March 20, 1956 L. C. WALES 2,738,732

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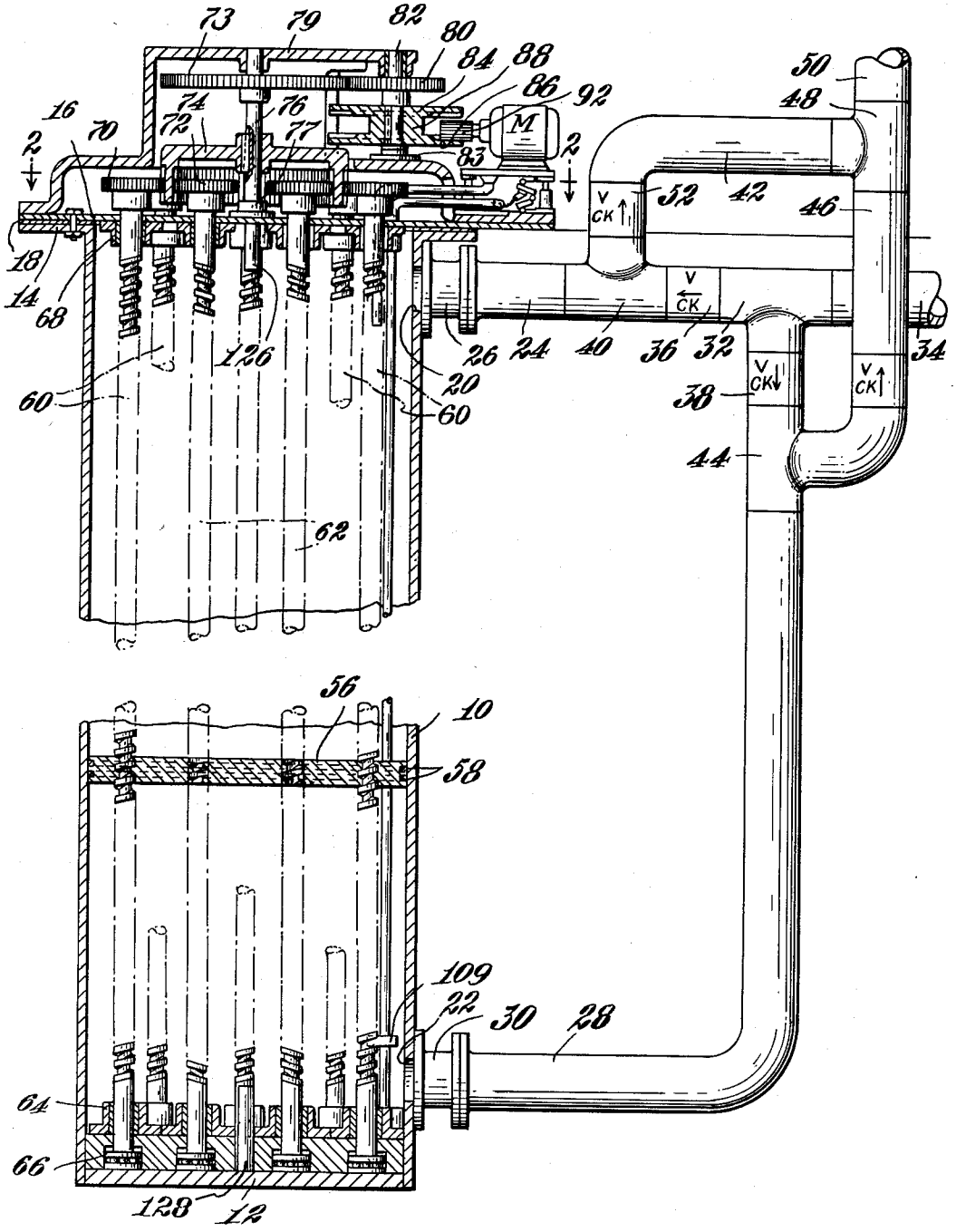


