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EARTH BORING IMPLEMENT

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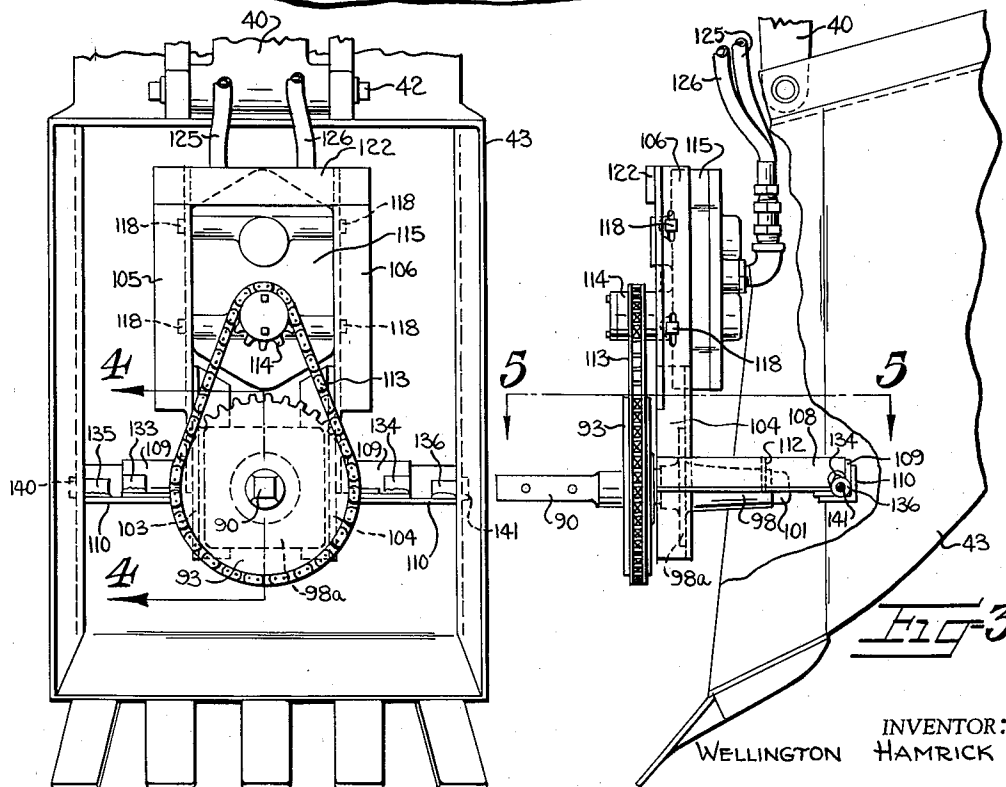
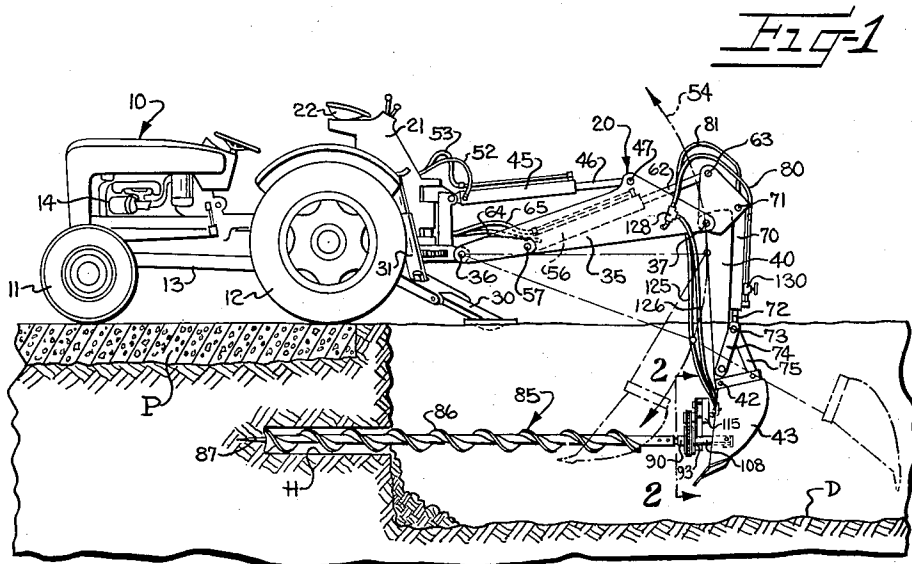


