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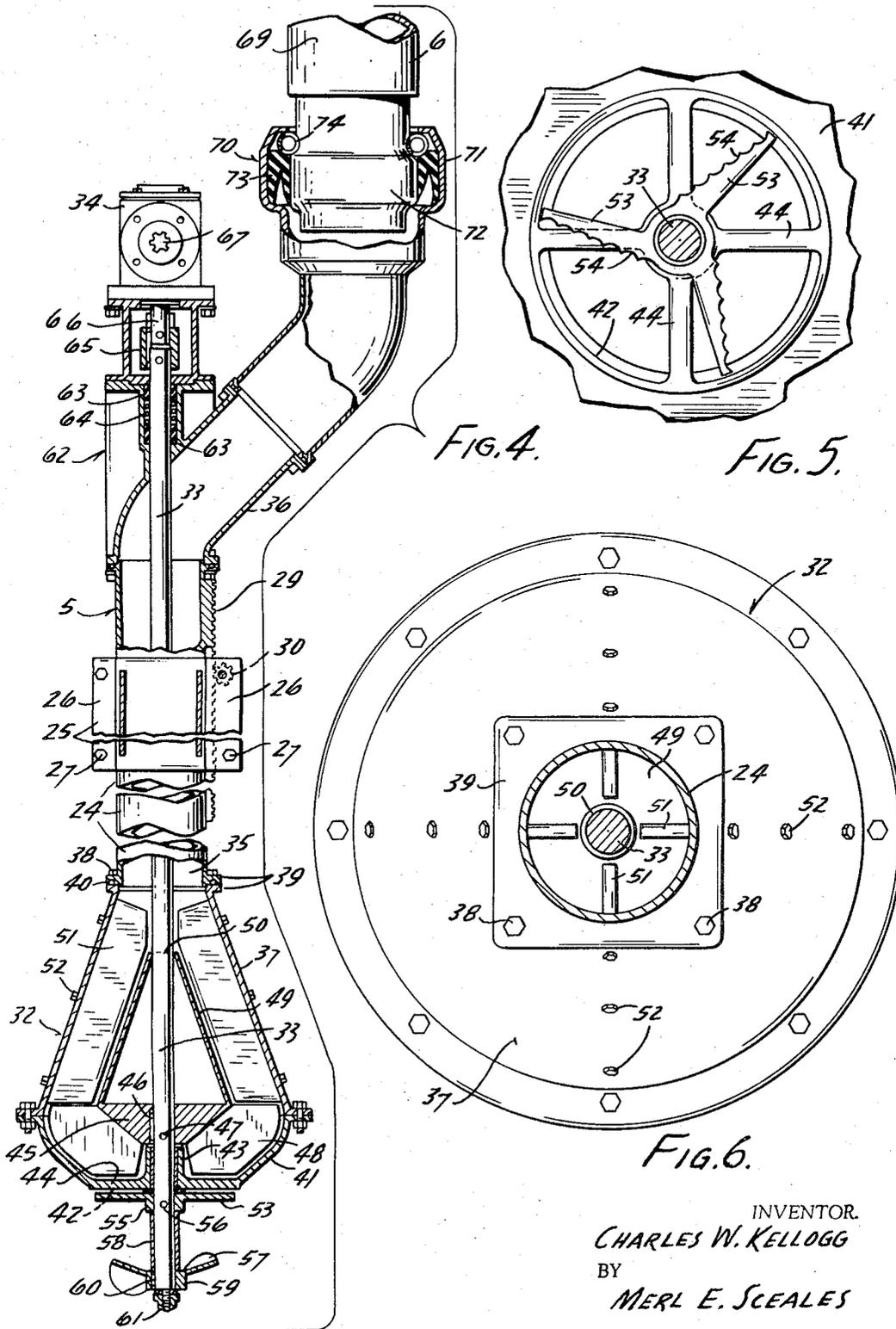
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MANURE HANDLING SYSTEM

