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3,548,604

POST IMPLANTING METHOD AND VEHICULAR APPARATUS

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4 Sheets-Sheet 2

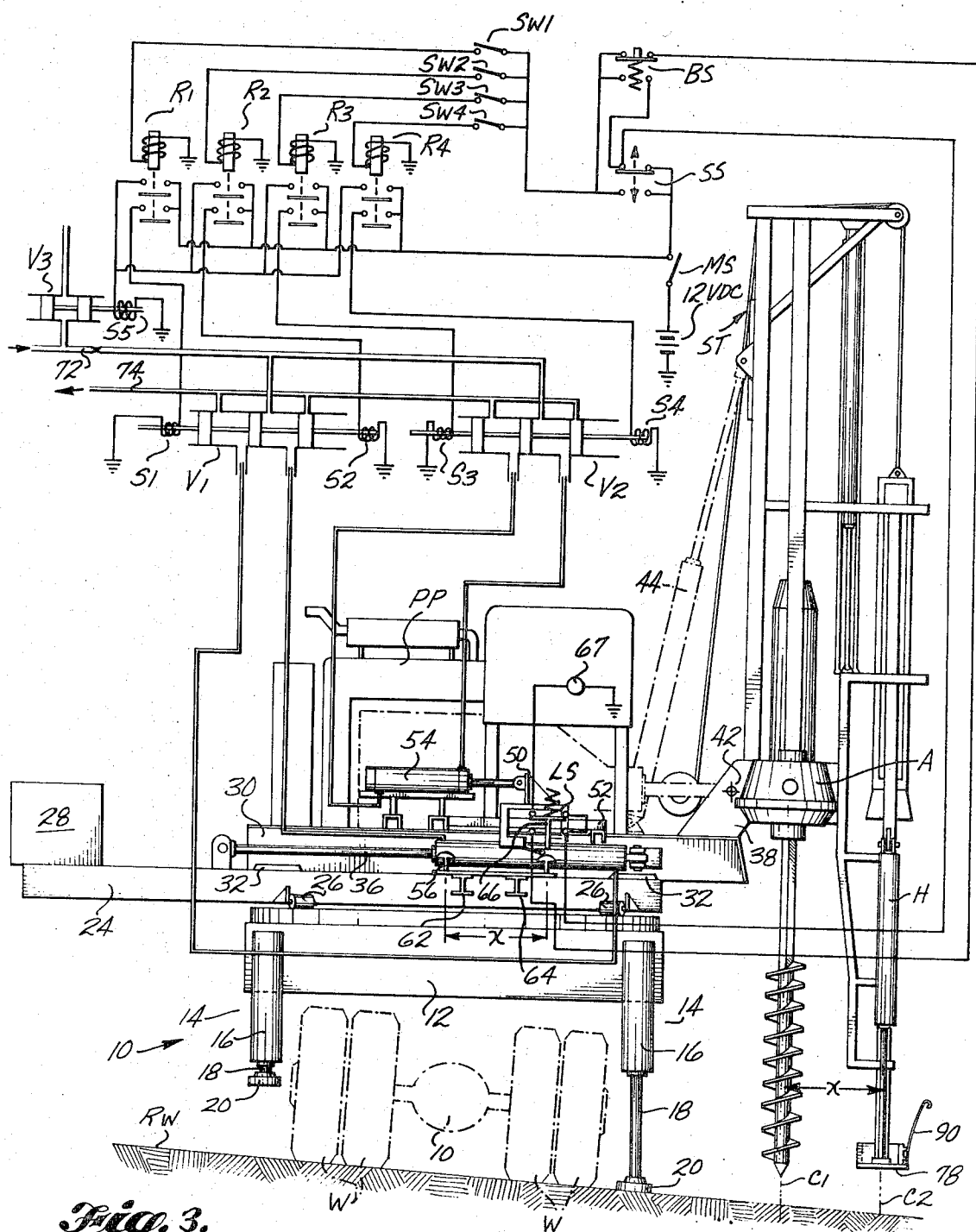


Fig. 3.

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Fig. 4.

