# United States Patent

[11] 3,576,218


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[45] Patented **Apr. 27, 1971**


[54] **COMBINED EARTH BORING AND POST DRIVING APPARATUS**
**9 Claims, 11 Drawing Figs.**


[52] **U.S. Cl.** ..... **173/28,** 173/43, 173/46
[51] **Int. Cl.** ..... **E21c 11/02**
[50] **Field of Search** ..... 173/28, 43, 46, 29



[56] **References Cited**

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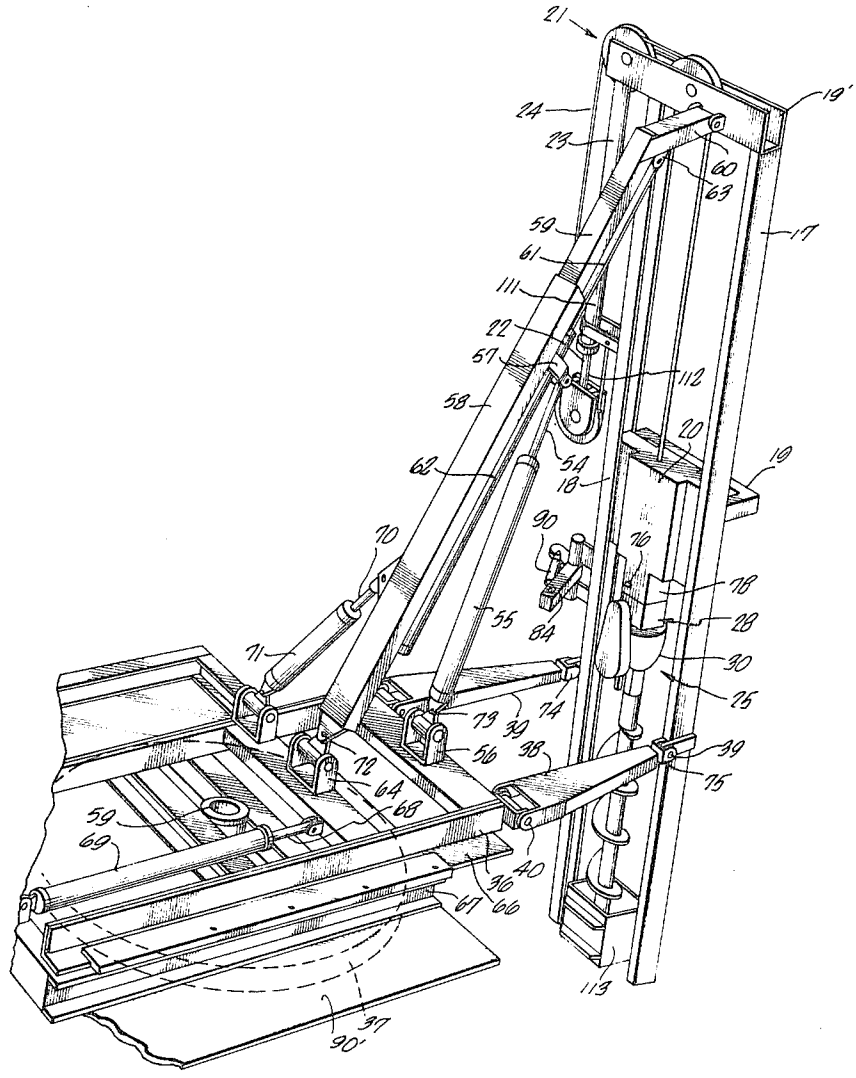
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**ABSTRACT:** The earth boring and post driving apparatus disclosed herein is carried on a trunk bed and includes an upright frame laterally cantilevered therefrom for selectively supporting an earth auger and a post driver in such a manner that either may be employed independent of each other or combined during an earth boring procedure to assist the auger in biting into the earth. Hydraulic cylinder and piston assemblages are employed to move the earth auger and post driving mechanism into and out of operating position and to maneuver the upright frame into various angular orientations so that the apparatus can function on slopes or uneven terrain. The frame is universally mounted on the trunk bed by a turntable mount and by a pivoting arrangement so that maneuvering of the frame can be readily achieved.

