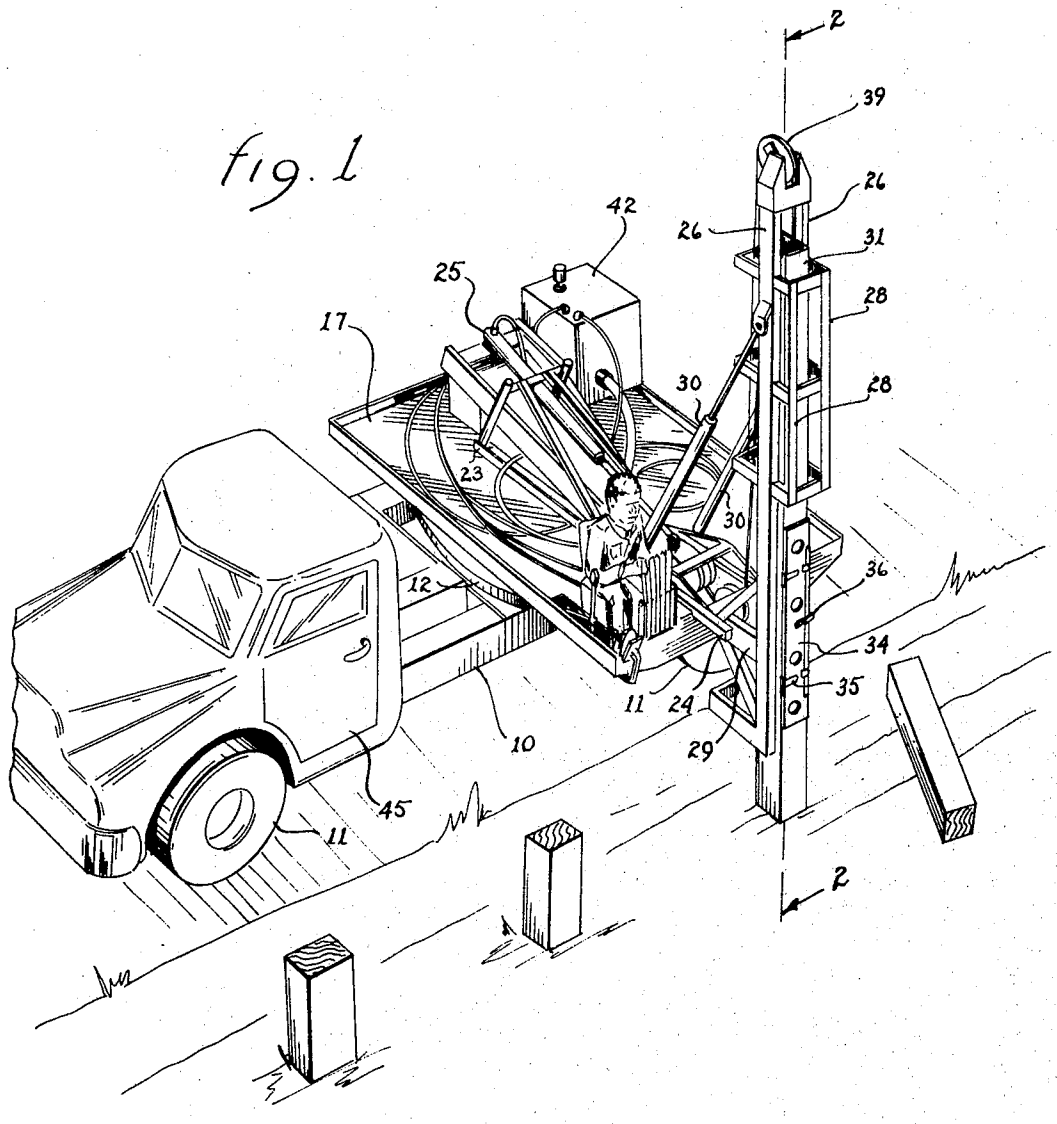
April 21, 1970 W. A. McWATERS ETAL 3,507,338

