

[54] **HYDRAULICALLY ACTUATED CAVITY FORMING DEVICE**

[76] Inventor: **Ernest J. Gremillion**, P.O. Box 11-K,
Cut Off, La. 70345

[22] Filed: **Nov. 16, 1971**

[21] Appl. No.: **199,121**

[52] U.S. Cl. **175/108, 173/50, 173/147**

[51] Int. Cl. **E21c 5/06, E21c 5/11**

[58] Field of Search..... **175/108, 122, 203;
173/147.50, 52**

[56] **References Cited**

UNITED STATES PATENTS

2,088,649	8/1937	Hart.....	173/147 X
3,179,186	4/1965	Bull.....	173/147 X
3,520,374	7/1970	Ebert.....	173/147 X
2,958,514	11/1960	Lee.....	173/147 X
2,394,771	2/1946	Hill.....	173/50 X
2,845,251	7/1958	Barton et al.....	173/147 X
2,849,212	8/1958	Robbins.....	173/147 X
3,089,550	5/1963	Watson.....	173/147
3,108,645	10/1963	Hill.....	175/108

3,288,229 11/1966 Chappuis 173/147 X

Primary Examiner—David H. Brown
Attorney—Harvey B. Jacobson

[57] **ABSTRACT**

A pair of longitudinally movable stems supported for generally vertical movement by a supporting and guiding structure on a mobile vehicle with the stems being extended and retracted by a unique actuating mechanism in the form of a hydraulically powered piston and cylinder assembly and an overdrive driving connecting with the stems for moving the stems a longitudinal distance twice the longitudinal extension and retraction of the piston and cylinder assembly. A hydraulic motor is provided for rotating the stems which are hollow and provided with an auger flight on the lower end thereof to facilitate insertion into the ground surface after which the stems may be slightly elevated to form an underground cavity into which an explosive charge may be introduced through the hollow stems for detonation, such as is employed in determining underground formations in underground surveys.

