

Jan. 14, 1964

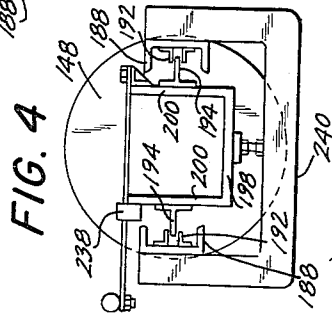
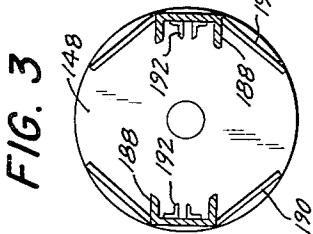
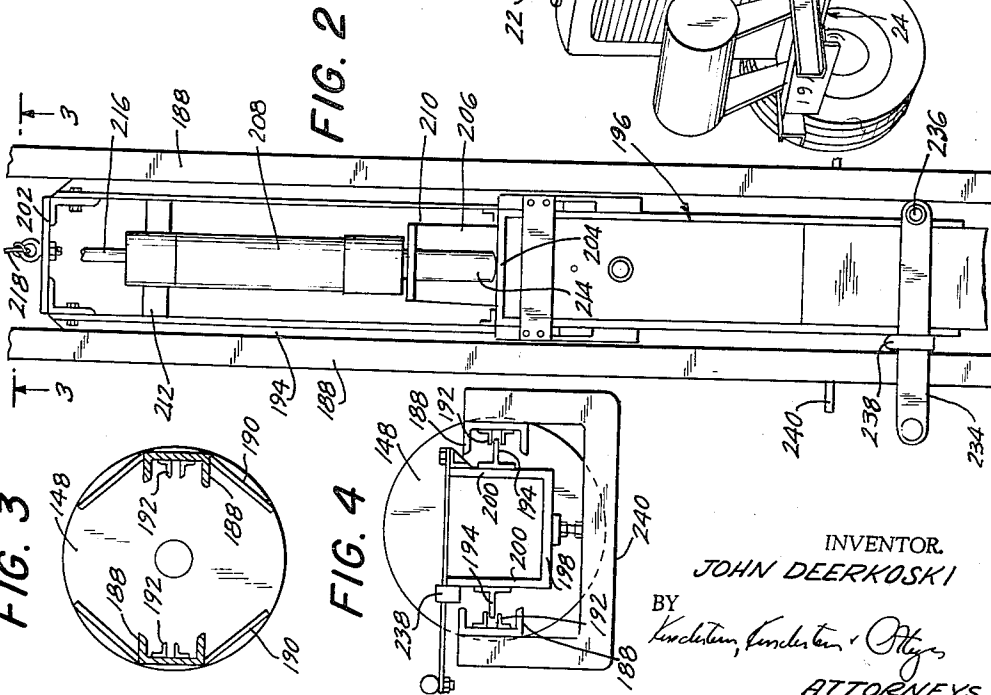
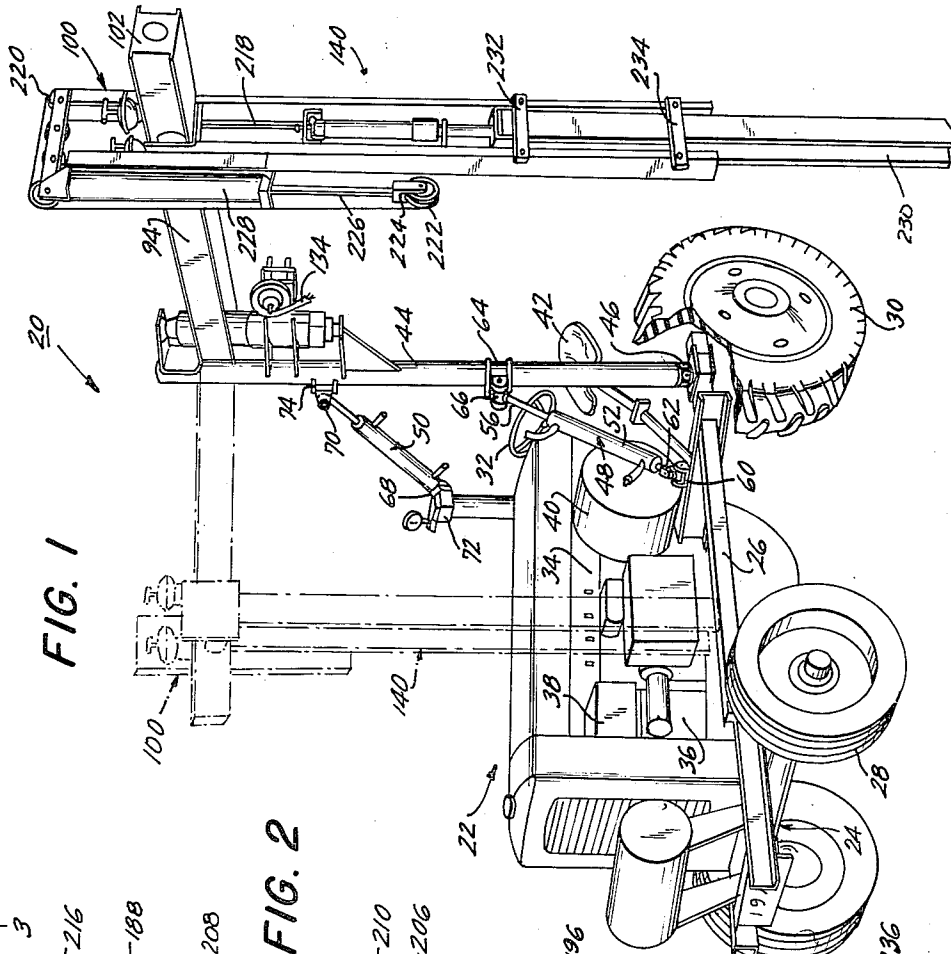
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3,117,635