HOLE-FORMING AND POST-DRIVING APPARATUS

Filed Dec. 9, 1968 4 Sheets-Sheet 1

Fig. 1



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HOLE-FORMING AND POST-DRIVING APPARATUS

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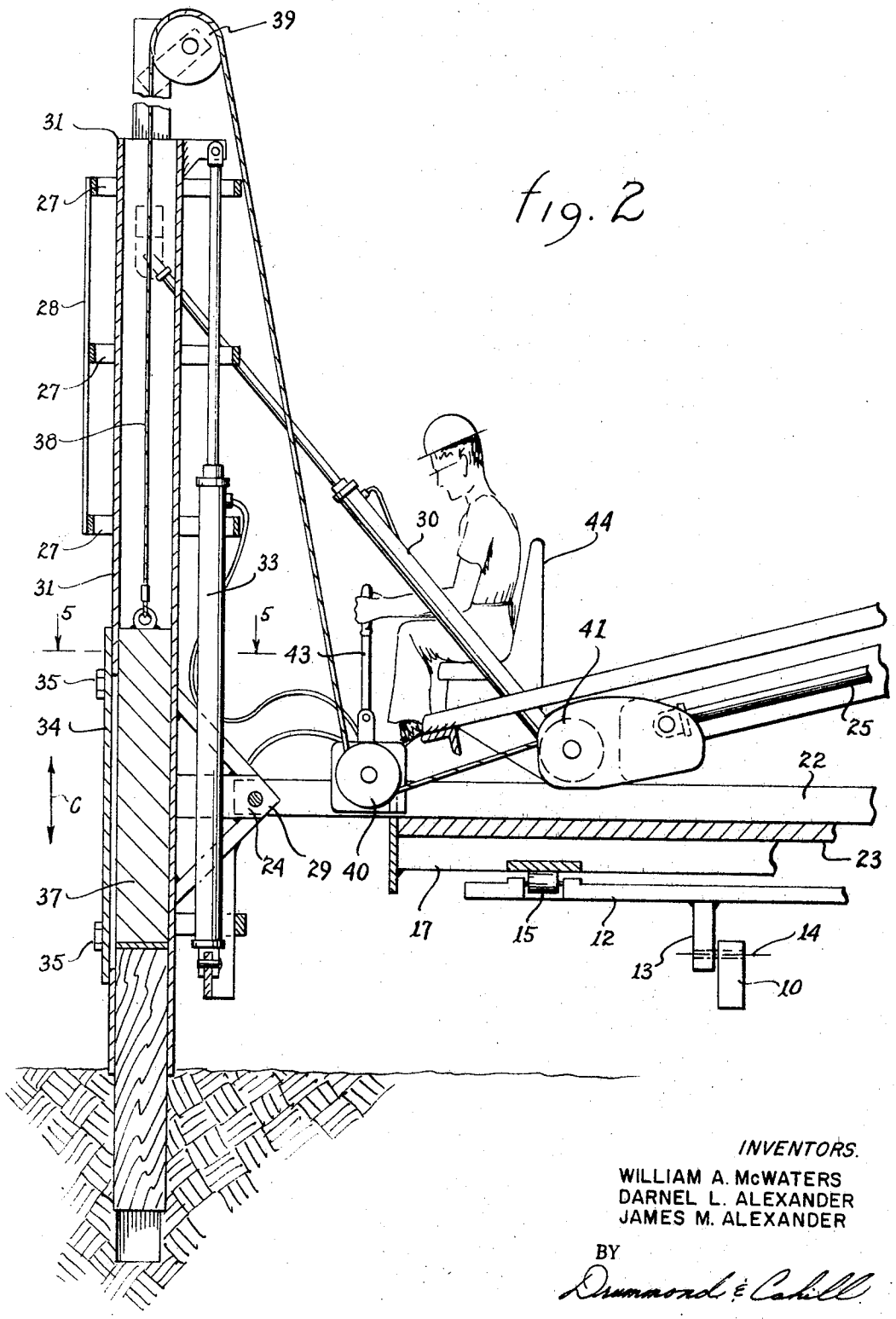


