

Oct. 13, 1953

K. H. HOEN ET AL

2,655,006

FENCING MACHINE

Filed Aug. 24, 1950

9 Sheets-Sheet 1

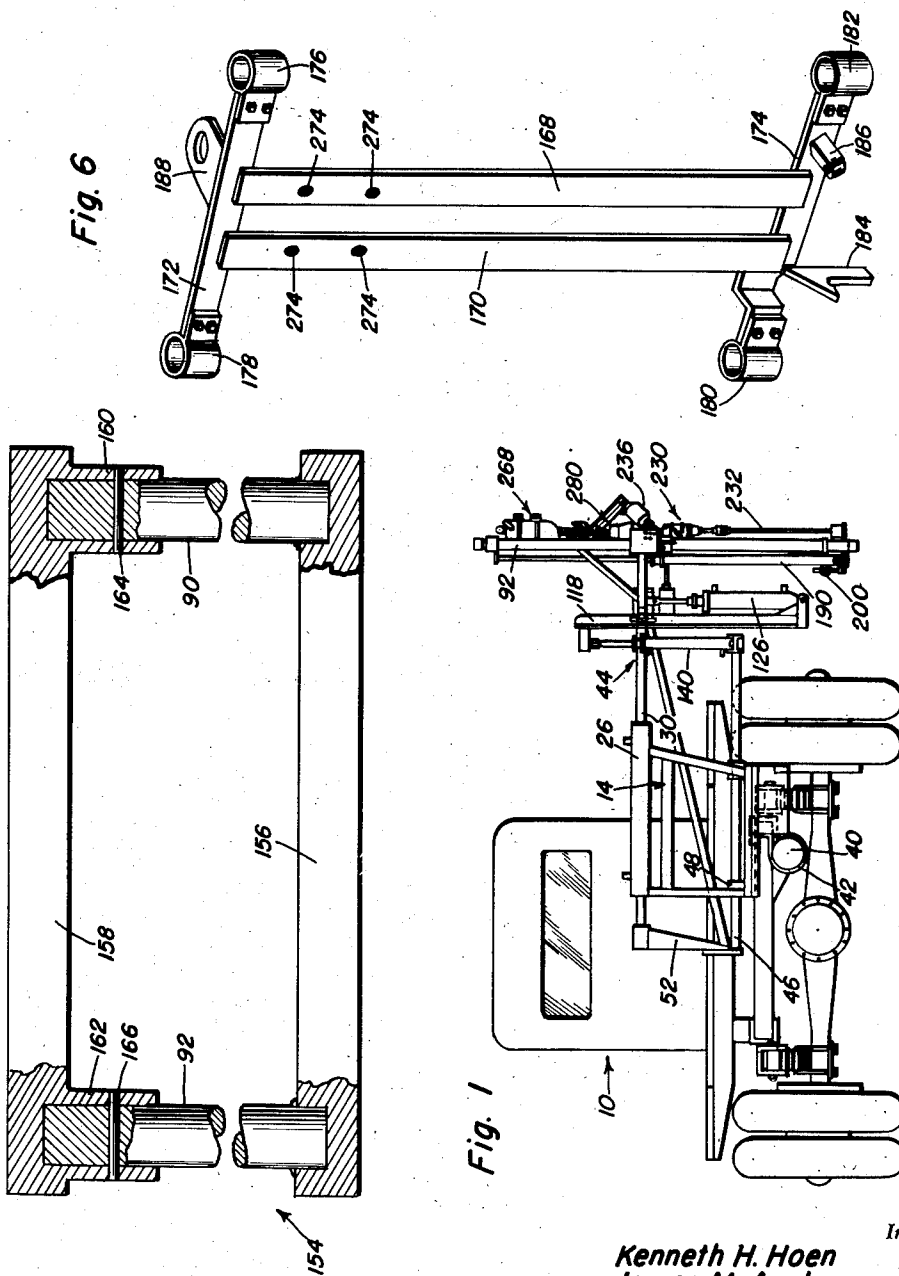


Fig. 1

Fig. 6

Fig. 7

Inventor

Kenneth H. Hoen

James M. Archer, Deceased

by Gilbert M. Williams, Administrator

By

Clarence A. O'Brien
and Harvey B. Jacobson
 Attorneys

Oct. 13, 1953

K. H. HOEN ET AL

2,655,006

FENCING MACHINE

Filed Aug. 24, 1950

9 Sheets-Sheet 2

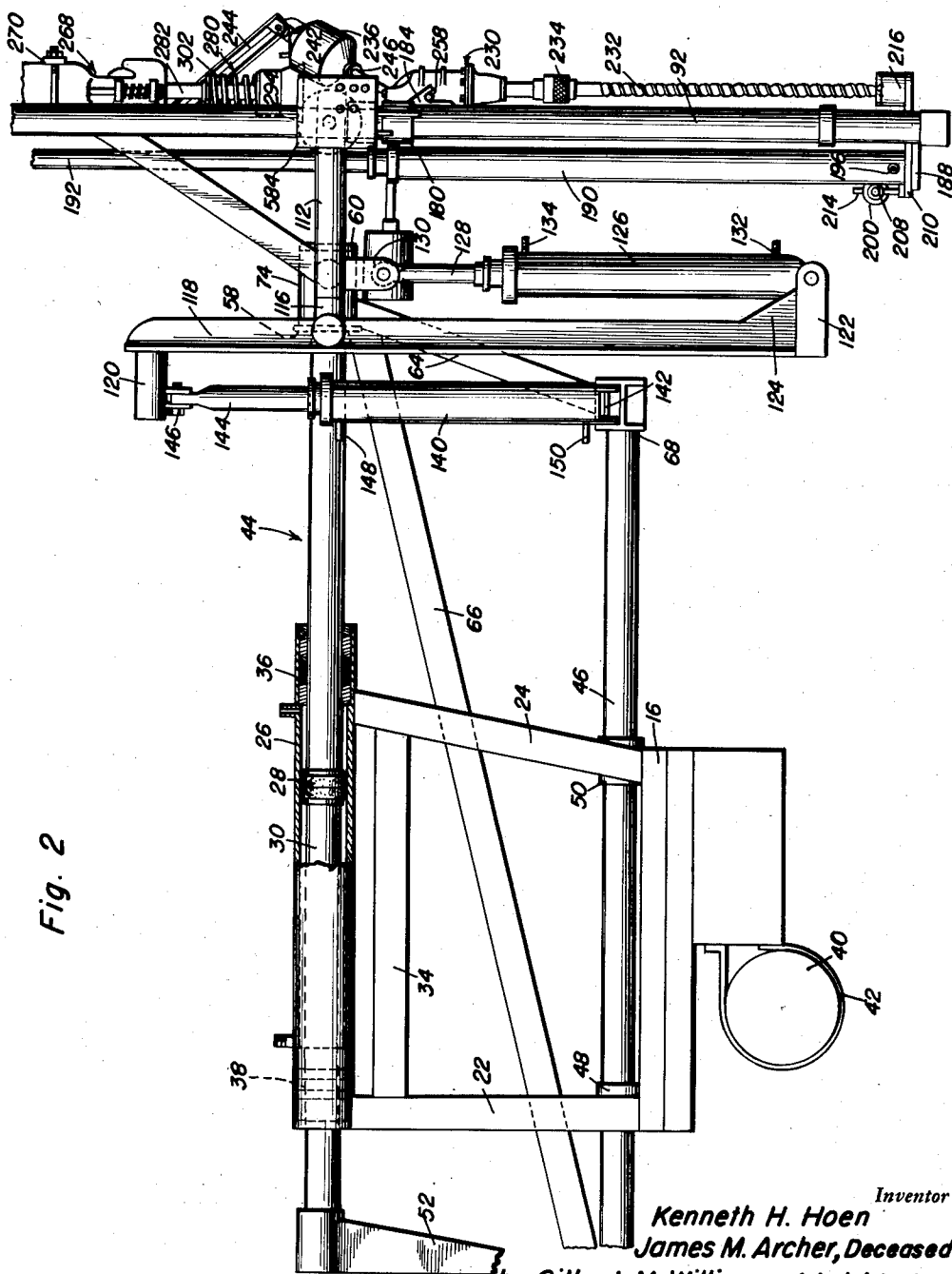


Fig. 2

Inventor
Kenneth H. Hoen
James M. Archer, Deceased
by Gilbert M. Williams, Administrator

By *Almonce A. O'Brien*
and *Harvey B. Jacobson*
Attorneys

Oct. 13, 1953

K. H. HOEN ET AL

2,655,006

FENCING MACHINE

Filed Aug. 24, 1950

9 Sheets-Sheet 3

Fig. 3

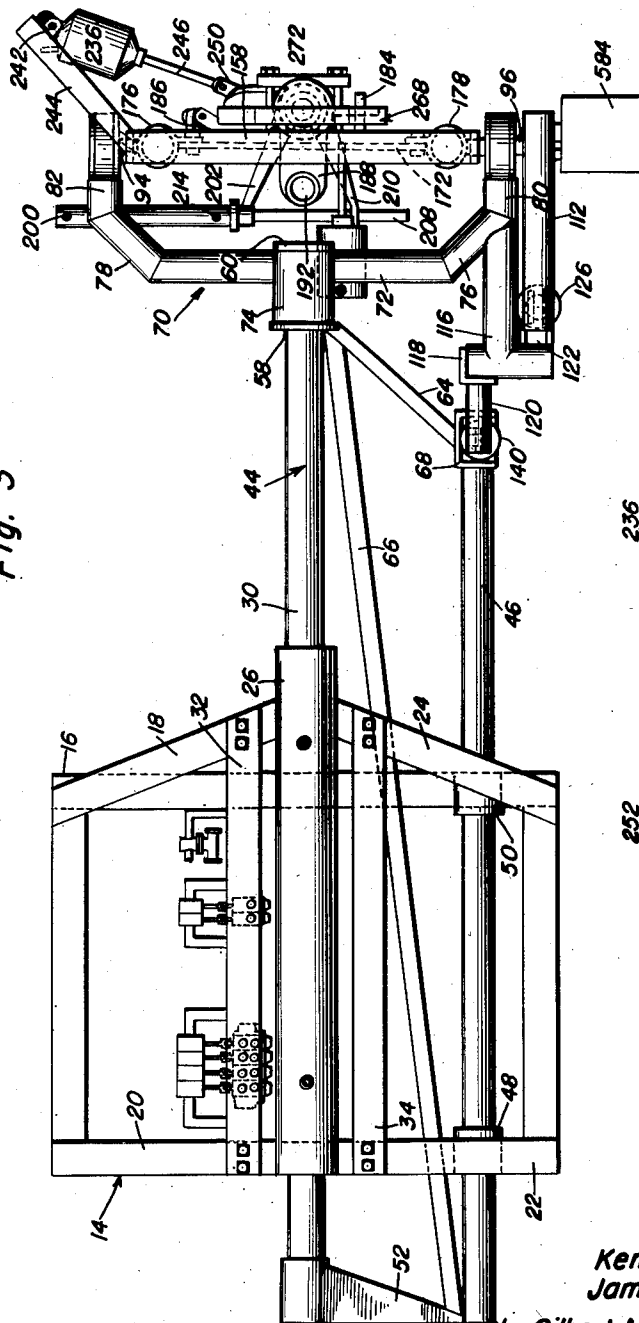
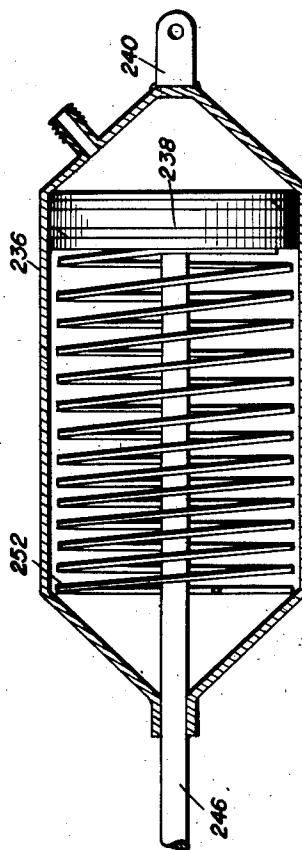