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FIG. 1

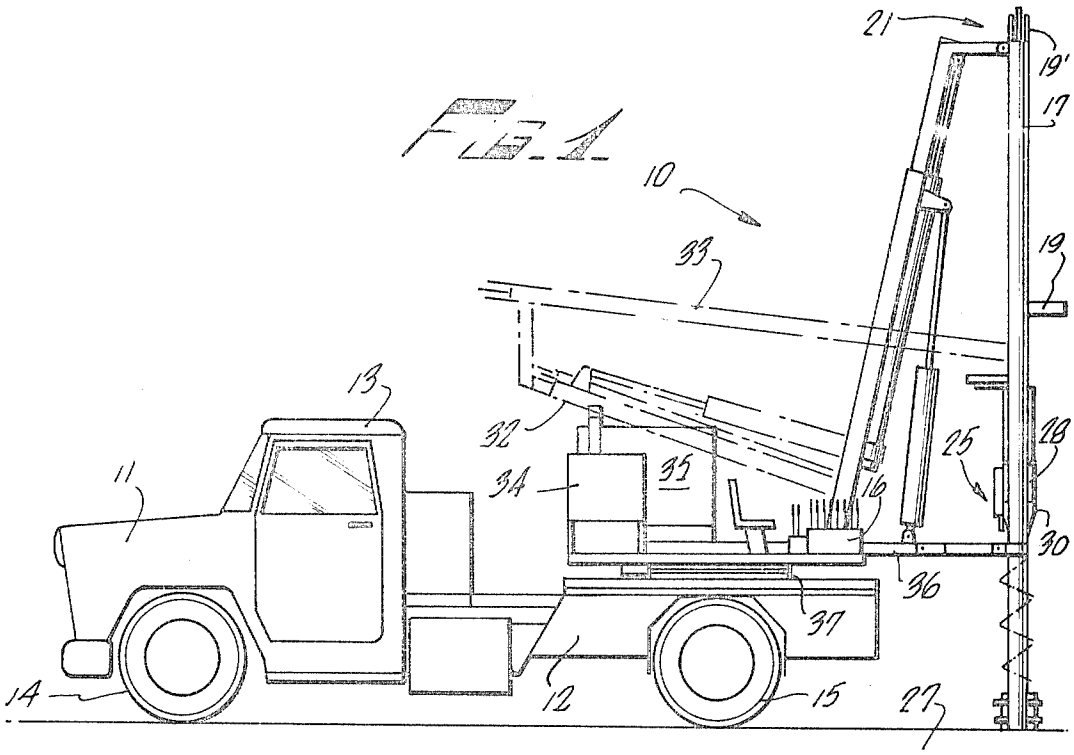
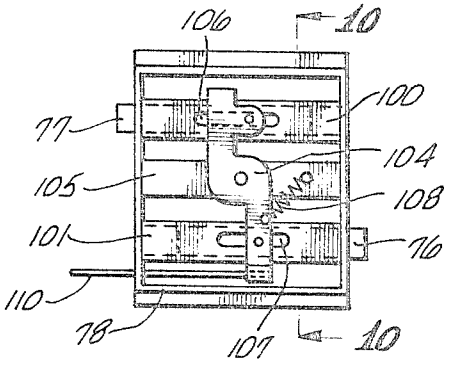



FIG. 9



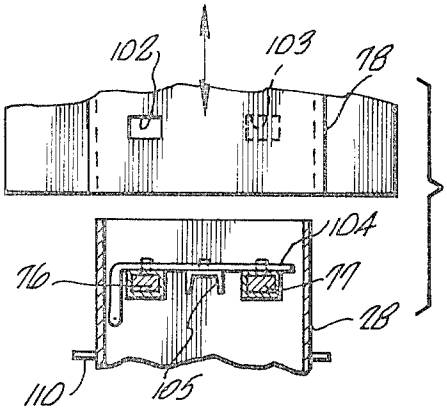
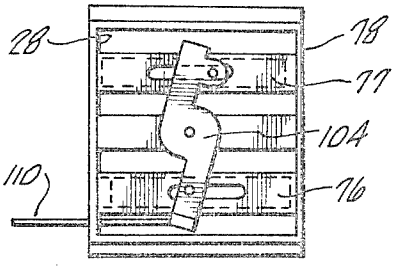