Fig. 1

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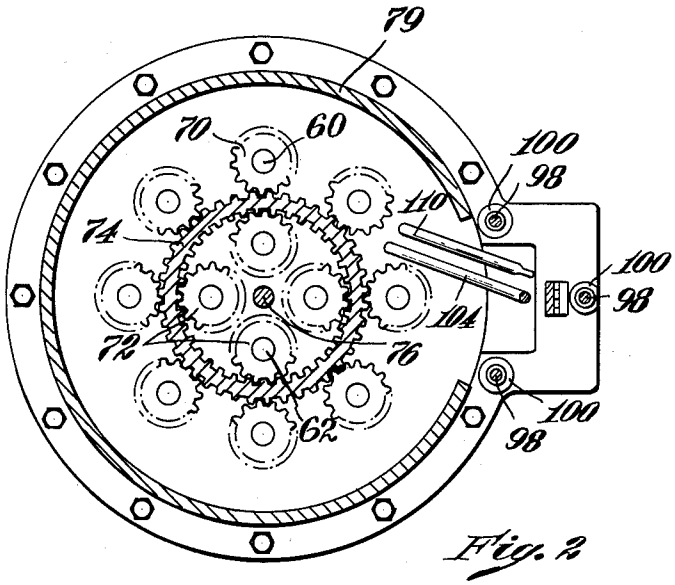


Fig. 2

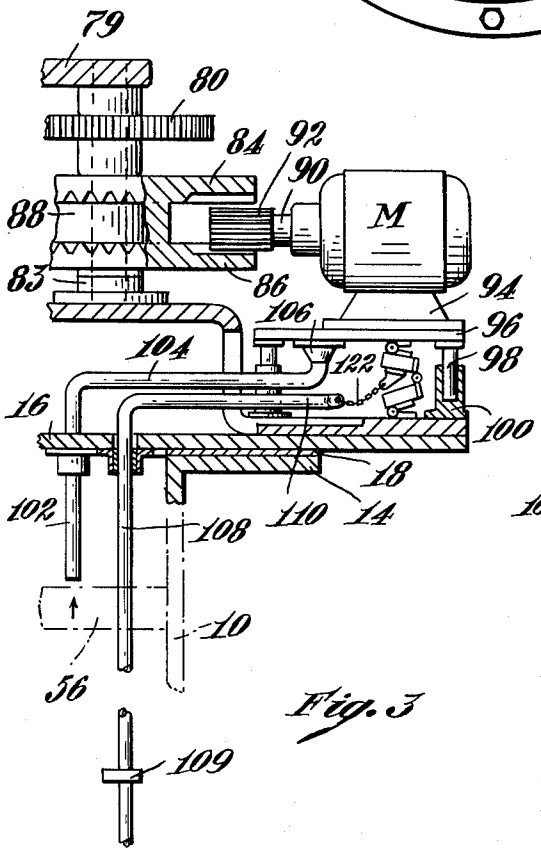


Fig. 3

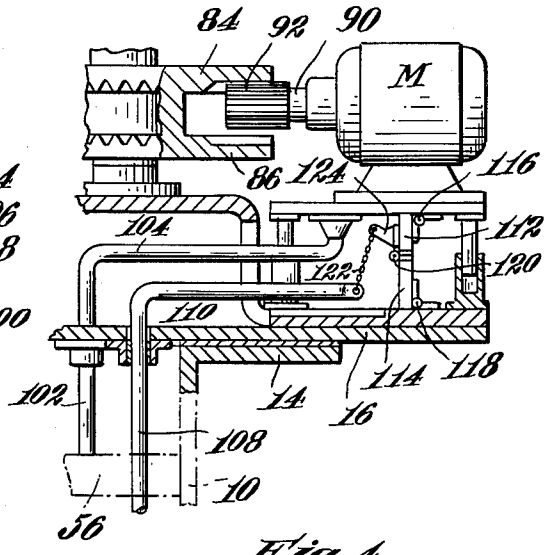


Fig. 4

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9 Claims. (Cl. 103—175)

This invention relates to pumping apparatus and has for its principal purposes to provide a reliable pump for use on farms and other rural districts where the only available water supply comes from streams and/or ponds, to deliver water from such a source to a water tower on the premises or, if need be, directly to a water distribution system including connection for a hose in the event of fire. Other objects are to provide a pump which is double acting so as to minimize pulsation, is of simple construction and operation, and which requires little upkeep and little expenditure of electric power for operation. Still further objects are to provide a compact apparatus so designed that it may be buried in the ground close to the source of water to conceal the major portion of it and so that water is delivered to the pump gravitationally, and in which the driving mechanism for the pump is located above the level of the ground so as to be accessible.

