May 25, 1965 R. T. SECREST 3,185,100

COMMINUTING PUMP

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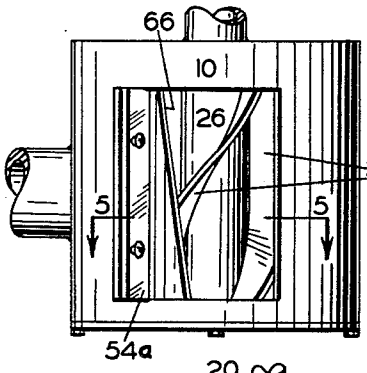


FIG. 4

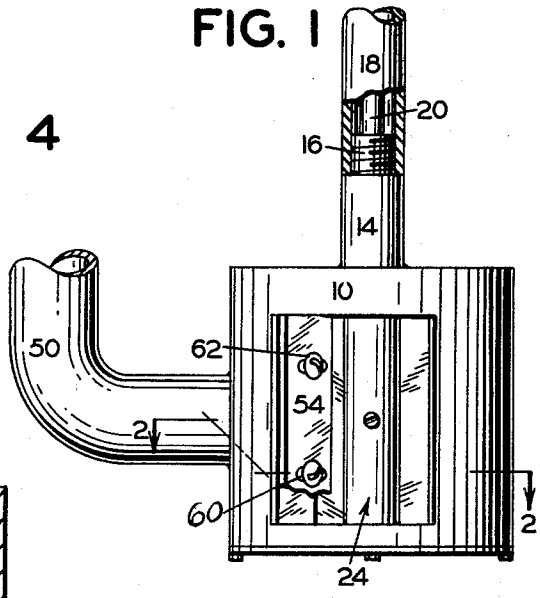


FIG. 1

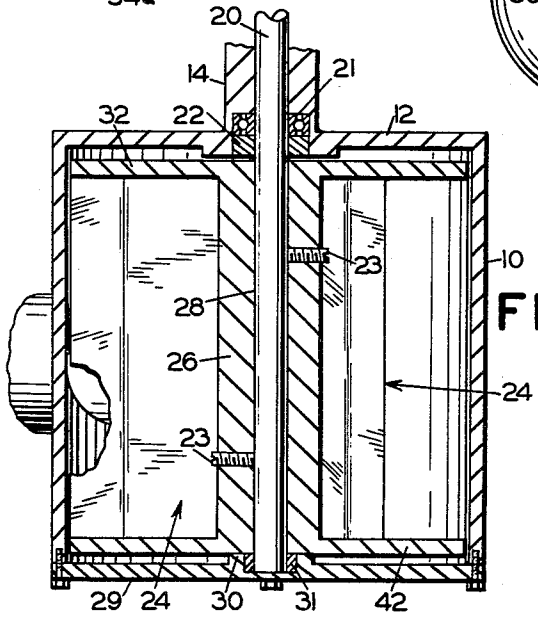


FIG. 3

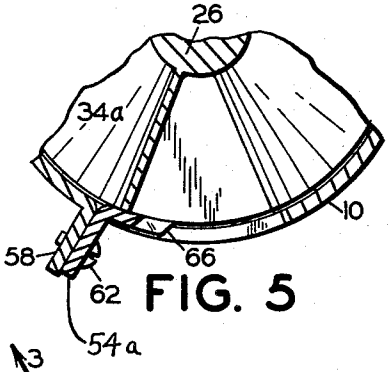


FIG. 5

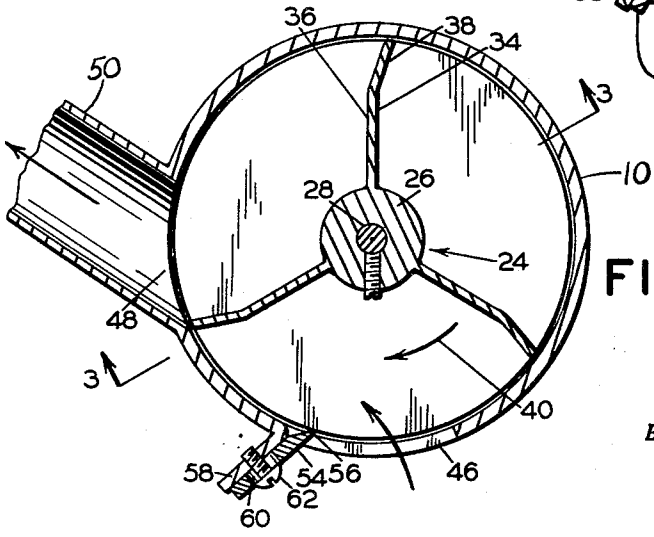


FIG. 2

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COMMINUTING PUMP

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This invention relates to new and useful improvements in pump structures and more particularly is concerned with a pump unit which is adapted simultaneously to pump a liquified mass and to reduce any coarse material in the mass to a fine state.

