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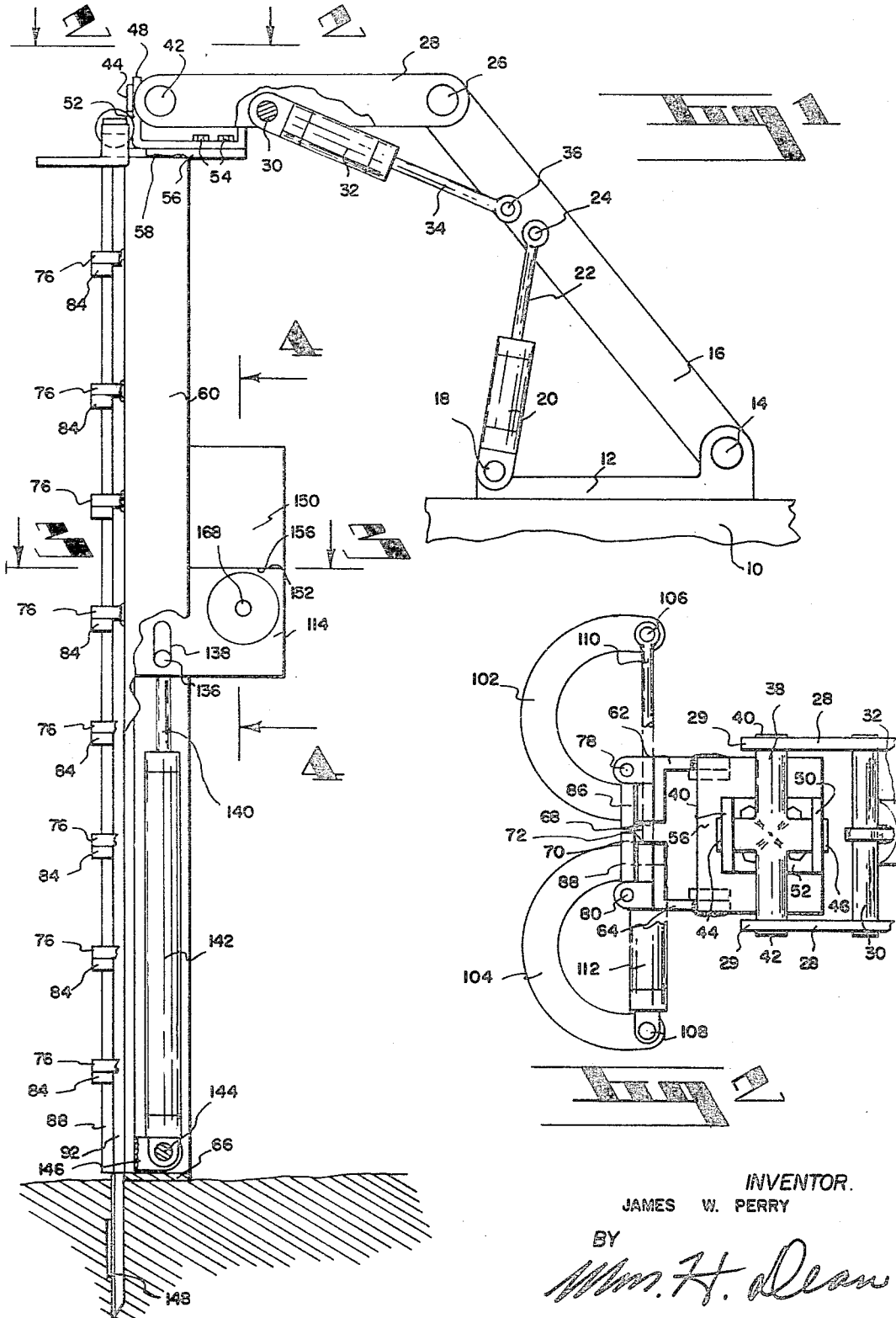
J. W. PERRY

3,302,731

POST DRIVING AND COMPACTING MACHINE

Filed Sept. 27, 1965

7 Sheets-Sheet 1



INVENTOR.

JAMES W. PERRY

BY

*Wm. H. Dean*

Feb. 7, 1967

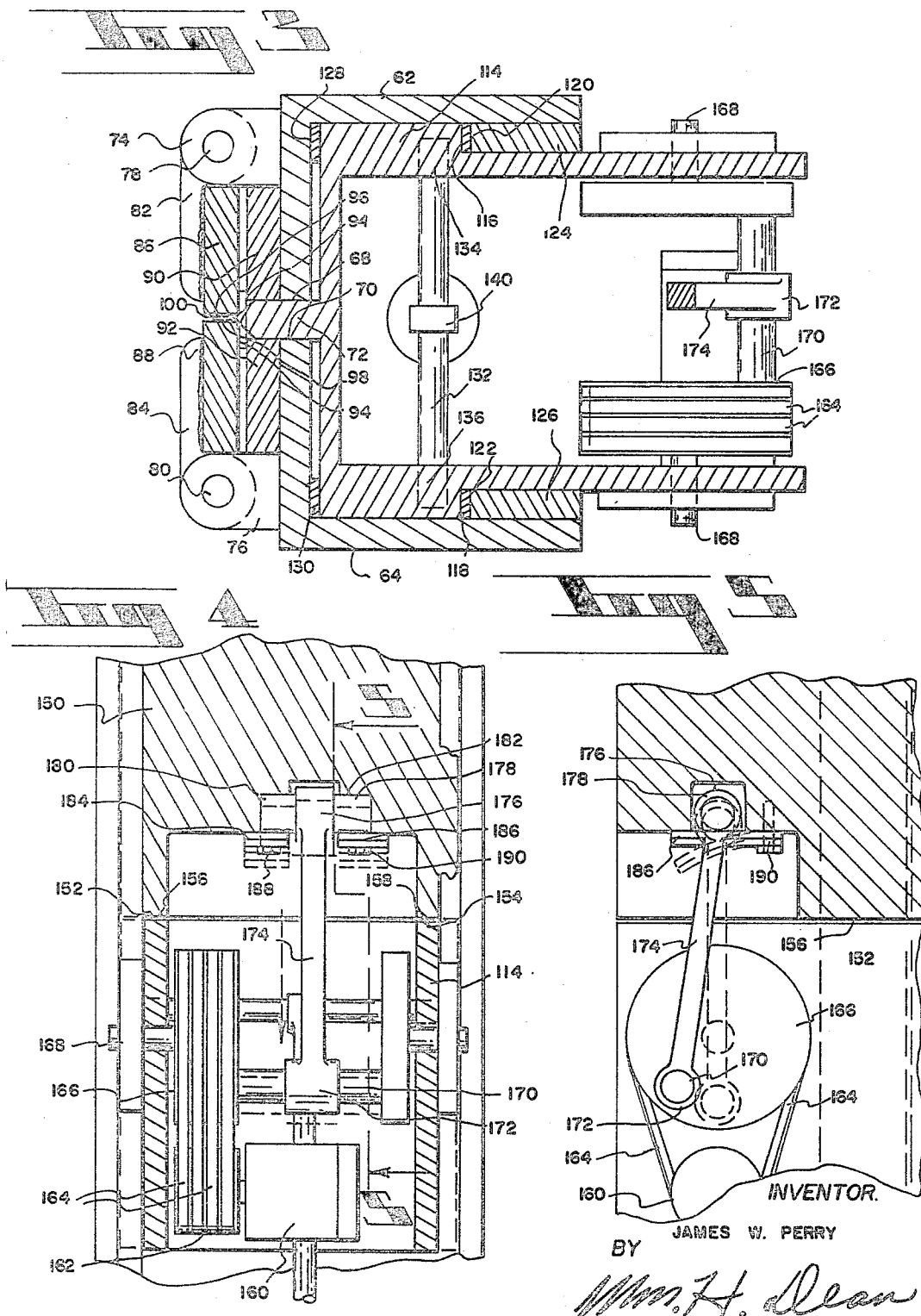
J. W. PERRY

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POST DRIVING AND COMPACTING MACHINE