Fig. 2

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HOLE-FORMING AND POST-DRIVING APPARATUS

Filed Dec. 9, 1968 4 Sheets-Sheet 3

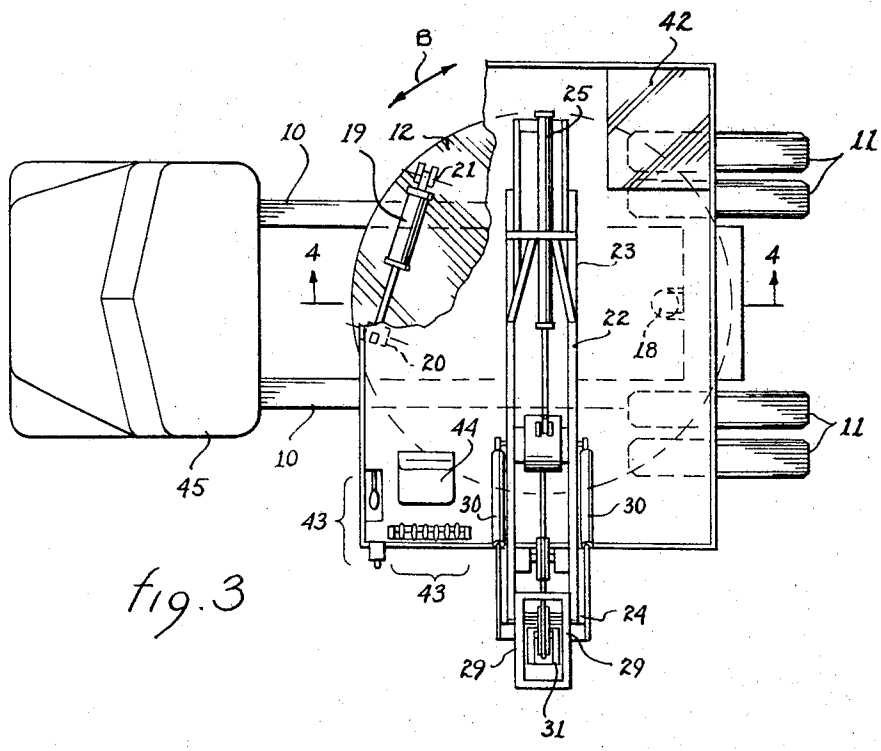
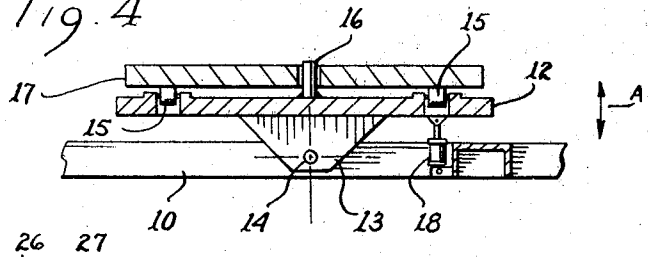