Fig. 12



Kenneth H. Hoen *Inventor*
James M. Archer, Deceased

by Gilbert M. Williams, Administrator

By

Charles A. O'Brien
and *Harvey B. Jacobson*
Attorneys

Oct. 13, 1953

K. H. HOEN ET AL
FENCING MACHINE

2,655,006

Filed Aug. 24, 1950

9 Sheets-Sheet 5

Fig. 11

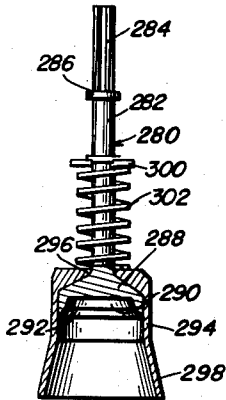


Fig. 8

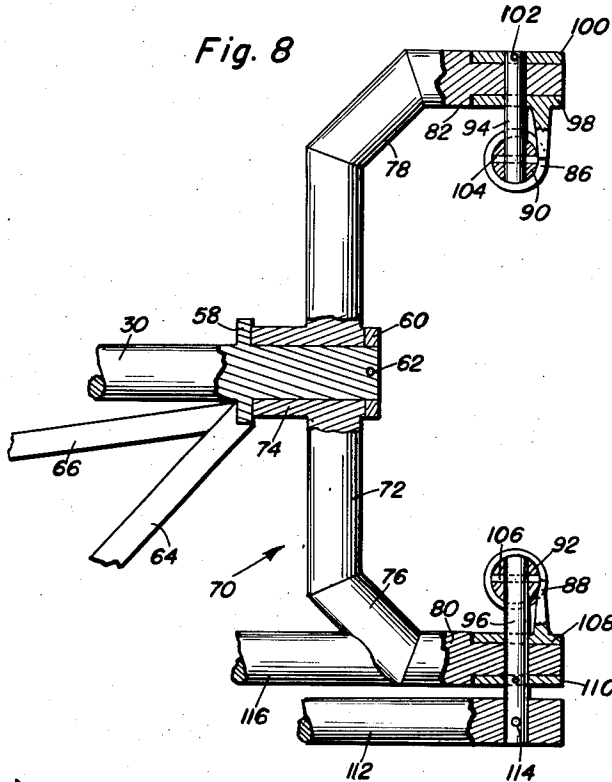


Fig. 9

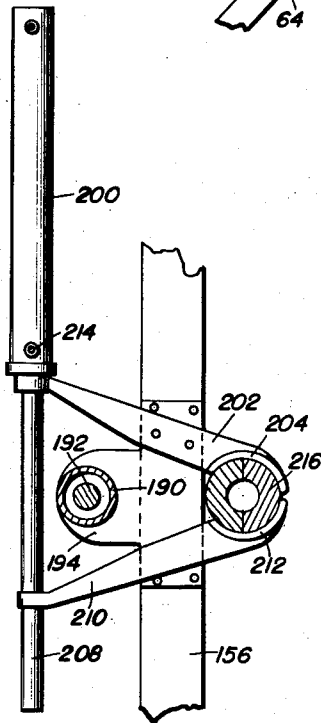
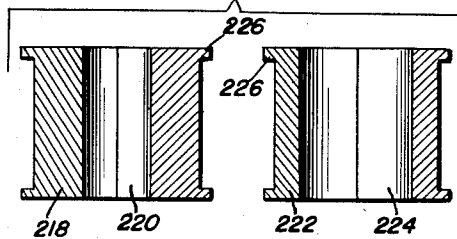


Fig. 10



Inventor
Kenneth H. Hoen
James M. Archer, Deceased
by Gilbert M. Williams, Administrator

By

Clarence W. Olson
and Harvey B. Jacobson
Attorneys

Oct. 13, 1953

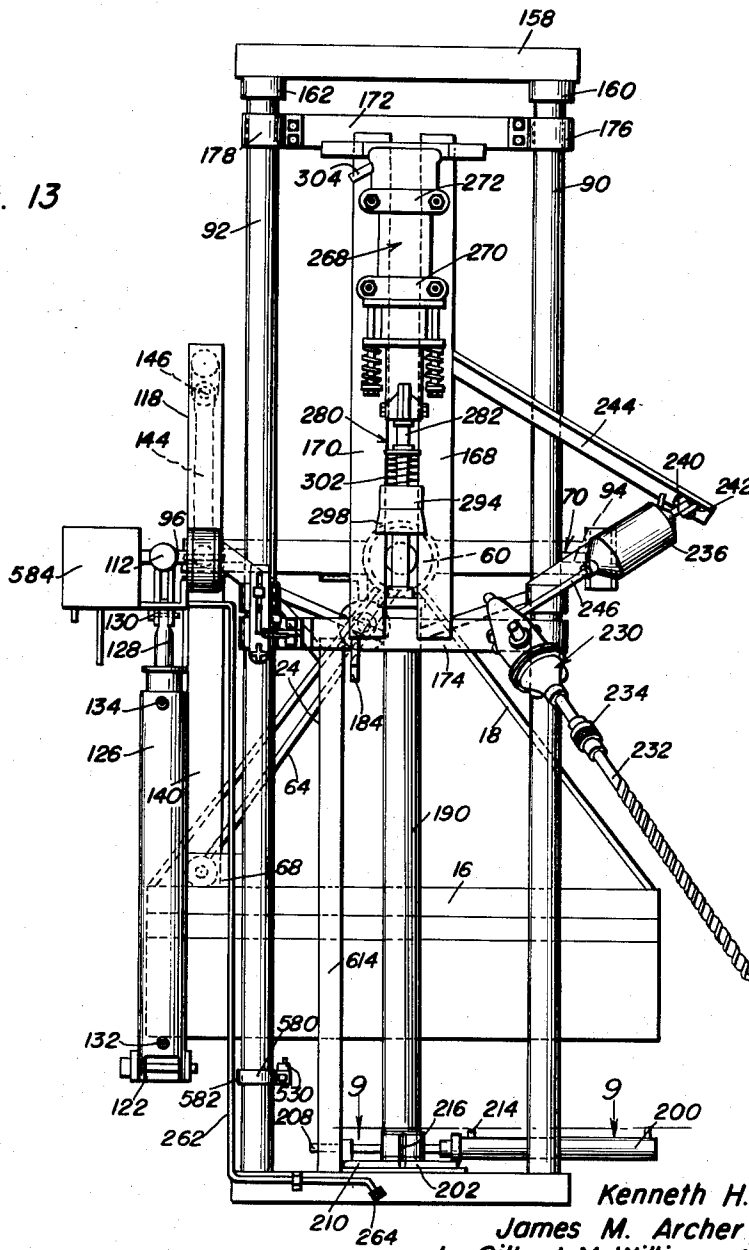
K. H. HOEN ET AL
FENCING MACHINE

2,655,006

Filed Aug. 24, 1950

9 Sheets-Sheet 6

Fig. 13



Kenneth H. Hoen
James M. Archer, Deceased
by Gilbert M. Williams, Administrator
INVENTOR.

BY *Almon O'Brien*
and *Harvey E. Jacobs*
Attorneys

Oct. 13, 1953

K. H. HOEN ET AL
FENCING MACHINE

2,655,006

Filed Aug. 24, 1950

9 Sheets-Sheet 7

Fig. 15

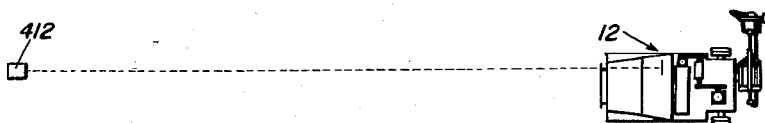


Fig. 16

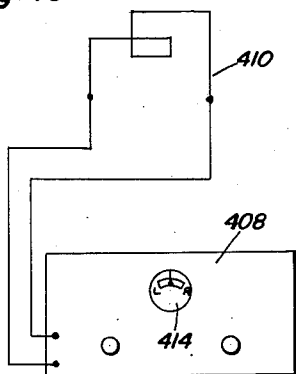


Fig. 14

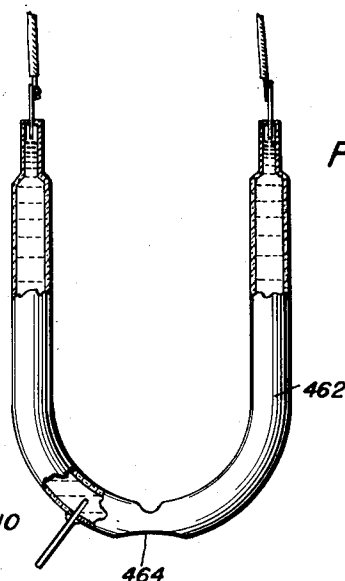


Fig. 23

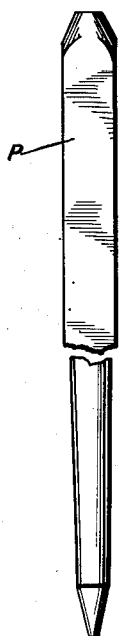
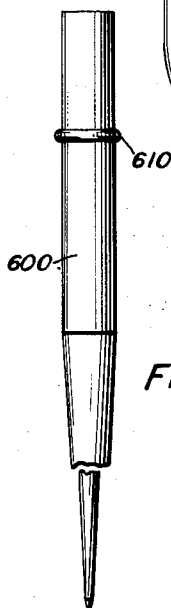


Fig. 22



Kenneth H. Hoehn
James M. Archer, Deceased
by Gilbert M. Williams, Administrator
INVENTOR.