Filed Sept. 27, 1965

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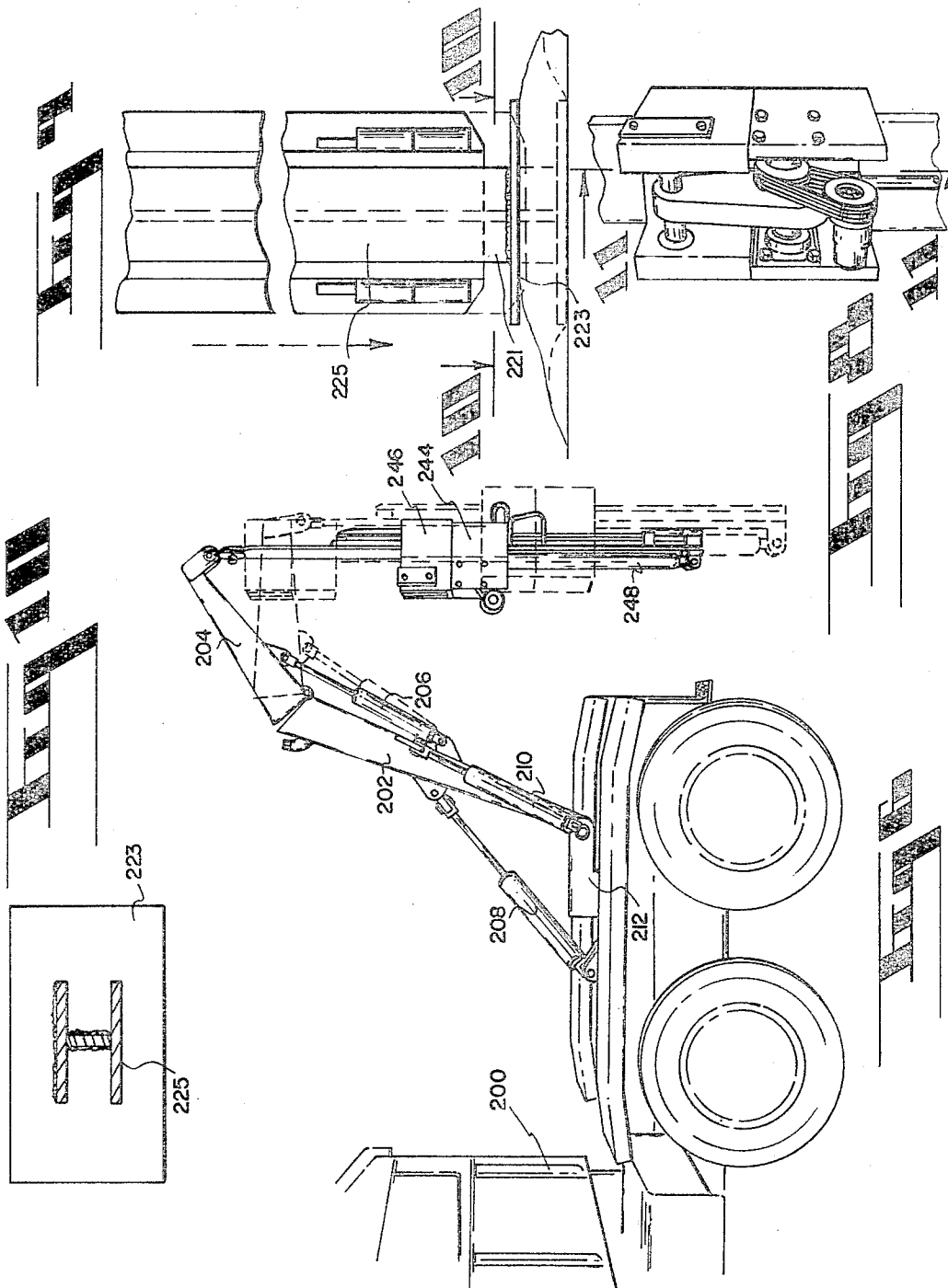
J. W. PERRY

3,302,731

POST DRIVING AND COMPACTING MACHINE

Filed Sept. 27, 1965

7 Sheets-Sheet 3



INVENTOR

BY JAMES W. PERRY

*Wm. H. Dean*

Feb. 7, 1967

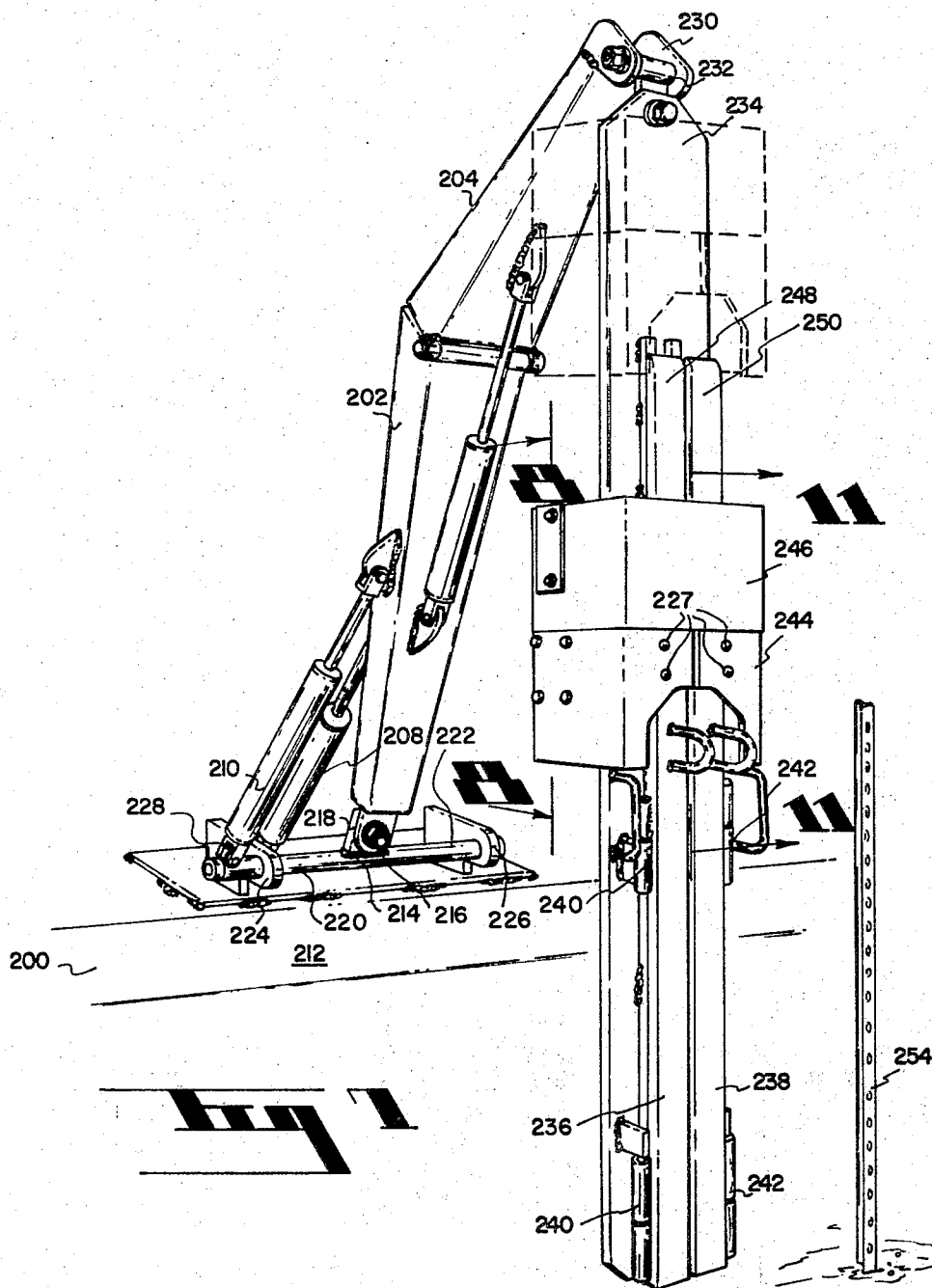
J. W. PERRY

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POST DRIVING AND COMPACTING MACHINE