12 Claims, 8 Drawing Figures

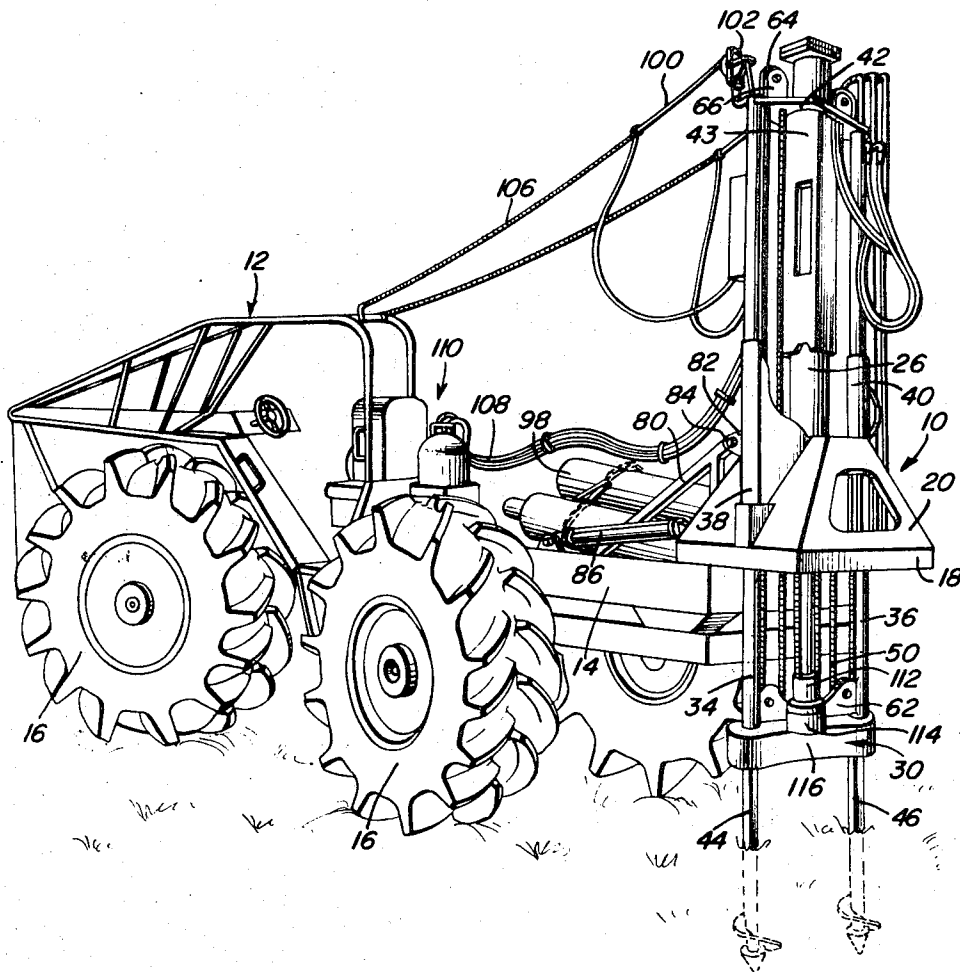


Fig. 1

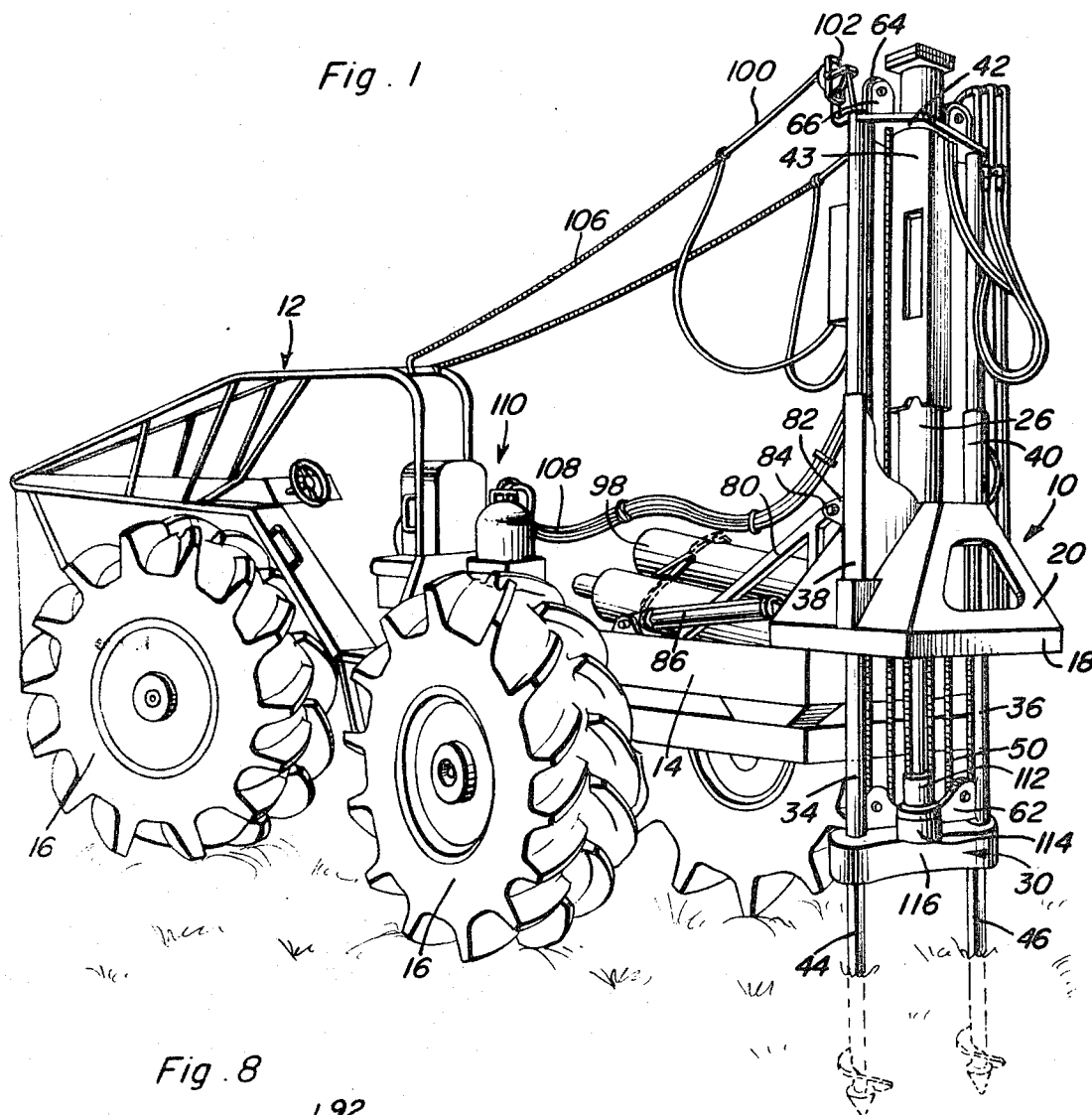
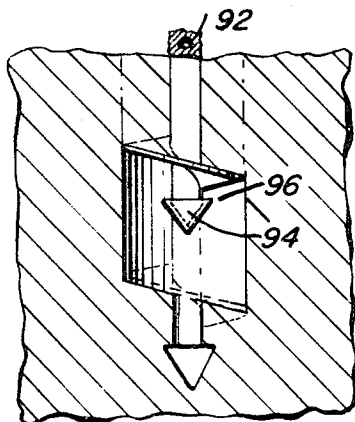


Fig. 8



Ernest J. Gremillion

INVENTOR.