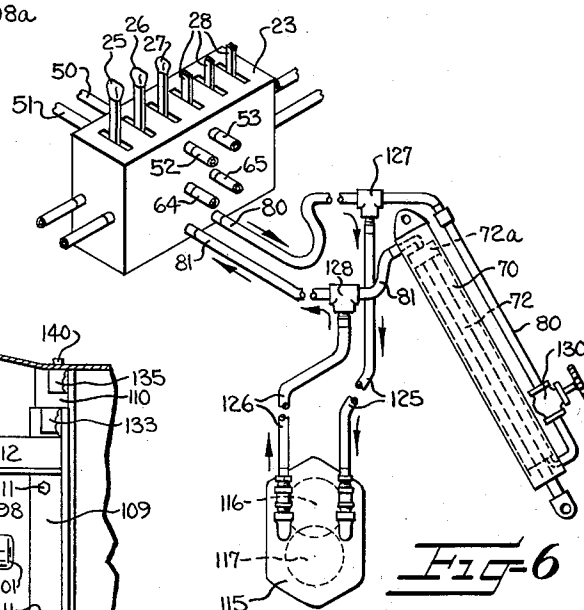
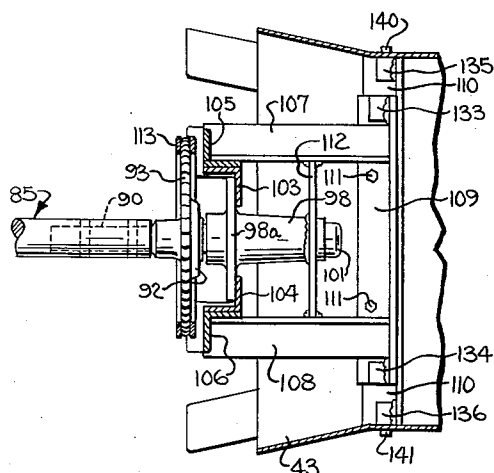
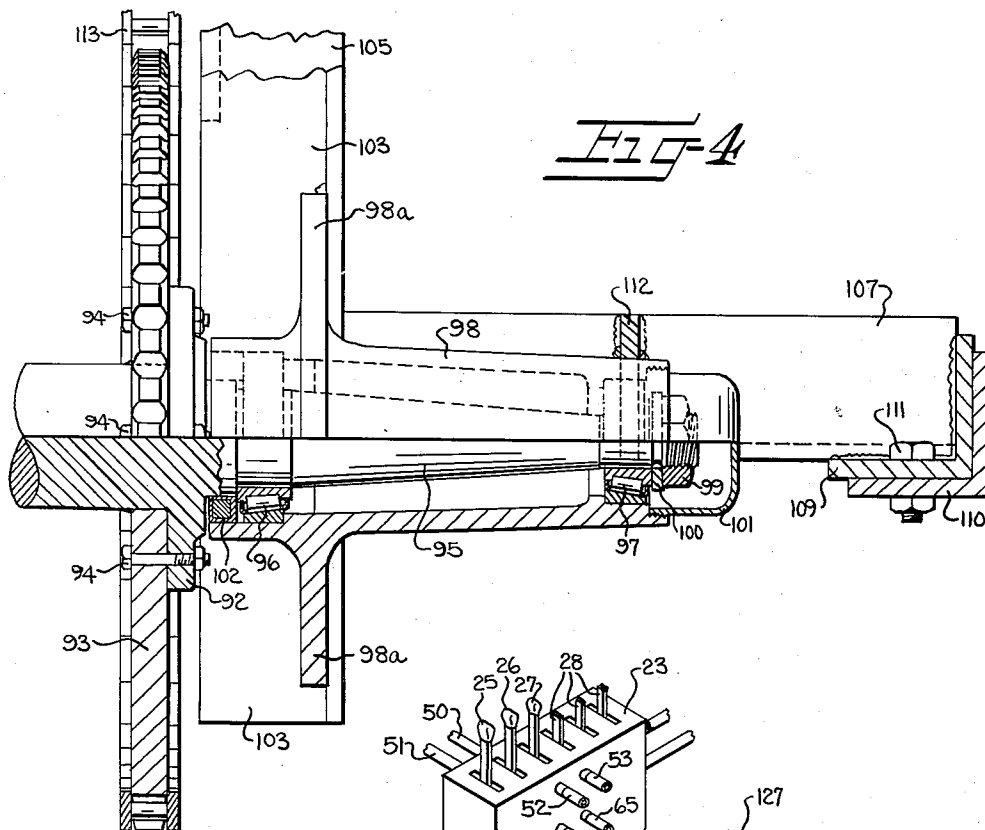
Fig-2