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7 Sheets-Sheet 4



INVENTOR

JAMES W. PERRY

BY

*Wm. H. Dean*

Feb. 7, 1967

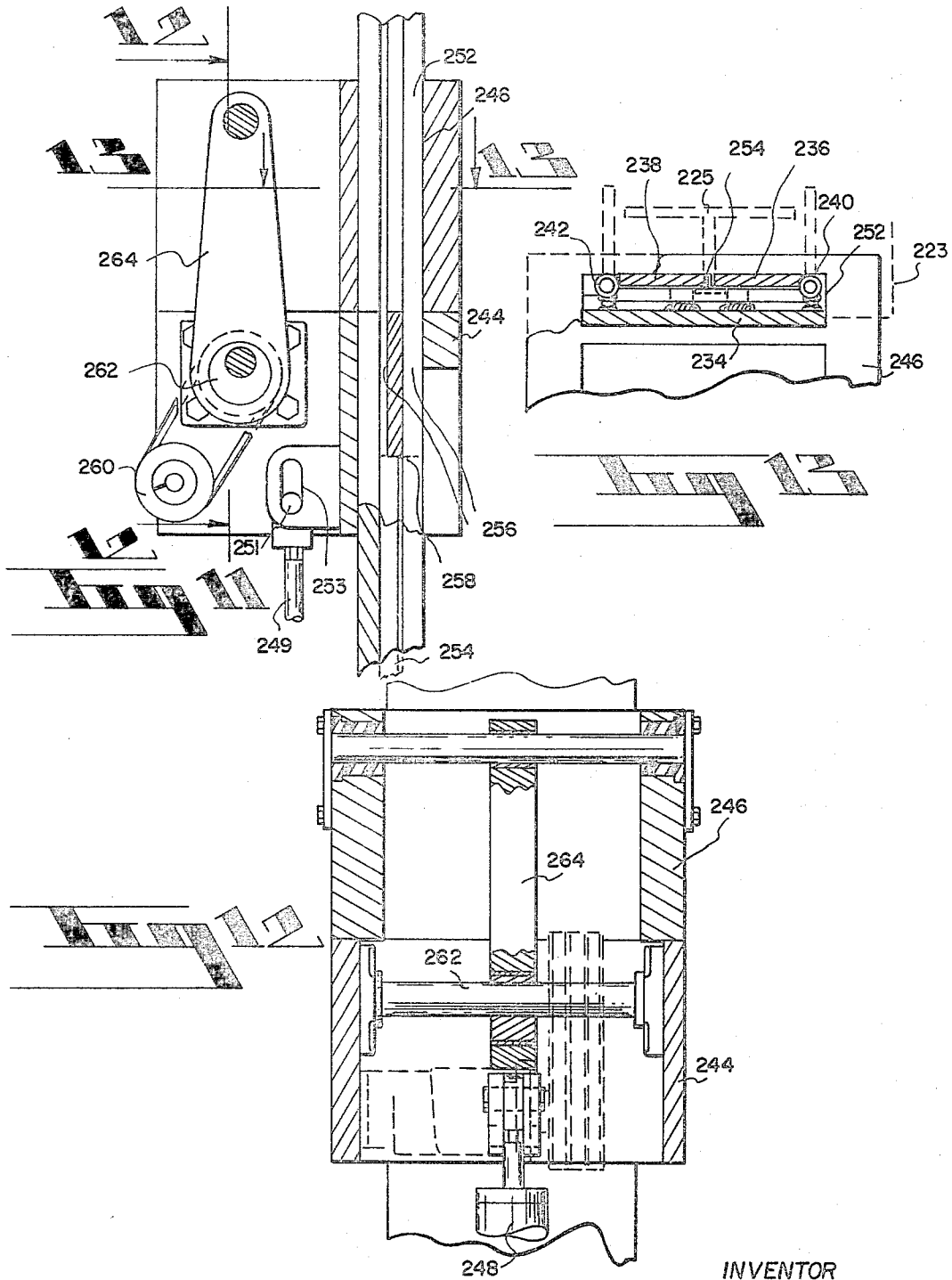
J. W. PERRY

3,302,731

POST DRIVING AND COMPACTING MACHINE

Filed Sept. 27, 1965

7 Sheets-Sheet 5



INVENTOR  
JAMES W. PERRY

BY

*Wm. H. Dean*

Feb. 7, 1967

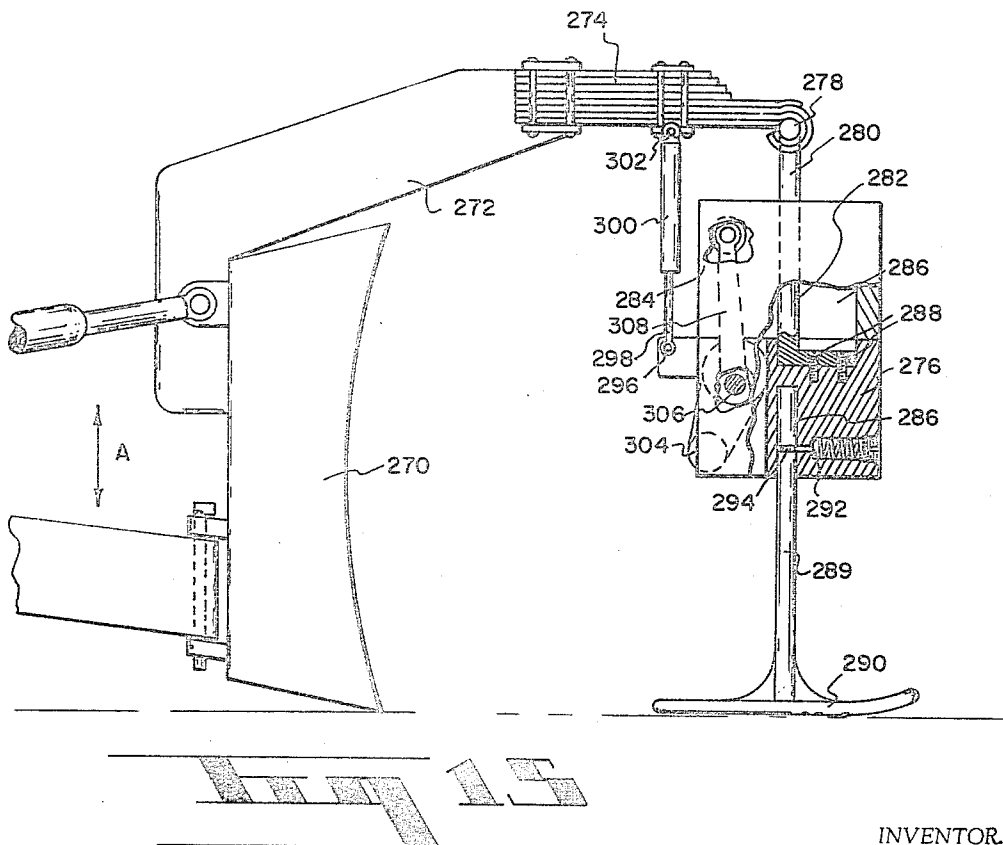
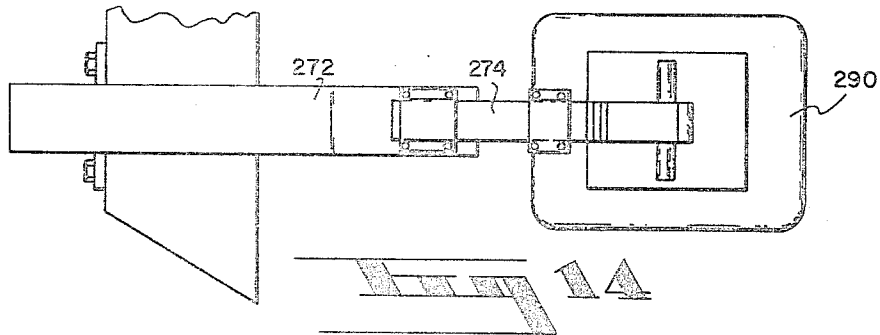
J. W. PERRY