BY *Clarence A. O'Brien*
and *Harvey E. Jacobson*
Attorneys

Fig. 2

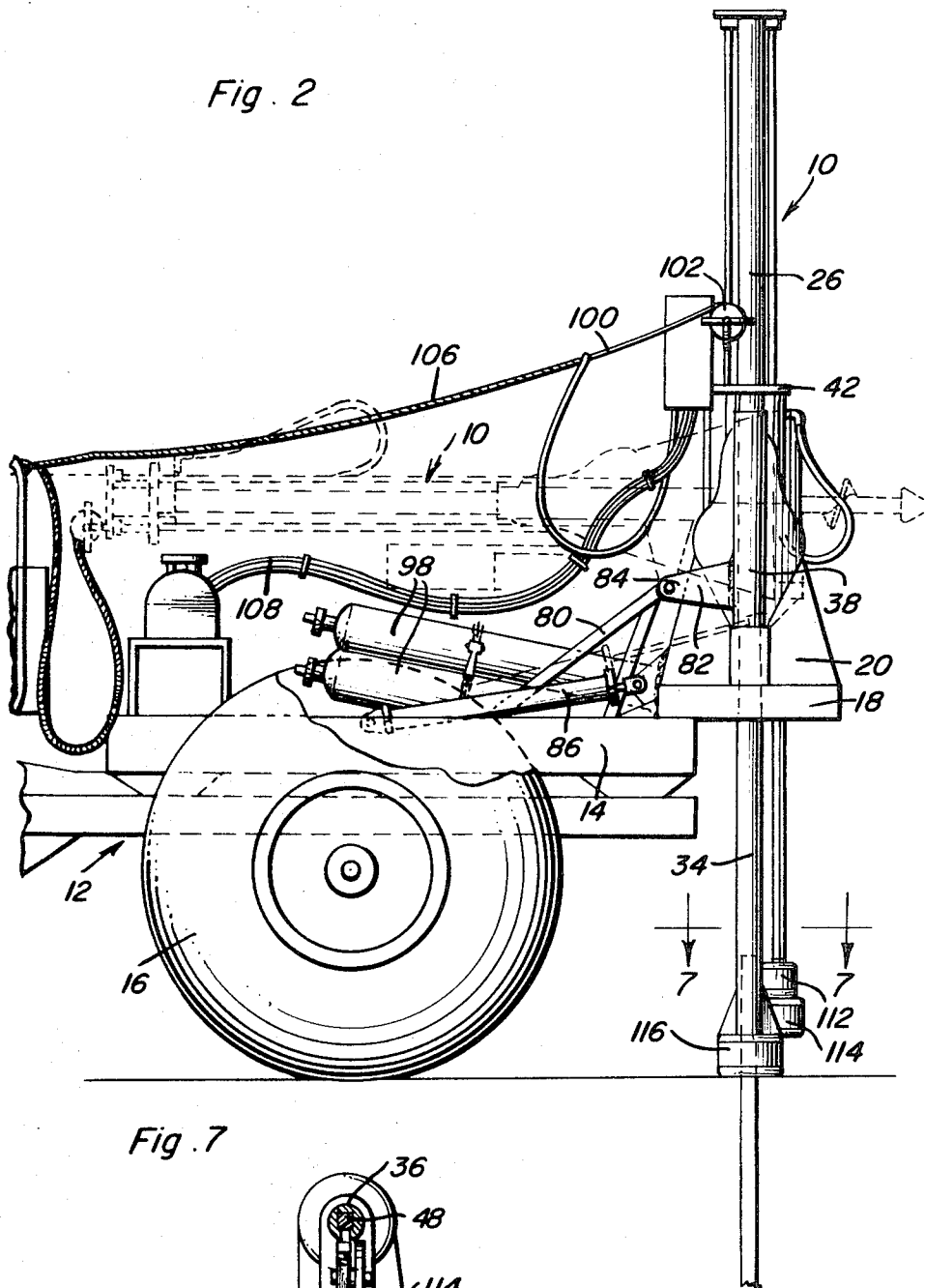
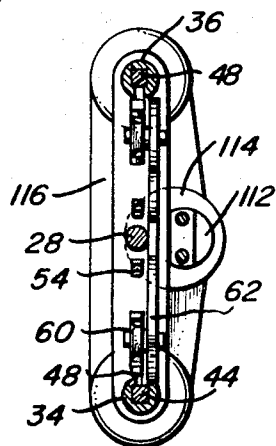


Fig .7



Ernest J. Gremillion

INVENTOR.

BY *Clarence A. O'Brien*
and Harvey E. Jacobson
Attorneys

Fig. 3

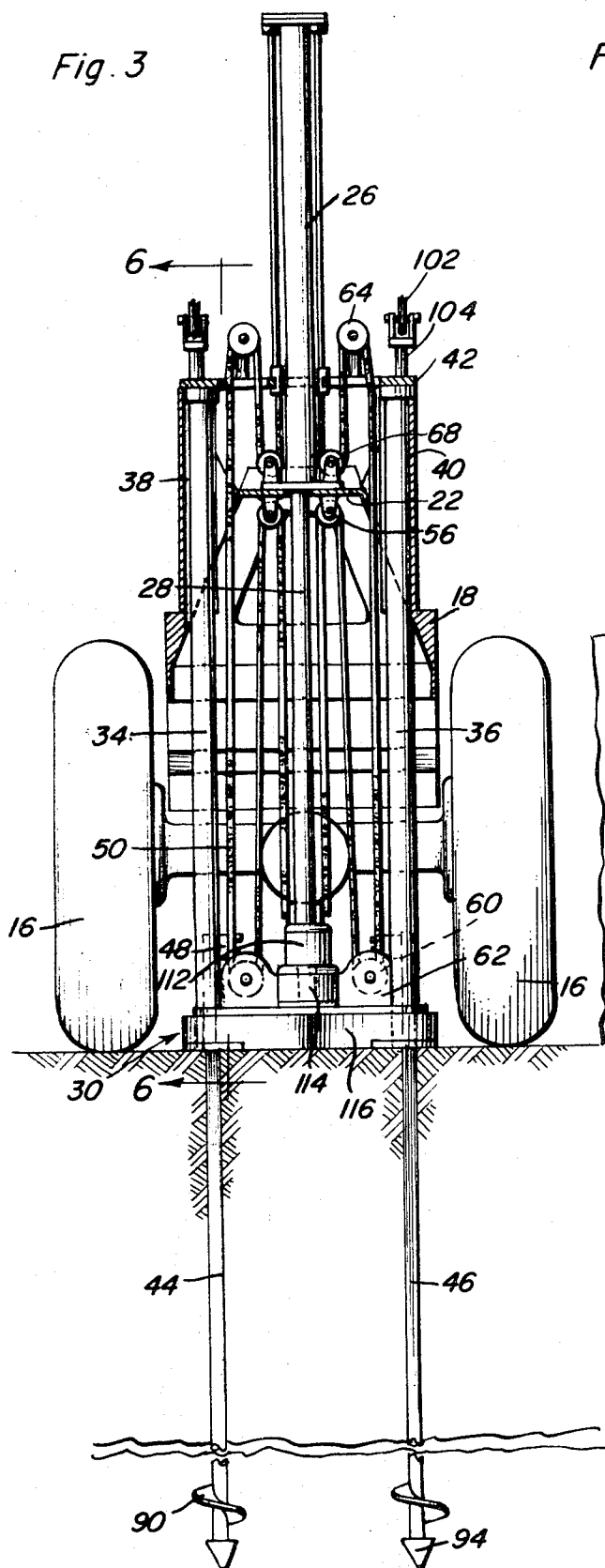
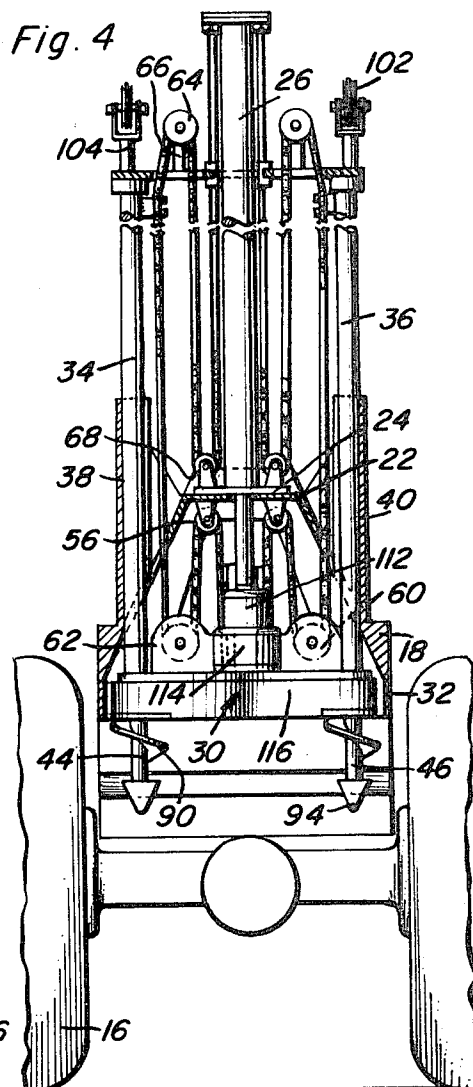


