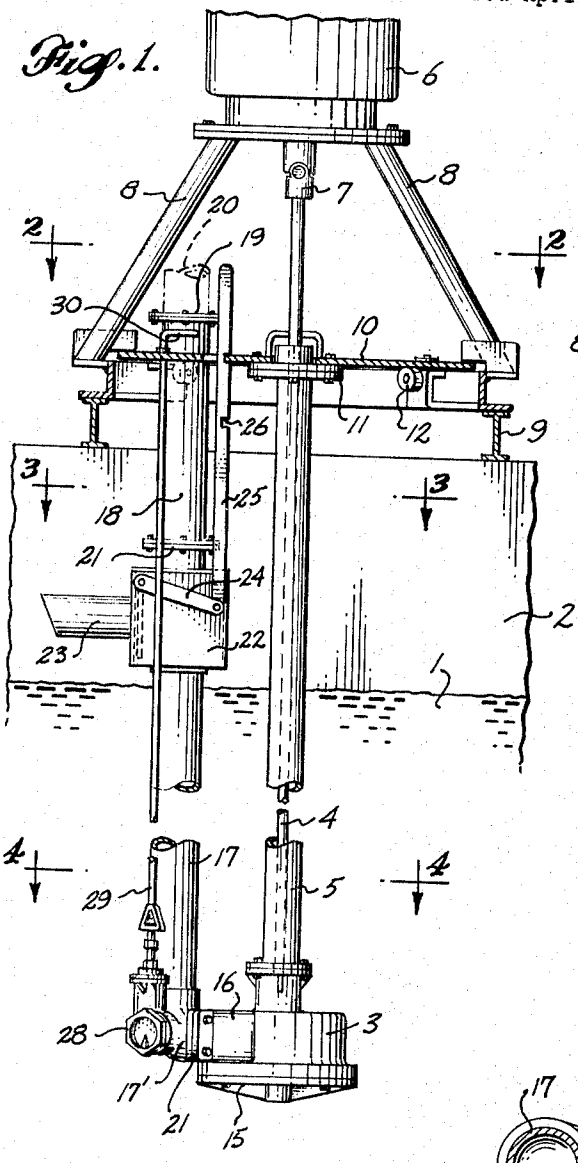
May 2, 1967 J. E. VAUGHAN 3,316,843

TANK SUMP PUMP INSTALLATION

Filed April 26, 1965

Fig. 1.



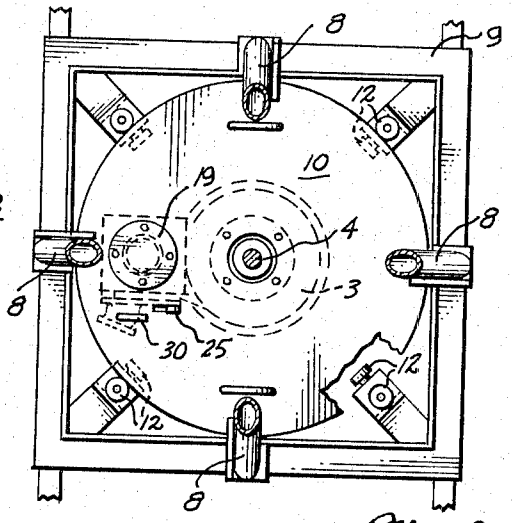


Fig. 2.

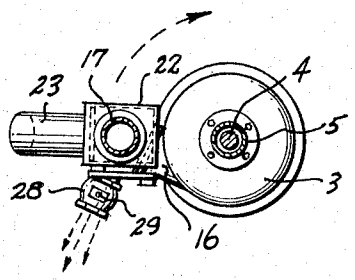


Fig. 3.

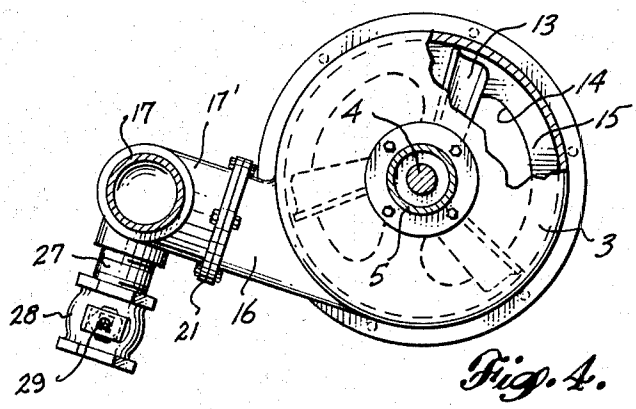


Fig. 4.