SELF-PROPELLED POST DRIVER

Filed Sept. 20, 1961

3 Sheets-Sheet 1



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SELF-PROPELLED POST DRIVER

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3 Sheets-Sheet 2

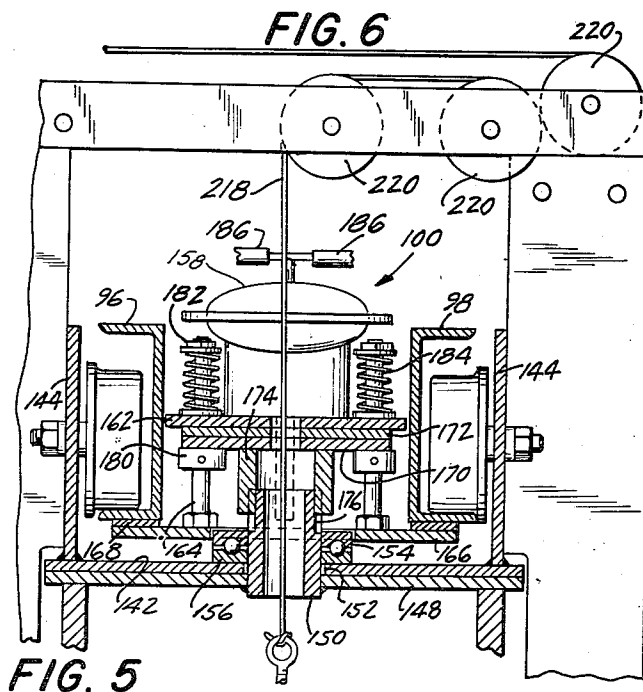
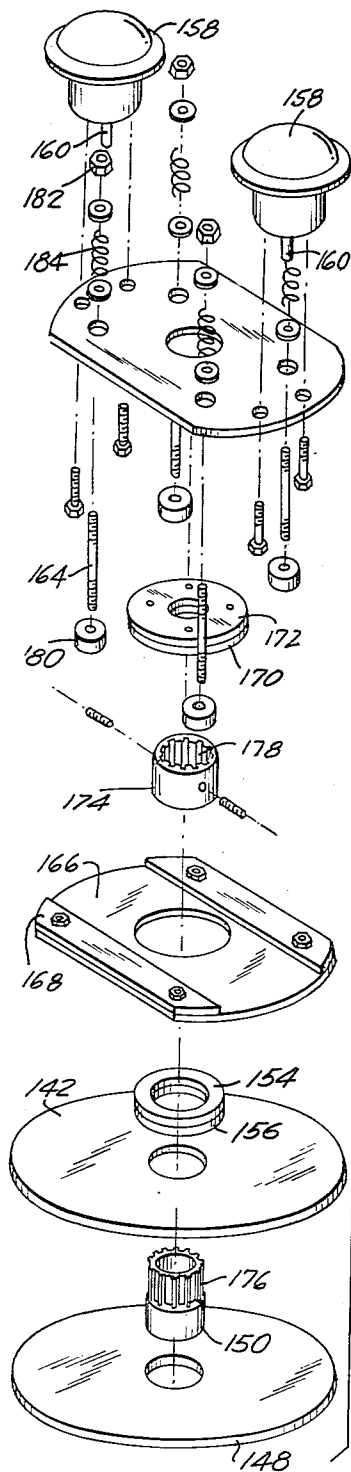