Fig. 4



Ernest J. Gremillion

INVENTOR.

BY *Clarence A. O'Brien*
and *Harvey B. Jackson*
Attorneys

Fig. 5

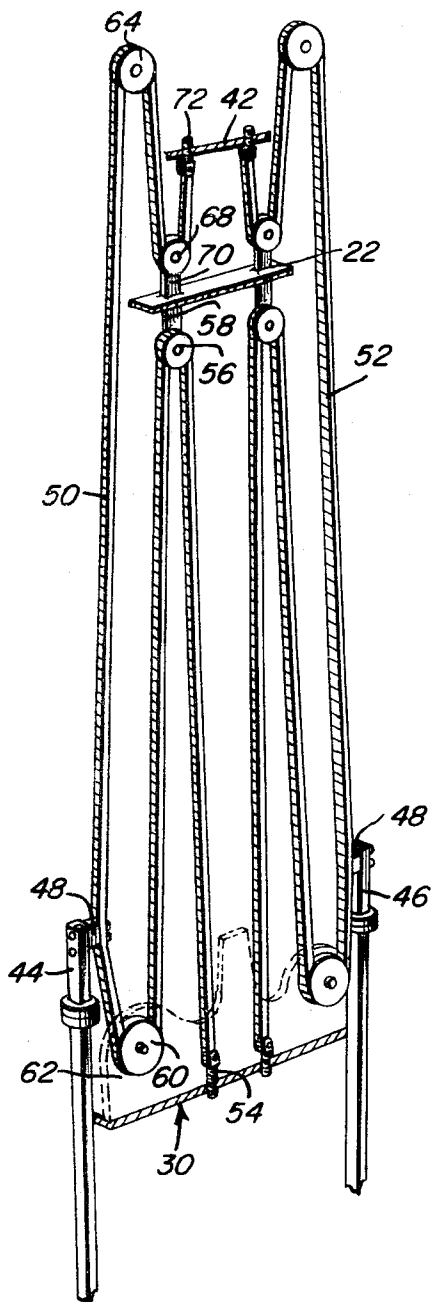
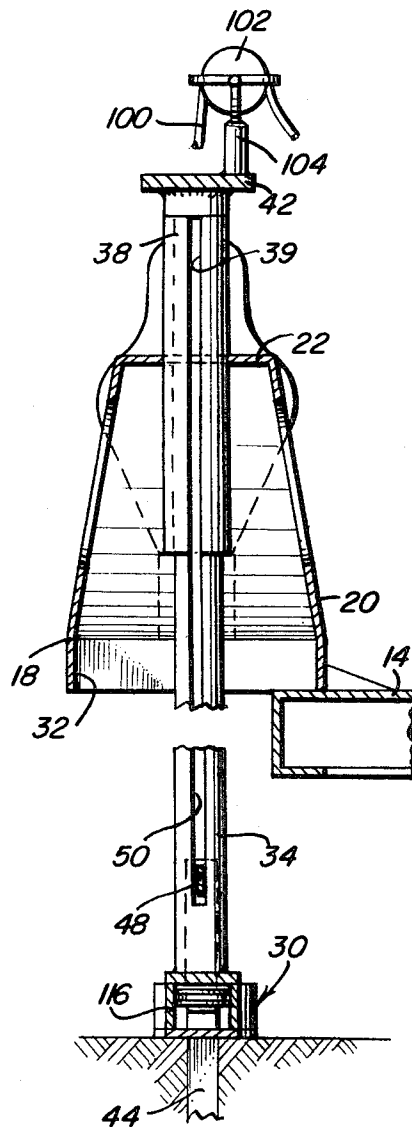


Fig. 6



Ernest J. Gremillion

INVENTOR.