As illustrated, the pump has a casing or barrel adapted to be placed in the ground with its upper end substantially at the level of the pond or brook from which the water is to be taken. The casing has at its upper and lower ends openings from which extend conduits, both of which are joined to a common intake conduit, the latter being situated at about the mean level of the water or just below that level so that the water from the source will gravitate through it to the conduits and hence into the casing. In the casing is a piston and in the conduits are check valves so arranged that as the piston is moved in one direction, water flows into the casing from the intake through one of the valves above the piston and water is forced ahead of the piston, closing the other valve. Between the casing and the foregoing check valves are branch conduits which merge in a common discharge conduit, for example to a water tower or to a water distribution system, and in these branch conduits are other check valves arranged so that the water driven ahead of the piston and prevented from flowing through the second check valve back to the intake is discharged through one of the branch conduits to the common discharge conduit. Reverse movement of the piston affects a corresponding flow of water into the casing below the piston and discharge of water above the piston through the other branch conduit to the common discharge conduit. Movement of the piston is effected by power operated means, the latter being operable to reverse movement of the piston at each end of its stroke. As illustrated, screws extend through the casing from top to bottom and the piston is mounted on the screws so that rotation of the screws raise or lower the piston depending upon their direction of rotation. The screws are driven through a train of gears by a motor having a pinion on its shaft, and in the gear train there is a pair of opposed gears fast to a common hub. The motor is mounted on a movable support and there is means operable by the piston at opposite ends of its movement in the casing to move the motor support in a direction to engage the pinion with one or the other of the gears, hence to reverse the direction of movement of the piston.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

Fig. 1 is a vertical section through the pump shown with its lower portion buried in the ground and with the necessary conduits for delivering water to it and discharging water from it;

Fig. 2 is a horizontal section taken on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary section of the driving connection between the motor and the gearing for operating the pump, showing the pump on its upstroke; and

Fig. 4 is a corresponding view showing the pump on its downstroke.

Referring to the drawings, the pump casing has a barrel 10 of cylindrical shape, closed at its lower end by a bottom 12 and having an open upper end bounded by a horizontal, radially extending flange 14. The barrel 10 is set into the ground so that its flange 14 is substantially on a level with the surface of the ground, and has applied to its upper end a cover 16 which is bolted thereto with a gasket between it and the flange. The casing is preferably placed fairly close to the source of water supply, for example a pond, or brook, so that water may be delivered thereto gravitationally and to this end, the barrel has upper and lower openings 20 and 22 in its vertical wall through which water may flow to the interior of the casing and be discharged therefrom. A conductor 24 is fastened to the wall of the barrel over the opening 20 by a flanged coupling member 26 and a conductor 28 is connected to the bottom opening 22 by a flanged coupling member 30. The conduits 24 and 28 are joined by a T connection 32 to a common intake conduit 34. The intake conduit 34 and the conductor 24 are laid at such a level with respect to the mean level of the supply of water, that the water will gravitate through the conductor 34 to the conductors 24 and 28 and hence into the barrel. In some instances it may be desirable to pitch the intake conductor 34 slightly so as to insure a free gravitational flow of the water. The conductor 24 has in it a check valve 36 through which water may flow gravitationally to the top of the pump casing, but which will prevent return flow. In like manner, the conductor 28 has a check valve 38 in it through which water may flow gravitationally from the intake conduit 34 to the bottom of the pump casing, but which will prevent counterflow of water through it to the supply conduit. In the conductor 24, ahead of the check valve 36, that is between it and the pump casing, there is a T 40 to which there is connected a branch conduit 42 and in like manner, in the conduit 38 there is a T 44 to which there is connected a branch conduit 46. The conduits 42 and 46 are joined by a T connection 48 to a common discharge conduit 50 which leads to a storage tank or directly to a water distribution system. In the branch conduit 42 there is a check valve 52 which permits flow of water through the condit 42 toward the discharge conduit but prevents return flow. In like manner, there is a check valve 54 in the conduit 46 which permits flow through the conduit 46 toward the discharge conduit 50 but prevents return flow.