FIG. 5

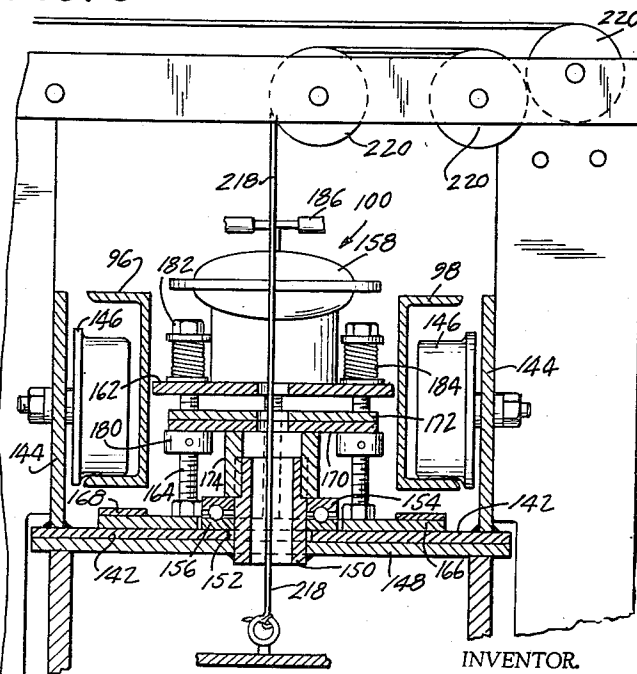


FIG. 7

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3 Sheets-Sheet 3

FIG. 8

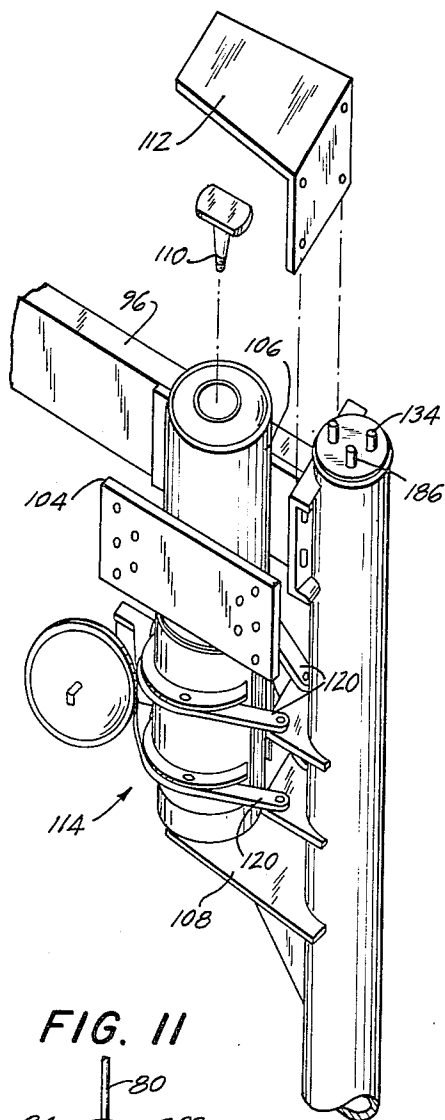


FIG. 11

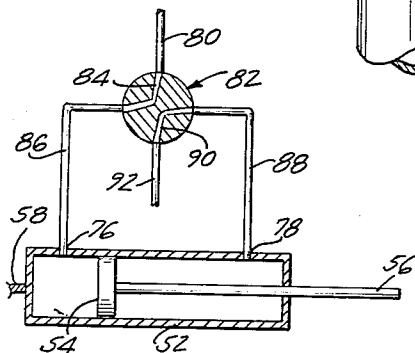


FIG. 9

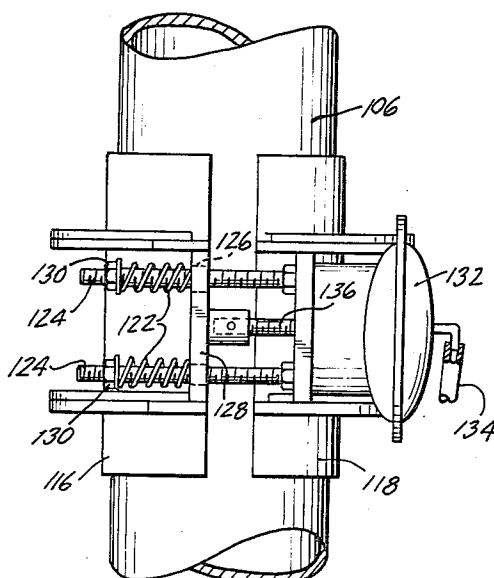
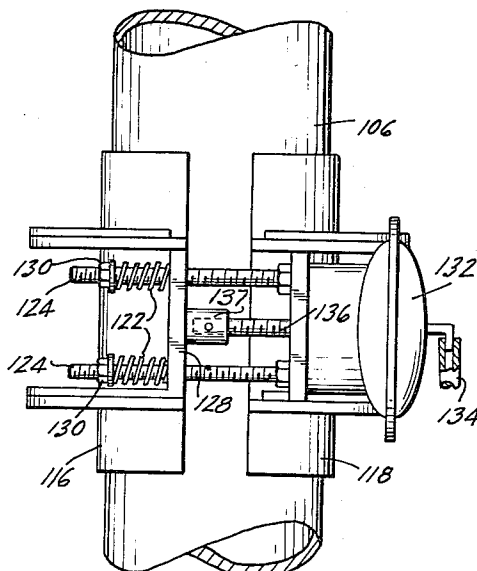


FIG. 10



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SELF-PROPELLED POST DRIVER

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Filed Sept. 20, 1961, Ser. No. 139,598

13 Claims. (Cl. 175-135)

This invention relates to a self-propelled post driver. More particularly, the invention is concerned with a mobile field unit that is adapted to hold and drive a short post in a substantially vertical position.

There is a great demand, particularly in connection with highways, for inserting posts into the ground in predetermined, usually parallel, vertical orientation. For example, one type of highway guard employs a string of spaced erect posts to which horizontal bumper rails are affixed. The posts can, of course, be set in by hand with the aid of a plumb bob or level but this is an expensive and drawn out procedure.

It also has been proposed to insert the posts with a drop hammer mounted on the bed of a truck; however this arrangement too has several drawbacks. For instance, since the drop hammer is heavy it must be rigidly secured to the base of the truck and there is, therefore, little likelihood that the drop hammer will drive vertically when the wheels of the truck are haphazardly located on the ground at the field location adjacent the site where the post is to be driven. Nor is it easy to level the truck since this requires a system of heavy jacks. Moreover, a pile driver of this type is quite costly, takes considerable time to set up for each post and necessitates the presence of a maintenance engineer due to contractual relationships with unions, although the engineer performs very little work.

It is an object of the present invention to provide a self-propelled post driver which is not subject to any of the foregoing drawbacks.

More particularly, it is an object of the invention to provide a self-propelled post driver which can quickly and accurately drive short light-weight posts at field locations in substantially true vertical positions.

It is another object of the present invention to provide a self-propelled post driver of the character described which is comparatively inexpensive and light, is composed of relatively few parts and can be used by ordinary construction workers without a maintenance or other engineer.

It is another object of the present invention to provide a self-propelled post driver of the character described which can be very rapidly adjusted to drive a post vertically despite any unevenness in the terrain and yet which will securely retain its adjusted position until the post driving operation is completed.

It is another object of the present invention to provide a self-propelled post driver of the character described which is rugged and durable in construction and is simple and easy to maintain.

It is another object of the present invention to provide a small, light self-propelled post driver of the character described which is entirely self-contained, that is to say, which carries and moves about with it its own source of post driving power.

It is another object of the present invention to provide a self-propelled post driver of the character described which can be quickly engaged with and disengaged from the posts to be driven whereby the combined set-up and driving time can be reduced to the order of a minute or less.

It is another object of the present invention to provide a self-propelled post driver of the character described

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which is versatile in its handling of the post driving unit so that the post driver can be situated at any desired location near the site at which the post is to be driven whereby the post driver can be used under any field conditions likely to be encountered.

Other objects of the invention in part will be obvious and in part will be pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts which will be exemplified in the post driver hereinafter described, and of which the scope of application will be indicated in the appended claims.