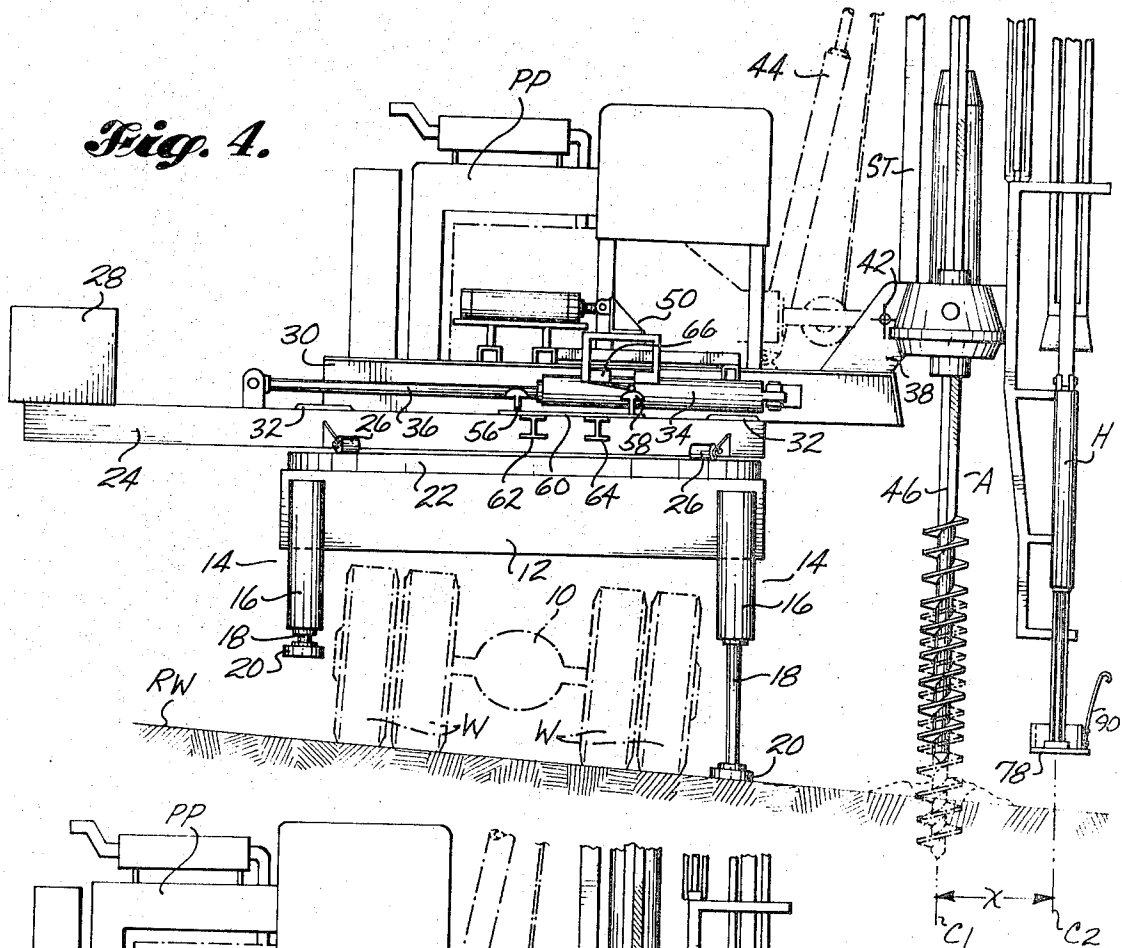
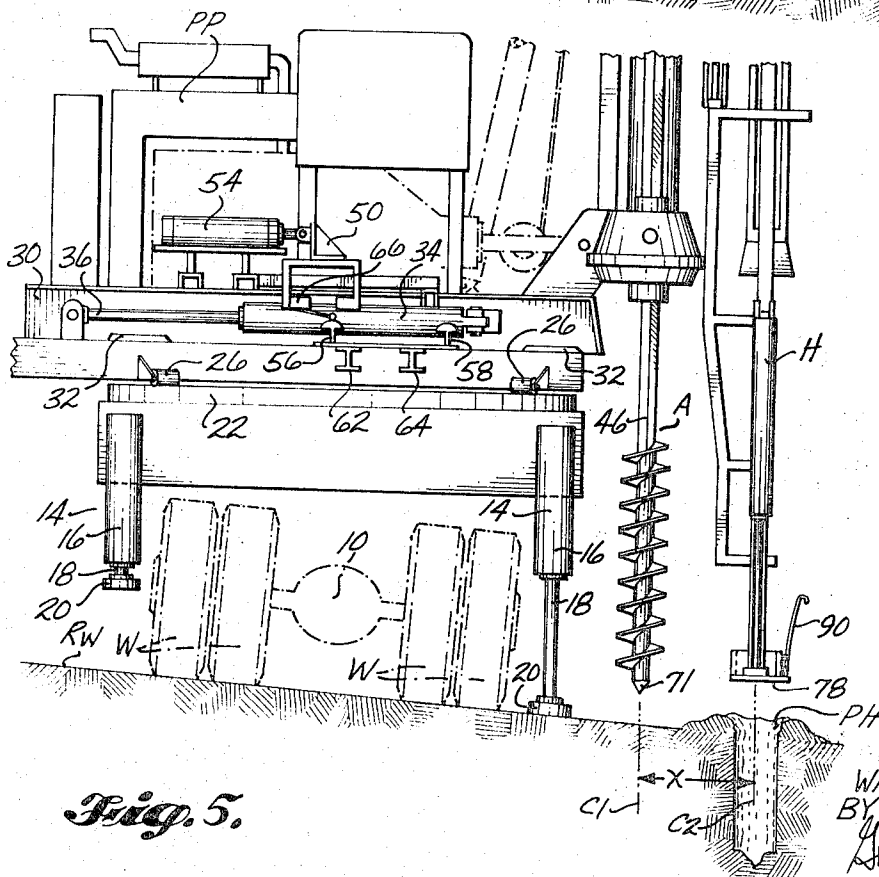