In the pump casing there is a piston 56 which fits closely within the barrel and has rings 58 to make it tight. The piston 56 is reciprocated in the pump barrel as will appear hereinafter, and operates to effect a continuous non-pulsing flow of water to the storage or system as follows. Starting with the piston 56 at the top of the barrel and assuming that there is no water below the piston, as the piston descends, water flows gravitationally through the intake 34 and conduit 24 to the top side of the piston, filling the barrel as the piston descends to the bottom thereof, that is to a point just above the opening 22. Now as the piston returns to its upper posi-

tion, the water above it is forced out of the barrel through the opening 20, through the conduit 24, through the check valve 52 and through the conduit 42 to the discharge conduit 50, the valve 36 being closed and preventing return flow of water through the intake 34. During the elevation of the piston 56 and discharge of water through the branch conduit 42, water flows gravitationally through the intake 34, check valve 38 and conduit 28 to the bottom of the barrel, filling the barrel beneath the piston 56. When the piston 56 reaches the top of the barrel, all of the water above it will have been discharged through the conduit 42 and it will then begin to descend and force the water below it through the conduit 28, check valve 54, conduit 46 and discharge conduit 50, the check valves 38 and 52 being closed. During discharge of the water below the piston, water again flows through the intake conduit 34, check valve 36 and conduit 24 to the upper side of the piston 56, refilling the barrel. Thus a continuous and non-pulsating flow of water is insured by the pump to the system or to a storage tank.

Reciprocation of the piston 56 is effected by a plurality of screws 60 and 62 arranged in the casing in concentric relation and extending from top to bottom. The lower ends of the screws are journaled in a bearing plate 64 through which unthreaded portions of the screws pass, and their lower ends rest on antifriction bearing plates 66 contained within recesses formed in an annular block below the bearing plate 64. The upper unthreaded ends of the screws are journaled in a bearing plate 68 fastened to the under side of the cover plate 16. The screws pass upwardly through the bearing plate 68 and through openings in the cover plate and have fast to their upper ends gears 70 and 72. As stated heretofore, the screws 60 and 62 are arranged concentrically as illustrated in Fig. 2, and mesh with an annular gear 74 fast on a shaft 76 which has internal and external teeth for engagement with the respective sets of gears 70 and 72. Rotation of the annular gear 74 will effect a rotation of the screws 60 in one direction and rotation of the screws 62 in the opposite direction. The screws 60 and 62 are threaded through the piston 56 in such manner that their combined rotational effect is to raise or lower the piston while maintaining it preferably level so that it will not bind on the walls of the barrel. The shaft 76 is journaled at its lower end in a foot bearing 77 resting on the cover 16 and at its upper end in a cover or cap 79 made fast to the upper side of the cover 16 and of such proportions as to house the gearing. A large gear 78 is also made fast to the shaft 76 and meshes with a gear 80 on a countershaft 82 which is journaled in a stepped bearing 83 at its lower end and in the cap 79 at its upper end. On the shaft 82 and fast thereto, is a compound gear consisting of a gear 84 and a gear 86 fast to a hub 88 which have on their opposed faces teeth. Rotation of the compound gear in one direction will raise the piston and in the other direction will lower the piston. Rotation in one direction or the other is effected by bringing a driven pinion 92 fast to a motor shaft 90 into mesh with the gear 84 or the gear 86. To this end, the motor M (Fig. 3) is mounted on a base 94 which rests on a table 96. The table 96 is supported for vertical movement on posts 98 arranged to slide vertically in guide sleeves 100, the latter being fastened to the cover 16. By raising the table 96, the pinion 92 may be brought into engagement with the gear teeth of the gear 84 and by lowering it, the pinion may be brought into engagement with the teeth of the gear 86. To effect raising and lowering of the table 96 and hence reciprocation of the piston in an automatic manner, there are provided push and pull control rods. These rods are shifted by contact of the piston therewith. The push rod 102 is located at the top of the pump casing, extending downwardly through the cover 16 so that its lower end is in a position to be engaged and lifted by the upward movement of the piston 56. Above the cover 16, the push rod 102 has a lateral extension 104 which projects through an opening in the side of the cap 79 to a point below the table 96 and has on its extremity an upwardly facing pad 106 which is engaged with the under side of the table 96. As thus constructed, when the piston approaches the upper end of the barrel, it strikes the push rod 102, lifting it or shifting it upwardly and thereby lifts the table 96 so as to raise the pinion 92 into contact with the gear 84, thus reversing the direction of rotation of the screws and causing the piston to begin to descend. A pull rod 108 is also arranged in the casing and extends from the cover 16 downwardly through the piston to near the lower end of the casing and has on it a dog 109 which when engaged by the piston as it reaches the lower end of the casing, pulls or shifts the rod 108 downwardly. The upper end of the rod 108 has a lateral extension projecting through the cap 79 beneath the table 96. There is also situated beneath the table 96 an articulated member consisting of a pair of posts 112 and 114 hinged respectively in end-to-end abutting relation by hinges 116 and 118 to the under side of the table and the upper side of the cover 16. The abutting ends of the posts are also hinged together by a hinge 120 in such manner that by applying a force, the posts may be buckled on the hinge 120 from their straight line position shown in Fig. 4 to the broken line position shown in Fig. 3. To effect such buckling, the pull rod extension 110 is connected by a chain 122 to a bracket 124 fast to the upper post. Thus as the pull rod is lowered, the bracket 124 is pulled downwardly, breaking the joint at the hinge 120 so that the posts fold toward each other, thereby lowering the table 96 and bringing the pinion 92 downwardly into engagement with the gear 86. This reverses the rotation of the screws and the piston begins to rise. The posts 112 and 114 are restored to their end-to-end position by engagement of the piston with the lower end of the push rod 102 which raises the table 96 as heretofore pointed out. The abutting ends of the parts are broad enough so that when placed end to end, they will provide a rigid support which will sustain the table and motor until it is positively broken by force applied to the bracket 124. Thus it is apparent that an automatic reversal of the movement of the piston is effected at each end of its stroke and hence a continuous flow of water is assured as long as the motor is operated.