INVENTOR.
JAMES E. VAUGHAN

BY
Robert W. Beach

ATTORNEY

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TANK SUMP PUMP INSTALLATION

James E. Vaughan, Elma, Wash., assignor to Vaughan Co., Inc., Montesano, Wash., a corporation of Washington

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6 Claims. (Cl. 103—2)

This invention relates to the installation of a sump pump in a tank, and particularly in a tank in which liquid manure containing solid material is stored.

A principal object is to provide such an installation in which the pump can be used to circulate material, particularly in a circular tank, for the purpose of maintaining the solid material in suspension in the liquid. A more specific object is to provide such a pump installation by which material can be transferred from one portion of the tank to another so as to promote homogeneity.

Another object is to provide a pump installation in which the material will be circulated in different portions of the tank automatically.

It is a further object to provide a pump installation which can be used to discharge material from the tank as an alternate to circulating the material within the tank or redistributing the material with the tank.

An additional object is to provide a pump installation, the operation of which can be converted quickly from one type to another, such as from circulation of liquid to redistribution of liquid or to discharge or liquid from the tank or to some combination of these types of operation.

Further it is an object to provide a pump installation for a tank which is simple, compact and rugged so that it will require a minimum of maintenance, will not occupy a large portion of the tank area and which will not become fouled readily by its operation.

The foregoing objects can be accomplished by mounting a nonclogging type of pump in a tank on a rotatable support which can be rotated unidirectionally and automatically by projecting a jet offset from the rotative axis of the pump. By providing an outlet directed radially of the pump's axis of rotation above the level of the liquid in the tank, material can be transferred from the lower portion of the tank to the surface of the tank at various desired locations. To the same outlet pipe a discharge conduit can be connected for discharging material from the tank.

FIGURE 1 is an elevation of the tank sump pump installation, parts being broken away.

FIGURE 2 is a transverse section through the installation on line 2—2 of FIGURE 1 having parts broken away; FIGURE 3 is a transverse section through the installation on line 3—3 of FIGURE 1; and FIGURE 4 is an enlarged transverse section taken on line 4—4 of FIGURE 1 with parts broken away.

For the present pump installation a nonclogging pump of the type disclosed in my United States Patent No. 3,155,046 can be used. As pointed out in that patent, a pump of that type is particularly useful for pumping liquid manure which may contain stringy materials, such as hay or straw. The present installation is primarily intended for pumping liquid manure 1 stored in a tank 2, such as on a farm. The pump 3 is suspended in the liquid manure at a location well below its surface.

The pump 3 is driven by the upright shaft 4 extending through the pump shaft housing 5. Such shaft is driven by the motor 6 through the universal joint 7. Preferably such motor is of electric type, but the power can be

supplied by a tractor power takeoff. The motor or power takeoff is supported by downwardly diverging legs 8 bearing on a base 9. Such base is located over that portion of the tank 2 in which the pump is to be suspended by the shaft housing 5. The upper end of such shaft housing is secured to a rotatable pump-supporting plate 10 by a bolted coupling 11.

In order to enable the pump installation to be rotated through 360 degrees about the axis of drive shaft 4, the plate 10 is rotatively mounted and held centered by combined radial and thrust bearing units 12. Each unit includes a roller on which a marginal portion of the plate 10 bears directly and such roller rotates about a horizontal axis extending radially of shaft 4. The other roller of each mounting unit turns about an upright axis and the periphery of such roller is engaged with the circumference of plate 10 to resist shifting of such plate radially of shaft 4 toward the mounting.

The pump 3, shown for purposes of installation, includes impeller blades 13 of angular cross section rotatable in the chamber into which liquid manure can flow from the tank 2 through arcuate intake ports 14, located eccentrically of the axis of shaft 4 in the bottom on end plate 15 of the pump housing. As the impeller rotates, the sharp leading edges shear stringy material entering the housing through the intake openings; and the liquid and chopped solid material is discharged from the housing through the pump outlet 16 extending generally tangentially from the circular housing.