fig. 3

fig. 4



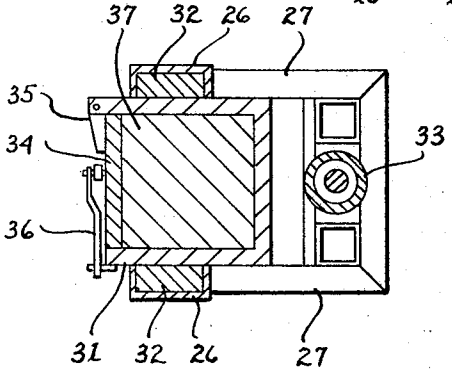


fig. 5

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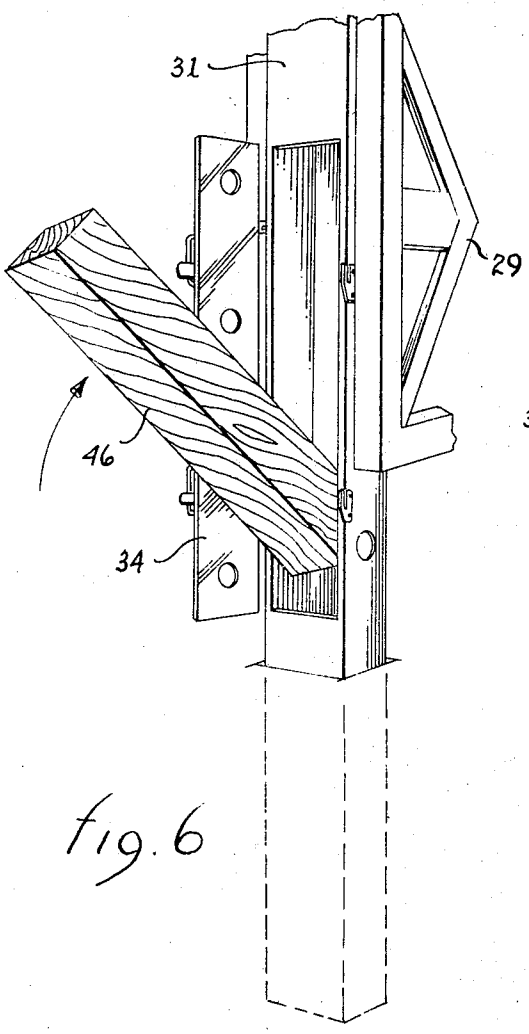


Fig. 6

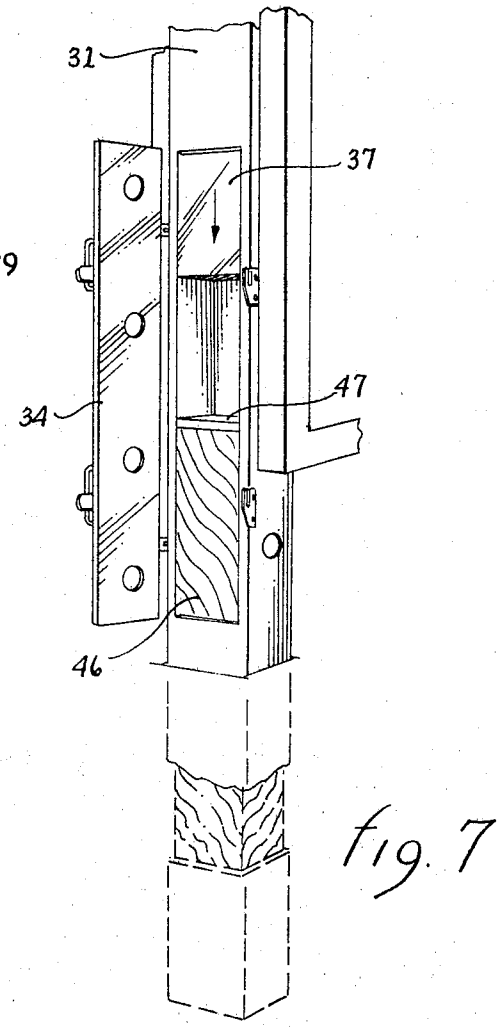


Fig. 7

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HOLE-FORMING AND POST-DRIVING APPARATUS

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U.S. Cl. 173—28 2 Claims

ABSTRACT OF THE DISCLOSURE

A hole-forming and post-driving machine which includes both a novel mechanism for adjusting the angle of the hole and the post with respect to the ground and a novel hole-forming and post-driving mechanism. The apparatus for adjusting the angular position of the hole and the post includes a horizontal platform support carried by and pivotally connected to a ground-supported frame, horizontal platform rotatably mounted on the support member and a slide assembly carried by a track on the platform. Power means are provided to adjust the plane of the support member, the angular position of the platform and the position of the slide on the platform. A hole-forming and post-driving mechanism is pivotally supported on the end of the slide and power means are provided for adjusting the angular position of the hole-forming and post-driving mechanism with respect to the ground.