Fig. 5.



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POST IMPLANTING METHOD AND VEHICULAR APPARATUS

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13 Claims

ABSTRACT OF THE DISCLOSURE

A post hole boring auger and a drop weight hammer are mounted on a carriage with the hammer outwardly of the auger. The carriage is mounted on a vehicle for longitudinal movement laterally of the vehicle. The vertical center lines of the auger and the hammer lie in a vertical plane which extends in the direction of carriage movement. The carriage is moved outwardly under manual control of an operator to center the auger with respect to a surveyed mark on the ground. Following boring an automatic portion of a control circuit is energized and the carriage is retracted. The automatic control stops the carriage once the vertical center line of the hammer is substantially coincident with the position previously occupied by the vertical center line of the auger. Then a post is set into the hole and guided and driven into the hole by the hammer.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to post implanting. More particularly it relates to a method and a vehicular machine for accurately implanting guardrail posts and the like on a surveyed center line.

Description of the prior art

One presently used method of setting guardrail posts comprises first drilling a hole for the post by use of a truck mounted auger. Following completion of the hole and removal of the auger therefrom a post is manually set into the top of the hole and a drop weight hammer is used to drive the post into the hole. The truck mounted drop weight hammer is moved by the operator into a driving position. The operator guides the hammer until it appears to him to be approximately centered with respect to the hole. Then the post is set into place and driven into the ground by use of the hammer.

A disadvantage of this technique is that it has been shown by actual practice that the posts cannot be accurately placed when the hammer and the post guide associated with it are operator centered with respect to the hole. Guardrail posts must be accurately placed. Deviation of the posts of more than one-half inch from a surveyed line would result in an unpleasing appearance of the finished guardrail and in some instances would prevent proper placement of the horizontal rail on the posts.

SUMMARY OF THE INVENTION

This invention relates to a method and apparatus for accurately guiding and power hammering guardrail posts and the like into centered positions within previously bored holes which have been bored on center with respect to a surveyed center line.