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EARTH BORING IMPLEMENT

2 Sheets-Sheet 2



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EARTH BORING IMPLEMENT

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4 Claims. (Cl. 175—130)

This invention relates to an earth boring implement particularly adapted for use with an earth digging apparatus such as a power digger of the type normally attached to a tractor.

It is the usual practice when laying pipe to carry water, gas, electrical wires or the like to dig a ditch or trench with a power digger or backhoe attached to a tractor or the like and then lay the pipe in the trench. The digging or trenching operation is relatively simple unless an obstacle such as a paved street, highway, driveway, sidewalk or the like is encountered and at this time, the usual practice is to break up the pavement and continue the trench. Many times it is not practical to break up very thick pavement and sometimes not possible to trench across a heavily traveled road. Various types of earth boring machines have been built which operate in the trench to bore a hole beneath a paved street or the like when it is not practical to trench across it, but in order to use these machines it is necessary to move the trench digging apparatus out of the way before moving the earth boring machine into position. This is a time consuming operation and also requires the purchase of two machines to be able to lay pipe under all conditions.

With the foregoing in mind, it is the primary object of this invention to provide an earth boring implement which may be quickly and easily attached to a ditch digging apparatus to bore the earth beneath any obstacle encountered by the ditch digging apparatus and thereby utilize the ditch digging apparatus during the boring operation as well as during the ditch digging operation.

It is another object of this invention to provide an earth boring bit or auger which is supported and guided on the digger actuating elements of a power digging implement, may be economically manufactured and maintained, relatively light weight for easy manipulation, and easily adaptable for attachment on the digger actuating elements of various different types of earth digging apparatuses.

It is a more specific object of this invention to provide a hydraulically driven earth boring bit or auger which is particularly adapted to be easily attached to the digging bucket or shovel of a power digger or backhoe attachment on a tractor so that one end of the auger is supported and guided by the bucket as the auger is forced into the earth by movement of the bucket. Thus, the angle or direction the auger is moved may be controlled by movement of the actuating arms which control movement of the bucket.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which—

Figure 1 is a vertical sectional view through a trench and showing the boring implement attached in the bucket of a power digger or backhoe attachment on a tractor;

Figure 2 is an enlarged vertical sectional view through the auger and showing the manner in which one end of the auger is mounted in the bucket of the backhoe in elevation;

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Figure 3 is a fragmentary elevation with parts broken away and looking at the left-hand side of Figure 2;

Figure 4 is an enlarged fragmentary vertical sectional view through the pivotal support of the auger, with the upper portion in elevation and being taken substantially along the line 4—4 in Figure 2;

Figure 5 is a horizontal sectional plan view through the front portion of the bucket, showing one end of the auger pivotally mounted therein and being taken substantially along the line 5—5 in Figure 3;

Figure 6 is a somewhat schematic illustration of the manner in which the hydraulic lines of the power digger may be utilized to rotate the auger.

Referring more specifically to the drawings, the numeral 10 broadly designates a suitable mobile vehicle which is shown as a tractor. The tractor 10 has the usual front and rear wheels 11 and 12, a frame 13 and an engine 14.

The tractor 10 is equipped with earth removing means illustrated as a power digger or backhoe attachment broadly indicated at 20 which is adapted to attach to the frame 13 of the tractor 10 in a conventional manner. The backhoe 20 includes a control stand 21 provided with a seat 22 for an operator, a valve unit 23 (Figure 6) having control levers 25, 26, 27 and 28 mounted therein for controlling various elements of the backhoe 20 in a manner to be later described.

