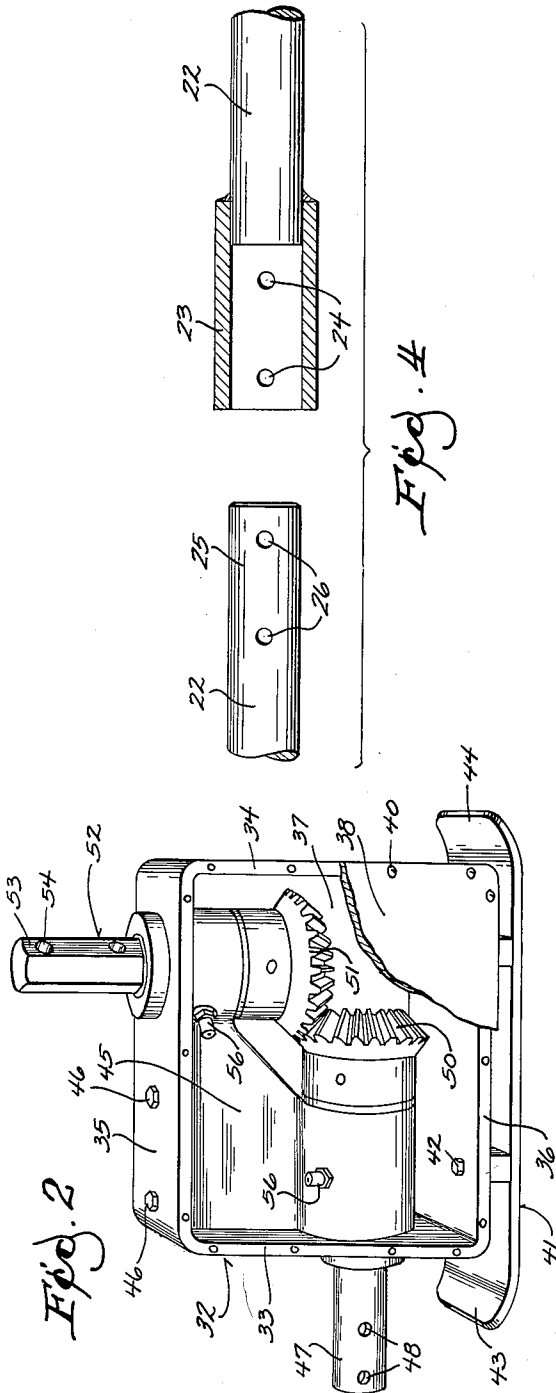
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1

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EARTH BORING APPARATUS

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1 Claim. (Cl. 175—19)

This invention relates generally to drilling apparatus and finds particular utility in drilling small diameter holes, for gas lines for example, between streets and sidewalks, or the like, where a starting trench of only very limited size is available in which to insert and operate the drilling unit.

In many drilling operations the access hole for the drilling equipment is often limited by existing sidewalks, buildings or paved streets. Where it is necessary to install a gas line beneath the street, for example, the only space available for a starting and a finishing trench at the ends of such a hole is between the curb of the street and the sidewalks. This space may only be two feet long and conventional practice, for drilling a hole under a street for the insertion of a gas line of one or one and one-half inches in diameter, has often necessitated removal of some existing concrete.

In accordance with the present invention, however, a compact and efficient drilling apparatus is provided that can be operated from the surface of the ground and a hole beneath the street can be drilled in incremental lengths as the drive unit for the drill is moved forward and back in a relatively small access hole.

The invention contemplates a unique method for drilling such a hole, in which the drill pulls itself through the earth and simply compresses the earth to form the hole rather than removing the spoil from the hole. The drill and its sectioned drive shaft may be removed at the terminal end of the hole and the pipe, for example, flexible tubing, is finally pulled through the formed hole by being attached to the last drive shaft section.

Other objects and advantages of the invention will appear hereinafter as this disclosure progresses, reference being had to the accompanying drawings in which:

Figure 1 is an elevational, sectional view taken transversely through a street and showing a drilling operation performed in accordance with this invention;

Figure 2 is an enlarged view of the right angle drive unit shown in Figure 1, but with its cover plate removed;

Figure 3 is an enlarged view of the drill head; and

Figure 4 shows a connection between the drive shaft sections as shown in Figure 1, but on an enlarged scale.

Referring more particularly to Figure 1, the invention has been shown by way of illustrating the invention, as used where it is desired to drill a small hole under a paved street and the only space for access trenches is between the curbs of the street and the adjacent sidewalks. The space between the curbs C of the paved street S and the sidewalks W may be only in the order of three feet which would be too small to accommodate the entire drill unit 10. The required depth at which these holes are often drilled for gas lines or the like is on the order of two and one-half or three feet.

An access trench 12 is dug on one side of the street at the starting side of the hole and a similar trench 13 is dug across the street at a point where it is estimated the drill will emerge.