BY *Charles A. O'Brien*
and *Harvey B. Jacobson*
Attorneys

Oct. 13, 1953

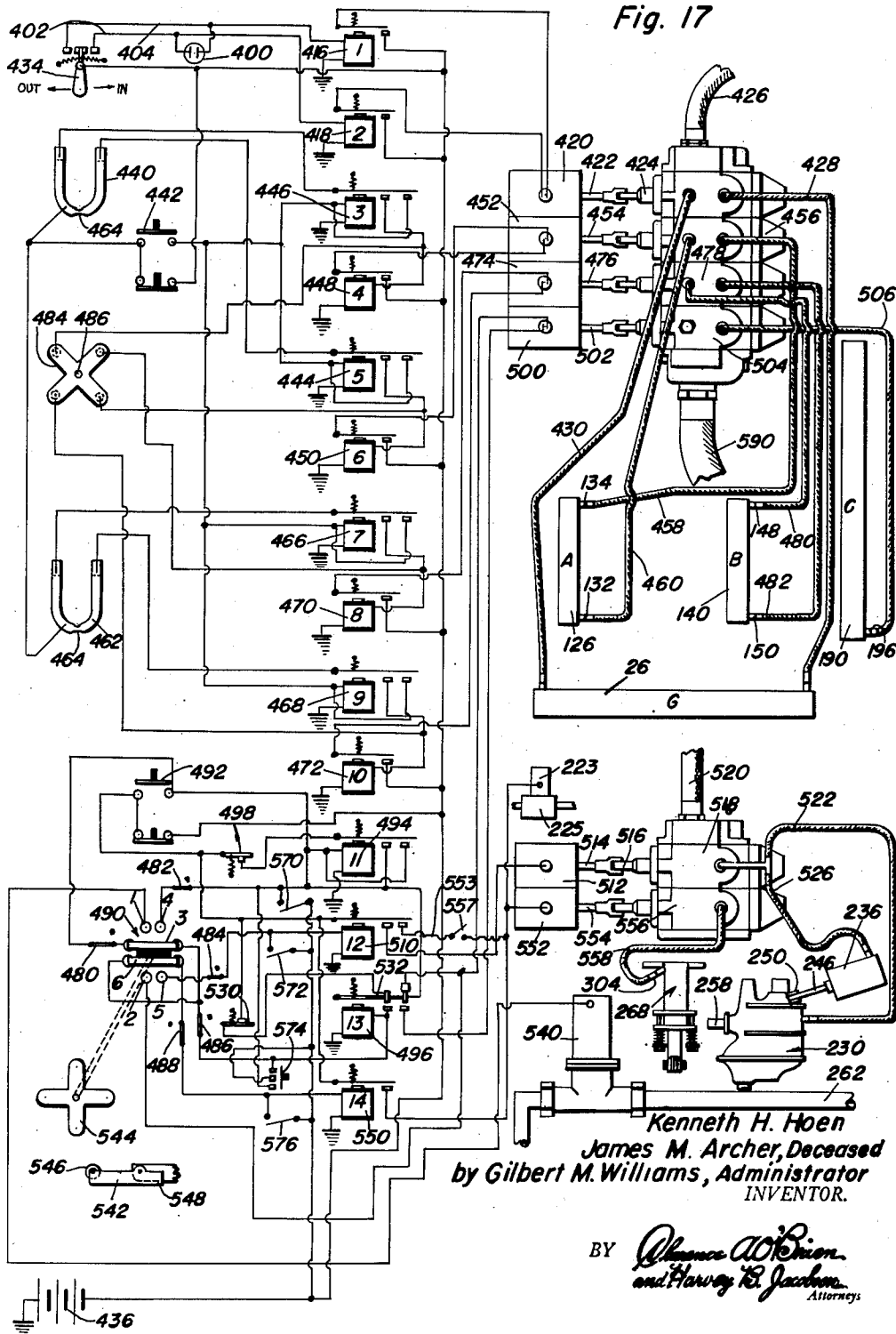
K. H. HOEN ET AL

2,655,006

FENCING MACHINE

Filed Aug. 24, 1950

9 Sheets-Sheet 8



Oct. 13, 1953

K. H. HOEN ET AL

2,655,006

FENCING MACHINE

Filed Aug. 24, 1950

9 Sheets-Sheet 9

Fig. 18

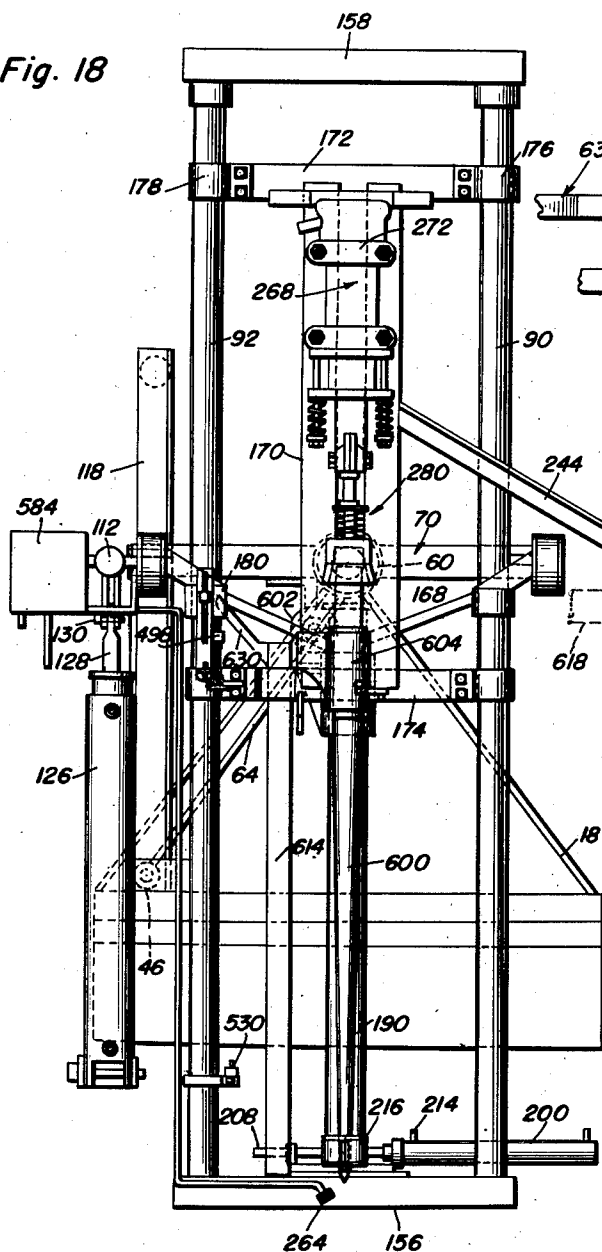


Fig. 19

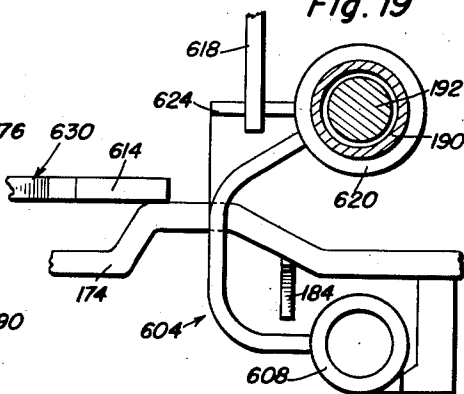


Fig. 20

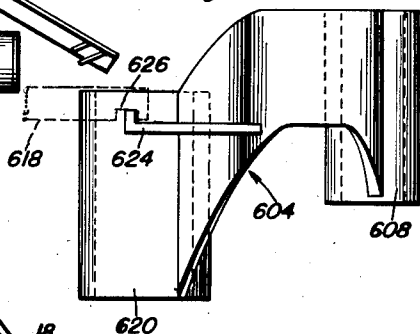
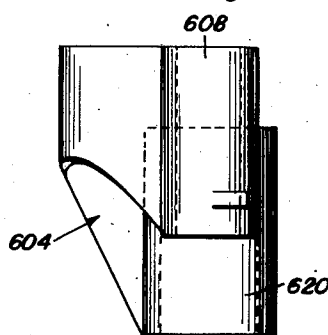


Fig. 21



Inventor

Kenneth H. Hoen
James M. Archer, Deceased
by Gilbert M. Williams, Administrator

By

Clarence A. O'Brien
and Harvey B. Jacobson
Attorneys

UNITED STATES PATENT OFFICE

2,655,006

FENCING MACHINE

Kenneth H. Hoen, Billings, Mont., and James M. Archer, deceased, late of Billings, Mont., by Gilbert M. Williams, administrator, Billings, Mont.; Ruby E. Archer, administratrix de bonis non of said James M. Archer, deceased; assignors to Pioneer Fencing Co., Inc., Billings, Mont., a corporation of Montana

Application August 24, 1950, Serial No. 181,304

19 Claims. (Cl. 61—73)

1

This invention relates to novel and useful improvements in fencing machines.

The primary object of this invention is to drill a pilot hole in the ground and then place the lower end of a post in the pilot hole so that a hammer drives the post into the pilot hole, the pilot hole being formed and the hammering being accomplished in proper sequential steps.

Another object of this invention is to perform the above steps together with other ancillary steps by means of an apparatus which is fully automatic, that is, the completion of one step immediately leads to the next step without the necessity of any manual operation.

Another object of this invention is manifest in the sub-combination involved in the support having a horizontally movable traverse apparatus carried thereby with a vertical standard secured to and forming a part of the horizontal traverse apparatus, and the traverse apparatus also including intersecting horizontal pivots whereby the vertical support is capable of swinging movement about both of the horizontal pivots so as to maintain the vertical standard in the vertical position regardless of the pitch (movement of the vehicle whereby the front and rear is raised and lowered) and roll (movement whereby the vehicle has one side depressed or raised with respect to the other side), the corrective movement of the vertical standard being accomplished preferably by a pair of cylinders having pistons therein with liquid supplied to the cylinders through appropriate valves, which valves are operated by an electrical system having level control switches appropriately placed on the apparatus.

The utility of the traverse or traverse apparatus is to compensate for deviations from a straight line of travel of the vehicle. No matter how skillful the operator of the vehicle may be, throughout a day's work there will be some deviations from the required straight line of travel of the vehicle. With the traverse operable in a horizontal plane, the standard may be operated inwardly and outwardly with respect to the vehicle or support. There is a selectivity involved in the operation of the traverse in that a manual switch may be employed energizing appropriate electrical apparatus for valve control to feed a cylinder piston assembly, or a radio signal, such as a radio beam, may be employed as a part of a beam directive system. A receiver is disposed in an appropriate place on the vehicle so that when the receiver is not following the beam properly (deviates therefrom), a condition of resonance is set up in the receiver to supply current for energizing one or more relays which in turn control

2

the valve for supplying fluid to the same cylinder operatively connected with and forming a part of the traverse.