A discharge pipe 17 extends upwardly from the pump outlet to which it is connected by an elbow 17'. The discharge pipe is shown as including an extension upper section 18 passing through the rotative pump-supporting plate 10 to which it may be secured, such as by welding, to supplement the pump-supporting action of coupling 11. The upper end of the discharge pipe extension can be closed by a plate 19, or a pipe 20 can be connected to the upper end of such extension to conduct the liquid manure to any desired location. Preferably the lower section 17 of the discharge pipe is removable from the installation by disconnection of couplings 21 connecting the opposite ends of this pipe section to the pump outlet 16 and the upper section 18 of the discharge pipe.

The reason for mounting the lower section 17 of the discharge pipe so that it can be removed from the installation without disturbing the pump 3 or its supporting plate 10 is to enable the circulating and redistributing mechanism to be withdrawn conveniently for servicing when desired. The redistributing means includes the valve 22 incorporated in the discharge pipe from which the outlet 23 projects in a direction transversely of the discharge pipe and preferably substantially radially of the axis of rotation of pump 3, as indicated in FIGURE 3. Valve 22 is a diversion valve, the position of which can be adjusted by swinging pivoted arm 24 between a position in which the entire flow through the lower discharge pipe section 17 passes upwardly into the upper discharge pipe section 18, and a position in which the valve closes such upper pipe section and the entire discharge is diverted from the lower discharge pipe section 17 through the valve outlet 23. Swinging of this valve control arm can be effected by longitudinal movement of the upright control bar 25. Notches 26 in one side of such control bar can be engaged with the edge of the aperture in plate 10 through which the control bar extends to hold such bar, and correspondingly the arm 24 and valve 22, in any of various adjusted positions to which the respective notches 26 correspond.

From one side of the elbow 17' in the lower section of the discharge pipe projects a further discharge outlet

27, preferably in a direction substantially perpendicular to the pump outlet 16. Whether or not the outlet 27 has precisely this relationship to the outlet 16, the flow direction through the outlet 27 should be along a line offset a substantial distance from the axis of the impeller drive shaft 4, as shown in FIGURE 4. The offset should be sufficient to provide a substantial moment arm between the rotative axis of plate 10 and the pump shaft housing 5 on which the thrust of the liquid jet discharged from the jet outlet 27 can act.

A control valve 28 is included in the line of outlet 27 to control the amount of liquid diverted from the discharge pipe 17. Such valve preferably is of the gate-valve type so as to enable a wide variation in quantity of liquid discharged from the jet outlet 27 to be effected in order to regulate the speed of rotation of the pump installation and plate 10 about the axis of such plate in the direction indicated by the arrow in FIGURE 3. The degree of opening of the valve can be regulated by rotation of the control rod 29 in one direction or the other, effected by turning the angle handle 30 on the upper end of such rod projecting above plate 10 so that it will be accessible to an operator.

The pump installation can be operated in various ways. If the control bar 25 is in its lowermost position, as shown in FIGURE 1, so that the valve 22 is positioned to close the outlet 23, and gate valve 28 controlling the jet outlet 27 also is completely closed, the liquid manure discharged by pump 3 will all pass completely through upright pipes 17 and 18 and be discharged through the extension pipe 20 connected to the upper end of the upper discharge pipe section 18. During such operation rotative plate 10 can be locked against rotation in any suitable fashion, or engagement of the discharge pipe against a leg 8 will limit rotative movement of plate 10 and the apparatus suspended from it. Under such circumstances the pump 3 will operate to pump liquid manure and chopped solid material from the pump location out of the tank 2 in the same manner that the pump disclosed in Patent 3,155,046 operates.

If it is desired to circulate or stir the contents of the tank 2 in order to effect mixing of the tank contents or deter settlement of solid waste material in the liquid in the tank, valve 28 can be opened to a greater or lesser extent by the operator swinging handle 30 to rotate valve rod 29 in the valve-opening direction. The jet action of the liquid discharged from the jet outlet 27, as indicated in FIGURE 3, will then effect rotation of the pump about the axis of shaft 4 and plate 10 at a speed corresponding to the amount of liquid discharged from such outlet. Of course, the velocity of the liquid discharged also will affect the rotative force produced and consequently the speed of pump rotation. Thus, if the speed of shaft 4 and of impeller 13 is increased, the greater force and velocity with which the liquid is discharged from the jet outlet 27 will increase the torque on the pump installation. Also, opening the valve 28 will increase the torque on the pump assembly because of the increased amount of liquid manure which would be discharged past the valve.