In the accompanying drawings, in which are shown one of the various possible embodiments of the invention,

FIG. 1 is a perspective view of a self-propelled post driver constructed in accordance with the present invention, the post driver unit being shown in operative position by full lines and in idle position by dot and dash lines;

FIG. 2 is an enlarged fragmentary front view of the post driver unit;

FIG. 3 is a sectional view taken substantially along the line 3-3 of FIG. 2;

FIG. 4 is a bottom view of the post driver unit;

FIG. 5 is an exploded view of the brakes for securing the post driver unit in any selected angular position with respect to the trolley and for securing the trolley at any selected point along the length of the boom;

FIG. 6 is an enlarged vertical sectional view through the brakes of FIG. 5, the same being illustrated in locked position;

FIG. 7 is a view similar to FIG. 6, but showing the brakes in open position;

FIG. 8 is a perspective partly exploded view of the brake for locking the boom in any selected angular position with respect to the mast;

FIG. 9 is a front view of the boom brake, the same being illustrated in locked position;

FIG. 10 is a view similar to FIG. 9, but showing the boom brake in open position; and

FIG. 11 is a hydraulic circuit diagram for a plumbing cylinder.

In general, the several objects of the present invention are achieved by providing a post driver which includes a plurality of cooperating elements.

One of the elements is a self-propelled steerable tractor, that is to say, a wheeled chassis on which there is mounted a prime mover, preferably an internal combustion engine, e.g., an Otto or Diesel engine. Mounted on the chassis and driven by the prime mover are two pumps, one hydraulic and the other pneumatic. The pneumatic pump supplies compressed air to a storage tank carried by the chassis. The hydraulic pump draws oil from a reservoir carried by the chassis. In addition, the prime mover has an output shaft which is connected through a clutch and transmission to one or more of the chassis wheels for driving the same about. Suitable steering means is included, e.g., a conventional steering wheel connected to the steerable front wheels of the chassis. The wheels also are provided with brakes so that during a post driving operation the chassis wheels can be locked at the driving site.

The second element of the new combination is a mast which is stepped on the mobile chassis for universal swivelling movement with respect thereto, i.e., for movement about two generally horizontal orthogonal axes, this swivelling being accomplished as with the aid of a universal (Cardan) joint.

The third element of the new combination comprises a pair of plumbing cylinders which are hydraulically operated, the power for the same being derived from the hydraulic pump. The plumbing cylinders are mu-

tually orthogonally disposed and are connected at opposite ends to the chassis and to the mast so that by proper manipulation of these cylinders through a manually controlled set of hydraulic valves the mast can be quickly vertically oriented regardless of the random angular position of the tractor chassis.

The fourth element of the new combination is a boom which is secured to the mast in fixed perpendicular relationship thereto so that when the mast is set in vertical position by the plumbing cylinders the boom will be horizontal. Moreover, the boom is mounted for rotation about an axis parallel to the longitudinal axis of the mast whereby to afford versatility in placement of the post driving unit.

The fifth element of the new combination is a trolley which rides along the boom and which supports the sixth element, the latter constituting the post driving unit. Said post driving unit is rotatable with respect to the trolley about an axis parallel to the length of the mast whereby to enable the post to be fixed in any desirable relationship with respect to surrounding objects. The post driving unit further includes a pneumatically actuated jack hammer (multiple rapid short stroke compressed air actuated hammer) which is freely vertically slidable in gibs parallel to the length of the unit and is movable along with a cage that can be detachably clamped to a post whereby when the post is positioned in the cage and the hammer actuated the post will be driven into the ground by a rapidly repeated series of comparatively mild impacts rather than the sledge-like widely spaced blows of a pile driver.

The seventh element of the new combination constitutes a group of brakes which selectively fix the boom in any angular position with respect to the mast, fix the trolley in any position along the length of the boom, and fix the post driving unit in any angular position with respect to the trolley.

Referring now in detail to the drawings, the reference numeral 20 denotes a mobile self-propelled post driver embodying the present invention and including all of the foregoing elements. The first element is a self-propelled mobile air compressor tractor 22 which is a conventional unit that is manufactured by several industrial concerns. Simply by way of example, we have shown a tractor made by Schramm, Inc., of West Chester, Pennsylvania, and known as the standard Schramm No. 125 "Pneuma-tractor."

This tractor, which can be purchased on the open market, comprises a chassis 24 consisting of a frame 26 made up of longitudinal and transverse beams. Suspended from the frame for rotation about horizontal axes are a pair of front wheels 28 and a pair of rear wheels 30. The front wheels are mounted to additionally permit rotation thereof about vertical axes under the control of a steering wheel 32, the linkage between the steering wheel and front wheels being omitted from the drawings since it is conventional. A gasoline Otto cycle engine 34 is supported on the frame 26. Said engine drives an air compressor 36 and an oil pump 38 both of these being of conventional types (the oil pump is not standard equipment on the No. 125 but is a standard accessory for the tractor). The engine is also connected through a clutch and transmission (not shown) to the rear driving wheels 30. Pressurized air from the compressor 36 is stored in a compressed air reservoir 40. Desirably a seat 42 is supplied for the driver of the tractor. This type of tractor which is indigenous to the American scene is a light weight strong rugged piece of equipment which although slow in speed, can be driven to rough construction sites and is traditionally used for a wide variety of purposes which require the field supply of compressed air. The tractor 22 is often referred to as a self-propelled self-powered air compressor.

A mast 44 is supported on the frame 26 at some convenient point, preferably near the rear of the chassis.

The lower end of the mast is stepped on the frame by a universal joint 46. Any conventional kind of universal joint may be employed as, for example, a ball at the lower end of the mast capively seated in a ball socket carried by the frame, or a Cardan joint comprising a cross-arm having one registered pair of arms rotatably connected to the mast and the other registered pair of arms which are at right angles to the first pair of arms rotatably connected to the frame. This latter type is employed in the mobile post driver 20. Universal stepping is provided in order to permit the mast to be swivelled with respect to the frame of the tractor so that when the tractor frame is in any position other than level the mast nevertheless can be arranged to assume a true vertical orientation. It will be apparent, of course, that it will be seldom indeed that the frame of the tractor is level when the tractor is driven to a field site at which a post is to be inserted, inasmuch as such a site either is on rough ground or alongside a crowned road.

To permit the operator of the mobile post driver to set the mast in vertical position two plumbing cylinders 48, 50 are provided. The first of these, to wit, the cylinder 48 is referred to as the fore-and-after plumbing cylinder and the second, the cylinder 50, as the transverse plumbing cylinder.