Filed July 6, 1965

4 Sheets-Sheet 2



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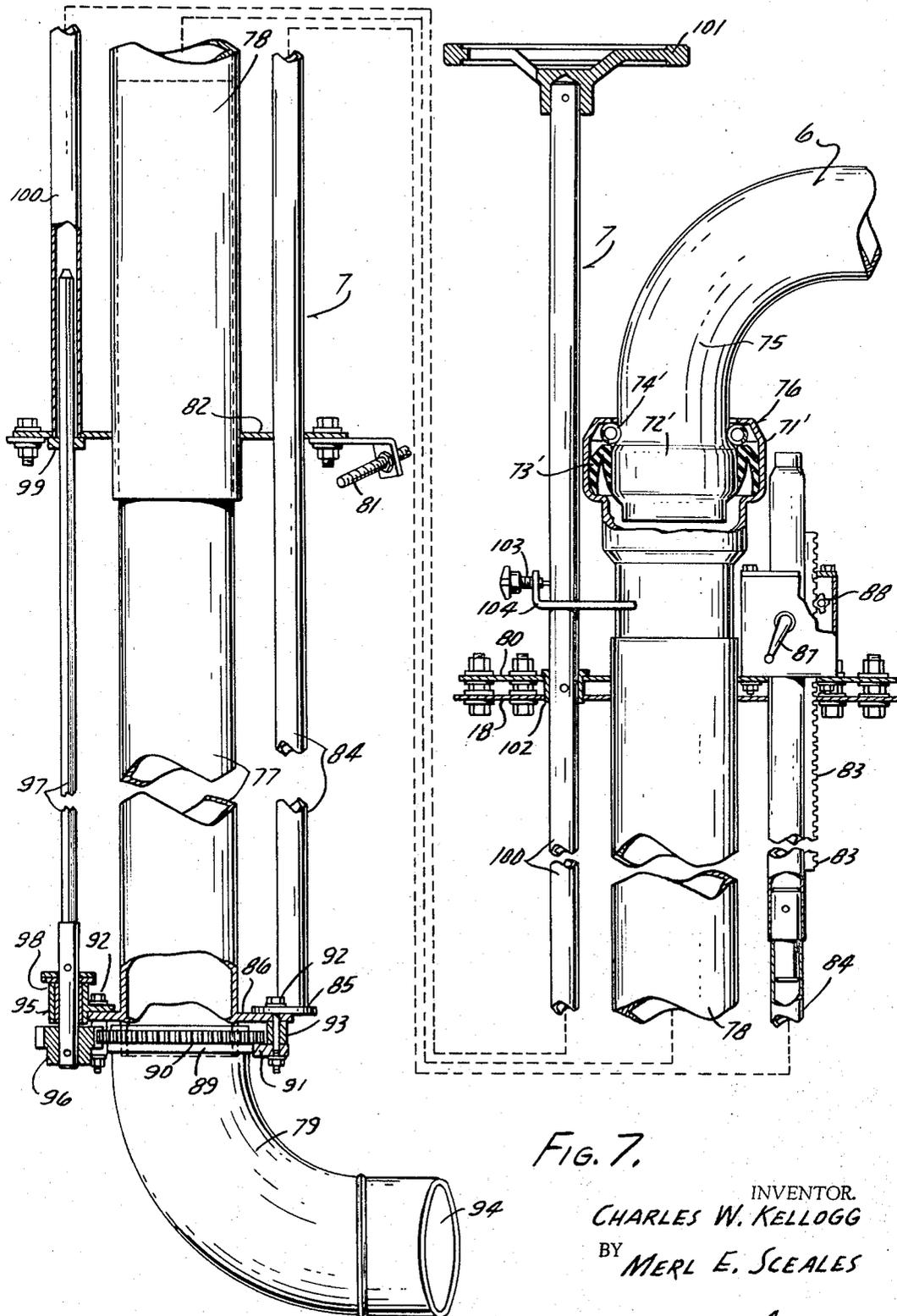


FIG. 7.

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3,367,583

**MANURE HANDLING SYSTEM**

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20 Claims. (Cl. 241-98)

**ABSTRACT OF THE DISCLOSURE**

A liquid storage tank, buried, with a ground level opening, contains a pump unit disposed near one side wall of the tank and a rotatable, hydraulic jet unit disposed centrally within the tank. The pump unit includes a vertically disposed connecting conduit which contains a coaxial drive shaft that projects through the upper end of the conduit externally of the tank and into a gear box assembly designed for purposes of access to a tractor power take-off. The pump and conduit assembly is secured by means of a tubular slide which is an integral part of a trailer unit used to move the entire assembly to and from vertical and horizontal positions. The rotatable jet unit utilizes a horizontal off center nozzle connected at the bottom end of a conduit assembly centrally and vertically disposed within the tank. This conduit assembly consists of two telescoping conduits, the upper portion of which is securely fastened to a wall of the tank and the lower portion of which is secured by means of a rack and pinion assembly allowing vertical positioning of the jet nozzle. The jet nozzle is secured to the vertical conduit assembly in a freely rotatable manner, but is connected to a ring gear and pin assembly which is part of a rotatable shaft assembly extending upwardly through the top of the tank for purposes of manual locking in place of the jet nozzle. The jet unit and the pump unit are connected by means of a transfer conduit which is fitted at both ends with quick detachable joints so that the conduit can either connect the pump to the jet unit or the pump to a discharge tank trailer unit.

This invention relates to an animal manure handling system and particularly to the accumulation, storage and subsequent distribution of manure in a liquid form.

In farming and the raising of livestock, hogs and the like, the handling of the excrement or manure produced by the animals becomes of practical significance in providing highly successful and profitable operations. The economic value of the livestock manure for fertilizer has long been recognized. However, it has often presented severe problems in connection with the handling both from the standpoint of labor and sanitary conditions. Generally, liquid manure is much more readily handled and stored and also is a more efficient manner of preserving the nutrients in the manure.

Liquid manure systems are of course well known; for example, U.S. Patent 3,155,375 which issued in 1964 discloses a submerged storage tank within which manure is collected and stored for subsequent distribution as fertilizer. As shown therein, selective agitation of the stored material is preferably provided to maintain essential uniform consistency of the stored material.

Generally in connection with such systems, a removable pump unit is employed for selective removal of the storage material. U.S. Patent 3,155,330 to O. Holz et al. discloses a removable pump system having certain advantages in the handling of manure and the like.

Liquid manure systems must be designed to maintain the efficient preservation of the necessary nutrients in the organic matter while permitting ready mechanization to reduce labor requirements. The design must also be such

that contamination of water supplies is prevented and the formation of breeding places for insects and rodents are prevented. The design should also provide control for any possible odor.

The present invention is particularly directed to a manure handling system which provides all of the required advantages. Generally, the system of this invention includes a storage tank substantially buried in the ground with a pump such as shown in the Holz patent, removably mounted for withdrawing stored material therefrom. A centrally located rotatable jet unit is provided in the tank and is selectively connected to the discharge of the pump. The jet unit is provided with control means to hold it in a given position or to permit rotation about a vertical axis. This permits recirculation of the stored material and hydraulic mixing.

The tank includes an inlet opening at ground level through which material is fed into the tank. A cover is provided over the opening to eventually seal it when material is not being delivered thereto, and also to permit controlled movement of run-off liquid due to rain and the like into the system to control the liquidity or consistency of the storage material.

The pump assembly employed in the system is preferably a submersible unit driven by a tractor take-off, an electric motor, or the like.

The pump assembly is preferably detachably mounted to pump carriage for selective insertion or removal from the tank. A hydraulic lift or the like is provided for tilting of the pump unit from the vertical to the horizontal transporting position. Further, an adjustable vertical positioning means is provided for positioning of the pump assembly in accordance with the depth of the tank and in accordance with the desired level within the tank. The pump assembly includes a discharge conduit with the drive shaft projecting concentrically downwardly therethrough.