According to the invention the auger is mounted near one end of a carriage which is shiftable in position laterally of the truck, and the power hammer is located outwardly of the auger. The hammer is fixed in position with respect to the auger. The vertical centers of both tools

are parallel and are situated in a vertical plane which is parallel to the direction carriage travel. A semiautomatic control system is utilized which includes mechanism for accurately shifting the carriage inwardly, following removal of the auger from a bored post hole, an amount substantially exactly equal to the spacing of the center of the hammer mechanism from the center of the auger. Movement of the carriage inwardly this amount results in the center of the power hammer being placed in substantially the same position previously occupied by the center of the auger, resulting in proper placement of the post on center in the surveyed line.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top plan view of a vehicular machine according to the invention, presenting a somewhat schematic showing of the mechanical implanting equipment;

FIG. 2 is an elevational view of the mechanical implanting equipment showing both the auger and the hammer raised and the carriage moved inwardly towards the truck free of a just planted post, with the upper portions of the auger and hammer cut away.

FIG. 3 is a functional schematic diagram of the mechanical, electrical and hydraulic components of the machine;

FIG. 4 is a view like FIG. 2 but showing the carriage moved outwardly, the auger down and boring, and the limit switch carrier in the process of being moved to a position placing the limit switch over the right side cam;

FIG. 5 is a view like FIGS. 2 and 4 but showing the auger up, the carriage retracted, the limit switch in a closed position on the left side cam, and the hammer centered with respect to the post hole;

FIG. 6 is a view like FIG. 5 but showing the hammer being used to place a post in the hole;

FIG. 7 is a fragmentary prospective view of the lower portion of the hammer, showing the squaring foot door open and no post in the hole; and

FIG. 8 is a view like FIG. 7 but showing the door closed and a post in the process of being hammered into the hole.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIGS. 1-6 the understructure of the truck T is depicted by broken lines and is designated 10. The truck bed 12 is located above and supported by and on the understructure 10, and is equipped with at least one ground anchoring and leveling assembly 14 for each side of the truck T. The assemblies 14 are shown to each comprise a hydraulic cylinder 16 rigidly secured to the truck bed 12 and including a downwardly extendable piston rod 18 carrying an anchor foot 20 at its lower end. The truck bed 12 is supported on the understructure 10 by suspension means (not shown) which permits leveling of the truck bed 12 while the wheels W are resting on a laterally sloping roadway RW.

A turntable which may be in the form of a circular track 22 is provided on top of the truck bed 12. A base frame 24 is supported for rotation on the track 22, such as by a plurality of rollers or bearings 26. On the post implanting side of the truck T the end boundary of frame 24 is almost even the side of the truck bed 12. On the opposite side of the truck T the frame 24 extends laterally outwardly from the truck T and carries near its end a suitable amount of counterweight 28.

An upper frame or carriage 30 is supported on top of frame 24 for sliding movement longitudinally of frame 24 and laterally of the truck T. Carriage 30 may have side members made from wide flange beams, with the lower flange thereof resting on an upper supporting surface of

the lower frame 24. The carriage 30 may be guided by slideway forming members 32 which are connected to the frame 24 and overhang the general type disclosed in Granville, U.S. Pat. No. 3,395,766.

The semiautomatic control system will now be described.

The electrical portion of the control system includes a bypassable limit switch LS. As shown by FIGS. 2-6, this limit switch is carried on a mount 50 which is supported for travel along a guide bar 52 which extends parallel to the direction of carriage movement. A small hydraulic actuator 54 is provided for moving the mount 50, and the limit switch LS carried thereby, back and forth along the guide bar 52. Both the guide bar 50 and the hydraulic actuator 54 are secured to, and movable with, the carriage 30. A pair of spaced apart cam elements 56, 58 are supported in fixed positions on a horizontal support member 60 which in turn is mounted in a fixed position relative to the frame 24, such as by means of a pair of support pedestals 62, 64 which are structurally interconnected between the member 60 and the frame 24. The cam members 56, 58 have upwardly rounded surfaces. The members 56, 58 are aligned with each other and below the limit switch LS. The limit switch LS is open, i.e., its contacts in the control circuit are open, whenever its movable contact arm 66 is resting on the crown of the cam surface of one of the cams 56 or 58.