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

HYDRAULICALLY ACTUATED CAVITY FORMING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to a device for forming below ground cavities for introduction of an explosive charge and which includes a pair of rotatably driven stems that are forced downwardly into the ground surface by a hydraulic mechanism which includes a piston and cylinder assembly which is longitudinally extensible and retractable and which is connected with the stems in such a manner to extend and retract the stems a longitudinal distance twice the longitudinal extension and retraction of the piston and cylinder assembly.

2. Description of the Prior Art

In underground exploration and survey work, the characteristics of the underground formations are determined by detonation of explosive charges in predetermined patterns and recording the characteristics of the shock waves emanating from such explosions. Those skilled in the art are then able to interpret such information to determine the characteristics of the underground formations involved. In carrying out such surveys, it is necessary to form an underground cavity into which the explosive charges are placed for detonation. Various techniques have been employed for forming such cavities and while the performance thereof is adequate to a certain degree, such previously known devices generally require excessively large equipment which is extremely difficult to maneuver into position and also does not form the cavity in a quick and efficient manner which is necessary to economically conduct an underground survey.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a cavity forming device mounted on a vehicle capable of traversing any terrain encountered and constructed for high maneuverability with the cavity forming device including a pair of stems which are longitudinally guided in a generally vertical direction by a suitable supporting and guiding framework and which are extended and retracted by a hydraulically operated piston and cylinder assembly connected to the respective stems by a unique mechanism which extends and retracts the stems a longitudinal distance twice that of the longitudinal extension or retraction of the piston and cylinder assembly, thereby enabling a rapid insertion and retraction of the stems for reducing the time necessary to form the cavities and also enabling an overall reduction in the dimensions of the piston and cylinder assembly and the related structure.

Another object of the invention is to provide a cavity forming device in which the stems are hydraulically rotated and provided with an auger flight at the bottom thereof which is substantially greater in diameter than the external dimensions of the stems to facilitate insertion of the stems into the ground and enabling a cavity to be formed after the stems have been inserted by elevating the stems a relatively short distance, thus lifting the column of soil above the flight a short distance to provide a cavity with which the bottom end of the stems communicate.

A further object of the invention is to provide a cavity forming device in accordance with the preceding

object in which the stems are hollow and adapted to be communicated with an explosive charge forming material for introduction of an explosive charge into the cavity formed below the auger flight through a check valve assembly in the lower end of each stem to provide for detonation of the explosive charge in the cavity after which the rotational direction of the stems may be reversed and the stems rapidly retracted from the ground surface without leaving a vertically elongated bore in the ground surface.

Yet another object of the invention is to provide a cavity forming device in accordance with the preceding objects in which the extending and retracting mechanism for the stems as well as the supporting and guiding mechanisms therefor includes a vertically movable crosshead forming the driving end and a portion of the guiding mechanism is vertically movable from a retracted upper position to a lower extended position against the ground surface to provide for maximum clearance when in elevated position and facilitate movement of the stems a distance twice that of the piston and cylinder assembly.

Still another important object of the present invention is to provide a hydraulically actuated cavity forming device which is highly maneuverable, quick and efficient in forming a plurality of cavities in a predetermined pattern and relatively inexpensive to manufacture, operate and maintain.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the hydraulically operated cavity forming device of the present invention illustrating the stems partially extended;

FIG. 2 is a side elevational view of the rear portion of the assembly of FIG. 1 illustrating the stems extended with the crosshead engaging the ground surface and illustrating the relationship of the various components of the mechanism;

FIG. 3 is a vertical sectional view taken transversely of the device, with parts in elevation, illustrating the association of the components of the device when the stems are in fully extended or lowered position;

FIG. 4 is a sectional view similar to FIG. 3 but with the stems elevated;

FIG. 5 is a diagrammatic perspective view illustrating the overdrive chain mechanism employed for moving the stems longitudinally a distance twice that of the longitudinal extension and retraction of the hydraulically actuated piston and cylinder assembly;

FIG. 6 is a fragmental sectional view illustrating the downwardly opening hollow cavity which receives the crosshead when in elevated position and taken substantially along a plane indicated by section line 6-6 of FIG. 3;

FIG. 7 is a sectional view taken substantially upon a plane passing along section line 7-7 of FIG. 2 illustrating the relationship of the components of the mechanism;

FIG. 8 is a fragmental detailed view illustrating the position and condition of the lower end of the stem after it has been slightly lifted or elevated after com-

plete insertion into the ground to form the underground cavity.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now specifically to the drawings, the hydraulically actuated cavity forming device of the present invention is generally designated by reference numeral 10 and is illustrated in combination with a carrying vehicle generally designated by the numeral 12 which may be in the form of an articulated, wheeled vehicle such as a "swamp buggy" which in and of itself is a conventional four-wheeled vehicle employed in terrain not suitable for conventional truck operation and the like. It is pointed out that the device of the present invention may be mounted on various types of vehicles which include a supporting framework 14 and ground engaging propelling and steering control wheels or other components 16.