The hole-forming and post-driving mechanism includes a vertical mast, a hollow casing carried by the mast and longitudinally movable thereon, power means for adjusting the longitudinal position of the casing member on the mast, a reciprocating hammer enclosed by the casing and a door for inserting a post within the casing below the hammer.

This invention relates to apparatus for forming postholes and for driving postholes along a predetermined line.

More specifically, the invention relates to a novel system for supporting a hole-forming and post-driving mechanism on a movable ground-supported frame such as a truck chassis, tractor, or the like.

In still another respect, the invention concerns a novel hole-forming and post-driving mechanism especially adapted to rapid and accurate placement of posts along a predetermined line.

In yet another aspect, the invention relates to a novel hole-forming and post-driving mechanism supported in a unique manner on a movable ground-supported frame in such a way as to permit one operator and a helper to rapidly emplace posts along a predetermined line, the overall apparatus being adapted to form a posthole, emplace a fence post in the hole and tamp earth around the emplaced post, all in a series of rapid machine-powered operations.

In many phases of the construction industry, it is necessary to place a plurality of posts along a predetermined line. For example, in the erection of highway guard rails, the erection of decorative or security fences, special utility lines, and the like, it is desired to rapidly and conveniently emplace a plurality of posts along a predetermined line with a minimum of manual labor and with improved accuracy. The art has provided various machines and apparatus for forming postholes and emplacing posts in the ground but, to date, the most effective and widely employed method is to merely drill a series of postholes along a predetermined line by means of an earth auger which drills a hole considerably larger than required to accommodate the post, setting the post into the hole by manual

labor, backfilling the hole around the post, and tamping the earth to provide lateral support for the post.

The above-described typical prior art method is uneconomical and time-consuming for several reasons. First, the drilling conditions encountered by the earth auger may vary widely along the predetermined post line, thus requiring several types of auger assemblies to drill the holes. Where rock is encountered, it may be that it is impossible to drill holes with a conventional auger and other drilling methods must be substituted. Secondly, because of the tendency of the earth to collapse into the hole when the auger is removed, the hole must ordinarily be drilled considerably larger than the post. Then, the posts are manually lowered into the holes, the space around the posts is backfilled and then tamped, either manually or with mechanical tamping machines. Aside from the increased labor costs, the backfilling results in a disturbed earth structure supporting the posts, the support strength of which may vary widely and in an unpredictable manner.

Therefore, it would be highly advantageous to provide a hole-forming and post-driving mechanism which could be effectively employed in widely varying soil conditions with a minimum of manual labor and which would emplace the posts with improved convenience and accuracy along a predetermined line.

It is therefore an object of the present invention to provide an improved hole-forming and post-driving machine.

Another object of the invention is to provide an improved support system for a hole-forming and post-driving machine, by means of which the machine is accurately positioned in the desired angular relationship to the earth and in such a position as to emplace the post accurately along a predetermined post line.

Still another object of the invention is to provide an improved hole-forming and post-driving mechanism which either directly emplaces the post or which forms a posthole only very slightly larger than the post, avoiding the majority of the back-filling and tamping labor and time encountered in connection with prior art methods.

Yet another object of the invention is to provide a hole-forming and post-driving mechanism which includes means integral with the machine to tamp the small amount of earth required to fill the space between the emplaced post and the walls of the hole.

These and other, further and more specific objects and advantages of the invention will become apparent to those skilled in the art from the following detailed description, taken in conjunction with the drawings, in which:

FIG. 1 is a perspective view of a truck-mounted, hole-forming and post-driving mechanism embodying the several features of the present invention;

FIG. 2 is a cross-sectional view of the apparatus of FIG. 1 taken along section line 2—2 thereof;

FIG. 3 is a plan view of the apparatus of FIGS. 1–2, partially cut away to show details of the mechanism for accurately positioning the hole-forming and post-driving machine;

FIG. 4 is a sectional view of the apparatus of FIG. 3 taken along section line 4—4 thereof;

FIG. 5 is a sectional view of the hole-forming and post-driving machine assembly of FIG. 3 taken along section line 5—5 thereof;

FIG. 6 is a perspective view showing the method of insertion of the posts into the machine of FIGS. 1–5; and

FIG. 7 is a perspective view illustrating how the post of FIG. 6 is emplaced by the apparatus of FIGS. 1–5.