The control and power circuit shown by FIG. 3 is merely illustrative of one of several ways the mechanical components of the invention can be powered and controlled. The system is shown to include a master switch MS which may be key operated, for completing a connection between a 12-volt DC battery and several selectively usable grounded electrical components hereinafter to be described. When the switch MS is closed current is supplied to two poles each of four normally open relays R1, R2, R3, R4. A third pole of each relay is connected to a grounded solenoid S5 which when energized serves to close a normally open valve V3. The fourth and last pole of each relay R1, R2, R3, R4 is connected to a related one of four control solenoids S1, S2, S3, S4 which serve to position the spools of two four-way slide valves V1, V2. Slide valve V1 serves to control the direction of hydraulic fluid flow into and out from the carriage moving piston-cylinder actuators 34, 36. Valve V2 controls the direction of fluid flow into and out from the limit switch positioning piston-cylinder actuator 54.

The traveling limit switch LS includes an upper pair of poles and a lower pair of poles. The switch is normally spring biased into position against the lower pair of poles which are in series with both the upper two poles of a two-way selector switch SS and four selectively usable manually operable control switches SW1, SW2, SW3, SW4 for the four relays R1, R2, R3, R4. The four switches SW1, SW2, SW3, SW4 may be controlled by a single lever having four positions (e.g., forward, rearward, left and right) so that only one of such switches can be closed at any given time. The upper two poles of the limit switch LS are in a circuit with an indicator light 67 which is mounted near the operator and serves to show when the limit switch LS is open with respect to the part of the control circuit extending from the battery through the limit switch LS.

The selector switch SS is of a type having two positions and is lockable by the operator in either position. Its upper two contacts are in series with the limit switch LS, and the lower two contacts provide a direct connection from the master switch MS to the four control switches SW1, SW2, SW3, SW4. The selector switch SS makes it possible for the operator to remove the limit switch from the control circuit so that the carriage can be moved outwardly or inwardly beyond the limits dictated by the limit switch LS. The bypass switch BS provides a way of temporarily bypassing the limit switch LS. The lower poles of the switch BS are in series with the two upper poles of the

selector switch SS and the four control switches SW1, SW2, SW3, SW4.

In operation, with both the auger A and the hammer H moved inwardly of the post line, and both raised above the ground, the truck driver D slowly drives the truck forwardly, keeping the equipment on line by means of a front bumper mounted locator rod LR (FIG. 1) having a downwardly directed outer end portion which the driver D causes to follow the surveyed line SL by his steering of the truck T. While the truck T is moving forwardly the auger and hammer operator O watches the pointed lower end 70 of the auger bit 46. When it is over a surveyed mark PS indicating the center of a post hole (and its post), or is at least laterally shiftable into a position on center, the operator O stops the truck by depressing a brake pedal BP at his station OS adjacent the auger A and the hammer H. Thus, forward travel of the machine is arrested not by the driver D but by the operator O who controls the auger A and the hammer H.

The operator O next lowers at least the low side ground anchor mechanism 14 and uses it to level the truck bed 12. A spirit level (not shown) or the like may be mounted on the equipment forwardly of the operator O, and used by him in leveling the equipment. Unless there is a severe change in grade due to operation of the machine on a curve, the bracing and attitude control arm 44 for the support tower ST need only be initially set at the start of operation and then left alone as the machine moves from post to post. However, a second spirit level (not shown) or the like is provided on the support tower ST and is watched by the operator O. If necessary an adjustment is made in the arm 44 to maintain the support tower ST sufficiently upright.

Referring to FIGS. 1-3, the operator O centers the auger bit 46 with respect to a surveyed post center mark PS by conjoint use of his control pedal BP for the brakes which stop the vehicle and lateral movement of the carriage 30. Prior to carriage movement the selector switch SS is moved against the two lower contacts and control switch SW2 is depressed, resulting in energization of solenoid S2, movement of the control spool for valve V1 to the right, and the flow of the pressure fluid from the supply conduit 72 into the closed end of the cylinder 34. This causes an outward movement of the carriage 30 until the operator O sees that the auger is centered with respect to the mark PS. Then he opens the switch SW2. Next the operator O moves the selector switch SS to put the limit switch LS into the control circuit and then he closes switch SW4. Switch SW4 energizes relay R4 and solenoid S4, causing a movement to the right of the control spool of valve V2 and a flow of pressure fluid from conduit 72 into the closed end portion of actuator 54. The actuator 54 moves the limit switch mount 50 to the right until the control rod 66 rides up onto the cam 58 and opens the limit switch LS.