The backhoe attachment 20 may be swung or moved from side to side of the tractor 10 by conventional hydraulic cylinders, not shown, and the tractor 10 is steadied or stabilized during the digging operation by stabilizing arms 30, only one of which is shown, the outer ends of which are positioned upon the surface on which the tractor sits and the inner ends of which are suitably secured to the frame 13 of the tractor 10. The stabilizers 30 are operated to raised and lowered position by hydraulic cylinders 31, only one of which is shown in Figure 1.

The lowermost portion of the control stand 21 has one end of a first actuating arm or boom 35 pivotally connected thereto as at 36 and the other end of which is pivotally connected as at 37 intermediate the ends of a second actuating arm or dipper stick 40. The lower end of the dipper stick 40 is pivotally connected as at 42 to earth scoop means illustrated as a bucket or shovel 43. The bucket 43 is adapted to scoop up dirt and the like when the boom 35 and dipper stick 40 are moved by manipulation of the control levers 25 through 28 by an operator seated on the seat 22. Vertical movement of the boom 35 is controlled by a boom cylinder 45 which is connected at one end to the control stand 21 and the other end of which has a piston rod 46 extending outwardly therefrom. The piston rod 46 has a suitable piston fixed on the end positioned inside of the cylinder 45 and the other end is pivotally connected as at 47 to the boom 35.

The valve control unit 23 is connected to the hydraulic pressure system, not shown, of the tractor 10 by a hydraulic pressure line 50 and a hydraulic pressure return line 51. Thus, when the control lever 25 is moved forwardly, hydraulic pressure will pass through the unit 23 and into one end of a line 52, the opposite end of which is connected to the rear end of the cylinder 45. With pressure directed to the rear end of the cylinder 45, the piston rod 46 will be forced outwardly from the cylinder 45 to lower the outer end of the boom 35 in an arc along the dash-dot line indicated at 54 in Figure 1. With rearward movement of the control lever 25, hydraulic pressure will be directed through the unit 23 and into one end of the line 53, the opposite end of which is connected to the front end of the cylinder 45. With pressure directed to the front end of the cylinder 45, the piston rod 46 will be forced inwardly into the cylinder

45 to raise the boom 35 along the dash-dot line 54 in Figure 1.

In order to move the dipper stick 40 relative to the boom 35, the rear end of a hydraulic cylinder 56 is pivotally connected as at 57 intermediate the ends of the boom 35 and is provided with a piston rod 62 extending outwardly therefrom. The piston rod 62 has a suitable piston fixed on the end positioned inside of the cylinder 56 and the other end of which is pivotally mounted as at 63 on the upper end of the dipper stick 40. Suitable hydraulic pressure lines 64 and 65 are connected at one end to opposite ends of the cylinder 56 and their other ends are suitably connected to the valve unit 23.

The control lever 26 (Figure 6) controls operation of the dipper stick 40 relative to the boom 35 and with rearward movement of the control lever 26, hydraulic fluid pressure will be directed from the line 50, through the valve unit 23, to the line 64, and to the outer end of the cylinder 56 to thus force the piston rod 62 inwardly into the cylinder 56 and swing the lower end of the dipper stick 40 about its pivot point 37 on the boom 35 outwardly away from the tractor 10 in Figure 1. With forward movement of the control lever 26, hydraulic fluid pressure will be directed from the line 50, through the valve unit 23, to the line 65, and to the inner end of the cylinder 56 to thus force the piston rod 62 outwardly from the cylinder 56 and swing the lower end of the dipper stick 40 inwardly towards the tractor 10 in Figure 1.

Movement of the bucket 43 relative to the dipper stick 40 is controlled by a hydraulic cylinder 70 pivotally mounted at its upper end as at 71 on the dipper stick 40 and provided with a movable piston rod 72. The piston rod 72 has a suitable piston 72a (Figure 6) fixed on its innermost end. The outer end of the piston rod 72 is pivotally connected as at 73 to one end of a pair of links 74 and 75, the opposite ends of which are respectively pivotally connected to the dipper stick 40 and the rear portion of the bucket 43. A hydraulic pressure line 80 is connected at one end to the lower end of the cylinder 70 (Figures 1 and 6) and its opposite end is connected to the valve unit 23. A hydraulic line 81 is connected at one end to the upper end of the cylinder 70 and its opposite end is connected to the valve unit 23. Movement of the control lever 27 controls operation of the piston rod 72 and thus controls movement of the bucket 43 relative to the dipper stick 40 in the manner desired. Forward movement of the control lever 27 will cause hydraulic pressure from the line 50 to be directed through the valve unit 23, to the line 80, and into the lower end of the cylinder 70 so that the piston rod 72 will be forced inwardly to substantially the position shown in Figures 1 and 6 and thus move the links 74 and 75 as well as the bucket 43 to the position shown. With rearward movement of the control lever 27, the hydraulic pressure from the line 50 will be directed through the valve unit 23, to the line 81, and into the upper end of the cylinder 70 to thus force the piston rod 72 outwardly and move the links 74 and 75 so that the bucket 43 will move inwardly towards the tractor 10 from the position shown in Figure 1.