FIG. 10

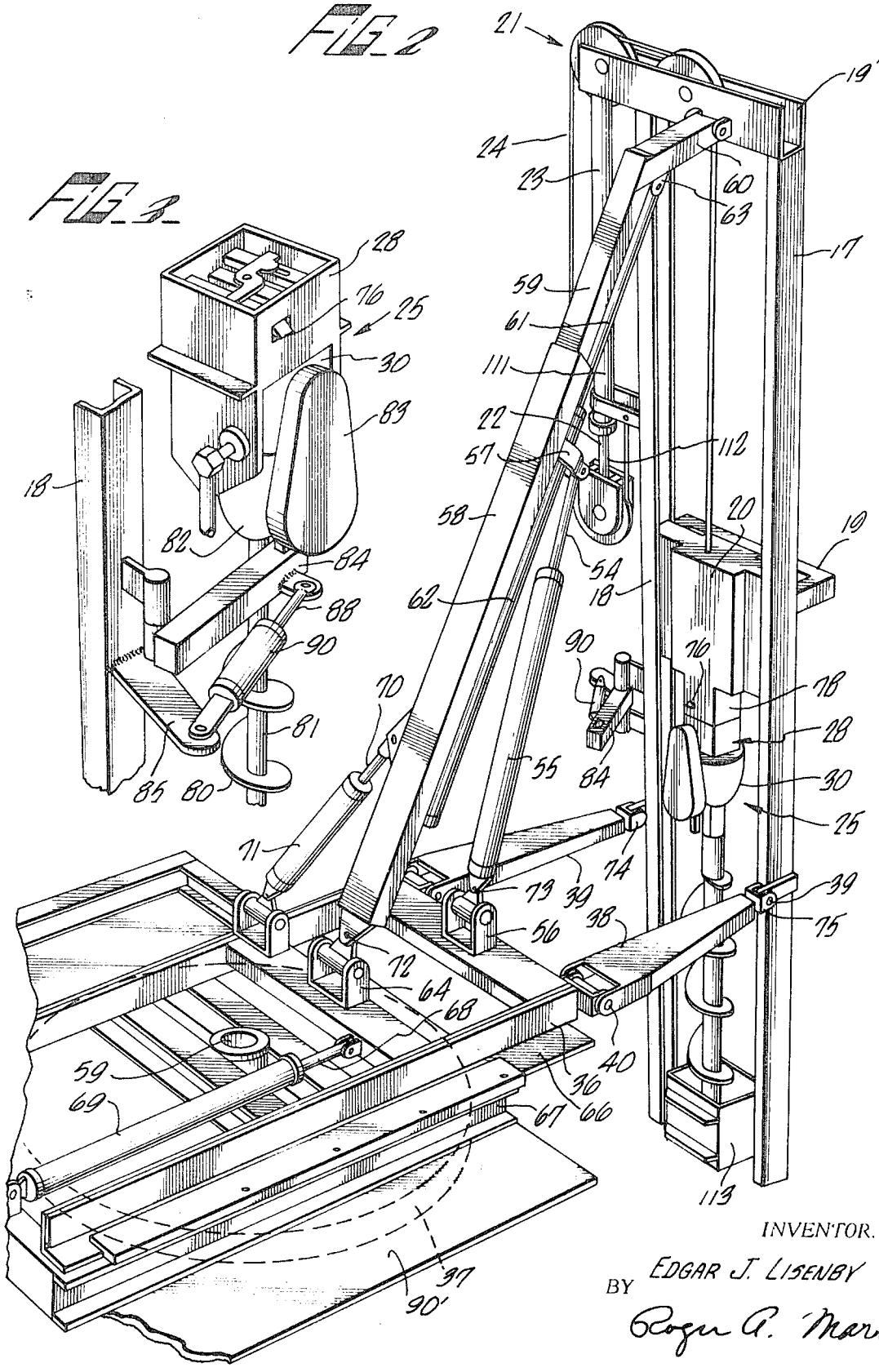
FIG. 11




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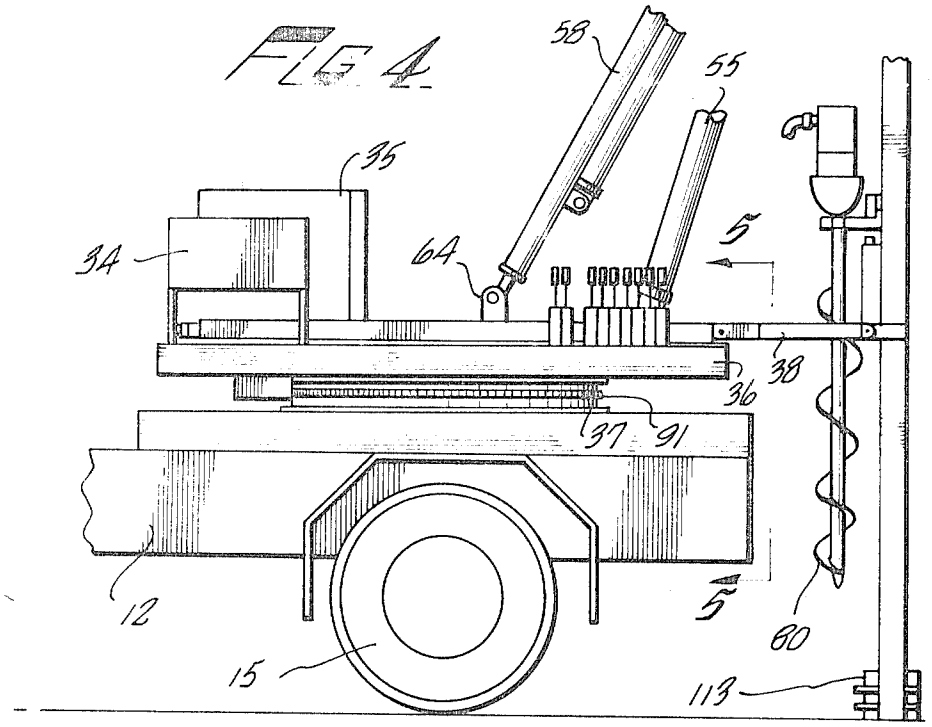
FIG 2