A generally bell-shaped housing is formed at the lower end with a suitable impeller mechanism in the lower portion thereof for forcing the material upwardly through the housing and the conduit. Dividers are secured in the upper portion of the housing dividing the unit into a plurality of side-by-side channels between the lower end of the housing and the conduit proper.

In accordance with the present invention, the lower end of the pump drive shaft is provided with a suitable bearing support such that it can rest directly on the base of the storage tank without interfering with the rotating motion of the pump.

The drawings furnished herewith illustrate a preferred construction for carrying out the invention and clearly disclose the above advantages and features as well as others which will be clear from the subsequent description of the drawings.

In the drawings:

FIG. 1 is a side elevational view of a storage and pumping system constructed in accordance with the present invention with the storage tank shown in vertical section for clarity of illustration;

FIG. 2 is a top elevational view of FIG. 1;

FIG. 3 is a fragmentary view showing details of the tank structure;

FIG. 4 is an enlarged vertical section of the pump shown in FIG. 1;

FIG. 5 is a view showing the inlet structure of the pump unit and taken generally on line 5-5 of FIG. 4;

FIG. 6 is a horizontal section taken on line 6-6 of FIG. 4;

FIG. 7 is an enlarged view of the circulating jet conduit shown in FIG. 1;

FIG. 8 is a horizontal section taken on line 8-8 of FIG. 7;

FIG. 9 is an enlarged side elevational view of the pump carriage unit; and

FIG. 10 is an end view of FIG. 9.

Referring to the drawings, and particularly to FIG. 1, the illustrated manure handling system generally includes a storage tank 1 substantially buried within the ground area 2 immediately adjacent a feed or livestock storage area having a concrete foundation 3 to one side of the storage tank. An access opening 4 in the side of tank 1 within the peripheral portion of the concrete foundation 3 permits ready transfer of manure directly into the storage tank 1 from the surface of the feed area. A pump assembly 5 is mounted in the side of the tank 1 opposite opening 4 and connected at its upper end to a U-shape transfer conduit unit 6. The conduit unit 6 is rotatably mounted at the pump assembly 5 for movement in a horizontal plane. In the full line shown, the discharge end is connected to a rotatable jet unit 7 which projects downwardly and terminates within the lower portion of the tank 1. Alternatively, the conduit unit 6 can be disconnected from unit 7 and swung to have its terminal end overlying a suitable wheeled spreader tank 8 or other form of spreader.

The pump unit or assembly 5 is driven by a tractor 9 through a power take-off for recirculation of the stored manure through jet unit 7 or transfer to the spreader 8. Additionally, the pump assembly 5 is detachably mounted to a carriage unit 10 which may be moved by tractor 9 and includes means for properly positioning and transporting of the pump assembly 5, as hereinafter described in detail.

Generally, in the illustrated embodiment of the invention, the manure is transferred into the storage tank 1 as by a blade secured to the front end of the tractor 9. The material may also be moved directly into the tank 1 by means of gravity flow gutters, special pumping units or the like.

During storage, the pump assembly 5 which is installed to the right side of the tank shown in FIG. 1 may be operated off the power of tractor 9 to circulate the stored material through the conduit unit 6 and the jet unit 7, which will cause recirculation of the complete mixture inside the tank to prevent solids from settling within the tank. When the material is to be removed, the transfer conduit unit 6 is uncoupled from the jet unit 7, properly positioned over the load opening of the spreader 8 and pump assembly 5 operated to transfer the stored materials directly into the spreader 8 which in turn can be coupled to the tractor for operation in spreading of the liquid manure over the fields.

Referring particularly to FIGS. 1-3, in the illustrated embodiment of the invention the storage tank 1 is a cylindrical member mounted on a reinforced concrete base or floor 12. The manure is therefore readily transferred and stored in the tank 1 with the desired amount of moisture provided. The glass-lined tank is similar to structures which have been widely employed by applicant's assignee in connection with above ground storage units and provides a very practical, long life storage assembly. The side and top walls of the tank 1 are preferably formed of glass coated steel sheets 13 having a suitable glass coating or the like 14 on all surfaces, shown in the fragmentary view of tank 1 in FIG. 3. The separate sheets are overlapped and interconnected by nut and bolt units 15 with a sealing mastic or compound 16 interposed between all joints. The sheets 13 are securely bolted together at uniform pressure and provide maximum projection against any possible loss of liquid seeping out and contaminating the adjacent ground and water supplies.

The exposed portion of the tank 1 is generally a shallow inverter cone shaped member with radially extending supporting struts or underbraces 17 welded or otherwise secured to the adjacent steel sheets 13. The top, central portion of the tank 1 is provided with a circular flat wall 18 through which the rotating jet unit 7 is mounted.

The opening 4 is formed in the side wall of tank 1 at ground level with an inclined chute 19 imbedded within

the concrete foundation 3 at the upper end and secured at the lower end to the tank side wall by suitable nut and bolt unit 15, as most clearly shown in FIG. 1. Additionally, a cover 20 is secured overlying the opening 4 and chute 19 and, in the illustrated embodiment of the invention, is secured to the top wall of the tank 1 by a pair of laterally spaced hinges 21 and 22. The cover includes a handle 23 for manual positioning thereof. In the lowered position it completely covers the opening 4 and substantially eliminates draining of water into the opening 4. To increase the liquidity of the stored material, the door 20 is open to permit drainage of liquids into the tank and thereby increasing the fluid consistency.