Another object of this invention is to arrange a structural combination of elements in such a manner that when a vehicle is operated having the combination thereon, a vertical standard is maintained vertical regardless of reasonable pitch and roll movement, and the standard travels in a substantially straight line fashion at the times which such straight line movement is desirable regardless of slight deviations from the straight line of travel path and when the posts are to be driven in the ground. A fully automatic or, as a selection, a manually operated system is energized which performs the steps of forming a pilot hole in the ground either by a drill or a drift pin, these pilot hole-forming members being carried by the carriage which is vertically movable on the standard, and the pilot hole-forming operation being carried out while the carriage is descending due to the force or pull of gravity and then, after the pilot hole has been dug the required sufficient amount, the carriage rises and the pilot hole-forming member stops operating, and a water spray is applied in the pilot hole so as to lubricate and more easily depress the post in the ground, which depression takes place by means of an air operated (preferably) hammer carried by the same carriage that supports the pilot hole-forming member. The hammer is rendered operative at substantially the same time that the pilot hole-forming member is rendered inoperative. At this time, the pilot hole-forming member is swung outwardly so as to be out of the path of operation of the hammer together with the post which is manually placed in the travel of the hammer. While the hammer is operating, the carriage descends by the pull of gravity again until such time that the pole is driven in the ground a sufficient amount. Then, the lower limit switch defining the lower limit of the path of travel of the carriage renders the hammer inoperative and also sets into operation a device for again raising or lifting the carriage.

And another object of this invention is to drive posts for fencing in a plotted course which is predetermined whereby a material reduction in field labor is realized in that the usual necessity of extensive survey including checking and rechecking is avoided, there being only the necessity of various stations in a traverse, the distance between stations being completely and accurately laid out through the utility of a radio beam or signal which forms a part of a radio directive apparatus.

Ancillary objects and features of novelty will

become apparent to those skilled in the art, in following the description of the preferred form of the invention, illustrated in the accompanying drawings, wherein:

Figure 1 is a rear view of a vehicle, preferably of the front and rear wheel drive type and having a device illustrative of the principles of the invention disposed thereon, this view illustrating particularly the relationship of the device with a vehicle;

Figure 2 is an enlarged rear view of the device, a portion of a cylinder being broken away to show the detail of the cylinder and piston, this being typical of the other cylinders in the device, and showing the said device attached to a part of the vehicle removed therefrom;

Figure 3 is a plan view of the device shown in Figure 2;

Figure 4 is an elevational view of the device, showing the relationship of the parts when the drill type pilot hole-forming member is ready to be operated and moved downwardly with the carriage to which it is attached;

Figure 5 is a longitudinal sectional view through the standard showing one cylinder, whose function is to raise the carriage after it has been gravity-lowered;

Figure 6 is a perspective view of the carriage which is slidable on the vertical standard;

Figure 7 is a view of the standard, the longitudinal side rails being broken away, and is provided for the purpose of illustrating the structure of the standard;

Figure 8 is a fragmentary view, partly in elevation and partly in section, taken on a horizontal plane through the intersecting pivots for the standard, forming a part of the traverse assembly;

Figure 9 is a sectional view taken substantially on the line 9—9 of Figure 13 and in the direction of the arrows, showing particularly a clamping cylinder for the guides shown in Figure 13;

Figure 10 is a sectional view of a pair of guides held by the clamp shown in Figure 9 and are used for the purpose of guiding the drift pin or the drill, depending upon which pilot hole-drilling member is being used;

Figure 11 is a sectional view of the driving head for the hammer, parts being shown in elevation, this view illustrating the resiliently loaded type driving head;

Figure 12 is a sectional view of a cylinder with a piston disposed therein, the piston being operated by compressed air and the spring opposing the piston operation, this cylinder being used in connection with the pilot hole-digging member;

Figure 13 is an elevational view of the device showing the pilot hole-forming member as being a drill and swung laterally about its pivot point, the post driving hammer being in position for operation;

Figure 14 is an elevational view of one of the U-tube type switches which are used in connection with the level control of the standard;

Figure 15 is a schematic view of the vehicle having the device attached thereto, illustrating particularly in a schematic way the radio beam control directive apparatus in use;

Figure 16 is a schematic view of the receiver which is to be disposed on the vehicle, having a loop antenna attached thereto;

Figure 17 is a schematic view including a wiring diagram of the entire apparatus, and a schematic showing of the fluid flow control system and apparatus which includes both water conducting

structure for the spray device and the hydraulic structure, together with the air for operating the air hammer and drill as well as drift pin;

Figure 18 is an elevational view of the device with the air drill removed and the drift pin in position for operation;

Figure 19 is a sectional view showing the mounting bracket to support the drift pin on the device;

Figure 20 is a side view of the mounting bracket;

Figure 21 is an end view of the mounting bracket;

Figure 22 is an elevational view of the drift pin; and

Figure 23 is an elevational view of a typical post to be driven into the ground by the apparatus.

In regions where it is necessary to fence miles of land, the ordinary mode of driving posts to form the fence, as by digging a hole with a post hole digger and applying the post, is rather expensive because this is time-consuming. It has been found that by digging a hole to accommodate the lower end of the post and then by placing the post in this hole, unless a binder is placed around the post and in the ground, the post is not substantial and is not solidly anchored in the ground. Moreover, to dig a hole in the ground for accommodation of the post, an appreciable period of field labor time is required.

In contradistinction to such a method of driving posts in the ground, our invention contemplates and actually uses only a pilot hole which is formed in the ground very rapidly. A post is then disposed in and over the top of the pilot hole with the pointed end within the hole and driven forcibly in the ground, spreading the soil slightly whereby the post is firmly entrenched in the ground, the soil around the sides of the post acting as the binder.

Sometimes it is desirable if not necessary to moisten the soil around and in the pilot hole. In our invention, we have made provision for such moistening by the use of a spray device which is automatically rendered operative and inoperative in response to other steps in a single cycle of operation, that is, a cycle which involves the placement of one pole in the ground.

In instances wherein a land owner has possession of huge acreage and desires to separate certain portions of the acreage for grazing or for any other reason, the problem of placing posts in proper alignment and along an exact path is not important. A foot, more or less, deviation from the desired line probably will not be too important. However, in fencing to separate one's property from another's property, it is most desirable that the exact line of division between the two properties be used. Deviation in one direction would be applying the fence in a manner as to be a trespass, whereas deviation in the other direction would be tantamount to a gift of land. Carried throughout miles of fencing, this becomes of appreciable importance.

Accordingly, in order that the post may be set properly and in the exact line, expensive traverses have to be run with many stations plotted and, in fact, to be sufficiently accurate, there should be a station for each post.

In our invention, we have overcome a considerable amount of expense and time involved in placing posts under these conditions. We have provided a radio directional apparatus which is adapted to be placed at one station. This device emits a signal, as, for example, a radio beam similar to that type employed in connection with

bringing aircraft to an airport in inclement weather, and a receiver which is secured to the vehicle having the invention device carried thereby. This receiver has an antenna, preferably of the loop type, which picks up the signal. Under certain conditions, a signal together with the receiver sets up a current, due to the resonance involved, energizing a pair of relays which, in turn, operate sufficient structure to be described later for operating a traverse apparatus whereby the pilot hole-forming structure and the post hammer are moved inwardly and outwardly with respect to the vehicle so as to position the hammer and the pilot hole-forming device in exact alignment with the radio beam or signal. Hence, very few stations are necessary with this system, thereby obviating the necessity of plotting a great number of stations and obviating the necessity of checking and re-checking during the actual application of the posts in the ground.

To be more specific with respect to the beam directive system, there are several variations which may be employed. The preferable one is to send out two signals in side-by-side relationship with each other. In the center of the two signals there is a void. When the antenna of the receiver which is carried by the traverse apparatus on the vehicle is between these signals, there is no indication either visual or audible. However, when the vehicle deviates from this void between the signals, the antenna is used as a receptor of one of the two beams or signals so that current energizes appropriate solenoids for operation of valves to apply fluid into the appropriate cylinder for corrective movement of the traverse. When the other beam is picked up by the antenna, corrective measure in the opposite direction takes place in a similar manner.

Even in the presence of such mechanism capable of these corrective maneuvers, if machine operators were required to follow the machine throughout the field to operate buttons or the like to cause such operations, the purpose of the invention with respect to material saving and labor would be defeated or at least lessened in efficacy. Accordingly, the device has been so arranged as to be "automatic."

The "automatic" operation of the traverse for vehicle travel deviation corrections has been discussed. A combination structural-hydraulic-electrical system is employed for correction of the vertical disposition of the standard when the vehicle is subjected to roll, as in driving on a great or slight incline, the two left wheels of the vehicle being either higher or lower than the two right wheels, and when the vehicle pitches, as when the two front wheels are either higher or lower than the two rear wheels. In this connection, mercury switches of the U type are employed. They must be carried by portions of the device which roll or pitch with the vehicle but which reflect the corrective movement of either the standard or a part that moves with the standard.

Moreover, the desired manner of driving the post into the ground is by simply forming a pilot hole and then driving the post or pole into the pilot hole. It is necessary, therefore, that the pilot hole be formed and the hammer for driving in the post be rendered operative immediately after the hole is dug so as not to lose time in application of a single post in the ground.

To this extent, we have arrived at a structure which is dependent upon the various positions of

a carriage which is reciprocatably disposed on the standard. When the carriage is in the full raised position and a convenient start button pressed or switch thrown, the cycle begins. The first thing that happens is the member for forming the pilot hole is set into operation. Since the carriage is gravity-lowered, the operating member is pressed into the ground. But, upon reaching the lower limit of movement of the carriage which is to be set in accordance with the depth of the pilot hole which is desired, a lower limit switch sets into motion a device for lifting the carriage while the pilot hole-forming member is still in operation. If the pilot hole-forming member is a simple bit as disclosed in the drawings, this will help to remove from the hole the displaced soil, which would ordinarily remain in the hole. The water spray device is rendered operative at this time in order to supply the pilot hole with liquid. The liquid being sprayed in the pilot hole after the bit or drift pin is removed facilitates insertion of the post P.

When the carriage reaches its upper limit, it strikes a specially constructed switch which performs a number of functions. The first is to stop the lifting or rising of the carriage and the second is to cause the pilot hole-forming member to be inoperative and to cause it to swing to such position as to be out of the line of travel of the hammer. Another function is to cause the hammer to become operative. Since there is no more lifting force on the carriage and it is gravity-lowered, the carriage simply begins to lower while the hammer is operative. A post is manually placed beneath the driving head of the hammer so that it is driven in the pilot hole.

When the carriage again reaches the lower limit, it engages the lower limit switch, causing the hammer to cease operating and causing the carriage to begin to rise again. As the carriage rises, it strikes the upper limit switch which causes all operations to cease and the device is ready to start the entire cycle again. The new cycle does not start until such time that the start button or switch is operated. At any time during the cycle of operation, the cycle can be stopped and any operation or function of the machine can be operated manually, ample control switches being provided in the circuit for this purpose. Any of the functions making up a complete cycle may be individually used and in reverse order, for example, to remove a post. By attaching an ordinary chain to the driving head of the machine and to the post, and manually operating the switch which controls the hydraulic system, the carriage may be lifted to pull the post. Moreover, the air hammer may be rendered operative at this time to act as a vibrator to facilitate removal of the post.