FIG 3




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FIG 4



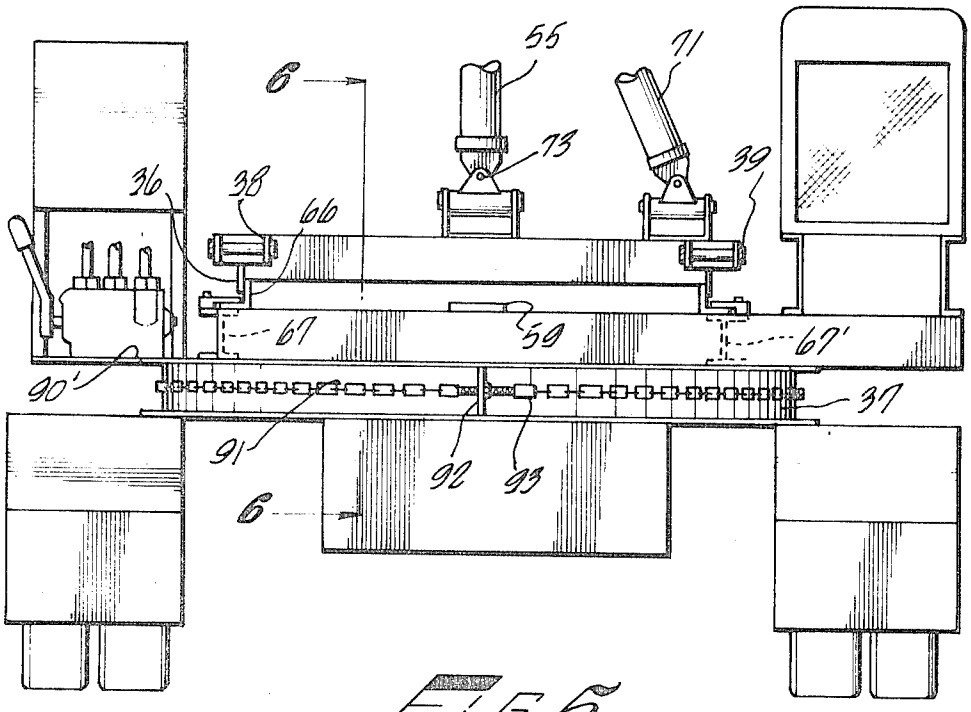




FIG 5

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FIG. 6

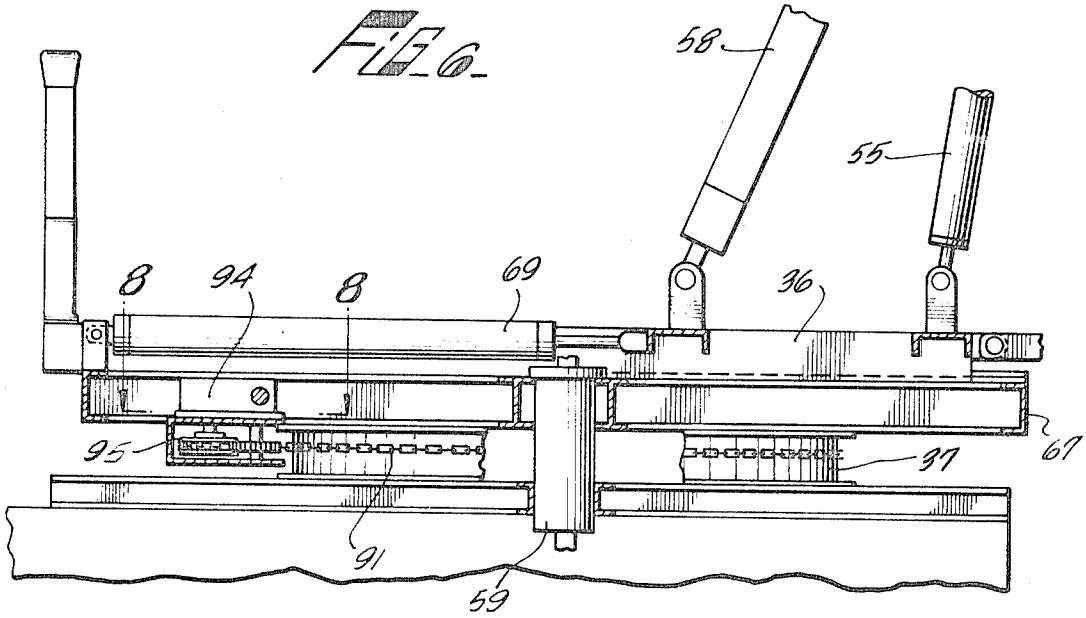



FIG. 7

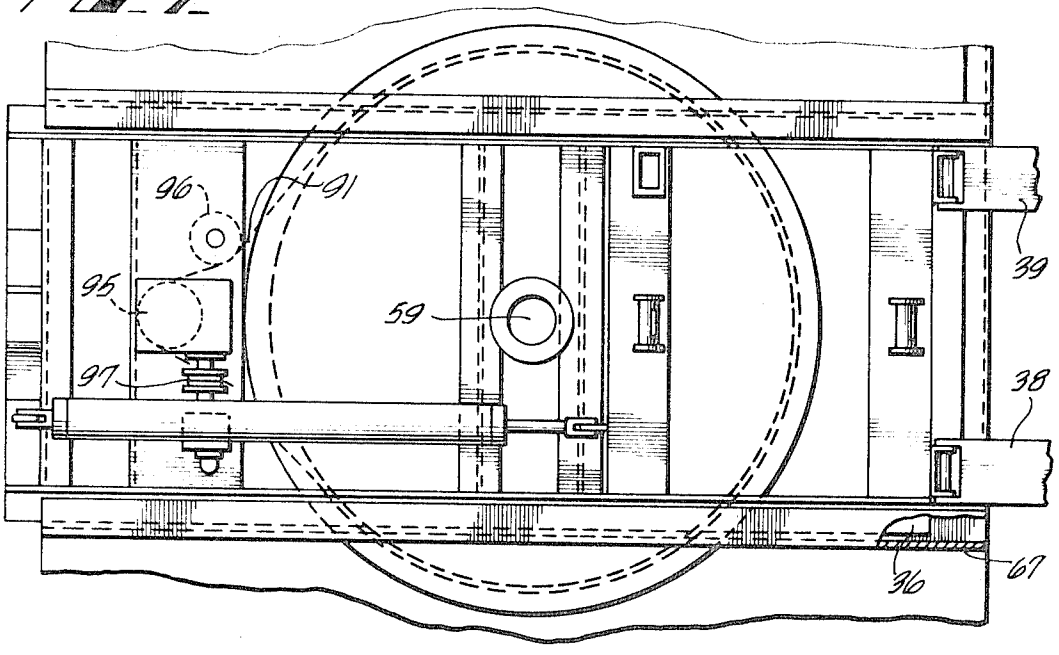
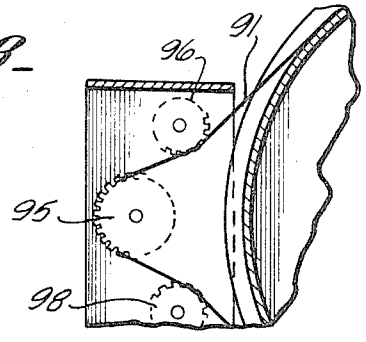



FIG. 8




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# COMBINED EARTH BORING AND POST DRIVING APPARATUS

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to earth boring and post driving equipment and, more particularly, to a novel apparatus of this class adapted to be used on uneven terrain and incorporating a universal mount for attaining a variety of earth tool working orientations including means for readily interchanging tools capable of performing earth boring and/or driving procedures.