The liquid manure is removed by the pump assembly 5 which is shown in cross section in FIG. 4. As more particularly shown in FIG. 1, the assembly 5 includes a vertically disposed pipe or conduit 24 which projects downwardly through a suitable opening in the top wall of the tank 1 diametrically opposite to the opening 4. The pump conduit 24 is secured at the upper end within a tubular slide 25 forming a part of the trailer or carriage unit 10, shown in FIG. 9. The tubular slide 25 is formed by a pair of complementing correspondingly formed channel members having outwardly projecting mating edge flanges 26 which are interconnected by a plurality of nuts and bolt units 27, defining a tubular defining slide. The mating edge flanges to the one side of slide 25 are spaced from each other by tubular spacers 28 encircling the bolt portions of the nut and bolt units 27 to accommodate a rack 29 integrally formed on the side conduit 24. A pinion 30 is rotatably mounted between the corresponding flanges 26 in mating engagement with the rack 29 for selective vertical movement of the pump assembly 5. The pinion 30 is connected to a hand wheel 31 through a suitable linkage on the carriage unit 10 for positioning of the pump conduit 24.

A liquid pump 32 is secured to the lower end of the conduit 24 and is connected to a drive shaft 33 which projects coaxially through conduit 24 and outwardly of the upper end of the conduit. The upper end of the shaft 33 is connected to a gear box 34 which is adapted to be coupled to the power take-off of tractor 9 for operation of pump 32. The diameter of the shaft 33 is substantially less than the diameter of the conduit 24 to define a discharge passageway 35 concentric with the shaft 33. An angled conduit 36 is secured to the upper end of the conduit 24 with the shaft 33 projecting through the side wall for discharging of the material to the transfer conduit unit 6 when pump 32 is operated.

The pump 32 includes a two-piece, bell-shaped casing including an upper or top housing 37 which is generally frusto conically shaped with the small end connected to the lower end of the conduit 24 by a plurality of circumferentially distributed nut and bolt units 38 passing through mating flanges 39 on the respective members. An O-ring seal 40 is disposed between the mating flanges 39 to provide a fluid-tight seal at the joint.

A bottom dished housing 41 is similarly bolted to the lower end of the housing 37 and includes a bottom inlet opening 42 for admitting of material into housing 41 with a central sleeve bearing 43 within which shaft 33 is journaled. The bearing 43 is secured to the outer portion of housing 41 by integral struts or ribs 44 spanning opening 42. An impeller unit is mounted within housing 41 and includes a hub 45 secured to the shaft 33 by a key 46 and also by a pin 47. A plurality of circumferentially distributed impeller blades 48 project downwardly and radially from the hub 45 within the lower housing 41. Additionally, the impeller unit includes an upper cone-shaped extension 49 projecting upwardly and inwardly from the outer edge of hub 45 in spaced parallel relation to the correspondingly shaped housing 37. The upper end of extension 49 engages the shaft 33 as at 50. Vanes or plates 51 are secured to the housing 37 by suitable stud and nut units 52 and project radially inwardly toward

the extension 50, terminating in slightly spaced relation thereto. In operation, rotation of the shaft 33 rotates the impeller blades 48 to suck the manure inwardly through the opening 42 and upwardly through the housing 37 and the conduit 24.

In accordance with the general teaching of the Holz patent, a cutter having three equicircumferentially distributed blades 53 is secured to the shaft 33 immediately below the housing 41. The leading edges of blades 53 are serrated as at 54 and cooperatively operate with the outer surface of the members 44 which support bearing 43. The cutter blades 53 are joined to a central hub 55 which is secured to the shaft 33 by a pin 56. A two bladed beater or stirrer 57 is secured to the lowermost end of the shaft 33 with a locating spacer 58 disposed between the cutter hub 55 and a corresponding hub 59 of the stirrer 57. The hub 59 is also keyed to shaft 33 by a suitable key 60 and held axially by a clamping acorn nut 61 which threads onto the lowermost end of shaft 33. The acorn nut 61 has an outer semi-spherical outer face or surface to define a bearing surface. If the pump assembly 5 is lowered into the tank 1 with the lower end engaging any solid matter or the floor of the storage tank 1, the shaft 33 remains completely free to rotate and thus maintain proper operation of the pump 32.

Although the illustrated pump 32 generally employs teachings of U.S. Patent 3,155,330 in the provision of chopper and the stirrer, the specific illustrated design has been found to provide a substantial improved flow and overall operation of the assembly.

The pump 32 is rotated by shaft 33, the upper end of which projects through the wall of angle conduit 36 and in particular through a stand assembly 62 integrally formed on conduit 36. Assembly 62 includes a generally inverted U-shaped frame having an upper wall from which a central sealing hub extends to the wall of conduit 36. The shaft 33 projects through the hub and spaced multi-ring sealing unit 63 held under compression within the hub by a centrally located spring 64 to seal the shaft opening in conduit 36. The sealing assembly is maintained within the hub by a gear box stand assembly which is bolted to the top wall of frame 62. The shaft 33 terminates within the stand assembly which is generally rectangular box member and is connected by a coupler 65 to a depending shaft 66 from the gear box 34 by suitable connecting pins.

The gear box 34 is bolted to the upper surface of the stand assembly. Gear box 34 may be of any suitable construction providing the desired gear ratio and having a suitable input shaft, shown as a splined shaft 67, which can be connected to a power take-off shaft 68 of the tractor 9. The liquid manure may thus be discharged through the angularly related conduit 36 to a vertical flexible connecting conduit 69 of the transfer conduit unit 6 through a ball and socket quick detachable coupler 70. The quick detachable joint may be of any well known and that illustrated is briefly described. The coupler 70 includes a socket 71 secured to the discharge conduit 36 and adapted to releasably receive a tubular member having an expanded portion defining a coupling ball 72.

A self-sealing rubber annular gasket 73 having a generally U-shaped cross-section is disposed within socket 71 and in the assembled relation encircles the coupling ball 72. Gasket 73 opens toward the flow from conduit 36 and forms a tight leak-proof joint under pressure. A coil spring 74 at the outer end of socket 71 provides a positive lock-in of the ball section under pressure.