The fore-and-aft plumbing cylinder 48 consists of a tube 52 closed at its opposite ends and having a piston 54 (see FIG. 11) slidable lengthwise therein. A piston rod 56 is attached to the piston so as to be movable therewith. Said rod passes through, and is slidingly and sealingly journaled in, an opening in one of the closed ends of the cylinder. The other closed end of the cylinder has a shaft 58 rigidly secured thereto and extending away from the cylinder in a direction opposite and parallel to that of the piston rod 56. The shaft 58 is connected to the frame 26 at a block 60 the connection being effected through a universal joint 62. The piston rod 56 is connected to a bracket 64 secured to the mast by a universal joint 66. The block 60 is directly in front of the universal joint 46, that is to say the two universal joints 46, 62 define a line running in a front-to-back direction on the tractor.

The transverse plumbing cylinder 50 is of similar construction and is similarly connected by universal joints 68, 70 at its opposite ends to a block 72 fixedly supported on the chassis and a bracket 74 secured on the mast. The universal joints 46, 68 define a line running athwart the longitudinal axis of the tractor, i.e., perpendicular to the line defined by the universal joints 46, 62.

Both of the plumbing cylinders are hydraulically rather than pneumatically operated for a reason which soon will be apparent. Since the actuation of the two cylinders is similar, the hydraulic circuit for only one of them, the cylinder 48, is shown in FIG. 11. It there will be seen that the cylinder has a distal port 76 and a proximal port 78, the latter being the closer to the mast. High pressure oil from the oil pump 38 is led by a conduit 80 to a manually manipulatable four-way valve 82. In the position of the valve shown in FIG. 11 an internal passageway 84 connects the high pressure oil conduit to a distal conduit 86 running to the distal port 76 so that oil under pressure forces the piston 54 toward the mast. At the same time, oil on the opposite side of the cylinder exits through the proximal port 78 and a proximal conduit 88 to the valve 82 which in the position shown in FIG. 11 has a passageway 90 connecting the proximal conduit 88 to an exhaust conduit 92 leading to the oil reservoir (not shown).

Thus, the two hydraulic plumbing cylinders are connected to the mast at right angles and thereby are capable upon manipulation of their separate valves 82 of pivoting the mast about the universal joint 46 in two separate erect planes, one transversely of the other in order to secure any desired angular position of the mast, the actual position, of course, being that in which the mast

is vertical regardless of the angle of the tractor chassis. The position of the mast is checked by levels (not shown), e.g. spirit bubbles, carried by the mast, or by applying a level to different positions on the mast itself.

It will be appreciated that because the plumbing cylinders are hydraulically rather than pneumatically operated, that is to say, operated by means of an inelastic rather than an elastic fluid, the mast easily can be locked in position simply by turning the two valves 82 to disalign the passageways 84, 90 with the conduits 80, 86, 88, 92. When this is done no flow of oil can take place into or out of the cylinders whereby the set pistons 54 will rigidly hold the mast in the position to which it has been adjusted.

Suitable means is included to mount a boom 94 on the post 44 in fixed perpendicular relationship thereto and for rotation relative to the post about an axis parallel to the longitudinal axis of the latter. The boom comprises a pair of parallel channel irons 96, 98 (see FIGS. 6 and 7) which serve as rails for a trolley 100. Each channel iron includes a vertical web having horizontal upper and lower flanges. The flanges on the two channel irons extend outwardly whereby the lower flanges of said irons can function as supports for the trolley wheels.

At their outer ends the two channel irons are secured to one another, as by welding to a common closure plate 102. At their inner ends the two channel irons are secured, as by riveting, to plates 104 permanently attached as by welding, to diametrically opposed vertical sides of a vertically elongated drum 106. The lower end of the drum is supported for vertical rotation on a step bearing mounted on a horizontal plate 108 fastened to the mast 44. In a similar fashion the upper end of the drum 106 is secured for vertical rotation by a bearing 110 carried by a horizontal plate 112 attached to the tip of the mast 44. The two plates 108, 112 are in registry and the bearings carried thereby are in alignment and are parallel to the mast.

Although it is essential for operation of the mobile post driver that the boom be angularly adjustable with respect to the mast so that the tractor will not have to be jockeyed into any special position before driving the post, it is equally important that the boom be arranged to be locked in any selected angular position. To this end a brake 114 is included. Said brake comprises a pair of arcuate brake plates 116, 118, i.e. shoes, the concave inner surfaces of which are lined with a braking material such as asbestos or rubber. Said concave surfaces are shaped to match the external surface of the drum 106. The brake shoes are secured to swing levers 120 pivoted to turn about axes parallel to the length of the mast. Between them the brake shoes in closed position define a split cylindrical surface which matches to the surface of the drum and which embraces less than 360°.

Said brake shoes are strongly urged toward the drum under a force sufficient to prevent rotation of the drum. For this purpose there is included a pair of helical compression springs 122 each of which encircles a different threaded spindle 124. Both spindles are secured to the outer end of one brake shoe 118 and pass freely through openings 126 in a panel 128 fixed to the free end of the other brake shoe 116. The springs 122 are compressed between the panel 128 and adjustable nuts 130 threaded on the tips of the spindles 124. Thus the springs force the brake shoes toward one another and into clamping engagement with the drum.

To spread the brake shoes apart a pneumatic cylinder 132 is provided which is supplied with high pressure air from the reservoir 40 by a conduit 134 through an off-and-on hand controlled valve (not shown). An actuating link 136 is driven by a piston (not shown) in the cylinder 132. The pneumatic cylinder 132 is mounted on the brake shoe 118. The free end of the actuating

link is secured in a socket 137 fastened to the panel 138 on the other brake shoe 116. Thus when high pressure air is fed to the cylinder 132 the link 136 will be forced outwardly away from the cylinder and will force the brake shoes apart thereby releasing the drum 106 so that the boom is free to turn with respect to the mast about an axis parallel to the length of said mast.