2. Description of the Prior Art

In the past, it has been the conventional practice in the excavation field, as well as other fields, to employ a drill rig carrying rock or soil drilling apparatus for drilling holes such as are required preparatory to the installation of a vertical shaft or post. After the hole has been prepared, additional equipment carrying post driving equipment is employed to insert the post into the hole and to forcibly urge the post therein. Conventional drill rigs and post drivers are unnecessarily unwieldy and cumbersome to set up for operation and service. For example, most drill rigs employed in the field of hard surface drilling are required to be firmly anchored to nearby structures or the adjacent ground area. At times, the anchoring arrangement may become quite extensive. Identical problems are also encountered in the use of conventional post driving equipment. Furthermore, it is difficult for conventional drill and post driving rigs to be employed in situations requiring operation at an angle since means are not usually provided for supporting the tool and its attendant driving means in an angular position so that its performance will be of maximum efficiency. It is also difficult to pull out or extract a drill rod or auger from its borehole by conventional methods.

The difficulties encountered with the use of drill and post driving rigs is particularly acute in specialized situations such as when fence posts are to be installed adjacent heavily frequented roadways and freeways where access to the installation site is restricted and vehicular traffic poses a danger not only to the equipment but to the working personnel. Under such conditions, the equipment must be self-contained, capable of functioning in a relatively restricted and confined area and be adapted for rapid and portable movement to and from the work site.

Typical examples of conventional drilling rigs are disclosed in U.S. Pat. Nos. 2,919,899; 2,562,276; 2,594,098; and 2,639,892. Although suggestions are made in some of these prior art references that the drilling tool can be angularly disposed with respect to the ground surface, complex mechanisms are required to support the tool and the ability of the tool to be maneuvered is greatly restricted. Therefore, these devices suffer from one or more of the defects noted above.

One attempt to provide a drill rig and post driver combination is disclosed in my U.S. Pat. No. 3,447,613. However, the conversion mechanism for changing operations from hole digging to post driving and conversely from driving to digging require considerable manual labor which causes delays and increases job time at the working site. Also, it has been found difficult to orient the mechanism about the sides of the truck bed supporting the equipment.

## SUMMARY OF THE INVENTION

Accordingly, the difficulties and problems encountered with conventional earth boring and post driving equipment are obviated by the present invention which, in general, provides a self-propelled mobile carrier for supporting a combined earth boring auger and post driving mechanism so that the equipment can be rapidly moved from one location to another with minimum assembly and disassembly time. The mechanism constitutes an improvement over the disclosure of the device in U.S. Pat. No. 3,447,613. The auger assembly is movably advanced to a position on a foldable upright frame so that adequate lateral support is attained during the boring procedure. The frame carries a movable weight adapted to urge the auger into biting contact with the earth to be removed so that a post hole of required depth is properly prepared. Means are also included on the upright frame for detachably carrying a post intended to be installed in the previously prepared hole. When such means are attached to the frame, the auger equipment is moved out of the way so that the movable weight may be employed for forcibly urging the post into the post hole prepared by the auger.



The upright frame is movably carried on a universal pivoting arrangement which includes a turntable mechanism, and a plurality of piston and cylinder assemblages are employed operably connected between the frame and the carriage to permit the frame to be tilted or angularly displaced with respect to the mobile carrier so that the earth auger or post driving procedures can be achieved at angular positions. Means are provided by piston and cylinder assemblages connected between the movable universal mount and the mobile carrier for advancing and retracting the upright frame laterally from the side or rear of the mobile carrier to a required distance therefrom so that the frame and associated equipment are cantilevered outwardly from the mobile carriage on the universal mount.

Therefore, it is a primary object of the present invention to provide a novel mounting means for a combined drilling mechanism and post driving assembly which may be readily cantilevered outwardly from a selected side or rear of the bed of a self-propelled mobile carrier and operated to bore a hole at any angle without employing extensive anchoring means.

Another object of the present invention is to provide a portable earth boring and post driving mechanism carried on a foldable upright frame cantilevered from a vehicle bed by means of a turntable mount whereby a variety of angular positions may be attained so that earth boring or post driving can be achieved at any desired angle with respect to the surface of the ground.

Another object of the present invention is to provide a novel combined earth boring and post driving rig which may be rapidly assembled and disassembled in a confined area within a relatively short time period and which includes means for interchanging the earth auger and post driving equipment so that separate and sequential procedures may be accommodated.

Yet another object of the present invention is to provide a self-contained mobile carrier for controlling combined earth boring and post driving equipment which is carried by a rotary universal means and employing a plurality of piston and cylinder assemblages adapted to position either the earth auger or post driving equipment at an angle with respect to the ground surface from the sides or rear of the carrier bed.

## BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings, in which:

FIG. 1 is a side elevational view of the novel combined earth boring and post driving apparatus of the present invention illustrating the apparatus arranged for earth boring operations in solid lines employing an auger preparatory to a post driving procedure, and in its folded position in broken lines for transport purposes;

FIG. 2 is an enlarged rear perspective view of the apparatus illustrated during the performance of an earth boring procedure;

FIG. 3 is an enlarged perspective view of the earth auger mechanism and means for moving the mechanism into and out of its operating position on the upright frame;

FIG. 4 is a side elevational view of the apparatus showing the earth auger positioned away from the upright frame;

FIG. 5 is a rear elevational view of apparatus showing the turntable mount therefor as taken in the direction of arrows 5–5 of FIG. 4;

FIG. 6 is a cross-sectional view of the turntable mount shown in FIG. 5 as taken in the direction of arrows 6–6 thereof;

FIG. 7 is a plan view of the apparatus illustrating the turntable mount and means for driving the turntable;

FIG. 8 is a fragmentary cross section view of the turntable drive means as taken in the direction of arrows 8–8 of FIG. 6; and

FIGS. 9—11 are plan views of the earth auger attachment means employed to detachably couple the earth auger to the weight as shown in FIG. 2.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, the novel earth boring and post or pile driving apparatus of the present invention is illustrated in the general direction of arrow 10 which includes a self-propelled mobile carrier taking the form of a truck 11. The truck includes a flat bed 12 extending rearwardly from a cabin 13 enclosing a conventional motor driver's compartment. The truck 11 is movably carried on wheel sets 14 and 15. An operator's console 16 is carried on the bed 12 which includes the necessary controls for operation of the apparatus.

The apparatus includes an upright frame consisting of frame portions 17 and 18 which are arranged in parallel spaced apart relationship in a substantially upright vertical position and that is projected in cantilevered fashion from the rear end of the truck bed 12. Brace 19 connects the frame portions together as well as a top cap 19'. The frame is employed for movably mounting a weight assembly 20 which is adapted to slidably move between the opposing sides of the frame portions 17 and 18. Mounted on the upper end of the frame, there is provided a means, indicated by arrow 21, for raising and lowering the weight 20 including a hydraulic piston and cylinder assemblage 22 and 23 via a rope or cable 24.

An earth auger assembly, indicated by arrow 25 is movably advanced and retracted between the opposing sides of the frame portions 17 and 18 and, as illustrated in FIG. 1, the assembly is advanced downwardly so that the auger digs or bores a hole in the ground 27 preparatory to the installation of a post therein. The auger assembly is used in combination with the weight assembly by means of a mechanical coupler 28 adapted to engage with a hydraulic motor unit 30 carried on the uppermost end of the auger assembly 25.

The lower part of the frame is movably mounted on a fore-and-aft slidable box member 36 so that the frame may be tilted or folded for storage or transportation purposes as indicated by the broken lines 32 and 33, respectively. The member 36 is slidably carried on a turntable 37 rotatably mounted on the flat bed 12 of the truck and the truck itself supports the apparatus so that additional anchoring means, such as cables, guide wires and ropes are unnecessary to stabilize the frame, and hence the apparatus, during an earth boring or post driving operation. Also carried on the flat bed 12 of the truck, there is provided a pair of housings 34 and 35 suitable for enclosing an air compressor, regulators, generators, pumps, tanks or other equipment necessary to power and actuate the piston and cylinder assemblages and the hydraulic motor 30.

Referring now to FIG. 2, it can be seen that the lower part of the frame is mounted on the end of member 36 by links 37 and 38 which are pivotally connected on one end along a pivot axis 39 to the lower part of the frame and pivotally connected at their opposite ends to the member 36. In this fashion, the frame may be moved towards or away from the bed 12, as well as up and down. The frame may be moved in its storage position by means of a piston and cylinder assemblage indicated by numerals 54 and 55, respectively, which is pivotally connected at bracket 56 to the member 36 and to bracket 57 carried on a beam 58. The beam includes a telescoping extension 59 that is pivotally coupled to the top cap 19' via an intermediate member 60. A piston and cylinder assemblage 61 and 62, carried on the beam 58, operates to advance and retract extension 59 to further achieve raising and lowering of the frame.

To actuate the movement of the frame so as to tilt the frame to the broken line position shown in FIG. 1, piston 61 is pivotally connected to member 60 by bracket 63, and a bracket 64 pivotally connects beam 58 to member 36. The advancement of the piston 54 outwardly from cylinder 55 will cause the frame to rotate about the pivot axis indicated by numeral 40.

The opposite sides of member 36 carry a pair of spaced apart L-shaped slide members 66 which are movably carried in slots formed in stationary beams 67 and 67' located in fixed spaced apart parallel relationship on the turntable 37. The slide members 66, member 36 and hence the frame, are forcibly urged forwardly and rearwardly under the control of a piston and cylinder assembly 68 and 69 pivotally connected on its opposite ends between member 36 and beams 67. Turntable 37 is rotatably carried on the truck bed by a pivot 59.

The frame 21 may be pivoted about its midsection so as to laterally tilt the frame by means of piston and cylinder assemblage 70 and 71 which is pivotally connected between the beam 58 and the member 36. The end of beam 58 and cylinder 55 are pivotally connected along a common axis to brackets 64 and 56 via pivot connections 72 and 73 so that lateral pivot movement may be accommodated. Also, the cantilevered ends of links 37 and 38 are pivotally coupled to the frame by the fixtures 74 and 75 which include the pivot axis 39. Therefore, the frame may be tilted laterally and/or fore and aft by means of the universal pivot connections.

As a means for connecting coupler 28 of the auger assembly with the weight assembly 20 during boring operation, a pair of lateral latches 76 and 77 are employed which rigidly couple through apertures carried on opposite sides of a receiver portion 78 of the weight 20.