Stops 126 and 128 are located at the top and bottom ends of the casing to limit the movement of the piston in the event that the reversing mechanism does not operate.

The casing is of fairly large capacity and is slow acting so that the gears and screws need no lubrication and may be made without much refinement or machining.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. A double acting pump comprising a pump casing having a cylindrical barrel closed at its lower end and having a radial flange at its upper end, said barrel being designed to be buried in the ground up to the radial flange at its upper end, the latter being adapted to rest on the surface of the ground and to support the casing, said casing having openings in its barrel at its upper and lower ends below the flange, a piston in the casing movable between said openings, conduits extending from the upper and lower openings, said conduits being connected to an intake conduit which extends to the source of water at approximately the mean level thereof, branch conduits extending from the upper and lower conduits and being connected to a discharge conduit, valves in said conduits and branch conduits adapted to admit water through the first named conduits from the intake conduit gravitationally to fill the pump case and to bypass water admitted to the pump case

to the discharge conduit on each stroke of the piston, and means for reciprocating the piston.

2. A double acting pump comprising a pump casing having a cylindrical barrel closed at its lower end and having a radial flange at its upper end, said barrel being designed to be buried in the ground up to the radial flange at its upper end, the latter being adapted to rest on the surface of the ground and to support the casing, said casing having openings in its barrel at its opposite ends below the flange for both intake and discharge, valves connected to the openings in the casing controlling the flow of water to and from the casing, a piston in the casing movable between said openings, two position drive means, operable in one position to effect movement of the piston in one direction and in the other position to effect movement in an opposite direction, and control means including shift rods operably connected to the two position drive means to effect movement thereof, said shift rods being located within the barrel in the path of reciprocation of the piston and being automatically operable by contact of the piston therewith at predetermined positions.

3. A double acting pump comprising a pump casing having a cylindrical barrel closed at its lower end and having a radial flange at its upper end, said barrel being designed to be buried in the ground up to the radial flange at its upper end, the latter being adapted to rest on the surface of the ground and to support the casing, said casing having at its opposite ends below the flange openings in its barrel for both intake and discharge, valves connected to the openings in the casing controlling the flow of water to and from the casing, a piston in the casing movable between said openings, screw means for moving the piston in the casing, means for reversing the direction of rotation of the screw means to reciprocate the piston in the casing, and means operable by contact of the piston therewith for automatically effecting operation of said reversing means at each end of the piston stroke.

4. A double acting pump comprising a pump casing having a cylindrical barrel closed at its lower end and having a radial flange at its upper end, said barrel being designed to be buried in the ground up to the radial flange at its upper end, the latter being adapted to rest on the surface of the ground and to support the casing, said casing having at opposite ends below the flange openings in its barrel for intake and discharge, a piston in the casing movable between said openings, a screw extending through said casing, said screw being threaded through the piston and rotatable to raise or lower the piston depending upon the direction of rotation of the screw, a motor having a shaft, a pinion on the motor shaft, a pair of opposed, toothed members with which the pinion may be selectively engaged to effect movement of said members alternatively in one direction or the other, means operably connecting said members to the screw to effect rotation thereof, and means at opposite ends of the casing to shift the pinion into engagement with the one of said toothed members which will reverse the direction of movement of the piston.