The transfer conduit unit 6 includes the flexible section 69 connected to the coupling ball number and to a main U-shaped section 75 connected at the opposite end to the rotating jet nozzle unit 7 by a similar ball and socket quick detachable joint identified by corresponding primed numbers 76.

As shown in full line in FIG. 1, the system is set up

for circulating liquid manure from the pump unit 5 through the rotating jet nozzle unit 7.

Referring particularly to FIGS. 1 and 7, the unit 7 includes a pair of telescoping conduits 77 and 78. The lower conduit 77 terminates in a bent portion terminating in a generally horizontal directed nozzle conduit 79. The assembly is vertically supported within an opening in the top wall by a double-wall support plate 80 to which the upper conduit 78 is welded and which in turn is bolted to the central wall 18 of the storage tank 1.

Circumferentially spaced and distributed stabilizing rods 81 are connected at one end to the outer wall of tank 1 to a stabilizing plate 82 secured to the lower end of the upper conduit 78 of unit 7. The lower conduit 77 is supported and adjustably vertically positioned by a rack and pinion assembly including a rack 83 secured to the top end of a support rod 84 which extends downwardly adjacent the unit 7. The lower end of rod 84 terminates in a plate 85 secured to the flange 86 on the lower end of conduit 77 immediately above nozzle conduit 79. Conduit 77 is raised and lowered by crank 87 mounted to top wall 18 and coupled to a drive pinion 88 which meshes with rack 83. This permits vertical positioning of the nozzle conduit 79.

The lower end of conduit 77 projects downwardly from flange 86 into the conduit 79 which is rotatably mounted as follows. The nozzle conduit 79 includes a top flange 89 with ring gear 90 secured to the top surface thereof encircling the conduit 79. A mounting ring 91 is secured to the conduit flange 86 by a plurality of nut and bolt units 92 and properly spaced by spacers 93 to extend immediately beneath ring gear 90 to support the nozzle conduit.

The nozzle conduit 79 is generally a ninety degree elbow having a horizontally directed nozzle 94 secured to the discharge end. Nozzle 94 is offset from the axis of the terminal end of conduit 79 such that the discharging liquid manure generates a resultant torque or force on the conduit unit to rotate it about the vertical axis. A jet constructed to produce a jet discharge which is generally 22½ degrees from the center line passing through the axis of rotation will produce a satisfactory jet rotation, as in FIG. 8.

Additionally, a stop assembly 95 is coupled to gear 90 to lock the unit 7 against rotation with nozzle 94 located in any desired direction. Assembly 95 includes a small gear 96 mating with ring gear 90 and pinned to a shaft or rod 97 which projects upwardly alongside of the conduit 77. The lower end of the rod 97 is rotatably supported in a bearing 98 having a support plate overlying flange 86 and secured thereto by one of the nut and bolt units 92. The upper end of shaft 97 is square and is slidably disposed within a coupling plate 99, having a correspondingly shaped opening secured to the lower end of an operating tube 100 which extends upwardly and outwardly of wall 18; terminating at its upper end in a hand wheel 101. Tube 100 is rotatably supported by a bearing 102 rotatably secured to the double wall plate 80 and guided at its lower end in an opening in the stabilizing plate 82. Rotation of the hand wheel 101 rotates the gear 96, ring gear 90 and the nozzle 94 to locate the nozzle within the tank 1. A locking bolt 103 is carried by a suitable bracket 104 adjacent the outer end of tube 100 for selectively frictional locking engagement with tube 100. When bolt 103 is drawn up, it is sufficient to overcome the reaction torque at nozzle 94 and prevents rotation of the gear system and therefore nozzle 94. This permits locking of the nozzle 94 in any given angular position within the tank 1, if desired. When bolt 103 is released, the reaction torque causes nozzle 94, the attached gears 90 and 96 and shafts 97 and 100 to rotate as a unit. The nozzle 94 thereby provides for complete recirculation of the manure mixture within the tank to positively prevent settling of manure solids. Further, this continuous recirculation employing the illustrated pump unit

5 permits the chopper-impeller assembly to continuously chop and rechop any solid materials into a free-flowing slurry.

The entire pump unit 5 is mounted on a two wheel trailer 10 for removal and transfer to a different liquid manure tank 1. The illustrated trailer is most clearly shown in FIGURES 1, 2, 9 and 10 and includes a frame structure with supporting wheels 105 secured to one end and a tractor hitch 106 secured to the opposite or forward end. A tubular frame member 107 extends between wheels 105 with a pivot cylinder 108 rotatably thereon. A pair of brace plates 109 are secured as by welding to the pivot cylinder 108 and project inwardly and upwardly with the outer ends secured to the outer wall of the slide 25 which encircles the conduit 24 of the pump unit 5. A hydraulic cylinder unit 110 is pivotally mounted at one end on the frame of the trailer 10 and includes a piston rod 111 connected to a crank arm 112 which projects radially from cylinder 108. Expansion of the cylinder unit 110 extends rod 111 and causes the cylinder 108 and brace plates 109 to move the slide 25 and pump unit from the horizontal position shown in FIG. 10 to the vertical position shown in FIG. 1. A support arm 113 is provided on the forward end of the trailer 10 for supporting the forward end of the pump unit 5 on the trailer in the horizontal transporting position. Arm 112 is pivotally mounted to permit moving it out of the way when not in use.

The hydraulic unit 110 is connected to a suitable hydraulic power take-off on the tractor 9 to allow simultaneous movement of the assembly over the ground with pivotal movement of the pump unit 5. To remove the pump assembly 5, the operator first cranks the assembly 5 upwardly. The tractor 9 is then driven forwardly while simultaneously rotating the pump support assembly to permit movement of the pump assembly through the top opening in the storage tank.