Referring now in detail to FIG. 3, the earth boring auger assembly 25 is illustrated in its retracted position such as when a post driving operation is being performed. The auger assembly includes a spiral auger 80 carried on a drive shaft 81 which is rotatably driven by the air motor 30 via a gear reduction train included within housings 82 and 83. In its nonoperative position, the auger assembly is seated on a movable frame 84, pivotally carried on frame portion 18 and which includes a fixed brace 85. The frame 84 is pivotally advanced and retracted by means of a piston and cylinder assemblage indicated by numerals 88 and 90, respectively, extendably coupled between frame 84 and brace 85. The auger assembly rests on the end of the frame 84 as the assembly is moved to and from the upright frame for storage purposes and for support during hookup with the weight assembly. Once the auger assembly has been transferred to the weight assembly, the frame 84 is detached and retracted. A stud 89 downwardly depending from the housing 83 may be readily indexed with a mating aperture in the end of frame 84 so that the auger assembly may be detachably coupled thereto.

Referring now to FIGS. 4 and 5, it can be seen that the member 36 and beams 67 and 67' are carried on a platform 90' which is fixed to turntable 37. By means of pivot 59, the turntable is rotatably carried on the truck bed. A form of chain, belt or cable drive is employed for controllably rotating the turntable which includes a cable or chain 91 having its opposite ends fixed to a flange 92 carried on the periphery of the turntable 37. The chain or cable may be readily loosened or tightened by means of a tension mechanism 93 whereby the frictional engagement of the chain or cable with the peripheral edge of the turntable may be readily adjusted.

Referring now to FIGS. 6 and 7, it can be seen that the member 36 and beams 67 are carried on the turntable 37 and that these latter structures are rotatably mounted on the truck bed by means of pivot 59. The means for rotating the turntable include a drive unit 94 having a drive wheel 95 in mesh with the cable or chain 91. An idler roller or gear 96 is employed

for maintaining the cable or chain taut. A gear 97 may be readily coupled to an engine or power source for rotating the drive gear 95. In FIG. 8, an enlarged view of the drive means is illustrated further showing a tension idler 98.

Referring now to FIGS. 9, 10 and 11, means are illustrated for detachably connecting the auger assembly 25 to the weight assembly 20. The connecting coupler 28 is provided with latches 76 and 77 which are arranged in slidable relationship with respect to guides 100 and 101, respectively. The ends of the latches are adapted to extend through apertures 102 and 103 formed in the opposite sides of the receiver portion 78 of the weight assembly. The latches are normally biased so that their ends project through the respective apertures by means of a spring loaded lever 104 which is pivotally carried on a fixed portion 105 of the receiver. The opposite ends of the lever are provided with pins that project into elongated slots 106 and 107 formed in the body of each of the latches 76 and 77, respectively. A spring 108 is coupled on its opposite ends between element 105 and one end of the latch 104 so that the lever is normally biased so as to effect projection of the latches through the apertures. However, as shown in FIG. 11, the latches inwardly slide on the guides 100 and 101 as the coupler 28 is insertably received within the receiver portion 78. Preferably, the ends of the latches are tapered, rounded or beveled so as to reduce friction as they slide against the internal surface of the receiver portion 78. In FIG. 10, the coupling portion 28 is shown in a position preparatory for insertion into the interior of the receiver portion 78. A rope or line 110 is coupled at one end to the lever 104 and extends exteriorly of the coupling portion 28. By pulling on rope 110, the spring tension of spring 108 is overcome and the lever 104 will pivot to a location where the downwardly depending pins on the underside of the lever will engage the latches at the ends of the slots so that the latches will be pulled inside of the coupling portion 28 and thereupon disengage with the apertures 102 and 103 in the receiver portion. By this means, the auger assembly may be readily detached from the weight assembly.

In actual operation of the earth boring and post driving apparatus of the present invention, the apparatus is transported to the work site by means of the truck 11 and the truck is parked adjacent to the area in which a post or pile is to be installed in the ground. In practice, generally a plurality of posts are to be installed, such as when a fence or barrier is being erected and, by means of the mobile truck, a first post is installed and the truck moved forward to a second location where the second post is installed and so on until all the posts of the plurality have been installed. Also, the present invention has been found to be particularly adapted to the installation of posts in roadway or highway dividers which include an upper surface of pavement material such as cement, asphalt or the like so that a hard and reinforced surface is presented to the earth boring equipment.

Once the vehicle has been located adjacent the installation site, the operator manipulates the controls on the console 16 to initially actuate the various piston assemblages so that the upright frame 21 is raised from its folded position to its vertical position. The frame pivots about pivot 40 as the frame is raised in response to actuation of piston and assemblages 54 and 55. The tilt of the frame may be adjusted by actuating piston and cylinder assemblages 61 and 62 which will cause the frame to pivot about pivots 39. Next, the piston associated with cylinder 69 is actuated so that the frame is moved outwardly to the rear of the truck on member 36 via slide members 66 on beams 67 and 67' to a position substantially over the earth area in which the post is to be installed. At this time, the piston associated with cylinder 71 is actuated so that the frame may be laterally tilted to a desired position, if necessary. Such pivoting movement will tilt the frame in a plane perpendicular to the longitudinal axis of the truck. Also, if it is desired to tilt the frame in a plane parallel to the longitudinal axis of the truck, this may be achieved by piston and assembly actuation of 61 and 62.

Once the attitude of the frame has been established, piston and cylinder assemblages 88 and 90 may be actuated to move the auger assembly 25 between the frame portions 17 and 18. The weight assembly 20 is then lowered so that the receiver portion 78 couples with the connecting portion 28 via the latches 76 and 77. The weight assembly 20 may be lowered by means of a piston and cylinder assemblage 111 and 112 via rope 24 so that the weight will rest on top of the coupling unit 28. The weight, being operatively connected with the auger assembly, increases the auger bite during rotation of the auger 80 in the earth when rotated by the motor 30.