3,302,731

POST DRIVING AND COMPACTING MACHINE

Filed Sept. 27, 1965

7 Sheets-Sheet 6



INVENTOR.  
JAMES W. PERRY

BY

*Wm. H. Dean*

Feb. 7, 1967

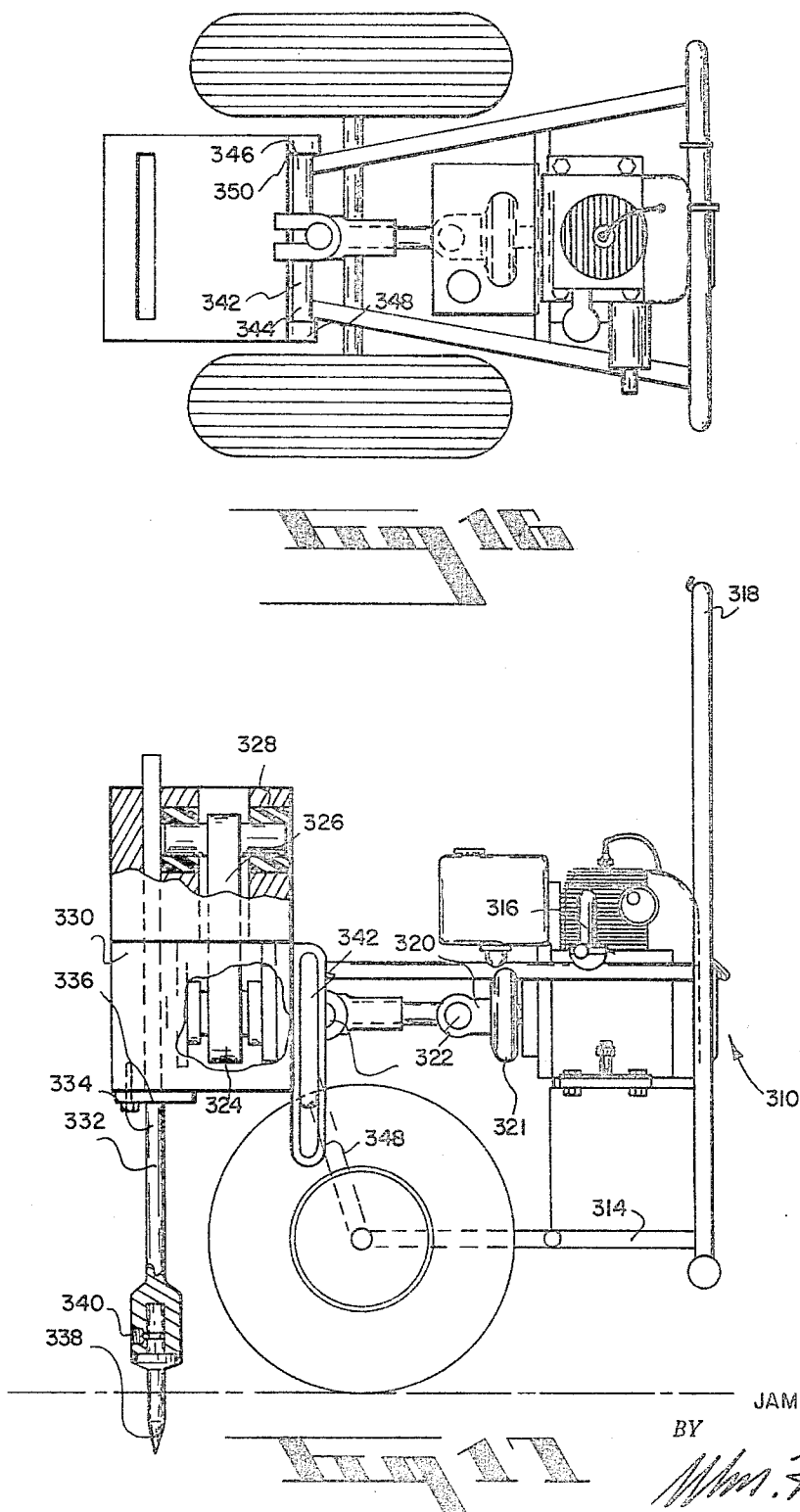
J. W. PERRY

3,302,731

POST DRIVING AND COMPACTING MACHINE

Filed Sept. 27, 1965

7 Sheets-Sheet 7



INVENTOR.

JAMES W. PERRY

BY

*Wm. H. Dean*

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3,302,731

**POST DRIVING AND COMPACTING MACHINE**  
James W. Perry, 302 W. Coulter, Phoenix, Ariz. 85013  
Filed Sept. 27, 1965, Ser. No. 490,195  
13 Claims. (Cl. 173-112)

This application is a continuation-in-part of my co-pending patent application, Serial No. 426,125, filed January 18, 1965.

This invention relates to a post driving and compacting machine, and more particularly to a post driving and compacting machine for driving metal fence posts, such as the conventional T-shaped in cross-section fence posts commonly used for supporting barbed or mesh wire and for compacting earthen fill in trenches, or the like.

It has been a problem economically and practically to provide a post driving machine which will efficiently drive metal posts into the ground and into very hard or rocky soil, and while driving such posts, to maintain them in vertical disposition and to hold them straight while driving them into the ground.

Further, it has been a problem to drive metal fence posts into the ground without battering and damaging these posts, particularly when they are driven into very hard or rocky soil.

Other difficulties encountered in driving fence posts into the ground have included the matter of vertical alignment of such posts under various post driving conditions, particularly uneven terrain, and from vehicles operated or disposed on uneven terrain when moving from one fence post to driving position to the next.

Additionally, many problems have been encountered relative to impact machines for compacting earthen fill above utility facilities in trenches. It has been a problem to attain suitable compaction of soil and materials in utility trenches, such that further settling or percolation may cause eventual breakdown of a roadway or other area in which a utilities trench is disposed and filled. Many prior art impact devices have been used for compacting soil in trenches, however, many of these devices have been relatively expensive or have been used manually.

Accordingly, it is an object of the present invention to provide a very efficient and very simple fence post driving machine which may be used very quickly and rapidly to drive fence posts in various terrain.

Another object of the invention is to provide a fence post machine having novel means for vertically aligning and guiding fence posts during the driving thereof into the ground.

Another object of the invention is to provide a novel fence post driving machine having very efficient post holding and guiding means which automatically aligns itself vertically and which prevents deformation of the fence post during the power driving thereof into the ground.

Another object of the invention is to provide a fence post driving machine which very efficiently holds and guides a fence post while a driving member engages the upper end of the post and which is preloaded thereagainst so that an impact means on the driving machine of the invention may pound the post into the ground while it is initially preloaded vertically to thereby avoid battering of the upper end of the fence post and also to effectively drive the post with a minimum amount of time and power.

Another object of the invention is to provide a very novel post driving machine in which a fence post may be preloaded vertically with respect to its driving position into the ground by a substantial portion of a vehicle carrying the machine, and whereupon additional

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vertical impact forces may successively be applied to the post under its vertically preloaded condition, thereby efficiently driving the post into very hard or rocky ground with a minimum amount of time and power.

Another object of the present invention is to provide a post driving machine which is mounted on a mobile ground supported vehicle frame which may be moved along various terrain from one post driving position to another, and which may be disposed in a variety of angular positions while the machine of the invention automatically aligns itself vertically to dispose the post guiding means in a vertical position, so that all posts are precisely aligned vertically regardless of the angular disposition of the carrying vehicle as it is disposed in a position to support the machine while driving a post.

A further object of the invention is to provide a very novel impact machine particularly adapted for use in compacting earth or other materials above public utility facilities, such as water, gas, electrical and telephone facility conduits in such trenches and particularly to attain sufficient compaction of soil thereabove to meet the standards of compaction compatible with the maintenance of support in a roadway, or the like.

Another object of the present invention is to provide an impact machine which is particularly adapted for use in driving posts, compacting soil, cutting and breaking paving or concrete curbs and also capable of breaking and splitting rocks, or the like.

Another object of the invention is to provide a very efficient portable post driving and compacting machine which may be carried on a four-wheel drive or other vehicle for very efficiently and quickly driving fence posts or compacting soil in a great variety of terrain.

Other objects and advantages of the invention may be apparent from the following specification, appended claims and accompanying drawings, in which:

FIG. 1 is a side elevational view of a post driving machine of the invention shown with a post partially driven into the ground and illustrating a ground supported vehicle frame fragmentarily; said vehicle frame being that of a mobile unit, such as a four-wheel drive vehicle or other comparable machine;

FIG. 2 is a fragmentary enlarged top or plan view of the machine taken from the line 2-2 of FIG. 1;

FIG. 3 is an enlarged plan sectional view taken from the line 3-3 of FIG. 1;

FIG. 4 is an enlarged fragmentary sectional view taken from the line 4-4 of FIG. 1;

FIG. 5 is a fragmentary sectional view taken from the line 5-5 of FIG. 4;

FIG. 6 is a side elevational view of a post driving and compacting machine comprising a modification of the present invention mounted on a fragmentary portion of a vehicle and illustrating by broken lines varying positions of the structure of the machine;

FIG. 7 is an enlarged perspective view of the modification shown in FIG. 6 and illustrating a post to be driven in relation to the machine, but not engaged thereby;

FIG. 8 is a fragmentary perspective view taken from the line 8-8 of FIG. 7;

FIG. 9 is a fragmentary front elevational view of the lower portion of the machine shown in FIG. 6 and illustrating a compacting shoe coupled in relation to the machine;

FIG. 10 is a plan sectional view taken from the line 10-10 of FIG. 9 showing the cross-section of the shank of the compaction shoe illustrated in FIG. 9;

FIG. 11 is an enlarged fragmentary sectional view taken from the line 11-11 of FIG. 8;

FIG. 12 is a sectional view taken from the line 12—12 of FIG. 11;

FIG. 13 is a fragmentary sectional view taken from the line 13—13 of FIG. 11 showing the structure rotated substantially 90 degrees;

FIG. 14 is the top or plan view of a modification of the present invention;

FIG. 15 is a side elevational view of the modification shown in FIG. 14 and illustrating portions of the structure broken away and in section to amplify the illustration;

FIG. 16 is a top or plan view of a further modification of the invention; and

FIG. 17 is a side elevational view of the structure shown in FIG. 16 and illustrating further portions broken away and in section to amplify the illustration.