The vehicle 10 (Figure 1) or the schematically shown vehicle 12 (Figure 15) indicates that any type of vehicle may be employed in connection with the invention. The vehicle 10 is of one popular make, while the vehicle 12 is of another different popular make. It is preferable that the invention be used in connection with vehicles having four wheel drives, but this is not essential. However, there must be sufficient structural accommodation in the vehicle for the various parts. One of these parts is a support which is generally indicated at 14 and which includes a bed 16 having convergent legs 18, 20, 22, and 24, respectively, terminating in an apex. A cylinder 26 is fixed to the apex of the convergent legs and has a piston 28 disposed therein, which piston

has a piston rod 30. Braces 32 and 34 are substantially parallel to each other and are bolted or otherwise secured to the convergent legs 18 and 20 and 24 and 22.

The cylinder 26 has end packing 36 at one end, and end packing 38 at the other end. The piston 28 may be of any conventional description but, as shown in Figure 2, the piston is preferably composed of a pair of fiber rings which are secured to the piston rod intermediate its ends.

The bed 16 of the support rests on one side, either the left or the right of the vehicle 10 or the vehicle 12. A longitudinal pole 40 is fixed to the under surface of the vehicle body and has a number of straps 42 secured therearound which are also secured to the bed, holding it firmly in place on the vehicle. Other methods of mounting the support on the vehicle 10 or the vehicle 12 may be resorted to as simply bolting the bed in place.

A traverse or traverse apparatus, generally indicated at 44, is provided in connection with and is supported by the support 14. This traverse or traverse apparatus includes the piston rod 30 and a rod 46 which are disposed in aligned bearings 48 and 50. These bearings are fixed to the bed 16 in such position that the rod 46 is capable only of movement in a horizontal plane, the movement being transverse to the travel of the vehicle. An end plate 52 is secured to the piston rod 44 and also the rod 46 so that the piston rod 30 and the rod 46 must move in unison.

At the outer end of the piston rod 30 (Figure 8), there is a collar 58 fixed thereto and there is a somewhat similar collar 60 fixed to the piston rod 30 but spaced from the first-mentioned collar 58. This forms or defines a bearing surface between the collars 58 and 60, the collar 60 being fixed in place by means of a pin 62 to facilitate assembly. Braces 64 and 66, respectively, are welded or otherwise rigidly secured to the collar 58 and to the end plate 52 and a channel bracket 68. This channel bracket is fixed to the end of the rod 46 (Figures 2 and 3). In the matter of bracing, it is proposed to use suitable bracing wherever it is found necessary to strengthen the frame construction of the support as well as the traverse apparatus.

A frame generally indicated at 70 and forming a part of the traverse (Figure 8) consists of a substantially U-shaped member which includes a web 72 having a central bearing 74 which is disposed on the surface of the piston rod 30 between the collars 58 and 60 for rotation about the piston rod 30 between the collars 58 and 60 for rotation about the piston rod as an axis. Since this piston rod has been defined as in a horizontal plane, the frame 70 is rotatable about the horizontal axis which is the same as the longitudinal axis of the piston rod 30. The substantially U-shaped frame includes diverging leg portions 76 and 78 which are integral at the ends of the web 72, each of which is provided with a downwardly inclined leg portion 80 and 82, respectively. The downward inclination of the leg portions 82 and 80 is manifest upon inspection of Figure 4.

Sleeve-type bearings 86 and 88, respectively, are secured to the leg portions 82 and 80 and have vertical posts 90 and 92, respectively, disposed therein. These vertical posts form a part of a standard which is to be described in detail subsequently.

A pair of pivot pins 94 and 96, respectively, are disposed in the downwardly inclined leg portions

80 and 82 and are coaxial. These pins are also in a horizontal plane, the longitudinal axis of both of the pins being perpendicular to the longitudinal axis of the piston rod 30. The pivot pins pass through openings in the collars 98 and 100 which are seated in suitable recesses formed in the downwardly inclined leg portion 82. A pin 102 is employed for the purpose of fixing the pivot pin 94 to the washer or collar 100, thereby preventing axial displacement of the pin 94 in that the opposite end thereof is fixed by means of a dowel 104 to the vertical post 90.

A pin 106 is passed through the pivot pin 96 and also through the post 92, thereby preventing axial displacement of the pivot pin 96. This pin passes through the washers or collars 108 and 110, respectively, which are disposed in recesses formed in the downwardly inclined leg portion 80. The brackets 86 and 88 are fixed integral with the washers or collars 98 and 108, respectively.

The pin 96 is somewhat longer than the pin 94. At the end of the pin 96 there is an operator or arm 112 fixed thereto by means of a pin or dowel 114. Accordingly, since the arm or operator 112 is fixed to the pivot pin 96 and the pivot pin 96 is fixed to the post 92 by means of a dowel, rotation of the arm 112 is reflected in movement of the post pivotally about the pin 96 and hence the pin 94 as an axis.

At the junction of the diverging portion 76 and the downwardly inclined portion 80 of the U-shaped member 70, there is an integral arm 116 with an angle iron 118 fixed to the end thereof and it has a horizontal bracket 120 projecting from the upper end thereof. Another horizontal bracket 122 is fixed to the bottom of the angle iron 118 and this bracket has a gusset plate 124 connected therewith for strengthening purposes.

A cylinder 126 is pivoted at its lower end to the bracket 122 and has a piston rod 128 operable therein. This piston rod is pivoted to a bracket 130 which is fixed to the bottom of the operator 112. Accordingly, when the piston is reciprocated in the cylinder 126, the piston rod 128 will move the arm 112 about the pivot 96 and 94 (both pivots taken collectively as a single pivot) so as to cause rotation of the previously mentioned standard which includes the posts 90 and 92. A combination inlet and outlet 132 and a second combination inlet and outlet member 134 are fixed to the cylinder 126 so that the piston may be operated positively in both directions.

A cylinder 140 is pivoted at its lower end within the channel bracket 68 by means of a suitable pivot pin 142 and has a piston rod 144 connected at its upper end to the bracket 120 by means of a pivotal connection 146. Combination inlet and outlet members 148 and 150, respectively, are provided in the cylinder 140 so that positive operation of the piston with the cylinder may be accomplished. Upon extension of the piston rod from the cylinder 140, rotation of the U-shaped frame 70 results about the piston rod 30 as an axis. The axis of the piston rod 30 is perpendicular to the pins 94 and 96 so that corrective movement of the standard is possible in two different directions.

The standard generally indicated at 154 includes the two posts 90 and 92, respectively. Extending across the bottom of a post is a base 156, and a header 158 extends across the top of the posts 90 and 92, respectively. This header has bosses 160 and 162 integral therewith with pins 164 and 166, respectively, passing through

the bosses and the posts, thereby fixing the posts substantially parallel to each other. Since the standard 154 moves inwardly and outwardly with the traverse apparatus, it may be considered a part of the traverse apparatus.

A carriage is disposed on said standard for reciprocative movement. The carriage (Figure 6) consists of a pair of structural members 168 and 170 having cross members 172 and 174 at the upper and lower ends, respectively. At the ends of the cross members, there are bearings 176, 178, 180 and 182, respectively, one bearing being provided at each end of each cross member. The bearings are slidably disposed on the posts 90 and 92, respectively.

A latch keeper 184 is fixed to the bottom cross member 174 and a boss 186 is secured thereto but spaced from the latch keeper. This boss has a bore therein and is adapted to support a member for swinging movement which will be described in detail subsequently. The carriage also has a bracket 188 fixed to the upper cross-member 172 and the function of this bracket will be described subsequently.

A cylinder 190 (Figures 3-5) has a piston rod 192 extending therefrom, the end of the piston rod being fixed to the bracket 188. The cylinder has its lower end disposed on a plate 194 which is secured to the lower cross member 156 of the standard. There is a combination inlet-outlet 196 in the cylinder 190 for conducting fluid into the cylinder beneath the piston which is attached to the piston rod 192 and which is unshown. Accordingly, when fluid is introduced into the cylinder 190 under pressure, the piston rod 192 is extended from the cylinder, thereby lifting the carriage. The carriage is gravity-lowered although power-raised or lifted. The cylinder 190 together with its piston and rod accomplishes the raising of the carriage after it has been gravity-lowered.

A cylinder 200 has an arm 202 fixed thereto, the end of the arm forming a jaw 204. This arm is also rigidly fastened to the plate 194, thereby mounting the arm on the standard. A piston rod 208 projects from the cylinder 200 and has an arm 210 fixed for movement therewith, with a jaw-forming end 212 disposed adjacent the jaw 204. A fluid (preferably air) inlet and outlet 214 are secured to the cylinder 200 so that it may receive fluid for urging the piston together with the piston rod 208 toward the interior of the cylinder. Hence, when fluid under pressure is applied through the inlet 214, the two jaws 212 and 204, respectively, are pulled together in order to clamp one of the guide blocks shown in Figure 10 therebetween. The length of the arms 202 and 210 is such that a selected one of the guide blocks is disposed on the front side of the standard when it is clamped between the jaws.

The guide block 216 has a bore sufficiently large so as to allow the pilot hole-forming member to pass therethrough. The guide 218 has a bore 220 of slightly larger size, while the guide 222 has a bore 224 of still larger size. Flanges 226 are disposed at the upper and lower ends of each guide so as to form an upper and lower limit for engagement of the jaws 204 and 212.

The control means for operating the piston in the cylinder 200 is a conventional solenoid 223 operated valve 225 to control the admission of air into the cylinder when the drill bit or drift pin is in position and the carriage starts downward.

A conventional air motor 230 forms a part of the pilot hole-forming assembly and is pivoted

to the boss 186 which is on the carriage. Since the boss is disposed at an angle with respect to the horizontal, the air motor is adapted to swing about the boss as an axis. In Figures 4 and 13, the two positions of the air motor 230 are illustrated. In this instance, a drill bit 232 is releasably held in the chucks 234 of the air motor and it is the drill bit 232 which is guided by the said guides (Figure 10) while the drill bit reciprocates with the carriage. The air motor rotates the drill bit at this time.

A cylinder 236 having a piston 238 therein is fixed at one end by means of the ear 240 to the bracket 242. This bracket 242 is fixed integral with or rigidly secured to a support arm 244 which has a rigid connection with the carriage members 168 and 170. This rigid connection is formed by bolting or welding.

The piston rod 246 for the piston passes through the cylinder and is pivotally secured to the motor 232 by means of the pivotal connection 250. A spring 252 having one end seated on and reacting on the lower end of the cylinder 236 reacts on the piston 238, constantly urging it interiorly of the cylinder 236. The spring is used for pulling the piston rod 246 within the cylinder and since this piston rod is pivotally connected with the air motor 230, it swings the air motor to the position shown in Figure 13. However, when air pressure is applied within the cylinder and on the piston, the spring is compressed and the piston rod 246 is pushed outwardly of the cylinder, thereby swinging the air motor 230 in an arc to such a position that the latch 258 is lockingly engaged with the latch keeper 184 by sliding thereunder. This stabilizes the air motor 230 in such position that descent of the carriage causes the bit 232 to pass through the guide which is held in place at the lower part of the standard and then into the ground for forming a pilot hole.