After the earth boring operation has been completed, the auger is removed from its position between the frame portions 17 and 18 by means of the piston and cylinder assemblages 88 and 90. A suitable post is inserted through the central receptacle of a post guide 113 so that the major length of the post resides within the bore previously prepared by the earth auger. Next, the weight assembly 20 is repeatedly raised to an upper position and subsequently released so that under the force of gravity, the weight will drop against the post to drive the post deeper into the prepared hole. When the post has been suitably driven to its desired depth, the guide 113 is removed and the weight assembly is raised to an at rest position on the frame.

The various piston and cylinder assemblages may be selectively actuated at the control console to remove the frame from the work area so that it is stored on the bed of the truck as shown in FIG. 1 in broken lines.

Therefore, it can be seen that the earth boring and post driving apparatus of the present invention provides a versatile apparatus not only for boring a hole preparatory to post driving but includes means for driving the post into the prepared hole. The various hydraulic piston and cylinder assemblages are adapted to precisely maneuver and orient the frame to any desired angle so that either earth boring or post driving can be achieved in an angular fashion. No anchoring means or stabilizing wires or lines are required since the self-propelled carrier is sufficient to provide the necessary stability and support for the apparatus.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

I claim:

1. In an earth boring and post driving apparatus, the combination comprising:

a self-propelled mobile carrier;

a retractable frame having side members, said side members comprising guide means for guiding movement of weight means along and between said members;

a turntable rotatably mounted on said carrier;

universal mounting means movably and operably carried on said turntable and pivotally supporting said frame so as to be cantilevered laterally from one side thereof as well as to the rear thereof;

an earth auger assembly movably carried on said frame adapted to be advanced to an operating position disposed between said frame side members and having an auger bit adapted to bore a post hole;

said weight means, for an earth boring operation, being detachably connected to said auger assembly to urge said auger bit into biting contact with the earth and, for a post driving operation when said auger assembly is retracted from its operating position, being lifted upwardly along said side members and dropped downwardly along said members to strike the upper end of a post to drive said post into the earth; and

hydraulic means for tilting said frame and for advancing and retracting said auger assembly.

2. The invention as defined in claim 1 including a slide member carried on said turntable for rectilinear movement and said universal mounting means carried on said slide member.

3. The invention as defined in claim 1 wherein

said means for detachably coupling said weight means to said auger assembly includes:

said weight means having a downwardly opening receptacle and apertures opening through the opposite sides thereof; and

latch means slidably carried on said auger assembly normally biased to outwardly extend from the opposite sides thereof and yieldably upon engagement with said weight means receptacle to permit a portion of said auger assembly to be seated therein and extendable under its bias to pass through said apertures for releasable securement therewith.

4. The invention as defined in claim 1 including

an elongated slide member movably carried on said turntable; and

a pair of spaced apart links pivotally connected to one end of said slide member and connected to said frame by universal joints so as to permit said frame to tilt as its midsection in a fore-and-aft direction and in a port and starboard direction.

5. The invention as defined in claim 4 wherein

said hydraulic means includes a first piston and cylinder assemblage pivotally connected at its opposite ends to said frame and said slide member so as to extend in a transverse direction across said slide member; and

a second piston and cylinder assembly pivotally connected at its opposite ends to said slide member and to said frame so as to extend in a fore-and-aft direction normal to the direction of extension of said first piston and cylinder assembly.

6. The invention as defined in claim 5 including

a third piston and cylinder assembly pivotally connected on its opposite ends between said frame and said auger assembly; and

means for detachably supporting said auger assembly on said third piston and cylinder assembly.

7. The invention as defined in claim 6 including

an extendable beam pivotally secured at one end to the upper end of said frame and universally jointed at its other end to said slide member; and

said first and second piston and cylinder assemblies being connected to said frame via said beam.

8. In an earth boring and post driving apparatus, the combination comprising:

a self-propelled mobile carrier;

an elongated, retractable frame having upper and lower side members, said side members comprising guide means for guiding movement of weight means along and between said side members;

a turntable rotatably mounted on said mobile carrier;

a slide member slidably carried on said turntable;

means pivotally coupled between said frame at its midsection and said slide member for selectively pivoting said frame to and from a first position substantially perpendicular to the ground and a second position at a substantial angle to the ground above said mobile carrier;

universal mounting means movably connected between said carrier and said pivotally supported frame so as to cantilever said frame laterally and rearward of said mobile carrier;

an earth auger assembly movably carried on said frame adapted to be advanced to an operating position disposed between said frame side members;

said weight means, for an earth boring operation, being detachably coupled to said auger assembly and, for a post driving operation when said assembly is retracted from its operating position, being moved along said side members to strike the upper end of a post to drive said post into the earth; and

hydraulic means for tilting said frame, slidably moving said slide member, and for advancing and retracting said auger assembly.

9. The invention as defined in claim 8 wherein

said hydraulic means includes:

an extendable beam pivotally connected between said frame and said slide member;

a first piston and cylinder assemblage pivotally connected between said beam and said slide member operable to tilt said frame normal to the longitudinal axis of said carrier;

a second piston and cylinder assemblage pivotally connected between said beam and said slide member operable to tilt said frame parallel to the longitudinal axis of said carrier; and

a third piston and cylinder assemblage operably connected between said slide member and said turntable to advance and retract said slide member.