As shown in FIG. 1 of the drawings, a ground supported vehicle frame 10 may be the frame of any suitable vehicle, such as a four-wheel drive vehicle adapted to be driven in rough country, or the frame 10 may be ground supported in any other manner, as desired.

A mounting bracket 12 is fixed to the frame 10 and is provided with a pivot pin 14 on which a lower end of an arm 16 is pivotally mounted. A pivot pin 18 mounted on the bracket 12 pivotally mounts a lower end of a hydraulic cylinder 20 having a plunger 22 pivotally mounted by a pin 24 to an intermediate portion of the pivoted arm 16. A normally upper end of the arm 16 carries a pivot pin 26 to which is pivotally connected one end of links 28. A mounting pin 30 mounts a hydraulic cylinder 32 pivotally on an intermediate portion of the links 28, while a plunger 34 of the cylinder 32 is pivotally mounted to an intermediate portion of the arm 16 by means of a pin 36. The hydraulically powered cylinders 20 and 32 are, thus, capable of swinging the arm 16 and the links 28 outwardly and/or upwardly, as will be hereinafter described.

Pivotally mounted between the links 28 is a universal joint member 38 having axially aligned and opposed trunnions 40 and 42 which are pivotally mounted in extending end portions 29 of the links 28.

The universal joint member 38 is provided with a second pair of trunnions 44 and 46 which are disposed at substantially right angles to the trunnions 40 and 42. These trunnions 44 and 46 are pivotally mounted in a pair of upstanding portions 48 and 50, respectively, of a suspension bracket 52 which is fixed by means of bolts 54 to an arm 56 welded or otherwise secured to an upper end 58 of a post holding and guiding frame 60. The post holding and guiding frame 60 is composed of a pair of structural L-shaped in cross-section members 62 and 64 having their upper ends fixed together in connection with the bracket 56 by welding or otherwise, as hereinbefore described, and the lower ends of these L-shaped in cross-section members 62 and 64 are fixed together by means of a plate 66 welded thereto in a similar manner to the connection of the bracket 56 therewith. Thus, the L-shaped in cross-section frame members 62 and 64 are fixed together and are disposed such that adjacent edge portions 68 and 70 of these L-shaped in cross-section members 62 and 64 are spaced apart sufficiently to permit vertical passage therebetween of a post engaging member 72, shown in FIGS. 2 and 3 of the drawings.

Fixed to the frame member 62 is a plurality of bracket elements 74 and fixed to the frame member 64 is a plurality of bracket elements 76. These elements 74 and 76 are vertically spaced along the frame members 62 and 64, as shown best in FIG. 1 of the drawings. Pivotally connected to the elements 74 and 76 by means of pins 78 and 80, respectively, are arms 82 and 84, respectively. These arms 82 and 84 carry guides 86 and 88 adapted to guide fence posts adjacent to guide bars 90 and 92, as will be hereinafter described. The bars 90 and 92, as shown in FIG. 3, are fixed to the angle frame members 62 and 64 and the bracket ele-

ments 74 and 76 support the guides 86 and 88 in slightly spaced relation with the bars 90 and 92, respectively, whereby flanges 94 of a T-shaped in cross-section post may be disposed between the guides 86 and 88 and the bars 90 and 92.

Adjacent edge portions 96 and 98 of the guides 86 and 88, respectively, are spaced apart to receive one center flange 100 of a T-shaped in cross-section post, all as shown best in FIG. 3 of the drawings.

Fixed to the guides 86 and 88 are actuator arms 102 and 104, respectively. These actuator arms 102 and 104 are provided with pivot pins 106 and 108, which respectively pivotally mount a plunger 110 and its respective hydraulic cylinder 112. The axis of the cylinder and the plunger being inward of the pins 78 and 80, whereby retraction of the plunger 110 into the cylinder 112 causes pivotal locking of the guide bars 86 and 88 in a position, as shown in FIG. 3, wherein the guides 86 and 88 are in spaced relation with the bars 90 and 92 and the adjacent edges 96 and 98 of the guides 86 and 88 are spaced so that a T-shaped in cross-section post may be disposed in vertical guided position, and whereby the post engaging member 72 may engage an upper end of a post at the intersection of its T-shaped flange structures, all as shown best in FIGS. 2 and 3 of the drawings.

The post engaging member 72 is fixed on a hammer carriage 114 which is vertically slidably mounted in the post guiding frame 60 and between the frame members 62 and 64, as shown in FIG. 5. This hammer carriage 114 is provided with gib portions 116 and 118 engaged by bearings 120 and 122 held by bars 124 and 126 fixed to the inner sides of the frame members 62 and 64 to, thus, retain frontal portions of the hammer carriage in sliding relationship with gib bearings 128 and 130. Thus, the hammer carriage is vertically slidably movable in the post holding and guiding frame 60.

A rod 132 is provided with opposite ends 134 and 136 mounted in respective slots 138, shown in FIG. 1 of the drawings. These slots 138 are disposed in opposite sides of the hammer carriage 114 and permit relative vertical movement of the rod 132 to which a plunger 140 of a hydraulic cylinder 142 is connected. Thus, the plunger 140 is connected to the bar 136 and a pin 144 pivotally mounts the hydraulic cylinder 142 to a bracket 146 fixed to the frame members 62 and 64. Thus, retraction of the plunger 140 may tend to urge the hammer carriage 114 downwardly.

The plunger 140 is sufficiently long to move the hammer carriage 114 upwardly to a position considerably above that shown in FIG. 1 of the drawings, so that the post engaging member 72 may be engaged with the upper end of a substantially long fence post, such as that shown at 148 in FIG. 1 of the drawings.

A hammer 150 is vertically slidably mounted on the frame members 62 and 64 in a manner similar to the vertical mounting of the hammer carriage 114, however, the hammer 150 is vertically movably mounted relative to upper edge portions 152 and 154 of the hammer carriage 114, as shown in FIG. 4 of the drawings. Lower edge portions 156 and 158 of the hammer carriage are adapted to pound on the upper edge portions 152 and 154 of the hammer carriage 114 to create impact loading on the member 72, which is firmly engaged with the upper end of a post 148 by retraction of the plunger 140 of the hydraulic cylinder 142.

Mounted in the hammer carriage 114 is a hydraulic motor 160 having a sheave 162 engaged by belts 164 which pass over another sheave 166 mounted on a crankshaft 168. A crank pin 170 of the crankshaft is engaged by a bearing 172 of a connecting rod 174 which is provided, at its normally upper end, with a wrist pin bearing 176. This wrist pin bearing 176 surrounds a wrist pin 178 which is mounted in bearing cradles 180 and 182 in the hammer 150.

Plate springs 184 and 186 are secured by bolts 188 and 190 to the hammer 150 and these plate springs 184 and 186 engage lower portions of the wrist pin 178 below the cradle portions 180 and 182. Thus, the crank pin 178 is adapted to overtravel an impact or engaged position of the edges 156 and 158 of the hammer with the edges 152 and 154 of the hammer carriage. In this manner, each rotating cycle of the crankshaft 168 causes the crank pin 170 to move the connecting rod 174 upwardly and force the wrist pin 178 to raise the hammer 150, whereupon downward rotation of the crank pin 170 brings the hammer downward in a forceful manner to cause impact of the hammer 150 at the edges 156 and 158 with the edges 152 and 154 of the hammer and the carriage, respectively. This raising and lowering of the hammer and successive impact operation of the hammer with the hammer carriage causes the post engaging member 72 to apply impact force to the upper end of the post 148 and, during this time and according to the mode of operation of the invention, the hydraulic cylinder 142 retracts its plunger 140 to hold the hammer carriage 114 downwardly and to hold the engaging member 72 firmly engaged with the upper end of the post. This prevents battering the post, and also permits a preloading of the post vertically to a magnitude which equals the weight of the machine of the invention and a portion of the weight of the vehicle of which the frame 10 is a part. The hydraulic cylinders 20 and 32 also hold the arm 16 and links 28 downwardly to maintain a reaction force acting to prevent upward movement of the frame 60.