A conduit 262 is suitably secured to the standard with a nozzle outlet 264 at the lower end thereof. This nozzle outlet is adapted to spray water in the pilot hole after it has been formed. The opposite end of the conduit 262 has attachment with a source or supply of water, as a tank carried by the vehicle. Water pressure for supplying the spray for the pilot hole is obtained by forcing air in the water reservoir. Pressure is maintained at a suitable pressure with a standard air regulator.

An air hammer motor, generally indicated at 268, is fixed to the carriage members 168 and 170 by means of the clamps 270 and 272 which have bolts passed therethrough and through the apertures 274 formed in the members 168 and 170, respectively. The air motor 268 is of conventional description and is the type used in connection with air hammers. However, a special head (Figure 11) is used in connection with the post driving air hammer motor. The piston 280 is provided with a shank 282 having an end 284 especially provided for accommodation within the hammer motor chuck, the limiting collar 286 being appropriately provided. The piston head 288 has a recess 290 therein with an outwardly flared wall 292 therearound. This piston head 288 is used as the driver for the post. However, the receptacle 294 also acts as a driver in addition to its function as a guide. The receptacle has an opening 296 at the top thereof with the shank 282 passed therethrough. The skirt 298 is outwardly flared in order to more easily accommodate the posts which will be of varying sizes.

A collar or pin 300 is fixed to the shank 282 intermediate its ends and has a spring 302 reacting thereon. This spring also reacts on the upper end of the receptacle 294 so that when the shank 282 is reciprocated, the driver piston head 288 hammers the post. An air inlet member 304 is fixed to the hammer driving motor so that air under pressure may be introduced into this conventional motor in order to operate the post driving head.

For the control system of the various described structural elements, attention is invited primarily to Figure 17. The hydraulic system is shown in connection with schematically illustrated cylinders. The air system is also shown by schematic characters, while the water or other type of fluid for spray purposes is schematically illustrated. It is noted that all of the schematic illustrations of mechanical parts and elements are tied together with a master electrical layout. There is provision, as is apparent from the wiring diagram, for both manual and automatic operation of the various elements and component parts of the invention. Considering first the transverse 44 control group, there is a radio receiver plug or inlet 400 which connects with the lines 402 and 404, respectively. The receiver schematically shown in Figure 16 and indicated at 408 is adapted to be disposed in a convenient place on the vehicle. The said receiver has electrical connection with the plug 400. An antenna 410, preferably of the loop type, is plugged into the receiver 408.

Forming a part of the beam directive apparatus is a sending set 412 which is to be disposed in a convenient location in a field wherein it is desired to drive posts. This sender emits a number of beams as previously described. A visual indicator 414 is supplied in the receiver 408 so as to indicate to the driver of the vehicle whether or not he is following the proper course. When the vehicle deviates slightly to the left, the needle moves to the left. When the vehicle deviates slightly to the right, the needle moves to the right. This is of importance, particularly in connection with the manual control of the traverse 44.

However, for the automatic control, when the vehicle deviates slightly from the prescribed path, a condition of resonance exists in either the electromagnet 416 or 418. This is dependent upon which way (left or right) the vehicle deviates from the prescribed travel so that corrective movement of the traverse may be provided. Either the relay 416 or 418 energized in this way operates the double acting solenoid 420 in one direction or the other; the relay 416 energizing the solenoid 420 so that it will push the plunger 422 outwardly and the relay 418 energizing the solenoid 420 so that it will pull the plunger 422 inwardly. The solenoid 420 is simply provided with two coils, one causing movement of the plunger 422 in one direction and the other, when energized, causing movement of the plunger 422 in the opposite direction. This movement of the plunger 422 is reflected in movement of a valve core 424, causing fluid to flow from the master inlet line 426 through the lines 428 or 430, respectively, in order to operate the piston within the cylinder. Such movement is reflected in corresponding movement of the entire traverse. When the line 428 is used as a pressure line, the line 430 is used as an exhaust line and the reverse is also true.

In order to manually operate the traverse apparatus or structure, a manual switch 434 is pro-

vided. This switch is of the single pole, double throw type causing current from the source 436 to operate the solenoid 420 so that the plunger will move in either direction. The receiver 408 is carried by the traverse apparatus, or simply the antenna is mounted in this position for movement with the traverse apparatus.

Reference is now made to the levelling control group. A mercury, or other type of conducting fluid, U-tube switch 440 is mounted parallel to the traverse apparatus axis. It is energized with a potential of preferably six volts. This U-tube type switch acts as a circuit breaker for use in connection with movement of the standard. It rotates with the standard as the standard moves about the piston rod 30 as an axis. When the start switch button 442 is depressed closing its contacts, the automatic cycle of operation starts. The relays 444 and 446, respectively, are closed by the start button and if the standard is level, that is, if the mercury in the tube touches neither electrode, both of these relays are released with the release of the start button. However, if either of the electrodes at the ends of the U-tube 440 is immersed in the conducting liquid, either the relay 444 or 446 remains closed by the current through the U-tube (which is always held at a potential). There are two sets of contacts operable in connection with the relays 444 and 446 (Figure 17). The second set of contacts in these relays are now also activated by the current in the U-tube switch 440 and its circuit thereby closes the relays 448 and 450, depending upon which electrode is in contact with the conducting medium in the U-tube type switch.

The relays 448 and 450 activate the double acting solenoid 452 so that the plunger 454 is urged inwardly or outwardly, depending upon which relay (448 or 450) is conducting current. Operation of the plunger 454 opens and closes the valve 456 so that fluid is conducted through the lines 458 and 460, respectively. The lines terminate in the inlets and outlets 134 and 132 which have been previously described as in connection with the cylinder 126. This causes corrective tilt to be administered to the standard until it assumes the upright or vertical position, thereby compensating for the roll of the vehicle.

When the mercury level in the mercury type switch 440 descends below the level of the electrodes, the current through the coils of the relays 446 and 444 is interrupted, thereby opening the relays. This causes the relay 448 and the relay 450, respectively, to open and to release the solenoid 452. Hence, the valve 456 has its core returned to neutral and the flow of fluid to the cylinder 126 is prevented, thereby locking the standard in the vertical position. In order to cause this corrective return movement of the core of the valve 446, there is a spring provided in the solenoid 452 opposing operation of the plunger 454 in either the inward or outward direction.

The next group of control elements to be considered involves corrective movement of the standard in response to the standard movement in the backward and forward direction, a direction parallel to the direction of travel of the vehicle in order to compensate for pitch of the said vehicle. The movement referred to of the standard is about the pivot defined by the pins 94 and 96.

The master control unit for this particular sub-combination of elements is a U-tube 462 which is identical in construction to the U-tube 440. Each U-tube has an inwardly extending detent 464 at the bottom and top thereof forming a re-

striction to prevent sloshing of the mercury or other conductive fluid in the U-tubes while the vehicle is in normal travel. It acts in the nature of a baffle within the U-tubes and is provided in the center of the web of each.

When the start button 442 is depressed, the automatic cycle begins to operate. The relays 466 and 468 are energized by the start switch and, if the standard is in the proper position, that is, vertical, the mercury in the tube 462 touches neither electrode and the relays 466 and 468 are released with the release of the start button.

However, if either of the electrodes in the U-tube 462 are immersed in the conducting liquid, the immersed contact causes the connected relay to be held in the closed position by the current through the U-tube. The second set of contacts on the relays 466 and 468 are now also activated by the current flow in the U-tube circuit and these close either of the relays 470 and 472, dependent upon which electrode is in contact with the conducting liquid. The relays 470 and 472 energize the double acting solenoid 474, thereby operating the solenoid plunger 474. This solenoid is similar to the previously described solenoids, that is, it is supplied with a double winding for operation of the plunger 476 in opposite directions, depending upon which winding is energized. The spring disposed therein always opposes the operation of the plunger 476 and returns it to the neutral position.

Operation of the solenoid 474 is reflected in operation of the core of the valve 478, thereby causing fluid to flow through the lines 480 and 482, respectively, which are attached to the inlet and outlet members 148 and 150. When the standard has reached the vertical position compensating for pitch of the vehicle, the valve is closed, preventing any fluid flow into or out of the cylinder 140, thereby causing the standard to be locked in a single position.

This is accomplished when the mercury level in the U-tube 462 descends below the level of the electrode and the current through the coils of the relays 466 and 468 is thereby interrupted, the relays then opening. This causes the relays 470 and 472, respectively, to open and release the solenoid 474. Hence, the spring in the solenoid 474 returns the plunger 476 to neutral, causing the described locking of the piston in one cylinder 140.

For the manual operation of the portion of the circuit described in connection with the two U-tube type switches, there is a four-way toggle switch 484. The slots in the switch housing (schematically shown), which permit movement, are oriented with the two axes of movement of the standard in such a manner that the movement of the bottom of the toggle produces a like movement of the bottom of the standard. This movement is produced merely by using the toggle switch arm 486 to energize the solenoid 474 in the same manner as the automatic operation described in connection with the two U-tubes. It is not necessary to depress the start button to operate this manual levelling switch 484.

Reference is now made to the carriage control group. For this operation, in the automatic cycle, the isolation switches 480, 482, 484, 486, and 488 are closed. The initial position of the double pole, double throw switch 490 is opposite that shown in Figure 17. That is, the contacts 1 and 2 are bridged by the bar 3, and the contacts 4 and 5 are bridged by the bar 5. Pressing the start button 492 closes the relays 494 and 496, respectively.

The relay 494 draws current through the upper limit switch 498 (to be described more in detail subsequently) to supply the moving contact of the relay 496 which is now closed. The current flows through this contact to the double acting solenoid 500 which in turn, through its plunger 502, operates the valve 504. This allows fluid to flow from the cylinder 190, thereby permitting the gravity-lowered carriage to descend.

When the relay 496 was activated, current through the switch contacts 4 and 5 activated the relay 510 which operates the double acting solenoid 512 for the air valve 518. The relay 510 at this time was energized from the source 436 to cause the operation of the solenoid 512.

The solenoid 512 has a plunger 514 therein which, when reciprocated, operates the valve plunger 516 of the valve 518. Since the main inlet 520 of the valve 518 is connected with a compressor and a plenum chamber, air under pressure is introduced into a line 522, thereby feeding the pilot hole-forming member air motor 230 and causing it to operate.

In the operation, since the carriage is now proceeding in a downward direction due to gravity, and the air motor 230 is operating, a pilot hole is being dug by the bit.

The air cylinder 236 which controls the position of the air drill motor 230 is attached to the same line by means of the conduit 526 as the air supply for the air motor 230 and operates to push the drill into position, swinging the entire assemblage about the described pivot points, when the relay 510 is energized initially.