The locked, i.e., effective, position of the boom brake is illustrated in FIG. 9 and the unlocked, i.e. idle, position thereof is shown in FIG. 10. It will be observed that the mobile post driver employs a fail-safe type of brake, to wit, one which holds the boom locked when power is off.

The trolley 100 supports the post driving unit 140. Said trolley includes a horizontal base 142 to which are secured as by welding a pair of parallel upstanding side plates 144. Journalled for horizontal rotation on the inner surface of each side plate are a pair of wheels 146. The wheels ride on the lower flanges of the channel irons 96, 98 so that the trolley can move in and out along the boom between limits defined by the closure plate 102 and the brake drum 106.

The upper end of the post driving unit constitutes a horizontal top frame plate 148 which is juxtaposed against the under surface of the horizontal base 142. It is desirable that the post driving unit be rotatable about an axis parallel to the length of the mast and to enable this to be accomplished a heavy erect ferrule 150 is secured as by welding to the frame plate 148 and rotatably extends through an opening 152 in the base 142. The ferrule is secured to the upper race 154 of a vertical thrust anti-friction bearing the lower race 156 of which is firmly attached to the horizontal base 142. Ball bearings ride in the races along a horizontal annular path whereby the post driving unit hangs from the trolley and can rotate with respect thereto. This gives the post driving unit two degrees of freedom, to wit, a translatory motion with the trolley along the boom and a rotational motion relative to the trolley about a substantially vertical axis perpendicular to the length of the boom.

As in the case of movement of the boom relative to the mast it is essential to include means which are selectively operable to prevent motion of the post driving unit relative to the boom and the trolley. Although a separate brake can be provided for each of the two types of motion the construction and operation of the post-driver 20 is simplified if a single brake is used for both. An exploded view of the parts of this brake is illustrated in FIG. 5 and a sectional view through the brake is shown in FIGS. 6 and 7, the former figure illustrating the brake in locked position and the latter in opened position.

The aforesaid brake is actuated by a pair of tandem pneumatic cylinders 158. It may be mentioned that two cylinders are used simply to provide symmetry of operation since, as soon will be seen, the center of the post driving unit and its connection to the trolley is left clear for the passage of a lift cable. Each of the pneumatic cylinders 158 is provided with an actuating link 160 which extends in a downward vertical direction.

The two pneumatic cylinders 158 are mounted on a horizontal support 162 which is carried in an elevated position between the channel irons 96, 98 by the horizontal base 142; thus the position of the support 162 and therefore of the pneumatic cylinders 158 is fixed with respect to the base 142. The connection between the support and base is effected, for example, by rigid struts.

Four vertical spindles 164 extend freely through openings in the support 162. Said spindles are disposed symmetrically about the center of the support, the support being centered with respect to the longitudinal axis of the ferrule 150. The lower ends of the spindles 164 are attached securely to a common horizontal trolley brake shoe 166 which is located beneath the lower flanges of the channel arms 96, 98. The brake shoe is provided

with brake linings 168 made, for example, of asbestos or rubber and which are designed under circumstances soon to be described, to be pressed against the undersurfaces of the lower flanges of the channel irons. It will be appreciated that the spindles 164 move longitudinally of the boom with the support 162 which in turn is fast to the horizontal base 142 of the trolley so that if the brake linings 168 are frictionally engaged with the channel irons 96, 98 the trolley will be prevented from moving along the boom.

A horizontal rotary brake shoe 170 is located directly beneath the horizontal support 162, the upper surface of the shoe 170 carrying a brake lining 172 designed to be pressed against the under surface of said support. The rotary brake shoe has a tubular dependent sleeve 174 integral therewith which sleeve is coaxial with the ferrule 150. The external surface of the upper end of the ferrule 150 is longitudinally splined as indicated by the reference numeral 176. The interior of the sleeve 174 is matchingly splined as indicated by the reference numeral 178. The sleeve and ferrule are in partially telescopic relationship whereby to permit relative longitudinal movement thereof but to prevent relative rotational movement.

All of the spindles 164 have fixed collars 180 pinned thereon. Although said spindles 164 are clear of the periphery of the rotary brake shoe 170 which latter preferably is circular the collars 180 protrude beneath said shoe so that they actually carry, i.e., support, the brake shoe 170.

The upper ends of the vertical spindles are threaded to receive stop nuts 182. Helical compression springs 184 encircle the upper ends of the spindles and are held under compression between the nuts 182 and the horizontal support 162. The two pneumatic cylinders 158 are adapted to be supplied with compressed air through conduits 186 which actuate the two cylinders simultaneously.

To explain the operation of the trolley and post driving unit brake let it be assumed that no air under pressure is being supplied to the pneumatic cylinders 158 this being the condition illustrated in FIG. 6. The springs 184 press upwardly against the stop nuts 182 thereby urging the spindles 164 upwardly. This causes the collars 180 to press the brake lining 172 upwardly against the support 162 so that the tubular sleeve 174 is prevented from rotating. But since this sleeve is rotationally tied to the ferrule 150 the horizontal top frame plate 148 of the post driving unit is locked against rotation. At the same time lifting of the spindles 164 raises the brake shoe 166 to urge the brake linings 168 against the channel arms thereby preventing movement of the trolley 142 along the boom. Since the ferrule 150 is a snug rotatable fit in the opening 152 this locking action effective on the base 142 of the trolley also functions to prevent movement of the post driving unit along the boom.

If now a manually operable off-on valve (not shown) in the line supplying compressed air to the conduit 186 is actuated to admit high pressure air to said conduit the pneumatic cylinders 158 will be energized to depress their actuating links 160. The lower tips of said links are adjacent the upper surface of the horizontal trolley brake shoe 166 so that upon energization of the pneumatic cylinders the shoe 166 will be lowered thereby disengaging the brake linings 168 from the channel irons to free the trolley and therefore the post driving unit for movement along the boom. Concurrently the rotary brake shoe 170 will be dropped since the collars 180 will be depressed. Thereby the ferrule 150 and post driving unit will be left free to turn. Hence when compressed air is cut off from the conduit 186 the trolley will be locked in some selected position along the length of the boom and the post driving unit will be locked in some selected angular position with respect to the trolley; and when compressed air is supplied to said conduit the position

of the trolley and the position of the post driver unit can be adjusted to locate said unit directly above the site where the post is to be driven.