It will be seen that the universal joint means 38, shown in FIG. 2, permits the frame 60 to be suspended vertically, and this frame 60 will seek a vertical position by reason of gravity acting thereon. Thus, the universal joint means 38 will permit the frame 60 automatically to seek a vertical position regardless of the angular disposition of the frame 10 or the vehicle supporting this frame, regardless of the disposition of the vehicle on uneven ground, and this is a good advantage when moving from one post driving position to the next.

It will be appreciated that the hydraulic cylinder 142 serves to preload the engaging member 72 on the upper end of the post and this preload may equal a substantial portion of the weight of the frame and the vehicle together with that of the machine itself, including the frame 60. Further, the impact hammering of the hammer 150 on the carriage frame 114, in addition to the preload force supplied by the cylinder 142 on the post 148, serves to efficiently drive the post in very hard ground or rocky ground with a minimum amount of power and without battering the upper end of the post, and the full length post guides 86 and 88, together with the bars 90 and 92, fully support all elements of the post and thereby prevent long column failure or buckling of the post while it is being forced and driven by impact into the ground.

The terms "driven member" used herein may be construed as either defining a post which may be driven into the ground or a soil engaging and compacting tool or other equivalent driven member.

The term "ground," as used herein, may be construed to mean soil, concrete, asphalt, rock, sand or other structure on the surface of the earth.

As shown in FIGS. 6 to 13, inclusive, of the drawings, a modified form of the invention comprises both means for driving posts and for driving a soil compacting member. The invention, as shown in FIGS. 6 and 7 of the drawings, may be mounted on a truck 200 or may be mounted on any other suitable vehicle, such as crawler tractor capable of carrying the structure of the invention.

The invention comprises a pair of connected boom members 202 and 204 which are similar to the hereinbefore described members 16 and 28, shown in FIG. 1 of the drawings. A hydraulic cylinder 206 is equivalent to the cylinder 32, shown in FIG. 1 of the drawings, and

a pair of hydraulic cylinders 208 and 210 interconnect the frame 212 of the vehicle 200 and the boom 202. The cylinder 208 performs a function similar to the cylinder 20, shown in FIG. 1 of the drawings, for raising the boom 202 by pivoting it about a horizontal axis. The cylinder 210 is disposed at the side of the member 202, as shown best in FIGS. 6 and 7, for tilting the boom members 202 and 204 laterally.

As shown in FIG. 7, a lower end portion 212 of the boom member 202 is pivoted by a universal joint member 214 to the frame 212. This universal joint 214 is provided with a pivot bolt 216, passing through a lower end of the beam 212 and through an upstanding tab 218 of the universal joint means, while lateral portions 220 and 222 of the universal joint means pass through bearings 224 and 226, respectively; the axes of these bearings being at right angles to the axis of the bolt 216.

The cylinder 210 is provided with a clevis end 228 pivotally mounted on an extending portion 220 of the universal joint means 214, so that this cylinder 210 moves pivotally in unison with the boom 202 in accordance with its actuation by the cylinder 208.

An upper end 230 of the boom member 204 carries a universal joint structure 232 similar to the universal joint structure 38, shown in FIG. 2 of the drawings, and suspended from this universal joint structure 232 is a frame 234 having a pair of holding gate members 236 and 238 pivotally mounted on member 234 by respective hinges 240 and 242 which pivot on vertical axes parallel to each other and which permit opening of the gates 236 and 238, as shown in FIG. 13 of the drawings, by broken lines.

A hammer carriage 244 similar to the hammer carriage 114 carries and actuates a hammer 246, which is similar to the hammer 150, hereinbefore described. The hammer carriage 244 and hammer 246 are vertically movable on the frame 234 by means of a hydraulically powered cylinder 248, which is similar to the cylinder 142 hereinbefore described, and this cylinder 248 has a plunger of sufficient stroke to position the hammer carriage 244 and hammer 246 in a broken line position, as shown in FIG. 8, which is above upper ends 248 and 250 of the gates 236 and 238. The hammer 246 and the carriage 244 are each provided with a rectangular opening, as shown in FIG. 13 of the drawings, which receives the frame member 234 and the gates 236 and 238, the said opening being designated 252 in the hammer, as shown in FIG. 13, while a similar opening extends downwardly through the hammer carriage 244 below the hammer 246.

It will be seen that the opening 252 is surrounded by a structure of the hammer and, likewise, the corresponding opening in the hammer carriage 244 is surrounded by a structure to maintain the gates 236 and 238 closed, when the hammer and the hammer carriage are moved downwardly over these gates, as shown in FIG. 7 of the drawings. Thus, the gates are held confined around a post 254, shown separate from the machine for purposes of illustration and shown disposed in the machine in FIG. 13 and held captive by the closed gates 236 and 238, which are held in closed position, as described.

It will be seen that the opening 252, as shown in FIG. 13, is capable of passing over the corresponding hinges 240 and 242, hereinbefore described.

This structure simplifies the invention, as compared to that as shown in FIGS. 1 and 2 of the drawings, and eliminates, as for example, the arms 102 and 104 shown in FIG. 2 of the drawings, as well as the cylinder 112. Thus, these parts are not needed in the modification of the invention, as shown in FIGS. 11 to 13 of the drawings.

As shown in FIG. 11 of the drawings, the hammer carriage 244 is provided with a crossbar 256, which passes laterally through its respective opening 252 and is adapted to engage an upper end of a post, indicated by a broken line 258; the post being shown also in broken lines and referenced 254 in FIG. 11 of the drawings.

The modified structure shown in FIGS. 8, 11 and 12 of the drawings comprises a hydraulic motor 260, crankshaft 262 and connecting rod 264 which are equivalent to the motor 160, crankshaft 170 and connecting rod 174, disclosed in FIGS. 4 and 5 of the drawings. Thus, the hammer 246 is operable with relation to the hammer carriage 244 in a similar manner to the impact operation of the hammer 150 relative to the hammer carriage 114, hereinbefore described.

A plunger 249 of the hydraulic cylinder 248 is provided with trunnions 251 disposed in a slotted structure 253 of the carriage 244, this structure corresponding to the trunnion 136 and slotted structure 138 disclosed in FIG. 1 of the drawings. This provides for overtravel of the hammer carriage at the moment of impact of the hammer therewith which is followed by retraction of the plunger 140 which continuously tends to maintain downward pressure on the hammer carriage 244 preliminary to each impact blow of the hammer 246 on the hammer carriage 244.

Operation of the structure, as shown in FIGS. 6 to 13 of the drawings, is similar to that shown in FIGS. 1 to 5 of the drawings with the exception that the gates 236 and 238 are held closed by the surrounding structures of the hammer and the hammer carriage and also with respect to the differences in mode of operation provided by the cylinder 210 for lateral movement of the frame members 202 and 204.

A compaction tamper plate 212, as shown in FIGS. 9 and 10, is provided with a soil engaging and compacting shoe 223 having an H-shaped vertical shank 225 securable to the hammer carriage by bolts which may be extended through openings 227 therein, as shown in FIG. 7. Reference is also made to FIG. 13 wherein the shank 225 is shown in relation to the gates 236 and 238, which may be hingedly disconnected and removed when the shank 225 is bolted in place. The hammer carriage thus carries the compaction tamper 221 which, in accordance with the invention, may be termed a driven member.

In the modification of the invention, as shown in FIGS. 14 and 15, a conventional bulldozer blade 270 is operated upwardly and downwardly, as indicated by an arrow A in FIG. 15 of the drawings; this being accomplished by the conventional means for moving the blade up and down, such means normally comprising hydraulically powered mechanism, and the blade 270 is thus capable of being moved downwardly to create a relatively heavy downward load on the blade 270.

The modification of the invention comprises a cantilever arm 272 mounted on the bulldozer blade 270 and comprising a resilient means, such as a leaf spring 274 which resiliently and/or yieldably supports a driven member holding and guiding frame 276 mounted on an eye 278 of the spring 274 by means of a bar 280 having a shank portion 282 extending downwardly through an impact hammer structure 284. This hammer structure 284 is hollow at 286 and the lower end of the shank 282 is secured by bolts 288 to the frame 276, which is provided with a socket 286 in its lower end, receiving an upwardly extending shank 289 of an impact tool having a soil compacting shoe 290, all as shown best in FIG. 15 of the drawings.