5. A double acting pump comprising a pump casing having a cylindrical barrel closed at its lower end and having a radial flange at its upper end, said barrel being designed to be buried in the ground up to the radial flange at its upper end, the latter being adapted to rest on the surface of the ground and to support the casing, said casing having openings in its barrel at opposite ends below the flange for intake and discharge, a piston in the casing movable between said openings, a screw extending through the casing, said screw being threaded through the piston and rotatable to raise or lower the piston depending upon the direction of rotation of the screw, a motor and motor shaft, a pinion on said motor shaft, a movable support for the motor, a gear train connected to the screw including opposed gears fast to a common shaft, means operably associated with the support to move the support in directions to bring the pinion into engagement with one or the other of said opposed gears, said means having parts located at opposite ends of the casing operable by contact of the piston therewith to effect movement of the support.

6. A double acting pump comprising a pump casing having a cylindrical barrel closed at its lower end and having a radial flange at its upper end, said barrel being designed to be buried in the ground up to the radial flange at its upper end, the latter being adapted to rest on the surface of the ground and to support the casing, said housing having openings in its barrel at opposite ends below the flange for both intake and discharge, a piston in the casing movable between said openings, a screw extending through the casing, said screw being threaded through the piston and rotatable to raise or lower the piston depending upon the direction of rotation of the screw, a motor and motor shaft, a pinion on the shaft, a pair of opposed gears fast to a common shaft, means drivably connecting the screw to said opposed gears, a support for the motor movable to engage the pinion with one or the other of said gears, a push rod at the upper end of the casing having a part thereof operably associated with the support, said push rod being operable by contact of the piston therewith to lift the support to engage the pinion with one of said gears, and a pull rod at the other end of the casing having a part operably associated with the support, said pull rod being operable by engagement of the piston therewith to lower the support to engage the pinion with the other of said gears.

7. A double acting pump comprising a pump casing having a cylindrical barrel closed at its lower end and having a radial flange at its upper end, said barrel being designed to be buried in the ground up to the radial flange at its upper end, the latter being adapted to rest on the surface of the ground and to support the casing, said housing having openings in its barrel at its opposite ends below the flange for both intake and discharge, a piston in the casing movable between said openings, a screw extending through the casing, said screw being threaded through the piston and rotatable to raise or lower the piston depending upon the direction of rotation of the screw, a motor and motor shaft, a pinion on the shaft, a pair of opposed gears fast to a common shaft, means drivably connecting the screw to said opposed gears, a base for the motor, an articulated prop including two elements hinged together supporting the base for vertical movement, a push rod having contact with the under side of the base and movable by contact of the piston therewith to lift the base and straighten the prop, and a pull rod connected to one element of the prop movable by contact of the piston therewith to jack knife the prop at its hinge.

8. A double acting pump comprising a pump casing having a cylindrical barrel closed at its lower end and having a radial flange at its upper end, said barrel being designed to be buried in the ground up to the radial flange at its upper end, the latter being adapted to rest on the surface of the ground and to support the casing, said housing having openings in its barrel at opposite ends below the flange for both intake and discharge, a piston in the casing movable between said openings, a plurality of screws journaled at opposite ends in the upper and lower ends of the casing, part of said screws being provided with right-hand threads and the remainder with left-hand threads, said piston being mounted on said screws and movable thereby, and means for rotating the right and left-hand screws in opposite directions to raise and lower the piston.

9. A double acting pump comprising a pump casing having a cylindrical barrel closed at its lower end and having a radial flange at its upper end, said barrel being designed to be buried in the ground up to the radial flange at its upper end, the latter being adapted to rest on the surface of the ground and to support the casing, said housing having openings in its barrel at opposite ends below the flange for both intake and discharge, a piston in the casing movable between said openings, a plurality of screws

journaled at opposite ends in the upper and lower ends of the casing, said screws being arranged in concentric groups, the inner group having threads of one hand and the outer group having threads of the opposite hand, said screws passing through the piston, gears at the upper ends of said screws, an annular gear having inner and outer toothed portions for contact with the gears of the inner and outer groups of screws, and means for driving the annular gear in opposite directions to raise and lower the piston.

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