The hydraulically actuated device includes a generally horizontally disposed frame 18 having an upwardly extending conical member 20 rigid therewith which terminates in a horizontal top plate 22 to which is attached a lower end plate 24 of a vertically elongated hydraulic cylinder 26 which has a double acting piston therein and a piston rod 28 extending downwardly therefrom through the top plate 22. The lower end of the piston rod 28 is connected with a crosshead generally designated by numeral 30 which is dimensioned to be telescopically received within the depending flange 32 which forms a part of frame 18 so that when the crosshead 30 is elevated, it will be within the confines of the frame 18 as illustrated in FIG. 4.

Also connected to the crosshead 30 is a pair of upwardly extending parallel rigid tubular members 34 and 36 which extend up through the frame 18 and upwardly extending tubular guides 38 and 40 projecting upwardly from the frame 18 to guide the tubular members 34 and 36 during vertical movement in relation to the frame 18 as the crosshead 30 is moved between a retracted position as illustrated in FIG. 3 to an extended position as illustrated in FIG. 4 in which the lower surface of the crosshead 30 engages the ground surface. The upper ends of the tubular members 34 and 36 are rigidly connected to a cross member 42 in the form of a plate that extends horizontally between the upper ends of the tubular members 34 and 36 and which is movable in relation to the hydraulic cylinder 26 with the hydraulic cylinder 26 being guided through and in relation to the plate 42 for stabilization thereof. Thus, the two tubular members 34 and 36 and the crosshead 30 and the cross member 42 form a rigid rectangular frame structure which is vertically guided by the tubular guides 38 and 40.

Longitudinally movably disposed in the tubular members 34 and 36 is a pair of stems or posts 44 and 46 which have their lower ends projecting below the crosshead 30. Each of the stems 44 and 46 includes a projecting lug 48 on the upper end thereof which extends through a longitudinal slot 50 along the inner surface of each of the tubular members 34 and 36 with the bracket or lug 48 on each of the stems 44 and 46 projecting beyond the surface of the tubular members 34 and 36 for guided longitudinal reciprocation. The lug 48 on the stem 44 is connected to an elongated flexible chain 50 while the lug 48 on the stem 46 is connected to a corresponding chain 52. The chains 50 and 52 are

substantially identical in construction and have a lower terminal end anchored to the crosshead 30 by an anchor 54 with a vertical run of the chain then extending upwardly and passing overtop of a pulley 56 supported from the undersurface of the top plate 22 on the conical portion 20 of the frame 18 by a suitable bracket 58. The chain 50 then extends downwardly and is entrained under a pulley 60 journaled from the bracket or plate 62 on the crosshead 30. The chain then extends upwardly and is entrained over a top pulley 64 supported by an upstanding bracket 66 on the cross member 42. The lug 48 is attached to the chain 50 between the pulleys 60 and 64 as illustrated in FIG. 5 and as can be seen in FIGS. 3 and 4. The chain 50 then extends downwardly and is entrained under a pulley 68 carried by a bracket 70 on the upper surface of the plate 22 that is rigid with the frame 18. The chain then extends upwardly and is provided with an anchored attachment 72 to cross member 42. The various pulleys are in the form of rollers which have smooth external surfaces with peripheral outwardly extending flanges on each end to retain a leaf-type chain thereon. The anchor points may be provided with adjustment means to facilitate adjustment of tautness of the chain as may be necessary. Also, the tubular guides 38 and 40 which slidably receive the tubular members 34 and 36 each also have a longitudinal slot 39 therein for permitting movement of the lugs 48 so that the stems 44 and 46 may move from a position adjacent the upper ends of the tubular members 34 and 36 to a lowered position adjacent the lower end of the tubular members 34 and 36.

In use of the invention, the crosshead 30 is installed so that it is four feet above the ground surface. As the piston rod 28 is extended to lower the crosshead 30 to engagement with the ground surface, the chain and pulley arrangement will move the stems 44 and 46 a distance of eight feet beyond the crosshead 30 which is the desired depth of detonation of an explosive charge during underground survey work. As the crosshead 30 is elevated by retracting the piston rod 28, the stems 44 and 46 will be retracted twice the distance of the crosshead 30 due to the particular arrangement of the chains and pulleys. This is accomplished by the pulleys 56 and 68 being stationary insofar as vertical movement is concerned and the pulleys 60 and 64 being vertically movable along with the anchor points 54 and 72 thereby causing longitudinal movement of the point of attachment of the lug 48 with the chain 50 to be moved downwardly to the bottom end of the slot in the tubular member 34 so that the full desired length of the stem 44 will be extended below the crosshead 30.

The frame 18 and its associated cone-shaped member 20, plate 22 and guides 38 and 40 are supported from the framework 14 of the vehicle by upwardly extending support brackets 80 carried by the frame 14 having the upper apex thereof pivotally attached to lugs 82 on the frame or guide members 38 and 40 by a pivot pin or bolt 84 thereby providing a transverse axis of pivotal movement for the device 10 to enable it to be pivoted from a substantially vertical operative position to a generally inclined position with the upper end thereof extending toward or over the top surface of the cab of the vehicle. A hydraulically actuated piston and cylinder assembly 86 interconnects the frame 14 of the vehicle and the frame 18 at a point below the pivot axis defined by the bolt 84 so that the device may be power actuated to be pivoted from an operative vertical posi-

tion to and from an inoperative horizontal or horizontally inclined position, such as when the device is being moved to a new location to eliminate possible entanglement of the upper end of the device with tree branches, power lines, or the like.