Thus, an experienced operator can dig a trench or ditch, such as is indicated at D, by proper operation of the control levers 25, 26 and 27 and control the scooping or digging of the bucket 43 so that practically any type of hole or trench may be dug which is within the radius of operation of the bucket 43, dipper stick 40 and boom 35. The parts thus far described are conventional parts of the type of backhoe or power digger 20 illustrated in Figure 1 and it is with this apparatus that the present invention will be described. It should be understood, however, that the present invention is not limited to use with this particular type of backhoe.

In order to utilize the ditch or trench digging apparatus to bore or drill a hole beneath an obstacle, such as the pavement indicated at P, the digging apparatus is used to dig the ditch D to substantially the location shown in Figure 1, the earth boring implement of the present invention, broadly indicated at 85, is attached to the bucket 43 of the digging apparatus and forced into the earth beneath the pavement as rotation is imparted to the boring implement 85, in a manner to be presently described.

The earth boring implement includes an auger or drill bit 86 having a relatively long tapering guide point 87 on the leading end and the rear end of which is removably connected to the front end of a drive shaft 90 which is preferably provided with a square drill receiving end. The drive shaft 90 has an enlarged annular ring 92 formed integral (Figure 4) therewith and intermediate its ends to support a relatively large sprocket 93 fixed thereto as by bolts 94.

The rear portion of the shaft 90 is tapered as at 95 and is suitably supported for rotation in roller thrust bearings 96 and 97 (Figure 4) pressed into a support housing 98. The rearmost end of the shaft 90 is threaded to receive a locking nut 99 which is tightened against a washer 100 engaging the inner race of the bearing 97. The rear end of the housing 98 has a cap 101 threaded thereon to cover the nut 99 and prevent leakage of suitable lubricant placed in the housing. The front end of the housing 98 is sealed against leakage by a seal 102 surrounding the shaft 90 and engaging the housing 98. The housing 98 has a substantially square support flange 98a formed integral therewith which is suitably secured as by welding to a pair of vertically extending angle bars 103 and 104 (Figure 5). The bars 103 and 104 are fixed adjacent the lower ends of respective angle bars 105 and 106. The lower ends of the bars 105 and 106 are fixed on the forward ends of angle bars 107 and 108.

The rear ends of the angle irons 107 and 108 are suitably secured to a transverse angle bar frame member 109 removably attached to an auxiliary or secondary angle bar frame member 110 as by bolts 111 (Figures 4 and 5). The rear end of the housing 98 is suitably supported relative to the angle irons 107 and 108 by a bracing plate 112 fixed at opposite ends on the frame members 107 and 108 and suitably secured intermediate its ends to the upper rear portion of the housing 98. The sprocket 93 is driven by a chain 113 which partially surrounds the sprocket 93 and a relatively small sprocket 114 fixed on the output shaft of a fluid driven hydraulic motor 115. The fluid motor 115 is provided with a pair of intermeshing gears 116 and 117, shown in dotted lines in Figure 6, which are rotated relative to each other by hydraulic fluid under pressure passing therebetween in a manner to be presently described.

The fluid motor 115 is supported for vertical adjustment at opposite sides in the frame members 105 and 106 by screws 118 penetrating slots in the frame members 105 and 106 (Figure 3). The upper end of the frame members 105 and 106 are suitably secured together or bridged at their upper ends by a plate member 122. Vertical adjustment of the fluid motor 115 may be made by loosening the mounting screws 118 and moving the motor upwardly or downwardly between the frame members 105 and 106 to adjust the chain 113 to the desired tension.