As indicated heretofore the upper end of the post driving unit 140 constitutes the horizontal top frame plate 148 that moves with the trolley along the boom and that can turn with respect to the trolley about an axis parallel to the length of the mast 44. Depending from diametrically opposite marginal zones of the plate 148 are a pair of vertical channel irons 188 the side flanges of which extend toward one another. The channel irons are secured as by welding to the under surface of the plate 148 and are braced by gussets 190. Said channel irons are perpendicular to the boom 94 and are parallel to the mast 44.

Located on the inner faces of the main webs of the channel irons and extending toward one another are vertical gibs 192 which are arranged in parallelism. The pair of gibs on each of the channel irons is formed by a pair of spaced parallel angle irons which, in effect, constitute rails. Slidable between these rails are a pair of vertically elongated shoes 194 each of which constitutes the main web of a T-iron. The rails are coplanar and are smoothly slidable in the gibs so as to be guided for vertical movement. The head flanges of the T-irons are secured to a cage 196 which in effect constitutes an erect trough having a back wall 198 and side walls 200. Actually it is the lower ends of the T-irons 194 that are secured, as by rivets or bolts, to the upper end of the cage. The upper ends of the T-irons are bridged by a spacer plate 202. Thus the cage is guided for vertical movement within and as part of the post driving unit.

A bracket 206 for a pneumatic hammer 208 is located in the space between the top wall 204 of the cage and the spacer plate 202. Said bracket is connected to the top wall 204 and is provided with a horizontal shelf 210 to which the lower end of the casing of the pneumatic hammer is affixed. The upper end of said casing may be positioned between guides 212 extending inwardly from the T-irons whereby the pneumatic hammer is held in place in erect position above the cage.

The impact tip of the pneumatic hammer rests on the top wall 204 of the cage. The pneumatic hammer is of a standard type which has a rapidly reciprocating internal piston in the casing which will intermittently drive the impact element 214 downwardly. Compressed air is supplied to the hammer for actuation thereof by a conduit 216 running to the compressed air reservoir 40. A hand valve (not shown) is included to place the pneumatic hammer under the control of the operator.

The cage is suspended between the gibs 192 at one end of a lift cable 218 which extends through the ferrule 150 and through central openings in the rotary brake shoe 170, the lining 172 and the horizontal support 162. Said cable is guided around a plurality of idler sheaves 220 carried by the trolley 100. The cable has two parallel reaches thereof trained about a vertically reciprocable sheave 222 journaled between the legs of a fork 224 that is supported by a rod 226. Said rod is connected to a piston (not shown) slidable in a vertical pneumatic cylinder 228 mounted on the trolley. The piston is arranged to be driven downwardly by compressed air. The other end of the cable, i.e. the end opposite to that connected to the cage, is fast to the trolley so that when the piston is actuated and the sheave 222 driven downwardly the cage will be raised. No means is provided for driving the fork 224 upwardly.

The front of the cage 196 is open so that a post 230 can be inserted therein. The lower ends of the vertical supporting channel irons 188 are spaced above the ground a distance which preferably is slightly greater than the height which the driven posts are to extend from the ground. When the sheave 222 is at the bottom of its travel the top wall 204 of the cage is sufficiently

far from the ground to permit the insertion of a post 230 into the cage.

The post is removably held within the cage by a permanent bridging strap 232 near the top of the cage and spanning the front thereof. For the same purpose there is provided a swing strap 234 at a lower level and also spanning the front of the cage. One end of the swing strap turns on a horizontal pivot 236 carried by a side wall 200 of the cage while the strap adjacent its other end is adapted to be received in an upwardly extending hook 238 secured to the opposite side wall of the cage. When the swing strap 234 is raised it exposes the front of the cage and permits a post 230 to be inserted into the cage under the permanent strap 232. Then when the swing strap is lowered it will captively hold the post in the cage (except for downward movement). Now when the compressed air is cut off from the cylinder 228 the cage will drop until it touches the top of the post, the post already being in contact with the ground, in other words the cage telescopically slides down on the post while holding the post in a true vertical position. With the bottom of the post engaging the ground and the top wall 204 butting against the top of the post, the pneumatic hammer is energized and it will proceed to drive the cage downward so as to force the post into the ground and at the same time it will raise the sheave 222.

The lower ends of the supporting channel irons 188 are maintained in proper spaced relationship by a U-shaped brace 240.

It thus will be seen that I have provided a post driver which achieves the several objects of this invention, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

1. A self-propelled post driver comprising, a self-propelled tractor having a chassis, an erect elongated mast, swivel means mounting the lower end of said mast on said tractor chassis for universal movement with respect thereto, controllably extensible elongated elements having their longitudinal axes disposed in substantially vertical planes oriented substantially at right angles to one another and passing through the longitudinal axis of the mast, each of said elements having one end pivotally connected to the mast above the lower end of said mast and the other end pivotally connected to the tractor chassis for adjustable pivotal movement of said mast with respect to the tractor about the swivel means in two separate erect planes, one transversely of the other intersecting at the swivel means, a boom, means securing said boom to said mast at an angle of 90° with respect thereto, a trolley, means mounting the trolley for movement along the length of the boom, a post driving unit connected to the trolley, means mounting the post driving unit for rotation with respect to the trolley about a driving axis parallel to the length of the mast, and selectively operable brake means for fixing the trolley anywhere along the length of the boom and fixing the post driving unit in any angular position about said driving axis, said post driving unit including a pneumatically actuable jack hammer, a cage arranged to be driven by said hammer, and means guiding said cage for movement in said unit in a direction parallel to said driving axes.