A conventional detent mechanism 292 engages an annular groove 294 in the shank 289 and retains the shank 289 and its shoe 290 in connection with the driven member supporting and guiding frame 276. Thus, the shank and shoe 290 comprise a tool which may be construed as a driven member.

Pivotaly connected by means of a pin 296, to the frame 276, is a plunger 298 of a hydraulic cylinder 300, which is pivotaly connected to the spring 274 at 302. The cylinder 300 is utilized, merely, for swinging alignment of the frame 276 and the impact portion 290 of the tool, with soil to be compacted.

In operation, the blade 270 may be moved upwardly and downwardly to place the shoe 290 over soil to be

compacted and when the blade 270 is forced downwardly, it forces the shoe 290 firmly against the soil and a motor 304, similar to the hereinbefore described motors 114 and 260, drives an eccentric crankshaft 306 which drives a connecting rod 308 to move the hammer 284 upwardly and downwardly to cause impact driving of the frame 276 with the result that the shoe portion 290 is impact driven with relation to the soil, while the bulldozer blade 270 and the weight of the tractor portion of the bulldozer holds the shoe 290 downwardly.

It will be understood by those skilled in the art that the spring 274 is a yieldable means or a resilient means which may transmit downward force on the shoe 290 imposed by downward movement of the bulldozer blade 270.

It will be understood by those skilled in the art that the bulldozer blade 270 may be a suitable mount for the invention for specific uses, while other mounts such as those hereinbefore described for creating downward pressure may also be used and that the simple expedient of using a resilient member, such as the spring 274 may obviate the necessity of providing for the slot 136, as shown in FIG. 1 of the drawings, or the slot 253 as shown in FIG. 11 of the drawings, and corresponding relief for the plunger of the respective hydraulic cylinder tending to create downward force on the frame, which is impact driven by the respective hammer of the invention.

In the modification of the invention, as shown in FIGS. 16 and 17, a small handcart 310 is provided with ground engaging wheels 312 rotatably mounted on a frame 314 which also carries a small gas powered engine 316; the whole vehicle being transportable and movable manually by means of a handle 318.

The engine 316 is provided with an output shaft 320 driving a universal joint and spline coupling mechanism 322, which rotates a crankshaft 324, similar to the hereinbefore described crankshafts 168 and 262. A connecting rod 326 is driven by the crankshaft 324 and this connecting rod, thus, moves a hammer 328 upwardly and downwardly relative to a hammer carriage frame 330, which is similar to the frames 114 and 244, hereinbefore described.

A driven tool 332 is provided with a shank 334 having a flange 336, abutted to and secured on the lower portion of the carriage 330. The tool 332 is provided with a removable bit 338 held by a detent 340. This bit 338 may be a wedge-shaped paving cutter or any other suitable cutter which may be used to cut into asphalt roadways in order to open a trench for the placement of utilities, or the like.

The machine being manually operable by pulling the handle 318 backwardly or forwardly to tilt the machine about the axis of the wheels 312 and to clear the bit 338 of the tool relative to an upper surface 340 of the ground which may, as hereinbefore described, constitute the upper surface of an asphalt paving, or the like. Thus, the modified machine, as shown in FIGS. 16 and 17 and according to the invention, may be operated manually and during this manual operation, while the hammer 328 creates impact upon the hammer carriage 330, is permitted to move downwardly on a guide bar 342 carried on the frame 314. This guide bar 342 is provided with oppositely extending portions 344 and 346 over which loop-shaped slides 348 and 350 on the carriage 330 are vertically slidably mounted. These slide structures 348 and 350 have slotted openings substantially longer than the vertical dimension of the guide portions 344 and 346 to thereby allow vertical relief for the hammer carriage 330 as it moves downwardly relative to the frame 314. Thus, forward tilting of the handle 318 causes the guide 342 to move downwardly in the slots of the slide members 348 and 350 and to thereby permit the hammer 328 to impact drive the carriage 330 and the tool 332 downwardly relative to the frame 314.

It will be obvious to those skilled in the art that various modifications of the present invention may be resorted to

in a manner limited only by a just interpretation of the following claims.

I claim:

1. In a post driving and compacting machine the combination of: a ground supported frame; first means vertically movably mounted on said ground supported frame; a post holding and guiding frame suspended from said first means; substantially perpendicular guides on said guiding frame for engaging a post to be driven into the ground; a hammer carriage vertically movably mounted on said guiding frame; a post engaging member fixed to said hammer carriage and engageable with an upper end of a post guided by said guides; a second means tending to force said hammer carriage downwardly relative to said guiding frame and to force said post engaging member into firm contact with a post guided by said guides; a vertically movable hammer on said hammer carriage; and power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said hammer carriage to thereby cause the force of said successive impact to be applied to said post while it is also urged downwardly by said second means and said post engaging member.

2. In a post driving and compacting machine the combination of: a ground supported vehicle frame; first means vertically movably mounted on said ground supported vehicle frame; a post holding and guiding frame suspended from said first means; substantially perpendicular guides on said guiding frame for holding posts in a vertical position to be driven into the ground; a hammer carriage vertically movably mounted on said guiding frame; a post engaging member carried by said hammer carriage and engageable with an upper end of a post guided by said guides; first power operated means tending to force said hammer carriage downwardly relative to said guide frame and to force said post engaging member into firm contact with a post guided by said guides; a vertically movable hammer on said hammer carriage; and second power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said hammer carriage to thereby cause the force of successive impact to be applied to said post while it is also urged downwardly by engagement of said post engaging member.

3. In a post driving and compacting machine the combination of: a ground supported frame; first means vertically movably mounted on said ground supported frame; a post holding and guiding frame suspended from said first means; substantially perpendicular guides on said guiding frame for engaging a post to be driven into the ground; a hammer carriage vertically movably mounted on said guiding frame; a post engaging member fixed to said hammer carriage and engageable with an upper end of a post guided by said guides; a second means tending to force said hammer carriage downwardly relative to said guiding frame and to force said post engaging member into firm contact with a post guided by said guides; a vertically movable hammer on said hammer carriage; and power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said hammer carriage to thereby cause the force of said successive impact to be applied to said post while it is also urged downwardly by said second means and said post engaging member; universal joint means carried by said first means and connected to said post holding and guiding frame to suspend said guiding frame vertically whereby the weight of said guiding frame in response to gravity tends to align said guides in a substantially vertical disposition.

4. In a post driving and compacting machine the combination of: a ground supported frame; first means vertically movably mounted on said ground supported frame; a post holding and guiding frame suspended from said first means; substantially perpendicular guides on said

guiding frame for engaging a post to be driven into the ground; a hammer carriage vertically movably mounted on said guiding frame; a post engaging member fixed to said hammer carriage and engageable with an upper end of a post guided by said guides; a second means tending to force said hammer carriage downwardly relative to said guiding frame and to force said post engaging member into firm contact with a post guided by said guides; a vertically movable hammer on said hammer carriage; and power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said hammer carriage to thereby cause the force of said successive impact to be applied to said post while it is also urged downwardly by said second means and said post engaging member; said perpendicular guides each independently pivotally mounted on a substantially vertical axis on said guiding frame and thus adapted to be pivotally moved apart away from a central post engaging and guiding position, said guides adapted to be pivotally moved toward each other to a position adjacent said frame to guide a post between said guides and said frame; and power operated means coupled to said guides for pivotally actuating them and for holding them in adjacent relationship to each other and said frame for guiding a post therebetween.

5. In a post driving and compacting machine the combination of: a ground supported frame; first means vertically movably mounted on said ground supported frame; a post holding and guiding frame suspended from said first means; substantially perpendicular guides on said guiding frame for engaging a post to be driven into the ground; a hammer carriage vertically movably mounted on said guiding frame; a post engaging member fixed to said hammer carriage and engageable with an upper end of a post guided by said guides; a second means tending to force said hammer carriage downwardly relative to said guiding frame and to force said post engaging member into firm contact with a post guided by said guides; a vertically movable hammer on said hammer carriage; and power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said hammer carriage to thereby cause the force of said successive impact to be applied to said post while it is also urged downwardly by said second means and said post engaging member; said power operated means disposed to actuate said hammer comprising a hydraulic motor; a crankshaft driven thereby; a connecting rod pivotally coupled to said crankshaft and driven thereby; a wrist pin coupled to said connecting rod and engageable with said hammer; and resilient means coupled to said hammer and engaged by said wrist pin to permit resilient action of said wrist pin relative to said hammer when said hammer reaches an impact position relative to said hammer carriage thereby permitting said crankshaft to slightly overtravel a position corresponding to the impact position of said hammer relative to said hammer carriage.