Hydraulic fluid under pressure is directed to the fluid motor 115 through lines 125 and 126 (Figure 6), one end of each of which is suitably connected to opposite sides of the motor 115. The other end of the line 125 is releasably connected to a T-connector 127 positioned intermediate the ends of the pressure line 80. The other end of the line 126, opposite the end which is connected to the motor 115, is releasably connected to a T-connector 128 positioned intermediate the ends of the line 81. The lines 125 and 126 are pref-

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erably attached to the T-connectors 127 and 128 by quick disconnect connectors of the type that close when the ends of the lines 125 and 126 are removed and provide a convenient means for quickly and easily attaching and removing the ends of the lines 125 and 126. The line 80 is provided with a manually operable valve shut-off 130 interposed therein and shown positioned closely adjacent the lower end of the cylinder 70 for purposes to be later described.

In order to easily and quickly mount the earth boring implement 85 in the bucket 43 of the backhoe 20, the frame members 109 and 110 are provided with respective internally threaded boss members (Figure 2) 133, 134 and 135, 136 which are adapted to receive shoulder bolts 140 and 141 (Figure 5). The frame members 109 and 110 of different lengths so that if it is desired that the earth boring implement 85 be used with a backhoe having a relatively wide bucket 43, the bolts 140 and 141 may be passed through suitable holes, not shown, positioned in the sides of the bucket 43 and threaded into the boss members 135 and 136 respectively. Should it be desired to use the boring implement 85 with a bucket which is not as wide as the bucket 43 shown, the bolts 111 may be removed along with the frame member 110 and the frame member 109 pivotally secured in the bucket by passing the bolts 140 and 141 through the sides of the narrow bucket and into the threaded boss members 133 and 134 carried by the frame member 109.

In operation, the tractor 10 and backhoe 20 may be operated in the usual manner to dig a trench or ditch D for the purpose of laying a pipe therein and upon approaching an obstacle such as the pavement indicated at P the shovel or bucket 43 will then be moved to the position shown, relative to the dipper stick 40, and the shut-off valve 130 closed to thus lock the piston rod 72 in its innermost position and prevent movement of the bucket 43 relative to the dipper stick 40. The earth boring auger 86 may then be laid in the ditch D, the frame member 110 pivotally attached to the bucket by inserting the shoulder bolts 140 and 141 into the threaded bushings 135 and 136 carried by the frame member 110, the bucket 43 and fluid motor 115 lowered into the ditch and the shaft 90 connected to the auger 86. The ends of the lines 125 and 126 are then connected to the T-connectors 127 and 128 in the respective lines 80 and 81 so that fluid pressure may be directed to the fluid motor 115.

The point 87 of the bit or auger 86 is then positioned in the front wall of the ditch at the desired height and the bucket 43 moved to position the auger 86 at the proper drilling angle and apply pressure against the auger 86. Rotation of the auger 87 in one direction is then started by forward movement of the lever 27 so that fluid pressure will pass from the line 50, the unit 23, line 80, line 125, fluid motor 115, line 126, line 81, valve unit 23, and line 51 to the return side of the pressure system of the tractor 10. Of course, reverse rotation may be imparted to the auger 86 by reversing the direction of flow of fluid through the motor 115 with rearward movement of the lever 27. As the auger 86 is rotated, the control levers 25 and 26 will be manipulated by an operator to move the bucket 43 forwardly along a predetermined line and drill a hole indicated at H into the earth beneath the tractor 10 and pavement P. When the forward limit of the bucket 43 has been reached, the auger 86 may be disconnected, the bucket 43 moved rearwardly and an additional length of auger, not shown, connected at opposite ends to the auger 86 and shaft 90.

In order to assist the operator in drilling a hole at a predetermined angle, a guide line or string may be strung inside of the ditch D at the desired angle and the operator can then manipulate the boom 35 and dipper stick 40

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so that the bucket 43 travels a path following the guide line or string.