Generally the operation of the illustrated embodiment of the invention can be summarized as follows. The storage tank 1 is built within the ground area 2 with the central rotating jet unit 7 fixed within the top wall 18 to locate the nozzle within the lower portion of the tank 1. The concrete ramp 3 which connects the feed lot or the like to the filler chute 19. To fill the storage tank 1 the cover 20 is opened and the material shoveled or bladed directly into the tank 1. The cover 20 over the opening 4 permits control of surface water flowing into the tank 1 and thereby provides a means to control the consistency of the slurry for pumping and the like.

The transfer conduit unit 6 is connected to the central portion of the tank 1. When it is desired to remove manure from the storage tank 1, or to mix the stored manure, the trailer 10 with the pump unit 10 is backed into position overlying the opening in the top wall of the storage tank 1. Simultaneously, the unit 5 is pivoted from the horizontal to the vertical position and the trailer assembly is moved toward the tank to lower pump assembly into the tank 1. The handwheel 31 is then actuated to complete the lowering of the pump unit 5 into the tank 1. The transfer conduit unit 6 is connected by the quick detachable joint 20 to the output of the pump unit 5 and the power take-off 18 of the tractor 9 is connected to the gear box 34 to transfer rotatable power from the tractor to the pump shaft 33. Actuation of the shaft 33 and thereby pump 32 causes the liquid manure to be forced upwardly through the pump. With the unit 6 connected by joint 76 for recirculation, the pumped liquid manure is rapidly forced through unit 7 and particularly the jet nozzle 94. The hydraulic reaction causes rotation of nozzle 94, if bolt 103 is released, to maintain complete hydraulic agitation and recirculation of the complete mixture within the tank 1. Continuous recirculation chops and rechops the solid material into a uniform free flowing slurry as previously noted. When manure is to be transferred to the spreader 8, conduit unit 6 is disconnected

at the quick detachable joint 76 and the corresponding end is swung over the opening of the spreader 8. The pump unit 5 is then actuated to rapidly withdraw the liquid manure from the storage tank and transfer it to the spreader. Thereafter, the tractor 9 may be connected to the spreader 8 for transporting of the spreader to the field.

The present invention thus provides an efficient mechanized system for storing and handling of liquid manure in sanitary and convenient manner.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In a liquid manure handling and storage system, a storage tank means, a rotatably mounted jet unit mounted within the tank and including an inlet conduit accessible from exteriorly of the tank means, a fluid pump means disposed in the storage tank and including a discharge conduit accessible from exteriorly of the tank means, and a transfer conduit releasably secured at opposite ends to the inlet conduit and to the discharge conduit, said transfer conduit constructed of such length so as to direct the flow of stored liquid for discharge by selective connection and disconnection to the pump and to also direct the flow of the stored liquid for mixing by selective connection and disconnection to the rotating jet unit.
2. In a liquid manure handling and storage system, a storage tank means adapted to be at least partially buried in a ground area, a fluid conduit having a horizontally directed jet nozzle adapted to rotate about a vertical axis within the tank and including an inlet conduit terminating exteriorly of the tank means, said jet nozzle being hydraulically actuated by a selected rate of liquid discharge therefrom, a fluid pump means releasably mounted in the storage tank and including a discharge conduit terminating exteriorly of the tank means, said pump means having a capacity at least as great as said selected rate of liquid discharge, and a transfer conduit releasably secured at opposite ends to the inlet conduit and to the discharge conduit to selectively provide for connection and disconnection to the pump and for connection and disconnection to the rotating jet.
3. In a liquid manure handling and storage system, a storage tank means adapted to be buried in a ground area with the top wall thereof exposed, a fluid agitating unit including a vertical inlet conduit terminating exteriorly of the tank means and adjacent the lower portion of the tank in a horizontally directed rotatable jet adapted to rotate about the vertical axis of the inlet conduit for hydraulic agitation of liquid manure within the tank, said jet nozzle being hydraulically actuated by a selected rate of liquid discharge therefrom, a fluid pump means mounted in the storage tank adjacent the outer wall of the tank and including a discharge conduit terminating exteriorly of the top wall, said pump means having a capacity at least as great as said selected rate of liquid discharge, and a transfer conduit releasably secured at opposite ends to the top of the vertical inlet conduit and to the top of the discharge conduit, said transfer conduit constructed of such length so as to direct the flow of the stored liquid for discharge by selective connection and disconnection to the pump and to also direct the flow of the stored liquid for mixing by selective connection and disconnection to the rotating jet unit.

4. The liquid manure handling and storage system of claim 2 wherein said rotatable jet is an L-shaped conduit having one end coaxially rotatably secured to the inlet conduit and the opposite end including a horizontally offset portion to develop a rotating force in response to said rate of liquid discharge therethrough.

5. The liquid manure handling and storage system of claim 2 wherein said rotatable jet is an L-shaped conduit having one end coaxially rotatably secured to the inlet conduit and the opposite end including a horizontally offset portion to develop a rotating force in response to said rate of liquid discharge therethrough, and means coupled to the rotatable jet and having an actuation exteriorly of the tank means to selectively position and lock the jet against rotation.

6. The liquid manure handling and storage system of claim 2 wherein said pump means includes

an elongated conduit terminating at the one end in the discharge conduit and at the opposite end in a pump unit having an impeller,

a drive shaft spaced and mounted within the elongated conduit in spaced relationship thereto and connected at the one end to the pump impeller, and including an input means at the opposite end.

7. The liquid manure handling and storage system of claim 2 wherein said pump means includes

an elongated conduit terminating at the one end in the discharge conduit and at the opposite end in a pump unit having an impeller,

a drive shaft spaced and mounted within the elongated conduit in spaced relationship thereto and connected at the lower end to the pump impeller and projecting from the top end of the conduit, and

a gear box unit secured to the top end of the shaft and including an input means adapted to be connected to a rotating drive.