Briefly, in accordance with our invention, we provide an improved hole-forming and post-driving machine which is mounted on a movable ground-supported frame in such a manner as to permit the operator to quickly and conveniently adjust the point of placement and the angular

position of the post as the ground-supported frame moves along a predetermined postline. We also provide an improved hole-forming and post-driving mechanism especially useful when mounted as previously described and which is especially adapted to permit rapid and economical emplacement of posts along a predetermined line.

According to one broad aspect of our invention, we provide improvements in post-driving machines which include power means for adjusting the angular position of the post-driving mechanism with respect to the ground and for adjusting the horizontal placement of the post-driving mechanism with respect to the ground-supported frame, the power means including a substantially horizontal platform support member carried by and pivotally connected to the ground-supported frame, a substantially horizontal platform rotatable mounted upon the platform support member, and a substantially horizontal slide assembly having an inboard end and an outboard end, the slide assembly being carried by a track on the rotatable horizontal platform. Power means are provided for adjusting the plane of the platform support member with respect to the ground-supported frame by tilting the support member around its pivotal connection with the ground-supported frame. Power means are provided for adjusting the angular position of the horizontal platform with respect to the platform support member by rotating the platform and its rotatable mounting on the support member, and power means are provided for moving the slide assembly along its track to vary the horizontal distance between the outboard end of the slide and the ground-supported frame. A hole-forming and post-driving mechanism is supported by the outboard end of the slide and includes a mast pivotally attached to the outboard end of the slide assembly, power means for adjusting the angular position of the mast with respect to the slide assembly by tilting the mast around its said pivotal connection, an elongate hollow casing carried by the mast, a hammer disposed within the casing, and means for reciprocating the hammer longitudinally within the casing.

The novel hole-forming and post-driving mechanism, in a preferred embodiment of our invention, includes an elongate mast member adapted to be positioned at a predetermined angle with respect to the ground, an elongate hollow casing having an upper end and a lower end carried by the mast member and movable longitudinally with respect to the mast, the casing being shaped and dimensioned to receive one of the posts coaxially therewithin. Power means are provided for adjusting the longitudinal position of the casing member with respect to the mast between a raised position in which the lower end of the casing is above ground level, and a lowered position in which the lower end of the casing is below ground level. Door means are provided for inserting a post within the casing when the casing is in lowered position, a hammer is disposed within the casing, and power means are provided for reciprocating the hammer longitudinally coaxially within the casing from a raised position above the door means to a dropped position.

Turning now to the drawings in which the presently preferred embodiment of the invention, chosen for purposes of illustration, is depicted and in which like reference numerals identify corresponding parts, FIGS. 1–5 illustrate a machine embodying the invention mounted on a truck chassis. The truck chassis **10** and its associated wheels **11** comprise a movable ground-supported frame which can be intermittently propelled along a predetermined postline. The mounting apparatus includes a platform support member **12** pivotally attached by means of a flange **13** and a pivot pin **14** to the longitudinal chassis member **10**. The platform support member **12** is provided with rollers **15** near its periphery and an upstanding shaft **16** located at the center thereof. A horizontal platform **17** is rotatably supported by means of the rollers **15** for rotation about the shaft **16**. The platform support member **12** is adjusted by means of a hydraulic jack **18** which tilts the platform support member **12** (see double-headed arrow A) around its pivotal connection **14** with the truck frame. The angular position of the horizontal platform **17** (see double-headed arrow B) is adjusted by means of a hydraulic jack **19** extending between a connection **20** with the support member **12** and a connection **21** with the horizontal platform **17**. A slide assembly **22** carried by a track **23** which, in turn, is supported by the platform **17** has an inboard end **23** and an outboard end **24**. A hydraulic jack **25** is provided to adjust the distance between the outboard end **24** of the slide **22** and the frame **10**. A mast assembly comprising a pair of vertical channel members **26** and spaced horizontal frame members **27** secured together by stringers **28** is pivotally attached by means of a pair of angle brackets **29**. A pair of hydraulic cylinders **30** are provided to adjust the angular position of the mast assembly with respect to the horizontal slide **22**.