If the control bar 25 is raised from the closed position shown in FIGURE 1 to swing control arm 24 upward for opening the valve 22, the liquid which is discharged through the redistribution outlet 23 will be deposited onto the surface of the liquid manure 1 in the tank. Such discharge can have the effect of removing thicker material or material containing more solid material from the bottom portion of the tank and depositing it in the upper portion of the tank at a location spaced horizontally from the pump intake. Thus, the pump normally would be located generally centrally of a reasonably small circular tank and the liquid discharged through the outlet 23 would be projected substantially radially of the axis of rotation of the pump assembly. The greater the opening of valve 22, of course, the more liquid manure would be

discharged from the discharge pipe at this location. The greater the pressure developed by the pump 3, the farther liquid would be projected from outlet 23 in a free stream. Also, of course, it will be evident that the length of the outlet pipe 23 is not critical and it could be considerably longer than shown in FIGURE 1 if desired.

It will be evident that control bar 25 can be moved up and down into any desired adjusted position independently of the opening of valve 28. If valve 28 is closed it will be desirable to rotate plate 10 manually through successive increments from time to time in order to equalize substantially the distribution over the surface of the liquid manure in the tank thicker liquid pumped from the bottom of the tank. Rotative shifting of the outlet 23 can be effected automatically and continuously, however, by having valve 28 opened to a greater or lesser extent at the same time that valve 22 is opened so as to effect continuous progressive angular movement of the outlet 23.

Alternatively, valve 22 may be left in the closed position and valve 28 can be opened to a greater or lesser degree for the purpose of circulating or stirring the heavier material in the lower portion of tank 2 to maintain it in suspension. A very substantial circulation of liquid can thus be effected if the upper section 18 of the discharge pipe is capped as well as valve 22 being closed. Under these circumstances the mixing discharge from outlet 27 as well as the rotative speed of the installation around the axis of the shaft 4 can be maximum.

I claim as my invention:

1. A tank sump pump installation comprising a tank, a sump pump, rotative disk, means suspending said pump in said tank from said disk in a position for bodily rotation about the rotative axis of said disk, a discharge pipe extending from said pump upward through said disk, a first branch outlet projecting from said discharge pipe transversely of the length thereof and at a location adjacent to said pump and forming a discharge opening along a line offset from the rotative axis of said disk, a second branch outlet projecting from said discharge pipe transversely of the length thereof at a location near the surface of the liquid in said tank, first valve means operable to control discharge of liquid through said first branch outlet, and second valve means operable independently of said first valve means to control discharge of liquid from said second branch outlet.

2. A tank sump pump installation comprising a tank, a sump pump including a casing having an intake port communicating with said tank and an impeller in said casing, means suspending said pump casing in said tank for bodily rotation of said casing about an upright axis, discharge pipe means connected to said pump casing and including a jet outlet directed generally horizontally along a line offset in spaced relation to the rotative axis of said pump-suspending means, means driving said impeller to draw liquid from said tank through said casing intake port and to discharge such liquid from said casing through said jet outlet to produce a reaction torque effecting bodily rotation of said pump-suspending means about its upright axis, and valve means for controlling discharge of liquid from said jet outlet to vary the reaction torque effected by discharge of liquid from said jet outlet.

3. The tank sump pump installation defined in claim 2, in which the discharge pipe means includes a discharge pipe extending from the pump upward to a location near the surface of liquid in the tank and a branch outlet projecting transversely of the length of said discharge pipe means and providing the jet outlet.

4. The tank sump pump installation defined in claim 3, and second valve means operable to control flow through the upwardly-extending discharge pipe independently of flow through the branch outlet.

5. The tank sump pump installation defined in claim 3, in which the discharge pipe means includes a second branch outlet that is connected to the upwardly-extending

discharge pipe, located near the surface of the liquid in the tank and projecting therefrom substantially radially of the rotative axis of the pump-suspending means, and second valve means operable independently of the first valve means to control discharge of liquid from said second branch outlet.

6. The tank sump pump installation defined in claim 2, in which the discharge pipe means includes a discharge pipe extending from the pump upward above the surface of liquid in the tank and a branch outlet projecting transversely of the length of said discharge pipe at a location near the surface of liquid in the tank and directed generally horizontally for discharging near the surface of the liquid in the tank material taken into the pump to redistribute material in the tank.

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DONLEY J. STOCKING, *Primary Examiner.*

HENRY F. RADUAZO, *Examiner.*