8. In a liquid manure storage and handling system, a storage tank having a cylindrical portion and a generally conical top, said tank being adapted to have the cylindrical portion buried in the ground and including an inlet chute structure in the upper portion of the cylindrical portion, said chute structure having a top opening at ground level,

a vertical conduit disposed centrally of the storage tank and terminating within the lower portion of the tank, an L-shaped conduit rotatably secured to the lower end of the lower conduit and terminating in an angularly related nozzle whereby liquid flowing downwardly through said conduits generates a hydraulic reaction force,

locking and positioning means secured to the L-shaped conduit and including an exterior operator for selectively locking the L-shaped conduit in a preselected angular position,

an elongate outlet pump conduit slidably mounted within a support member,

adjustable means for selectively positioning the outlet conduit within the support member,

a pump secured to the lower end of the outlet conduit and having a drive shaft secured to a pump impeller and extending upwardly through the outlet conduit,

a U-shaped transfer conduit,

a detachable coupling releasably connecting the transfer conduit to the inlet end of the upper conduit, and

a detachable coupling releasably connecting the opposite end of the transfer conduit to the outlet conduit.

9. The liquid manure storage and handling system of claim 8 wherein said pump includes a bottom inlet opening with a plurality of generally radial arms secured to a central shaft bearing through which said drive shaft extends, a multiblade cutter fixed to the shaft immediately adjacent the outer face of said arm and including serrated leading edges cooperating with the arms to provide a chopping action on material flowing through said opening.

10. In a liquid manure storage and handling system, a glass lined storage tank having a cylindrical portion and a generally conical top, said tank being adapted to have the cylindrical portion buried in the ground and including an inlet opening in the upper wall of the cylindrical portion,

a chute structure secured to the tank overlying the opening,

a pair of telescoped conduits vertically disposed centrally of the storage tank,

means to secure the upper of said conduits to the tank with the upper inlet end exteriorly of the tank,

means to adjustably mount the lower of said conduits and including an exterior operator for positioning of the lower end thereof,

an L-shaped conduit rotatably secured to the lower end of the lower conduit and terminating in an angularly related nozzle whereby liquid flowing downwardly through said conduits generates a hydraulic reaction force,

locking and positioning means secured to the L-shaped conduit and including an exterior operator for selectively locking the L-shaped conduit in a preselected position,

a mobile unit having a tubular support member selectively rotated between a horizontal position and a vertical position,

an elongate outlet pump conduit slidably mounted within the support member,

adjustable means connected to the mobile unit and coupled to the pump conduit for selectively axially positioning the outlet conduit within the support member,

a pump secured to the lower end of the outlet conduit and having a drive shaft secured to a pump impeller and extending upwardly through the outlet conduit, said pump having a bottom inlet opening with a plurality of generally radial arms secured to a central shaft bearing, a multi-blade cutter fixed to the shaft immediately adjacent the outer face of said arm and including serrated leading edges cooperating with the arms,

a U-shaped transfer conduit,

a detachable coupling releasably connecting the transfer conduit to the inlet end of the upper conduit, and

a detachable coupling releasably connecting the opposite end of the transfer conduit to the outlet conduit.

11. In a liquid manure storage and handling system, a storage tank having a cylindrical portion and a generally conical top, said tank being adapted to have the cylindrical portion buried in the ground and including an inlet opening in the upper wall of the cylindrical portion,

a chute structure secured to the tank overlying the opening,

a pair of telescoped conduits vertically disposed centrally of the storage tank, the lower of said conduits having a flange spaced from the lowermost end thereof,

means to secure the upper of said conduits to the tank with the upper inlet end exteriorly of the tank,

a rack member secured to the lower of said conduits and projecting upwardly through the top of the tank,

a pinion mounted to the top of the tank in mesh with said rack,

a crank secured to the pinion to rotate the pinion and vertically position the lower of said conduits,

an L-shaped conduit having a vertical portion telescoped over the lower end of the lower conduit below said flange and terminating in an angularly related nozzle whereby liquid flowing downwardly through said conduits generates a hydraulic turning force on the L-shaped conduit,

a support ring secured to the flange and spaced downwardly thereof,

a ring gear secured to the vertical portion of an L-shaped conduit and resting on the support ring to vertically support the L-shaped conduit,  
 an operating tube extending parallel to the upper conduit and rotatably mounted, the lower end including a rectangular opening,  
 a control shaft extending parallel to the lower conduit and rotatably secured to the flange, the upper end of said shaft being telescoped into the tube member and having a rectangular perimeter complementing the tube opening,  
 a gear secured to the shaft in mesh with the ring gear, clamp means secured to the top of the tank and selectively engageable with the tube member to prevent rotation thereof,  
 a mobile unit having a tubular support member selectively rotated between a horizontal position and a vertical position,  
 an elongate outlet pump conduit slidably mounted within the support member,  
 adjustable means including a rack secured to the pump conduit and a meshing pinion secured to the support member for selectively positioning the outlet conduit within the support member,  
 a pump secured to the lower end of the outlet conduit and having a drive shaft secured to a pump impeller and extending upwardly through the outlet conduit, said pump having a bottom inlet opening with a plurality of generally radial arms secured to a central shaft bearing, a multi-blade cutter fixed to the shaft immediately adjacent the outer face of said arm and including serrated leading edges cooperating with the arms,  
 a U-shaped transfer conduit,  
 a detachable coupling releasably connecting the transfer conduit to the inlet end of the upper conduit, and a detachable coupling releasably connecting the opposite end of the transfer conduit to the outlet conduit.

**12.** In a liquid manure storage and handling system, a storage tank,  
 a pair of telescoped liquid handling conduits vertically disposed in the tank, and including an upper conduit secured to the tank and lower conduit extending downwardly therefrom,  
 a positioning shaft adjustably secured to the mounting plate and extending downwardly adjacent the conduits and secured at the lower end to the lower conduit, and  
 an agitation conduit having a vertical portion rotatably secured to the lower end of the lower conduit and a horizontal portion terminating in a horizontally angularly offset nozzle, said offset nozzle creating a hydraulic turning torque on the agitation conduit when liquid manure flows therethrough.