An elongate hollow casing **31** having projecting lugs **32** registering with the channel members **26** is movable longitudinally with respect to the mast member in the directions of the double-headed arrow C, the vertical position of the casing **31** with respect to the mast being adjustable by means of a hydraulic jack **33**. The casing **31** is provided with a door **34** which swings outwardly on hinges **35** and which may be secured in closed position by means of a latch assembly **36**. The door is sized to permit one to insert a post within the casing **31**, as more fully explained in connection with the description of FIGS. 6 and 7.

A weighted elongate hammer or ram **37** is positioned coaxially within the casing **31** and is adapted to reciprocal movement by means of a cable **38** operating over sheaves **39** and **40** and connected to the reel **41** of a power winch which is adapted to raise the ram **37** upwardly in the casing **31** to a position above the door **34** and then to be released, dropping the ram **37** downwardly through the casing **31**.

Hydraulic power to operate the various jacks **18**, **21**, **25**, **30** and **33** and the winch **41** is supplied by a hydraulic pump **42** carried by the platform **17**. Controls for the jacks and the winch as well as remote controls **43** for positioning the truck along the postline are centrally located at an operator's station **44**.

The operation of the apparatus may be described as follows. The truck, operated from the rig cab **45**, is positioned substantially parallel to the predetermined postline and the hydraulic jacks **18**, **19** and **30** are operated to adjust the post-driving mechanism to its preselected angular position with respect to the ground. The jack **18** is used to level the platform support **12** and the platform **17** by tilting the assembly around the pin **14**. The angular position of the platform **17** is adjusted with respect to the platform support **12** by means of the jack **19**, and the mast assembly is adjusted to its proper angular position by means of the jacks **30**. In practice, it will normally be the objective of the equipment operator to position the post-driving mechanism is such a way as to emplace the posts in a substantially vertical position although, on occasion, it may be necessary to emplace the posts in a slanted position and this can be conveniently accomplished with the apparatus of the invention.

When the post-driving machine is properly positioned as described above, the operator may use one of several techniques to emplace the posts. In one method of operation, the casing **31** is lowered to ground level and the hammer **37** is repeatedly raised to a position above the ground and then dropped, in which case the impact force of the hammer forms a hole in the ground which is only slightly larger than the post to be emplaced. As the hole is deepened by successive hammer blows, the operator adjusts the vertical position of the casing **31**, moving it downwardly to prevent the walls of the hole from collapsing inwardly. As soon as the hole has been formed to the required depth, the hammer is then raised

and held above the door **34**, the door is opened, and a post **46** is inserted into the casing **31**, as shown in FIG. 6. A steel bearing plate **47** is then placed on top the post **46**, the door **34** is closed and operation of the reciprocating hammer **37** is commenced and continued until the post is driven downwardly into its hole to the required depth. After the post is driven to its final depth, the casing **31** is forced upwardly by the jack **33**, withdrawing the casing from the hole. A small amount of earth, corresponding to the volume of the hole which is not filled by the post **46**, may then be placed around the periphery of the hole and tamped into place by forcing the casing **31** downwardly by means of the jack **33**.

In an alternate mode of operation, where drilling conditions permit, a pilot auger may be used to drill a hole slightly smaller than the post, the machine is then positioned as explained above, the casing **31** is lowered until the lower end is slightly below ground level as shown in FIG. 2, the post is inserted within the casing **31** through the door **34**, the door **34** is closed and the post is driven home by the reciprocating hammer **37**.