2

The drill D used for this operation is shown in Figure 3 and comprises a long gradually tapered body having a tapered screw flight 14 of increasing radial depth which pulls itself into the material being drilled, in a corkscrew manner, when it is rotated. The drill also includes a cylindrical portion 15 which acts to compress the sides of the hole as it passes therethrough. The compacter 15 has front and rear beveled edges 16 and 17, respectively, which facilitate passage of the drill through the ground. The forward beveled face 16 of the compacter 15 converges into the rear end of the tapered drill body. The drill does not remove spoil from the hole but pulls itself into the earth by the lead angle of its flight 14 and leaves a hole in its path of the diameter of its drum section 15. The drill has a rear stub shaft 18 having two apertures 19 therethrough which are adapted to receive attaching pins 20.

The drive shaft sections 22 each comprise an end having a collar 23 welded thereon and containing apertures 24. The other end of the shaft sections have a male portion 25 which is adapted to fit into the collar 23 and be secured therein by locking pins 20 extending through apertures 26. Collar 23 also is adapted to receive the shaft portion 18 of the drill. The shaft sections 22 are of such a length so as to fit within the trenches 12, 13.

The power unit 10 shown for illustrative purposes comprises an air motor 27, an operator's handle 28, and a conduit 29 for attachment to a source of compressed air (not shown). The unit 10 has a drive shaft 30 extending downwardly therefrom. The unit is usually large, heavy and generally cumbersome and could not be operated in trenches of the type involved in this disclosure. Thus the source of power for rotating the drill must remain above the surface of the ground.

A right angle gear unit 32 is provided for transmitting power from the power shaft 30 to the drill shaft 22 and which slides along the bottom of the trench to follow the drill as it pulls itself into the ground. In operation, the gear unit is enclosed and comprises a substantially square steel housing formed by front, rear, top and bottom walls, 33, 34, 35 and 36, respectively. The housing also includes side walls 37, 38, which may be removable by cap bolts 40 for lubricating and repair of the unit. A runner or sled 41 is secured by bolts 42 to the bottom of the unit and has an upturned front and rear edge 43, 44 to facilitate pulling of the unit back and forth on the bottom of the trench. The skid 41 forms a good bearing surface for the weight of the power unit which it supports.

The unit 32 also includes a mounting bracket 45 bolted within the housing by bolts 46. A stub shaft 47 extends through the bracket 45 and out the front side of the housing. The outer end of the shaft 47 is hollow and is adapted to receive the end portion 25 of the drive shaft section 22, which is securable therein by pins 20 which extend through aligned apertures 48 and 26. The inner end of shaft 47 has a bevel gear 50 secured thereto which is in constant mesh with bevel gear 51. Gear 51 is rigidly secured to shaft 52 which at its upper end 53 is of non-circular cross section and has apertures 54 extending therethrough. The drive shaft 30 of the power unit is adapted to slip over the shaft 52 and is complementary thereto so as to form a driving connection therewith, also being held in driving relationship by pins 55 insertable in the aligned apertures in shafts 52 and 30. Grease fittings 56 are provided within the housing for the shafts 47 and 52.

A block and tackle 60 is anchored or otherwise secured in the terminal trench 13 and has pulleys 61, 62 over which is trained the flexible member 63 which can afford a mechanical advantage in the conventional manner.

3

Operation

At the beginning of the operation, if the trench is too small to accommodate the drill D and a shaft section 22, the drill alone would be attached to the stub shaft 47 of the drive unit when the latter was in the position shown in Figure 1. The unit 10 would then be started and the unit 32 pushed to the left as viewed in Figure 1, or toward the wall to be drilled. After the drill had substantially buried itself, its rotation would be stopped and the unit 32 disconnected therefrom. The unit 32 would then be slid back to the starting position, or to the right, where a section 22 of drive shaft would be inserted between the unit 32 and the drill D. The motor 27 would again be started which would cause the drill to penetrate farther and pull the first section 22 into the hole behind it. The unit 32 would then be disconnected from the first section 22, slid back to the starting position and the process repeated. Sufficient drive shaft sections 22 would be added until the drill D began to emerge into the trench 13. The drill D would then lose its bite and would be incapable of further forward movement due to its own rotation.

At this point the unit 32 would be disconnected from the rear end of the last drive shaft section and instead a section of gas pipe or the like fastened thereto. Flexible copper tubing, commonly used in this installation would also be attachable to the drive shaft end.

The flexible member 63 would then be attached to the drill D and the block and tackle then operated manually or by a hand winch or the like to pull the drill into the trench 13. After disconnecting the drill D from the first drive shaft section, the flexible member 63 would then be attached successively to the shaft sections and the latter likewise pulled through the hole by the block and

4

tackle. Finally the pipe, sections of which had been added in trench 12 as it was pulled through the hole, or the flexible tubing would also emerge from the drilled hole.

5 Various modes of carrying out the invention are contemplated as being within the scope of the following claim particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

10 Apparatus for drilling a horizontal hole in the earth comprising a drill member of substantial length with a gradually tapered conical body and an additionally tapered screw flight of increasing radial depth spirally disposed therealong for substantially the length thereof and secured
15 thereto, a cylindrical compacter at the trailing end of said member and having a diameter corresponding substantially to the largest diameter of said tapered flight and a forward face converging forwardly to the rear end of said conical body, and means coupled to the trailing
20 end of said member and of substantially smaller diameter than said compacter to secure the member to a rotary drive, said apparatus being characterized by progressive compacting of the earth outwardly to form a hole as the flight screws its way through the earth.

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