6. In a post driving and compacting machine the combination of: a ground supported frame; first means vertically movably mounted on said ground supported frame; a post holding and guiding frame suspended from said first means; substantially perpendicular guides on said guiding frame for engaging a post to be driven into the ground; a hammer carriage vertically movably mounted on said guiding frame; a post engaging member fixed to said hammer carriage and engageable with an upper end of a post guided by said guides; a second means tending to force said hammer carriage downwardly relative to said guiding frame and to force said post engaging member into firm contact with a post guided by said guides; a vertically movable hammer on said hammer carriage; and power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said ham-

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mer carirage to thereby cause the force of said successive impact to be applied to said post while it is also urged downwardly by said second means and said post engaging member; said first means comprising arm structure pivotally mounted on said ground supported frame; and hydraulic cylinder means adapted to pivot said arm relative to said ground supported frame for moving said post holding and guiding frame vertically and laterally relative to said ground supported frame.

7. In a post driving and compacting machine the combination of: a ground supported vehicle frame; arm means pivotally mounted on said frame; hydraulic cylinders pivotally connected with said arm and adapted to raise said arm pivotally relative to said frame; universal joint means carried by said arm means; a post holding and guiding frame having its upper end coupled to said universal joint means and suspended thereby in free swinging disposition whereby said post holding and guiding frame in response to gravity tends to align itself vertically; said post holding and guiding frame an elongated frame; a pair of substantially perpendicular guides, each individually pivotally mounted on said post holding and guiding frame and adapted to pivot toward and away from each other to permit the disposition of a post between said guides and said frame; and power operated means for pivoting said guides toward and away from each other and for holding said guides adjacent each other and said frame for retaining a post therebetween in substantially vertical guided position; a hammer carriage vertically movably mounted on said post holding and guiding frame; a post engaging member fixed to said hammer carriage and engageable with an upper end of a post held by said guides and said frame; a hydraulic cylinder mounted on said guiding frame and coupled with said hammer carriage tending when energized in one position to force said hammer carriage downwardly relative to said guiding frame and to force said post engaging member into firm contact with an upper end of a post held by said guides and said guiding frame; a vertically movable hammer on said hammer carriage; a hydraulic motor mounted on said hammer carriage; a crankshaft rotatably mounted on said hammer carriage; means coupling said hydraulic motor and said crankshaft for driving said crankshaft; a connecting rod pivotally operably mounted on said crankshaft; an opposite end of said connecting rod; a wrist pin engaged by said opposite end; said wrist pin resiliently coupled with said hammer whereby rotation of said crankshaft forces said hammer to move up and down vertically relative to said hammer carriage and to thereby cause vertical impact of said hammer relative to said hammer carriage to thereby cause the force of successive impact imposed by said hammer to be applied to said post while it is also urged downwardly by said post engaging member.

8. In a post driving and compacting machine, the combination of: a ground supported frame; first means mounted on said ground supported frame; a driven member; a driven member holding and guiding frame movably supported on said first means and engaging and holding said driven member against the ground; a second means supported by said ground supported frame and reactive in opposition to the weight of said ground supported frame, said second means yieldably tending to force said holding and guiding frame downwardly relative to said ground supported frame and to force said driven member into firm contact with the ground; a vertically movable hammer on said holding and guiding frame; and power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said holding and guiding frame to thereby cause the force of said successive impact to be applied to said driven member while it is also urged downwardly against the ground by said second means and said holding and guiding frame.

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9. In a post driving and compacting machine, the combination of: a ground supported frame; first means mounted on said ground supported frame; a driven member; a driven member holding and guiding frame movably supported on said first means and engaging and holding said driven member against the ground; a second means supported by said ground supported frame and reactive in opposition to the weight of said ground supported frame, said second means yieldably tending to force said holding and guiding frame downwardly relative to said ground supported frame and to force said driven member into firm contact with the ground; a vertically movable hammer on said holding and guiding frame; and power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said holding and guiding frame to thereby cause the force of said successive impact to be applied to said driven member while it is also urged downwardly against the ground by said second means and said holding and guiding frame; said second means being a spring.

10. In a post driving and compacting machine, the combination of: a ground supported frame; first means mounted on said ground supported frame; a driven member; a driven member holding and guiding frame movably supported on said first means and engaging and holding said driven member against the ground; a second means supported by said ground supported frame and reactive in opposition to the weight of said ground supported frame, said second means yieldably tending to force said holding and guiding frame downwardly relative to said ground supported frame and to force said driven member into firm contact with the ground; a vertically movable hammer on said holding and guiding frame; and power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said holding and guiding frame to thereby cause the force of said successive impact to be applied to said driven member while it is also urged downwardly against the ground by said second means and said holding and guiding frame; said second means being a spring; and an actuating means interconnecting said first means and said driven member holding and guiding frame for moving the same relative to said first means.

11. In a post driving and compacting machine, the combination of: a ground supported frame; first means vertically movably mounted on said ground supported frame; a post holding and guiding frame suspended from said first means; substantially perpendicular guides on said guiding frame for engaging a post to be driven into the ground; a hammer carriage vertically movably mounted on said guiding frame; a post engaging member fixed to said hammer carriage and engageable with an upper end of a post guided by said guides; a second means tending to force said hammer carriage downwardly relative to said guiding frame and to force said post engaging member into firm contact with a post guided by said guides; a vertically movable hammer on said hammer carriage; and power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said hammer carriage to thereby cause the force of said successive impact to be applied to said post while it is also urged downwardly by said second means and said post engaging member; said perpendicular guides each independently pivotally mounted on a substantially vertical axis on said guiding frame and thus adapted to be pivotally moved apart away from a central post engaging and guiding position, said guides adapted to be pivotally moved toward each other to a position adjacent said frame to guide a post between said guides and said frame; said hammer carriage and said hammer having vertical openings therethrough which are vertically slidable downwardly around said guides for holding them in a

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closed position adjacent to a post being engaged and driven.

12. In a post driving and compacting machine, the combination of: a ground supported frame; first means vertically movably mounted on said ground supported frame; a post holding and guiding frame suspended from said first means; substantially perpendicular guides on said guiding frame for engaging a post to be driven into the ground; a hammer carriage vertically movably mounted on said guiding frame; a post engaging member fixed to said hammer carriage and engageable with an upper end of a post guided by said guides; a second means tending to force said hammer carriage downwardly relative to said guiding frame and to force said post engaging member into firm contact with a post guided by said guides; a vertically movable hammer on said hammer carriage; and power operated means disposed to actuate said hammer vertically and to thereby successively cause vertical downward impact of said hammer relative to said hammer carriage to thereby cause the force of said successive impact to be applied to said post while it is also urged downwardly by said second means and said post engaging member; said perpendicular guides each independently pivotally mounted on a substantially vertical axis on said guiding frame and thus adapted to be pivotally moved apart away from a central post engaging and guiding position, said guides adapted to be pivotally moved toward each other to a position adjacent said frame to guide a post between said guides and said frame; said hammer carriage and said hammer having vertical openings therethrough which are vertically slidable downwardly around said guides for holding them in a closed position adjacent to a post being engaged and driven; means for moving said hammer carriage and said hammer to a position above upper ends of said guides to permit them to be pivoted outwardly about their vertical axes for receiving a post therebetween.

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13. In an impact machine, the combination of: a ground supported frame; wheels supporting said frame on the ground and mounting said frame tiltably on a horizontal axis; an engine on said frame; a crankshaft driven by said engine; a hammer carriage mounting said crankshaft; a connecting rod on said crankshaft; a hammer mounted on said connecting rod and reciprocable up and down relative to said hammer carriage for causing impact abutment of said hammer on said hammer carriage; means vertically movably mounting said hammer carriage on said frame; a tool mounted on said hammer carriage and extending downwardly and engageable with the surface of the ground upon forward tiltable movement of said frame, said hammer carriage being on a forward portion of said frame; and handle means at a rearward portion of said frame for tilting said frame about a vertical axis and for thereby raising said tool from the surface of the ground when said handle is tilted backwardly and for lowering said tool toward the surface of the ground when said handle is tilted forwardly about the horizontal axis of said wheels.

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FRED C. MATTERN, Jr., *Primary Examiner*.  
L. P. KESSLER, *Assistant Examiner*.