As will be observed by those skilled in the art, the apparatus of the present invention avoids many of the practical difficulties which attend the emplacement of posts by various prior art methods and machines. In particular, the invention provides a way to insert a wall-retaining hole casing during the drilling operation, emplace the post, withdraw the casing and tamp earth around the post, all with a single machine controlled by a single operator. Similarly, the apparatus described herein is to be carefully distinguished from prior art machines employing separate hole and guide casings and machines in which the separate hole casing is driven by means of external lugs positioned to receive impact or dead weight of a hammer, all of which prior art apparatus involve additional complexities and require additional maintenance and operating techniques.

Various minor changes in the precise form of the apparatus chosen for purposes of illustration in the drawings will readily occur to those skilled in the art. For example, the hydraulic jacks could be replaced with electric motor devices having appropriate gear trains, the precise physical configuration of the mast frame could be varied considerably, the location of the controls could be varied, and many other features which do not constitute the essence of the invention could be modified or substituted with art-recognized equivalents. To the extent that such changes and modifications do not depart from the spirit of the invention, they are intended to be included within the scope of the invention, which is to be determined only by a just interpretation of the following claims.

We claim:

1. In a post-driving machine adapted to emplace a plurality of posts in the ground along a predetermined post line, said machine including

a movable ground-supported frame,

means for intermittently propelling said frame substantially along said predetermined post line, and

a hole-forming and post-driving mechanism carried by said frame,

the improvements in said machine whereby said posts may be rapidly emplaced along said predetermined line with improved convenience and accuracy, said improvements comprising:

(a) power means for adjusting the angular position of said post-driving mechanism with respect to the ground and for adjusting the horizontal displacement of said post-driving mechanism with respect to said frame to emplace said post at a predetermined distance from said frame and at a predetermined angle with respect to the ground, said power means including

a substantially horizontal platform support member carried by and pivotally connected to said ground-supported frame,

power means for adjusting the plane of said platform support member with respect to said ground-supported frame by tilting said platform support member around said pivotal connection with said ground-supported frame,

a substantially horizontal platform rotatably mounted upon said platform support member,

power means for adjusting the angular position of said platform with respect to said platform support member by rotating said platform around said rotatable mounting,

a substantially horizontal slide assembly having an inboard end and an outboard end, said slide assembly carried by a track on said platform,

power means for moving said slide assembly along said track to vary the horizontal distance between the outboard end of said slide and said ground-supported frame; and

(b) a hole-forming and post-driving mechanism comprising:

a mast pivotally attached to the outboard end of said slide assembly,

power means for adjusting the angular position of said mast with respect to said slide assembly by tilting said mast around said pivotal connection with said slide assembly,

an elongate hollow casing carried by said mast,

a hammer within said casing, and

means for reciprocating said hammer longitudinally within said casing.

2. A hole-forming and post-driving mechanism for use with a machine adapted to emplace a plurality of posts in the ground along a predetermined post line, said machine including:

a movable ground-supported frame,

means for intermittently propelling said frame substantially along said predetermined post line, and

a post-driving mechanism carried by said frame,

said hole-forming and post-driving mechanism comprising:

(a) an elongate mast member adapted to be positioned at a predetermined angle with respect to the ground,

(b) an elongate hollow casing having an upper end and a lower end, carried by said mast member and movable longitudinally with respect to said mast, said casing being shaped and dimensioned to receive one of said posts coaxially therewithin,

(c) power means for adjusting the longitudinal position of said casing member with respect to said mast between

a raised position with said lower end above ground level, and

a lowered position with said lower end below ground level,

(d) door means for inserting a post within said casing when said casing is in lowered position,

(e) a hammer within said casing, and

(f) power means for reciprocating said hammer longitudinally coaxially within said casing from

a raised position above said door means to a dropped position.

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U.S. Cl. X.R.

173—43; 175—19