When the drill carriage reaches a predetermined depth, the lower limit switch 530 opens the relay 496. The moving contact 532 of this relay, which is spring lifted, is energized by the relay 494 which is still held down, thereby operating the solenoid 500 in a direction opposite to that previously described, thereby causing fluid to flow into the cylinder 190 to raise the carriage. During this time, the motor 230 continues to operate so that when a drill bit is used for forming a pilot hole, it continues to rotate while it is being lifted from the hole to help clean out the loose soil from the pilot hole.

There is a solenoid operated water valve 540 which is interposed in the conduit 262. This solenoid-operated water valve is rendered operative when the drill or drift pin is removed from the pilot hole before the driving operation on the post P begins so that the hole is sprayed with water or other liquid, thereby allowing the post which is to be driven in the pilot hole and enlarging it, to pass into the ground more easily. The electrical circuit is so timed that as the drill leaves the pilot hole, a period of a few seconds is used for spraying water into the pilot hole.

The second part of the cycle of operation is as follows: When the carriage nears the top of its travel, the carriage mounted actuator 542 engages the star wheel 544 controlling the double pole, double throw rotary switch 490. This rotates the star wheel 90°. The actuator 542 consists of an arm which is pivoted to the carriage having a roller 546 at the end thereof for engagement with the star wheel 544. Due to the overlapped portion 548 of the actuator with the part of a bracket on the carriage on which it is mounted, the actuator is capable of movement in one direction from the horizontal but is prevented from any movement in the opposite direction from the same horizontal datum.

When the switch 490 is rotated 90° as described, current flows through the switch contacts as disclosed in Figure 17 to energize the relay 496 which operates the solenoid 500 to release fluid from the cylinder 190, thereby allowing the carriage to be lowered by the pull of gravity. The relay 510 which was activated through the bridging of the contacts 4 and 5, was open when the switch was turned 90°, thereby stopping the air supply to the air motor 230. This also released the pressure from the cylinder 236, allowing the spring 252 to swing the motor laterally to an inoperative and out-of-the-way position. The water supply was also rendered inoperative.

Current through the switch contacts of the switch 490 bridged by the bar 6, as disclosed in Figure 17, operates the relay 550, and the double acting solenoid 552 is thus caused to be energized. Energization of the solenoid 552 causes axial displacement of the plunger 554 which in turn operates the valve 556 core so as to allow air under pressure to flow through the line or conduit 558 and into the inlet 304, ultimately for operation of the air hammer motor 268.

At this time, the post to be driven in the ground is disposed in part within the pilot hole (sharp end on bottom of post) by a worker and it is driven into the ground as the carriage moves downwardly due to the pull of gravity, the air hammer being operated continuously at this time.

When the post reaches a predetermined depth as defined by the lower limit of the carriage, the lower limit switch 530 is opened in response to engagement by the carriage. This causes the relay 496 to open, actuating the solenoid 500 causing the fluid again to flow into the cylinder 190 through the valve 504. This raises the carriage and at the same time the air hammer is rendered ineffectual by the release of the solenoid 550.

The above describes an automatic complete cycle of operation for driving one post into the ground. However, there may be times when it is found desirable and even necessary to operate either the entire cycle by manual control or any portion thereof by manual control. Provision is made to meet such a demand. Accordingly, four switches are interposed in the wiring connecting various relays. Each of the switches is energized from the source 436 so as to operate the solenoids directly from the source. The first switch 570 is so arranged to cause solenoid operation to lift the carriage. Then, the switch 572 controls the operation of the air motor 230. The switch 574 moves the carriage downwardly by releasing the fluid which is ordinarily trapped in the cylinder 190. The final switch 576 operates the air hammer motor 268, while the switch 578 is used for the control of the solenoid 540 operated valve for the water supply.

From a structural standpoint, when the carriage reaches its lower limit, the lower limit switch 530 is operated. Hence, this lower limit switch must be disposed in the line of travel of the carriage. Accordingly, by means of a clamp 580, held in place by a set screw 582 or some other suitable adjusting means, the said lower limit switch 530 is fixed to one of the parts of the standard.

The upper limit switch 498 is disposed slightly above the star wheel 544 of the double pole, double throw switch 490. Accordingly, in order for the carriage to reach its upper limit and energize the upper limit switch, it must pass the star wheel and operate the same.

There is a switch control box 584 disposed on a convenient bracket which is secured to the traverse. Accordingly, the various control switches are accessible to the individual causing operation of the device in the field.

Insofar as the bank of valves controlling the flow of liquid is concerned and the flow of air is concerned, two systems may be employed. The first system is the utility of a number of inlets, one provided for each individual valve, the inlets being connected with suitable sources such as a pump and compressor, respectively. The other system would be the use of special valves requiring only one inlet and one exhaust, as at 590, the valves being connected in a series so that fluid flowing from the upper valve as a supply is tapped may be directed through the various lines as the various valves are operated. With respect to the air group, no outlet is necessary in the bank of valves in that the conventional motors 230 and 268 are provided with exhaust ports.

In certain types of ground, the use of a drill to form the pilot hole is impractical. Under these conditions, the drift pin 600 (Figure 22) is employed, reference to Figure 18 showing the drift pin actually located in the machine. For operation of the machine on the automatic cycle, the switch 490 is rotated an amount so that the contact bar 6 bridges the contacts 1 and 2, and the contact bar 3 bridges the contacts 4 and 5. Pressing the start switch 442 closes the relays 494 and 496. The relay 494 draws current through the upper limit switch 498 to supply the moving contact of the relay 496 (which is now closed), and through this contact to the double acting solenoid 500, which operates the hydraulic control valve 504 to release oil from the cylinder 190 and allow the carriage to descend due to the pull of gravity. When the relay 496 was activated, current through the contacts 4 and 5 activated the relay 510, which, energized with current from the main supply, operates the solenoids 512 and 552 through the line 553 which has the manually operable switch 557 therein. This switch is employed inasmuch as the air hammer or air motor should not operate during the first part of the cycle of carriage operation when the drill is used in lieu of the drift pin 600.

The solenoid 512 operates the drift pin control cylinder 602 to swing the drift pin carriage 604 forward into position, and the solenoid 552 operates the air motor which moves down with the carriage.

The carriage is now proceeding in a downward direction with the air hammer operating. The drift pin control cylinder 602 is pressurized so that the drift pin carrier or carriage 604 has now swung off the latch or support and the carrier pin assembly is free to slip downward along the carrier cylinder 190, supported only by the lower carriage cross-arm until the point of the drift pin strikes the ground.

It should be understood that while the air motor is operating during this first part of the cycle, the air hammer head is not in contact with the drift pin because of the slack in the system. This slack in the system assures that the top of the drift pin will be struck only when the point is actually penetrating the soil; and also assures that the air hammer will not be causing the apparatus to shake to pieces.

The upper end of the drift pin is flat and for a distance is cylindrical so that it is free to slide up and down in the drift pin holder or carrier

17

sleeve 608. The supporting flange 610 of the drift pin 600 is essential. When the point of the drift pin contacts the ground, and only then, the pin stops temporarily as the carriage continues in its descent. When the slack or clearance is taken up between the upper end of the drift pin and the driving head of the air hammer, the head contacts the top of the drift pin and drives it into the ground.

When the carriage reaches a predetermined depth, the lower limit switch 530 opens the relay 496. The moving contact of this relay (which is spring lifted), energized by the relay 494 which is still held down, operates the solenoid 500 to reverse the direction of the carriage cylinder 190 operation. The air hammer continues to run, but as the carriage rises, it is not in contact with the drift pin 600. The drift pin carrier contacts the lower carriage cross-arm or cross-member and is lifted with it. When the drift pin carrier contacts the lifting flange 610 on the drift pin, the drift pin is pulled from the ground. The solenoid-operated water valve 225 is activated at this time and the hole is sprayed with water.

When the carriage nears the top of its travel, the carriage-mounted actuator 542 engages the cam or star wheel 554, causing many degree operation of the isolation switch 490. When this switch is operated, current flows through the contacts as disclosed in Figure 17 in order to energize the relay 496 which operates the solenoid 500 in such direction as to lower the cylinder 190 retained piston. The relay 510, which was activated through the isolation switch 490 was opened when this switch was turned, thereby stopping the air hammer and releasing pressure from the drift pin control cylinder 602 which is connected to a suitable conduit to the valve 513 in lieu of the conduits 522 and 526.

At this time, the drift pin carrier is above the off-cycle support 614 and at such a height that the control cylinder pawl (Figures 19 and 20) 618, which is attached for operation to the piston rod of the piston within the cylinder 602. When the air pressure is released, a spring connected with the control cylinder 602 reacts on this pawl, causing the drift pin carrier to rotate about the carriage cylinder 190, around which the mounting collar 620 of the carrier 604 is disposed.

The water valve 225 is closed; current through the relay 550 turns on the air hammer motor again; the post is inserted into the hole manually, and is driven into the ground as the carriage moves downward with the hammer operating.

When the post P reaches a predetermined depth, the lower limit switch 530 is opened by the carriage, causing relay 496 to open, activating the solenoid 500 to raise the piston in the cylinder 190. This stops the air hammer by releasing the relay 550.

When the carriage cylinder reaches the top of stroke, it rotates the switch 490 ninety degrees to put the apparatus in readiness for another cycle of operation. The cylinder continues to rise until the upper limit switch 498 opens, thereby opening the relay 494, this causing the cycle to stop by removing current from the solenoid 500.

It is noted that the drift pin carrier 604 is provided with a keeper 624 to engage in the notch 626 of the pawl 618. The drift pin holder or carrier 604 remains on the off-cycle support 614, which is fixed by means of the bracket 630 at its upper end to a suitable part of the apparatus and

18

welded at its lower end to the cross member 156. This retains the drift pin swung clear of the hammer during the operation of the post driving assembly. The drift pin does not come into position again until such time that the manual start button 442 is operated to initiate a new cycle of operation.

Having described the invention, what is claimed as new is:

1. In an automatic post driving device disposed on a vehicle which operates in the sequential steps of operating a pilot member to form a pilot hole in the ground, and swinging the pilot member from above the pilot hole and then actuating a hammer to drive a post in the pilot hole; the structure comprising a support secured to the vehicle, a standard carried by said support and having operatively connected therewith means for rotating said standard about a horizontal axis, and means for rotating said standard about an intersecting horizontal axis, a carriage disposed on said standard with a pilot hole forming member secured to said carriage, a post driving hammer secured to said carriage and means operatively connected to said hammer, and actuated in response to a movement of said carriage for rendering said hammer operative.

2. In an automatic post driving device disposed on a vehicle which operates in the sequential steps of operating a pilot member to form a pilot hole in the ground, and swinging the pilot member from above the pilot hole and then actuating a hammer to drive a post in the pilot hole; the structure comprising a support secured to the vehicle, a standard carried by said support, means operatively connected with said standard for rotating said standard about a horizontal axis, and means for rotating said standard about an intersecting horizontal axis, a carriage disposed on said standard, a pilot hole forming member, means securing said member to said carriage so that it is capable of swinging to an operative and an inoperative position, means operatively connected with said carriage for raising the carriage, and means in the line of travel of the carriage rendered operative upon engagement by the carriage for causing said pilot hole-forming member to swing to the inoperative position, and a post hammer carried by said carriage.