Next the operator O lowers the auger A and rotates it to form the post hole. When the hole is completed the operator O retracts the auger A, then depresses the operator button for the bypass switch BS, removing the open limit switch LS from the circuit. Next control switch SW1 is closed, resulting in movement of the spool for valve V1 to the left (into the position shown) so that the closed end of cylinder 34 is now in communication with the return line 74 and the piston rod end of the cylinder 34 is in communication with the pressure line 72. As soon as the limit switch control rod 66 clears cam 58 the operator O releases the switch BS, putting the now closed limit switch LS back into the circuit. The operator O lets the carriage 30 travel to the left until the limit switch actuator 66 contacts and rides up onto the left side control cam 56. Switch LS is again opened and the carriage is automatically stopped. Since the center-to-center spacing of the auger bit 46 and the post guide portion of the hammer H is the same as the center-to-center spacing of the cams 56, 58, the post guide is now centered with

respect to the post hole PH. This condition is shown by FIG. 5.

As shown by FIGS. 7 and 8, the hammer includes a drop weight DW, a post cap 76, a post guide 78 at its lower end, guide rods 80, 82 for the post guide 78, and position control actuators 84, 86. Once the post guide 78 is centered with respect to the post hole PH the operator operates the actuators 84, 86 to lower the guide 78 into a ground engaging position (FIGS. 6 and 7). The hinged side or "door" 88 on the guide 78 is closed and locked in a closed position by a pin 90. This function is performed by a ground workman GW (FIG. 1). The ground workman GW also sets a post P into the guide 78 and positions it under the cap 76. When the post P is ready for driving the operator O repetitiously raises and drops the drop weight DW until the ground worker GW signals him that the post P is sufficiently implanted. Then the operator O raises the root 78 and the door 88 is opened by the workman GW. Once the implanted post P is free of the cap 76 the operator O moves the carriage laterally inwardly and free of the implanted post P. The truck is then driven forwardly to the site of the next post whereat the above described procedure is repeated, and so on down the surveyed line SL until all of the posts are in the ground.

Thus, the post implantation is done quite simply and quickly by only three persons D, O, GW. The working time of each of these three persons is efficiently and fully utilized. And, most importantly, the posts P are accurately placed on the surveyed line SL, resulting in an easy installation of the horizontal rail members (not shown) and a pleasing appearance of the completed guardrail.

What is claimed is:

1. A method of accurately implanting posts on line, comprising:

moving a carriage on which is mounted a boring tool including a rotary bit and a power hammer including a post guide, with the center lines of said bit and guide substantially parallel and within a plane which extends in the direction of carriage movement, to place the center line of the boring tool bit substantially over a surveyed center mark for a post;

boring a hole for the post by holding the carriage in a fixed position and moving the boring tool bit downwardly while rotating the same;

withdrawing the boring tool bit from the hole and free of the ground while the carriage is still fixed in position;

shifting the carriage in position by an amount substantially equal to the spacing between the center line of the boring tool bit and the center line of the post guide portion of the hammer, and in a direction placing the hammer over the hole;

inserting a post in the guide and the post hole and using the hammer to power drive the post downwardly into the hole.

2. The method of claim 1, further comprising shifting the carriage in position by power drive means including a limit switch operable by carriage movement to terminate the power supply and stop the carriage once the carriage has been moved an amount equal to the spacing between the center line of the boring tool bit and the center line of the post guide.