2. A self-propelled post driver comprising, a self-propelled tractor having a chassis, an erect elongated mast, swivel means mounting the lower end of said mast on said tractor chassis for universal movement with respect thereto, controllably extensible elongated elements having their longitudinal axes disposed in substantially

vertical planes oriented substantially at right angles to one another and passing through the longitudinal axis of the mast, each of said elements having one end pivotally connected to the mast above the lower end of said mast and the other end pivotally connected to the tractor chassis for adjustable pivotal movement of said mast with respect to the tractor about the swivel means in two separate erect planes, one transversely of the other intersecting at the swivel means, a boom, means securing said boom to said mast at an angle of 90° with respect thereto, a trolley, means mounting the trolley for movement along the length of the boom, a post driving unit connected to the trolley, means mounting the post driving unit for rotation with respect to the trolley about a driving axis parallel to the length of the mast, and selectively operable brake means for fixing the trolley anywhere along the length of the boom and fixing the post driving unit in any angular position about said driving axis, said post driving unit including a pneumatically actuable jack hammer, a cage arranged to be driven by said hammer, means guiding said cage for movement in said unit in a direction parallel to said driving axis, and means for detachably securing a post in said cage.

3. A self-propelled post driver comprising, a self-propelled tractor having a chassis, an erect elongated mast, swivel means mounting the lower end of said mast on said tractor chassis for universal movement with respect thereto, controllably extensible elongated elements having their longitudinal axes disposed in substantially vertical planes oriented substantially at right angles to one another and passing through the longitudinal axis of the mast, each of said elements having one end pivotally connected to the mast above the lower end of said mast and the other end pivotally connected to the tractor chassis for adjustable pivotal movement of said mast with respect to the tractor about the swivel means in two separate erect planes, one transversely of the other intersecting at the swivel means, a boom, means securing said boom to said mast for rotation around the mast in a plane at 90° with respect to the length of the mast, a trolley, means mounting the trolley for movement along the length of the boom, a post driving unit connected to the trolley, means mounting the post driving unit for rotation with respect to the trolley about a driving axis parallel to the length of the mast, and selectively operable brake means located at the boom securing means and at the trolley for fixing the angular position of the boom about the length of the mast, fixing the trolley anywhere along the length of the boom and fixing the post driving unit in any angular position about said driving axis, said post driving unit including a pneumatically actuable jack hammer, a cage arranged to be driven by said hammer, means guiding said cage for movement in said unit in a direction parallel to said driving axis, and means for detachably securing a post in said cage.

4. A self-propelled post driver comprising, a self-propelled tractor having a chassis, an erect elongated mast, swivel means mounting the lower end of said mast on said tractor chassis for universal movement with respect thereto, a pair of orthogonally disposed hydraulic plumbing cylinders connecting said mast above the lower end thereof to said tractor chassis for pivotal movement of said mast with respect to the tractor about the swivel means in two separate erect planes, one transversely of the other intersecting at the swivel means, a boom, means securing said boom to said mast for rotation around the mast in a plane at 90° with respect to the length of the mast, a trolley, means mounting the trolley for movement along the length of the boom, a post driving unit connected to the trolley, means mounting the post driving unit for rotation with respect to the trolley about a driving axis parallel to the length of the mast, and selectively operable brake means located at the boom securing means and at the trolley for fixing the angular position of the boom about the length of the mast, fixing

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the trolley anywhere along the length of the boom and fixing the post driving unit in any angular position about said driving axis, said post driving unit including a pneumatically actuatable jack hammer, a cage arranged to be driven by said hammer, means guiding said cage for movement in said unit in a direction parallel to said driving axis, and means for detachably securing a post in said cage.

5. A self-propelled post driver as set forth in claim 4 wherein the self-propelled tractor includes a prime mover carried by the tractor chassis, an air compressor driven by the prime mover for supplying compressed air to the jack hammer and for operating the brake means, and a hydraulic pump driven by the prime mover for supplying hydraulic fluid under pressure to the plumbing cylinders.

6. A self-propelled post driver as set forth in claim 4 wherein the opposite ends of the plumbing cylinders are hydraulically connected to plural position valve means operable for selectively connecting each end of either cylinder to a hydraulic fluid under pressure and the other end of either cylinder to a reservoir, or for blocking said ends whereby said plumbing cylinders can adjust the mast to a selected position and then by having their ends blocked, lock the mast in such position.

7. A self-propelled post driver as set forth in claim 4 wherein the swivel means mounting the lower end of the mast on the tractor is a Cardan joint.

8. A self-propelled post driver as set forth in claim 4 wherein the means securing the boom to the mast comprises a pair of vertically registered elements fixedly secured to the mast in spaced relationship along the length of the mast, a vertically elongated element fixedly secured to the boom, and disposed between said spaced elements, and means journalling opposite ends of said elongated element in vertical alignment to the elements fixed to the mast.

9. A self-propelled post driver as set forth in claim 4 wherein the brake means includes a first selectively operable brake for fixing the boom with respect to the mast

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and a pair of selectively operable brakes actuated in common for fixing the trolley along the length of the boom and fixing the post driving unit with respect to the trolley.

10. A self-propelled post driver as set forth in claim 4 wherein a pneumatic cylinder is included for raising the cage.

11. A self-propelled post driver as set forth in claim 4 wherein the means guiding the cage for vertical movement constitutes a pair of vertical gibs supported by the trolley and slidably engaged by shoes carried by the cage.

12. A self-propelled post driver as set forth in claim 4 wherein the brake means for fixing the angular position of the boom about the length of the mast includes a drum rotatable with the boom, a brake shoe pivoted on the mast and spring biased against the drum, and a selectively operable pneumatic cylinder for urging the shoe away from the drum.

13. A self-propelled post driver as set forth in claim 4 wherein the brake means for fixing the trolley along the length of the boom and fixing the angular position of the post driving unit about the driving axis comprises a brake shoe carried by the trolley and mounted for movement toward and away from the boom and a brake shoe carried by the post driving unit and mounted for movement toward and away from the trolley, means connecting said brake shoes to one another for joint movement, spring means for biasing said brake shoes towards the boom and trolley, and a pneumatic cylinder for urging said brake shoes in an opposite direction.

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