3. The combination of claim 2, and means operatively connected with said carriage and rendered operative in response to movement of the carriage in one direction for actuating said hammer.

4. The combination of claim 3 and a water supply line secured to said standard for supplying a charge of water in the pilot hole prior to manual disposition of a post in the line of travel of the carriage while the post hammer is being actuated.

5. An apparatus for driving posts in the ground comprising a vehicle having a support, a standard, means mounting said standard on said support for movement about spaced parallel, relatively perpendicular horizontal axes, means operatively connected with said standard and responsive to the tilt of the vehicle for moving said standard to the vertical position, a horizontal cylinder secured to said support and having a piston secured to said standard, radio signal-responsive means operatively connected with the cylinder for operating the piston thereby horizontally displacing said standard to compensate for irregular travel of the vehicle, a pilot hole-

forming member carried by said standard, and a post-driving member carried by said standard.

6. An apparatus for driving posts in the ground comprising a vehicle having a support, a standard, means mounting said standard on said support for movement about spaced parallel, relatively perpendicular, horizontal axes, means operatively connected with said standard and responsive to the tilt of the vehicle for moving said standard to the vertical position, a horizontal cylinder secured to said support and having a piston secured to said standard, radio signal-responsive means operatively connected with the cylinder for operating the piston thereby horizontally displacing said standard to compensate for irregular travel of the vehicle, a pilot hole-forming member, a carriage disposed on said standard, means swingingly securing said pilot hole-forming member to said carriage, means for releasably holding said hole-forming member in a predetermined position, and a post-driving hammer secured to said carriage for movement therewith.

7. In an apparatus for driving posts in the ground, a vehicle, a support secured to said vehicle, a standard, means securing said standard to said support for displacement in a horizontal plane, means rendered operative in response to a radio signal for actuating said first named means and thereby displacing said standard, and a post driving means carried by said standard to drive posts into the ground.

8. In an apparatus for driving posts in the ground, a vehicle, a support secured to said vehicle, a standard, means securing said standard to said support for displacement in a horizontal plane, means rendered operative in response to a radio signal for actuating the first named means and thereby displacing said standard, a carriage slidably disposed on said standard and movable to an upper limit and a lower limit, at which limits there are respectively an upper and lower switch, a pilot hole-forming member swingingly secured to said carriage, means rendered operative when said carriage engages the upper limit switch for swinging said member to the inoperative position, a post driving hammer carried by said carriage, and other means rendered operative when said carriage engages and actuates said upper switch for operating said hammer to drive a post into the ground.

9. In an apparatus for driving posts in the ground, a vehicle, a support secured to said vehicle, a standard, means securing said standard to said support for displacement in a horizontal plane, means rendered operative in response to a radio signal for displacing said standard, a carriage disposed on said standard for movement thereon to an upper limit and a lower limit, at which limits there are respectively an upper and lower switch, a pilot hole-forming member swingingly secured to said carriage, means rendered operative when said carriage engages the upper limit switch for swinging said member to the inoperative position, a liquid spray device secured to said standard, means operatively connected with said device and actuated when said carriage operates said lower switch for spraying liquid in the pilot hole, a post driving hammer carried by said carriage, and means responsive to engagement of the carriage with the upper switch for closing the liquid spray device and for actuating said hammer.

10. The combination of claim 8 and means operatively connected with said carriage and the

lower switch for raising said carriage, and said carriage raising means being rendered inoperative when said carriage engages and actuates said upper switch.

11. In an apparatus for driving posts in the ground, a vehicle, a support secured to said vehicle, a standard, means securing said standard to said support for displacement in a horizontal plane, means rendered operative in response to a radio signal for displacing said standard, said standard displacing means having a manually operable switch operatively connected therewith for manually rendering said standard displacing means operative, and a post-driving means carried by said standard for actuating the first named means and thereby driving posts into the ground.

12. In an apparatus for driving posts to form a fence, a vehicle, a support carried by the vehicle, a vertical standard, means connected with said support for mounting said standard for lateral movement relative to said support, and other means responsive to a radio signal for moving said standard inwardly and outwardly of said support so as to compensate for deviations of the vehicle in straight line travel and thereby maintaining the vertical standard in a vertical plane while the vehicle is in motion.

13. In an apparatus for driving posts to form a fence, a vehicle, a support carried by the vehicle, a vertical standard carried by said support, and means responsive to a radio signal for moving said standard inwardly and outwardly of said support so as to compensate for deviations of the vehicle in straight line travel and thereby maintaining the vertical standard in a vertical plane while the vehicle is in motion, a horizontal pivot connecting said standard with a part of said means, and means responsive to roll of the vehicle for moving said vertical standard about said pivot to such position as to retain the standard to a vertical position within the vertical plane.

14. In an apparatus for driving posts to form a fence, a vehicle, a support carried by the vehicle, a vertical standard carried by said support, and means responsive to a radio signal for moving said standard inwardly and outwardly of said support so as to compensate for deviations of the vehicle in straight line travel in maintaining the vertical standard in a vertical plane while the vehicle is in motion, a horizontal pivot connecting said standard with a part of said means, and means responsive to roll of the vehicle for moving said vertical standard about said pivot to such position as to urge the standard to a vertical position within the vertical plane, a second horizontal pivot having its axis perpendicular to the axis of the first-mentioned pivot, said second pivot connecting said standard with a part of the means for moving the standard inwardly and outwardly of said support, and means operatively connected with said standard rendered operative in response to pitch of the vehicle for moving the standard to urge it to the vertical position.

15. In an apparatus for driving posts to form a fence, a vehicle, a support carried by the vehicle, a vertical standard carried by said support, and means responsive to a radio signal for moving said standard inwardly and outwardly of said support so as to compensate for deviations of the vehicle in straight line travel and thereby maintaining the vertical standard in a vertical plane while the vehicle is in motion, a horizontal

pivot connecting said standard with a part of said means, and means responsive to roll of the vehicle for moving said vertical standard about said pivot to urge the standard to the vertical position, a second horizontal pivot having its axis perpendicular to the axis of the first-mentioned pivot, said second pivot connecting said standard with a part of the means for moving the standard inwardly and outwardly of said support, and means operatively connected with said standard rendered operative in response to pitch of the vehicle for moving the standard to the vertical position, a carriage disposed on said standard, a power actuated pilot hole-forming member secured to said carriage, and a post driving member secured to said carriage.

16. In an apparatus for driving posts to form a fence, a vehicle, a support carried by the vehicle, a vertical standard carried by said support, and means responsive to a radio signal for moving said standard inwardly and outwardly of said support so as to compensate for deviations of the vehicle in straight line travel and thereby maintaining the vertical standard in a vertical plane while the vehicle is in motion, a horizontal pivot connecting said standard with a part of said means, and means responsive to roll of the vehicle for moving said vertical standard about said pivot to such position as to urge the standard to the vertical position, a second horizontal pivot having its axis perpendicular to the axis of the first-mentioned pivot, said second pivot connecting said standard with a part of the means for moving the standard inwardly and outwardly of said support, means operatively connected with said standard rendered operative in response to pitch of the vehicle for urging the standard to the vertical position, a gravity-lowered carriage slidably carried by said standard between an upper limit and a lower limit, a pilot hole-forming member secured to said carriage, means for lifting said carriage to the upper limit after it has been lowered to the lower limit, thereby withdrawing said member from the pilot hole, a post hammer secured to said carriage, a switch disposed at the upper limit engageable by and operated by said carriage, and means, of which said switch is a part, operatively connected with the carriage lifting means to render said lifting means inoperative.

17. An apparatus for driving posts into the ground to form a fence, comprising a vehicle, a support fixed to the vehicle, a traverse apparatus disposed on said support and movable in a horizontal plane, said traverse apparatus including a vertical standard, means carried by said vehicle responsive to a radio signal for operating said traverse apparatus in the horizontal plane inwardly and outwardly of said vehicle whereby when the vehicle deviates from a straight line of travel, the traverse moves to compensate for the deviations thereby maintaining said standard in a substantially straight line of travel, a carriage slidably disposed on said standard and arranged to be gravity lowered between an upper limit and a lower limit, a pilot hole-forming member secured to said carriage, and means operatively connected with said member for rotating said member while said carriage is being gravity-lowered so as to form a pilot hole, means carried in part by said standard and operatively engaged by said carriage when said carriage reaches the lower limit for lifting said carriage and for discontinuing rotation of said pilot hole-forming member, means carriage in part by said standard

and operatively engaged by said carriage when the carriage reaches the upper limit for rendering said carriage lifting means inoperative and for swinging said pilot hole-forming member to an inoperative position, a post driving hammer secured to said carriage, means operatively connected to said hammer rendered operative upon engagement by said carriage as the carriage reaches the lower limit, and means operatively connected with the part of said means which is engaged by said carriage when said carriage is lowered, for rendering said hammer inoperative and for rendering operative the means for lifting said carriage.

18. The combination of claim 17 and a liquid spray device secured to said standard and rendered operative in response to engagement of said carriage with the means disposed at the lower limit of the travel of the carriage so that liquid may be sprayed in the pilot hole.

19. In a device for driving posts into the ground so that a fence may be formed, a support having a traverse apparatus arranged for horizontal movement thereon, said traverse apparatus including a first horizontal pivot and a second horizontal pivot having an axis arranged at ninety degrees with respect to the axis of the first horizontal pivot, a frame arranged for rotation about said first horizontal pivot, a standard connected to said frame by said second horizontal pivot, means responsive to deviations of said standard from the vertical for rotating said frame about said first pivot to urge said frame to the vertical position, and means operatively connected with said standard for rotating said standard about the second horizontal pivot in response to deviations of said standard from the vertical so that the standard is retained in the vertical position, a rotatable pilot hole-forming member, a carriage gravity-lowered and power-lifted, said carriage having said pilot hole-forming member swingingly secured thereto, said carriage being slidably disposed on said standard, the carriage being power-lifted by means of a piston having a cylinder therein, the piston and cylinder reacting respectively on said standard and said carriage, a post-driving hammer secured to said carriage above said pilot hole-forming member, and means for operating said hammer, means including an upper limit switch and a lower limit switch secured to said standard, the switches being actuated upon engagement by said carriage when the carriage reaches the upper and lower limits, respectively, said means which includes the upper and lower limit switches being operatively connected with the means for raising the carriage and said pilot hole-forming member and said hammer for sequential operation; to wit, operation of said pilot hole-forming member, while the carriage is being gravity-lowered; the lifting of the carriage while the pilot hole member ceases to rotate; the operation of said hammer while the carriage is again being lowered; and finally the lifting of the carriage.

KENNETH H. HOEN,

GILBERT M. WILLIAMS.

Administrator of the estate of James M. Archer, deceased.

References Cited in the file of this patent UNITED STATES PATENTS

Number	Name	Date
1,005,770	Clark	Oct. 10, 1911
1,375,066	Rowe	Apr. 19, 1921
2,399,190	Kelly	Apr. 30, 1946