Although the earth boring implement 85 shown in the drawings is particularly for use with and particularly adapted to be pivotally mounted in the bucket of a backhoe attached to a tractor, it is to be understood that the earth boring implement 85 may be just as readily attached in the bucket of other types of digging devices such as in the shovel or bucket of a steam shovel or the like operated by hydraulically driven arms similar to the boom 35 and dipper stick 40 or by cable means. Also, it should be obvious that it is not absolutely necessary that the earth boring implement 85 be attached in the bucket but may be attached to a suitable auxiliary frame or support member, not shown, which would replace the bucket 43 if desired. It is also to be understood that the pressure lines 125 and 126 could extend directly to the pressure system of the tractor 10 and have a separate control lever to control rotation of the auger 86 instead of controlling rotation of the auger 86 through the control lever 27. It is also obvious that the auger 86 may be removed and a larger or smaller auger than that shown placed on the shaft 90, if desired, or the same size auger 86 may be used to drill a larger hole by attaching a cutting head of a larger diameter to the front end of the auger 86. The auger 86 will then carry most of the dirt out of the hole and the remaining loose dirt may be dragged out of the hole after the auger has been removed.

It is thus seen that an earth boring implement has been provided which has rotatable auger means carried by a frame having attaching means rendering the implement readily attachable to the actuating elements of an earth digging device in order to utilize the earth digging device when it is desired to bore the earth beneath pavement and the like.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. An earth boring attachment for a tractor comprising the combination of a boom operatively connected at one end to said tractor, a first hydraulic cylinder connected to said boom and said tractor to control the position of said boom, a dipper stick operatively connected at one end to the end of said boom opposite said tractor, a second hydraulic cylinder connected to said boom and said dipper stick to control the position of said dipper stick relative to said boom, control means for selectively directing fluid pressure to said hydraulic cylinders, an earth boring auger, a frame rotatably supporting one end of said auger, a fluid motor carried by said frame for rotating said auger, means connecting said frame to the end of said dipper stick opposite said boom, and means connecting said control means with said fluid motor to selectively direct fluid pressure to said fluid motor.

2. An earth boring attachment for the backhoe attachment of a tractor, said backhoe having earth scooping means comprising a boom pivotally connected at one end to said tractor, a dipper stick pivotally connected at one end to the other end of said boom, and a bucket connected to the other end of said dipper stick, said boom being operable to move said bucket in a vertical direction and said dipper stick being operable to move said bucket in a horizontal direction; said earth boring attachment comprising an earth boring auger, drive means for rotating said auger, and means pivotally connecting said auger to said bucket.

3. An earth boring attachment for the backhoe attachment of a tractor, said backhoe having earth scooping means comprising a boom pivotally connected at one end

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to said tractor, a first hydraulic cylinder connected to said boom and said tractor to control the position of said boom, a dipper stick pivotally connected at one end to the end of said boom opposite said tractor, a second hydraulic cylinder connected to said boom and said dipper stick to control the position of said dipper stick relative to said boom, a bucket connected to the end of said dipper stick opposite said boom, a third hydraulic cylinder connecting said bucket and said dipper stick to control movement of said bucket relative to said dipper stick, a valve control unit, and fluid pressure lines connecting each end of each of said cylinders and said valve control unit; said earth boring attachment comprising an earth boring auger, a frame rotatably supporting one end of said auger, a fluid motor carried by said frame for rotating said auger, and means pivotally connecting said frame to said bucket.

4. An earth boring attachment for the backhoe attachment of a tractor, said backhoe having earth scooping means comprising a boom pivotally connected at one end to said tractor, a first hydraulic cylinder connected to said boom and said tractor to control the position of said boom, a dipper stick pivotally connected at one end to the end of said boom opposite said tractor, a second hydraulic cylinder connected to said boom and said dipper stick to control the position of said dipper stick relative to said boom, a bucket connected to the

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end of said dipper stick opposite said boom, a third hydraulic cylinder connecting said bucket and said dipper stick to control movement of said bucket relative to said dipper stick, a valve control unit, and first fluid pressure lines connecting each end of each of said cylinders and said valve control unit; said earth boring attachment comprising an earth boring auger, a frame rotatably supporting one end of said auger, a fluid motor carried by said frame for rotating said auger, means pivotally connecting said frame to said bucket, second fluid pressure lines connected at one end to opposite sides of said fluid motor and at the other ends intermediate the ends of the first fluid pressure lines, and valve means interposed in one of said first fluid pressure lines to selectively render said third hydraulic cylinder inoperative and direct fluid under pressure from said third cylinder to said fluid motor.

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