Also, each of the stems 44 and 46 is provided with a spiral auger flight 90 at the lower end thereof which forms one revolution around each of the stems so that it will serve to auger the stems 44 and 46 into the ground in much the same manner as a screw anchor. Each stem 44 and 46 also includes a hollow bore or passageway 92 extending therethrough which terminates in the hollow interior of a lower tapered end 94 below the flight 90. This tapered end 94 is in the form of four pivotal triangular plates which have the depending apex and the two side edges thereof free of each other and normally oriented in a downwardly converging relation so as they penetrate the ground, the pointed ends 94 will facilitate insertion of the stems 44 and 46 into the ground during rotation thereof or by merely pressing the stems into the ground in the event the flights 90 are not used. When the stems 44 and 46 reach the bottom point of movement, the stems may be elevated or lifted a short distance (several inches) to form a cavity 96 and since no pressure is exerted on the pivotal plates forming the tapered end 94, the plates swing downwardly to an open position to provide communication between the cavity 96 and the bore 92 through the stems 44 and 46 thus enabling an explosive charge to be discharged into the cavity 96. The explosive charge may be in the form of a gaseous material having supply tanks 98 carried by the vehicle and communicated with the bore 92 through flexible hoses, tubes, or the like, 100 which extend over a pulley 102 mounted on the plate 42 by suitable bracket structure 104 so that the hose 100 may be moved with the stems 44 and 46 with the hose being guided over the pulley 102. Tension springs 106 or the like may be attached to the hoses 100 to retract the hoses when the stems are lifted and enable downward movement of the hoses when the stems are extended so that the explosive charge may be introduced into the cavity and ignited by a suitable ignition device which does not constitute any specific part of the present invention. The hydraulic fluid for actuating the piston rod may be supplied through hoses 108 connected to a suitable pump and tank assembly generally designated by numeral 110 to provide for extension and retraction of the hydraulic piston and cylinder assembly for extending and retracting the crosshead 30 and stems 44 and 46, in a well known manner with suitable controls being provided therefor.

The crosshead is provided with a hydraulic motor 112 with gearbox 114 associated therewith to provide a chain drive to both of the stems 44 and 46 with suitable hoses, pipes, or the like, providing hydraulic pressure to the motor 112. With this construction, a single torque arm reducer is employed and one hydraulic motor provides rotational torque to both of the stems 44 and 46.

As an alternative arrangement, two torque arm reducers driving individual stems may be employed which, of course, includes two hydraulic motors each driving a stem in order to increase the torque and rpm of the stems and in such an arrangement, a gearbox will not be necessary. The hydraulic motors, gearbox and drive chain connection with the stems 44 and 46 is con-

ventional whether a single torque arm is used or whether two torque arm reducers are employed for independently driving the stems through a chain drive. In either construction, the hydraulic system is connected to the hydraulic motors in a manner to provide reverse rotational direction thereof.

The gearbox 114 and motor 112 are connected with a housing 116 which forms the crosshead and has the chain drive and driving connection with the stems 44 and 46 disposed interiorly thereof in a manner well known in the art.

This device permits simultaneous insertion of two stems or poles into the earth. In many locations, a stem of reasonable size may be pushed directly into the soil rather than being augered by use of the double acting hydraulic cylinder mounted in a generally vertical position and fixed to a frame or other supporting structure. The piston rod protruding from the cylinder is attached to the crosshead 30 which in turn has two tubular guides 34 and 36 mounted in vertical position and braced across the top with the cross member 42. The stems slide freely inside the guides and protrude below the cross member. Force is transmitted from the cylinder to the stems to move them longitudinally by the chain system illustrated so that when the piston rod is moved downwardly, the chain anchored to the crosshead and entrained over the pulleys as illustrated and connected to the upper end of the stems so that the stems move twice as fast as the piston rod and crosshead thereby providing an overdrive arrangement. The return chain assembly works in the same manner and this extension and retraction mechanism also operates in the same manner when a mechanism is incorporated into the crosshead to rotatably drive the stems 44 and 46. Thus, the unique feature of the apparatus for moving the stems is the travelling pulleys which move the stems at twice the rate of the cylinder stroke as well as the compactness and simplicity of the movable guide members and the guide structure for the movable guide members and the association of the chains and connection between the chains and stems. This together with the movement of the crosshead from a position adjacent the ground to a higher off the ground position when retracted enables effective transportation from location to location and the engagement of the crosshead with the ground surface serves to anchor the column of dirt or soil above the auger flight when the explosive charge is detonated.

The plate 42 may be provided with a centrally disposed tubular guide or sleeve 43 which is rigid therewith and which is slidably mounted on the upper end portion of the cylinder 26 to stabilize the upper end of the cylinder 26 in relation to the vertically movable components. Suitable cutouts or openings may be provided for permitting passage of hydraulic hoses to enable inlet and outlet of hydraulic fluid to the upper end of the cylinder 26 as well as the lower end thereof. The particular orientation of all of the hoses is not shown in detail since this particular arrangement does not form an essential part of this invention.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and

equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A device for forming an underground cavity comprising a supporting frame adapted to be carried by a mobile vehicular structure, at least one stem extending generally vertically for longitudinal insertion into the soil, means guidingly supporting said stem from said frame to guide and support the stem during its longitudinal movement, and means interconnecting the frame and stem for extending and retracting the stem longitudinally, said means including a fluid pressure operated piston and cylinder assembly having a reciprocally movable power output rod, and overdrive means interconnecting the power output rod and the stem for moving the stem a longitudinal distance a multiple of the longitudinal distance of movement of the power output rod of the piston and cylinder assembly thereby enabling the stem to be forced downwardly into the ground a distance substantially greater than the over-all length of the piston and cylinder assembly, said means guiding and supporting the stem from the frame including a tubular sleeve rigid with the frame, a tubular member slidable longitudinally in the tubular sleeve, and said stem being longitudinally slidably movable in the tubular member, said tubular member being connected with power output rod for direct longitudinal reciprocation therewith whereby the guiding relationship of the stem within the tubular member is longitudinally reciprocated as the stem is longitudinally extended and retracted by operation of the piston and cylinder assembly, said overdrive means including a flexible chain member having one terminal end anchored with respect to the power output rod for movement therewith, an upwardly extending portion entrained over rotatable means journaled stationarily with respect to the frame, a downwardly extending portion entrained under journal means movable with the power output rod, an upwardly extending portion connected with the upper end of the stem and entrained over journal means movably supported with respect to the supporting frame, a downwardly extending portion entrained under journal means rigid with respect to the frame and an upwardly extending portion anchored movably with respect to the supporting frame to provide a positive longitudinal reciprocation of the stem a distance substantially twice the movement of the power output rod.