3. The method of claim 1, wherein the carriage is mounted on a motor vehicle, for movement laterally of the vehicle, said vehicle having a forwardly located driver's station and an implanting equipment operator's station located on the vehicle adjacent the carriage, on the post side of the vehicle, and in sight of the surveyed center marks for the posts, said method further comprising moving the vehicle forwardly from the site of each implanted post to the surveyed center mark for the next post, with the vehicle being steered by a driver at the driver's station and being stopped by an operator at the operator's station, by use of the vehicle's braking system, said operator braking the vehicle when the boring bit is

seen by him to be over or laterally in line with the surveyed post mark.

4. The method of claim 3, further comprising shifting the carriage in position by power drive means including a limit switch operable by carriage movement to terminate the power supply and stop the carriage once the carriage has been moved an amount equal to the spacing between the center line of the boring tool bit and the center line of the post guide.

5. The method of claim 3, wherein the posts are manually set into the post guide and post hole by a walking workman following shifting of the carriage to place said guide over the post hole.

6. The method of claim 5, wherein the implanting equipment operator controls the power hammer from his station on the vehicle, the walking workman watches the post and signals said operator when the post is sufficiently implanted, and said operator ceases power driving said post upon receipt of said signal.

7. The method of claim 5, further comprising shifting the carriage in position by power drive means including a limit switch operable by carriage movement to terminate the power supply and stop the carriage once the carriage has been moved an amount equal to the spacing between the center line of the boring tool bit and the center line of the post guide.

8. Post implanting equipment, comprising:

a transporter;

an elevated carriage on said transporter, mounted for longitudinal back-and-forth movement;

a vertically elongated rotary boring tool mounted on said carriage and including a vertically movable and rotatable boring bit having a vertical boring axis;

a vertically elongated power hammer mounted on said carriage in spaced relationship to said boring bit, and including a post guide having a vertical center line, with said vertical boring axis and said vertical center line both falling within a vertical plane which extends in the direction of carriage movement; and power means for shifting the carriage relative to the transporter to center the boring bit over a surveyed center position mark for a post hole, and for shifting the carriage in position to move the boring bit away from and the hammer towards a post hole following boring of same and lifting of the boring bit, said power means including control means which automatically stops the carriage when it has been shifted in position an amount substantially equal to the center-to-center spacing of the boring bit and the power hammer, so that said post guide, and the driven post are substantially centered with respect to the surveyed post center mark.

9. The post implanting equipment of claim 8, wherein said power means includes a motor, a power supply for the motor, and a control circuit for the power supply, and said control circuit includes limit switch means operable by carriage once the carriage has been moved from a boring bit centered position with respect to a post hole to a post guide centered position with respect to such hole.

10. Post implanting equipment according to claim 10, wherein said control means includes a pair of cams laterally spaced apart with respect to the transporter and both situated in a plane parallel to the direction of carriage movement, one of said cams being related to the boring bit and the other to the post guide of the power hammer, each cam having a cam surface in the path of the limit switch means, with the center-to-center spacing of the cams being substantially equal to the center-to-center spacing of the boring bit and the post guide.

11. Post implanting equipment according to claim 10, further comprising means mounting the limit switch for movement in a direction parallel to the direction of car-

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riage movement, so that once the carriage has been moved to center the boring bit with respect to a surveyed mark the limit switch can be moved in a position of contact with the cam related to the boring bit.

12. Post implanting equipment according to claim 8, further comprising an operator's station on the transporter in view of the lower end of the boring bit, said transporter being a motor vehicle having a driver's station forwardly of such operator's station, from which a driver drives the vehicle from each post position to the next, and said equipment including a vehicle brake control means at the operator's station, for use by the operator to stop the vehicle once he sees that the lower end of the boring bit is in a predetermined position with respect to a surveyed post center mark on the ground.

13. Post implanting equipment according to claim 12, further comprising a gauge rod extending laterally from

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the vehicle towards the line of post center marks, and in view of the driver, for use as a guide by the driver so he can drive the vehicle and watch the outer end of the gauge, keeping it substantially on the surveyed line, said gauge being of a length to provide proper spacing of the vehicle from the post center line.

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JACOB SHAPIRO, Primary Examiner

U.S. Cl. X.R.

61—63; 173—28, 43; 175—20, 315