**13.** The liquid manure handling and storage system of claim **12** including  
 an operating shaft means extending parallel to the first named conduits and including axially collapsible means,  
 coupling means connecting the lower end of the shaft means and the agitation conduit for simultaneous rotation, and  
 means to lock the shaft means against rotation and thereby lock the agitation conduit against rotation.

**14.** The liquid manure handling and storage system of claim **12** having  
 an outer ring gear secured to the vertical portion of the agitation conduit,  
 a support ring secured to the lower conduit and extends beneath the ring gear to rotatably support the agitation conduit,  
 a collapsible operating tube unit rotatably extends through the top of the tank and terminates at the lower end adjacent the ring gear,  
 means to lock said tube unit against rotation, and

a gear secured to the lower end of the tube unit in mating engagement with said ring gear.

**15.** In a liquid manure storage and handling system, a storage tank,  
 a pair of telescoped liquid handling conduits vertically disposed in the tank,  
 a fixed mounting plate secured to the upper of said conduits and to the tank,  
 a positioning shaft adjustably secured to the mounting plate and extending downwardly adjacent the conduits and secured at the lower end to a flange of the lower conduit,  
 a right angle conduit having a vertical portion telescoped over the lower end of the lower conduit and a horizontal portion terminating in a nozzle offset substantially 22 degrees from the conduit center line, an outer ring gear secured to the vertical portion of the right angle conduit,  
 a support ring secured to the flange on the lower conduit and extending beneath the ring gear to support the right angle conduit,  
 an operating tube rotatably mounted and extending through the mounting plate adjacent the upper tube and terminating at the lower end in an opening having a straight edge,  
 means to lock said tube against rotation,  
 a transfer shaft having an upper complementing end slidably mounted in said opening and rotatably secured to the lower conduit, and  
 a gear secured to the lower end of the transfer shaft in mating engagement with said ring gear.

**16.** In a liquid manure storage and handling system, a storage tank having a central top wall opening, a fixed mounting plate secured to the tank overlying the opening,  
 a vertical upper conduit secured to the plate and projecting into the storage tank,  
 a lower conduit telescoped over the upper conduit and terminating in the lower portion of the tank,  
 an encircling flange secured to the lower conduit,  
 a positioning shaft slidably disposed within an opening in the mounting plate and extending downwardly adjacent the conduits and secured at the lower end to a flange of the lower conduit,  
 a rack and pinion means secured to the mounting plate and the shaft for selectively vertical positioning of the shaft,  
 a right angle conduit having a vertical portion telescoped over the lower end of the lower conduit and a horizontal portion terminating in a nozzle offset substantially 22 degrees from the conduit center line,  
 an outer ring gear secured to the vertical portion of the right angle conduit,  
 a support ring secured to the flange and extending beneath the ring gear to support the right angle conduit,  
 an operating tube rotatably mounted and extending through the mounting plate adjacent the upper tube and terminating at the lower end in a square opening, bolt means threadably secured to the plate and selectively engageable with the operating tube to lock said tube against rotation,  
 a sleeve bearing unit having an axis parallel to the lower conduit and secured to the flange,  
 a transfer shaft having an upper corresponding square end slidably mounted in said square opening and rotatably secured within the bearing unit, and  
 a gear secured to the lower end of the transfer shaft in mating engagement with said ring gear.

**17.** A fluid pump for pumping of liquid manure from a storage tank, comprising  
 an outlet conduit adapted to be vertically mounted within the tank and having an upper offset dis-

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charge portion, said outlet conduit having a sealed shaft opening coaxial with the outlet tube,

- a pump housing including a frusto-conical upper member secured to the lower end of the outlet conduit and a cup-shaped lower member secured to the upper member and having a bottom inlet opening, said lower member having a central bearing unit connected to a plurality of radial support members spanning said opening, 5
- a pump shaft extending through the outlet conduit and the pump housing and journalled in the bearing unit with the upper end extending through said sealed opening, and 10
- a multi-blade impeller within the pump housing secured to the shaft. 15

18. The fluid pump of claim 17 wherein the shaft projects outwardly of the pump housing, a cutter blade means is secured thereto in chopping relation to said radial support members.

19. A fluid pump for pumping of liquid manure from a storage tank, comprising 20

- an outlet conduit adapted to be vertically mounted within the tank and having an upper offset discharge portion, said outlet conduit having a sealed shaft opening coaxial with the outlet tube, 25
- a pump housing including a frusto-conical upper member secured to the lower end of the outlet conduit and a cup-shaped lower member secured to the upper member and having a bottom inlet opening, said lower member having a central bearing unit connected to a plurality of radial support members spanning said opening, 30
- a pump shaft extending through the outlet conduit and the pump housing with the lower end journalled in the bearing unit and the upper end extending through said sealed opening, 35

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a multi-blade impeller located within the lower member and secured to the shaft for rotation therewith, said impeller including a central impeller hub including a frusto-conical portion projecting into the upper member of the housing with the upper edge bearing on the shaft, and

a plurality of circumferentially distributed plates secured to the upper member and projecting radially inwardly toward said frusto-conical portion.

20. A fluid pump for pumping of liquid manure from a storage tank, comprising

a mobile unit including a tubular support and a pivotal mount for the tubular support to progressively move the support between a horizontal and a vertical position, 15

an outlet conduit slidably disposed within the tubular support for vertical mounting within the tank, positioning means to axially position the conduit within the tubular support, and 20

a pump secured to the lower end of the outlet conduit and having discharge means aligned therewith and having an inlet opening, said pump means having a pump shaft extending through the outlet conduit and the pump housing. 25

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