2. The structure as defined in claim 1 wherein said piston and cylinder assembly is mounted substantially parallel to the path of reciprocation of the stem and tubular member, the lower end of said cylinder being rigidly supported from said frame, a guide member movably supported from the upper end of the cylinder and forming a support for the journal means supported movably in relation to the frame and a terminal anchor point for the terminal end of a chain movable with respect to the frame.

3. The structure as defined in claim 2 wherein the lower end of the power output rod is connected to a crosshead having the lower end of the tubular member anchored thereto, said crosshead including power means drivingly connected with the stem for rotating the portion of the stem inserted in the ground, said stem including an auger flight on the lower end portion thereof to facilitate insertion of the stem into the ground without removing a column of dirt therefrom.

4. The structure as defined in claim 3 wherein said supporting frame includes a downwardly opening hollow cavity receiving the crosshead and power means for the stem when in retracted position to enable the lower end of the stem to be elevated to a position for movement over substantially any terrain.

5. The structure as defined in claim 4 wherein said stem is provided with a longitudinal bore therethrough for communication with the lower end of the stem and adapted to be communicated with a pressurized source of explosive mixture for introducing an explosive charge into a cavity formed underground when the stem has been inserted completely into the ground surface and then elevated a short distance whereby the flight on the lower end of the stem will form a relatively short cavity for receiving an explosive charge to be detonated during underground survey.

6. The structure as defined in claim 5 together with means mounting the frame from a vehicle for pivotal movement about a transverse axis to enable the piston and cylinder assembly, tubular member, sleeve and stem to be pivoted to an inoperative position in a horizontally inclined position to facilitate movement from one location to another.

7. The structure as defined in claim 6 wherein said piston and cylinder assembly and power means for the stem are hydraulically actuated.

8. A device for simultaneously forming a pair of underground cavities comprising a supporting frame adapted to be carried by a mobile vehicular structure, a pair of parallel stems extending generally vertically for longitudinal insertion into the soil, means guidingly supporting said stems from said frame to guide and support the stems during their longitudinal movement, and means interconnecting the frame and stems for extending and retracting the stems longitudinally, said means including a fluid pressure operated piston and cylinder assembly having a reciprocally movable power output rod, and overdrive means interconnecting the power output rod and the stems for moving the stems a longitudinal distance a multiple of the longitudinal distance of movement of the power output rod of the piston and cylinder assembly thereby enabling the stems to be forced downwardly into the ground a distance substantially greater than the over-all length of the piston and cylinder assembly.

9. The structure as defined in claim 8 wherein said overdrive means includes a pair of flexible members each having one terminal end anchored for movement with the power output rod, an upwardly extending portion entrained over means mounted stationarily with respect to the frame, a downwardly extending portion entrained under means movable with the power output rod, an upwardly extending portion connected with the upper end of the respective stem and entrained over means movably supported with respect to the frame, a downwardly extending portion entrained under means stationary with respect to the frame and an upwardly extending portion anchored for movement with the power output rod to move the stem a longitudinal distance substantially twice the distance of movement of the power output rod.

10. The structure as defined in claim 9 wherein the lower anchored terminal ends of the flexible members are anchored to a crosshead attached to the lower end of the power output rod, said crosshead being lower-

able along with the terminal ends of the flexible members.

11. A device for forming an underground cavity comprising a supporting frame adapted to be carried by a mobile vehicular structure, at least one stem extending generally vertically for longitudinal insertion into the ground, means guidingly supporting said stem from said frame to guide and support the stem during its longitudinal movement, and means interconnecting the frame and stem for longitudinally extending and retracting the stem, said means including a power drive having a power output member, and overdrive means interconnecting the power output member and the stem for moving the stem a longitudinal distance a multiple of the distance of movement of the power output member of the power device, said overdrive means including a flexible member having one terminal end anchored with respect to the power output member for movement therewith, an upwardly extending portion entrained over means mounted stationarily with respect to the frame, a downwardly extending portion entrained under means movable with the power output

member, an upwardly extending portion connected with the upper end of the stem and entrained over means movably supported with respect to the supporting frame, a downwardly extending portion entrained under means stationary with respect to the frame and an upwardly extending portion anchored for movement with the power output member to move the stem a longitudinal distance substantially twice the distance of movement of the terminal ends of the flexible member.

12. The structure as defined in claim 11 wherein said power output member is connected to a vertically reciprocal crosshead having the lower terminal end of the flexible member anchored thereto, said means guidingly supporting said stem including a vertically extending tubular member reciprocally guided in the frame and having the crosshead rigid with the lower end thereof, said stem being reciprocally mounted in the tubular member for extension and retraction and means on the upper end of the tubular member to which the upper terminal end of the flexible member is anchored.

* * * * *

25

30

35

40

45

50

55

60

65