It is a primary object of the present invention to provide a pump which due to its novel structure is efficient in operation for the pumping and comminution of a liquified mass.

More specifically, it is an object of the present invention to provide a pump having improved structure which facilitates suspension thereof into a liquified mass to be pumped and reduced; to provide a pump which employs a novel blade structure as combined with a shear plate for reducing coarse material in the mass; and to provide a pump which has the inlet and outlet thereof closely located and disposed on the peripheral wall of a pump chamber for maximum efficiency.

It is another object to provide a pump which is simple in structure and inexpensive to manufacture.

Briefly stated, the present pump is adapted to be suspended or otherwise supported in a tank or the like containing a liquefied mass to be pumped and is particularly useful for the simultaneous reduction or comminution of coarse material in the mass. This pump includes a housing in which is incorporated a novel arrangement of cutter or impeller blades adapted to pump and reduce material and due to their structure and arrangement contribute to the efficient operation of the pump. Importantly, the inlet to the pump housing is closely located to the outlet to increase pumping efficiency, and the pump also incorporates other structural means which contribute to its efficiency such as confining means to prevent coarse material from getting between working parts and a particular cutter blade shape for cutting and transferring material to the outlet.

The invention will be better understood and additional objects will become apparent from the following specification and claims, considered together with the accompanying drawings, wherein the numerals of reference indicate like parts and wherein:

FIG. 1 is a side elevational view of a first form of the present pump with parts thereof being broken away for clarity;

FIG. 2 is a sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2,

FIG. 4 is a side elevational view of a second form of the present pump; and

FIG. 5 is a sectional view taken on the line 5—5 of FIG. 4.

The present pump has as one important use thereof the transferring of a liquified mass from a storage tank or the like to another place and at the same reducing or comminuting any material which may be in the liquid. For example, it is now common on farms to bury manure disposal tanks in the ground for storage of the manure. When desired, this manure is transferred from the tank to the field. This product most often contains straw or other bedding which is difficult to pump and which is impractical without comminution to spread on the ground, through the medium of liquid spreader means. The present pump is designed to prepare manure for such spreading but of course it may also be used for the pumping and cutting of various other substances.

Referring specifically to the drawings, the present pump has a housing or casing having a cylindrical side wall portion 10. This housing has a top wall or closure plate 12 provided with an integral, upwardly directed, hollow extension 14 such as a pipe section or hub. Extension 14 comprises a suspending support for the housing 10 whereby the latter is adapted to be suspended in desired positions in a tank or the like. As apparent in FIG. 1, the hub 14 has a reduced threaded extension 16 to which is threadedly connected an additional length of supporting pipe 18.

Leading through the pipe 18 and hollow extension 14 and rotatably projecting into the housing is a shaft 20 which is connected at its upper end to a power unit, not shown, such as an electric motor. The support pipe 18 and the shaft 20 are of sufficient length such that the power unit in a disposal tank of the type above mentioned is mounted on the upper side thereof. Thus, the suspended pump may be several feet from its power unit, with the pump suspended adjacent the bottom of the tank or at any intermediate point between the bottom and top of the tank. An antifriction bearing 21 for the shaft is mounted in the hub 14 and stabilizes the projecting end of the shaft. A packing seal 22 engageable with the shaft is provided in the pump housing adjacent the bearing 21.

Contained within the housing is a cutter blade or impeller assembly 24 comprising a hub or rotor 26 having a central bore 28 for integral attachment of the shaft 20 thereto as by set screws 23.

The lower end of the housing has a removable closure plate 29. This plate has an upwardly directed hub 30 which provides a bearing support for the impeller assembly and incorporates a bearing bushing 31 for receiving a projecting bottom end of shaft 20.

As best apparent in FIG. 3, the blade assembly includes a top annular flange 32. This flange has a diameter only slightly smaller than the interior diameter of the housing so that it operates at a close tolerance therewith and therefore confines any coarse material in the liquid therebelow to prevent such material from getting between rotating parts and hindering rotation of the blade assembly.

Mounted on the hub 26 are cutter blades 34, three of which are shown in a preferred arrangement, although it is to be understood that more or less blades may be utilized. Each of the blades has a first segment 36 leading from the hub and a second segment 38 leading angularly from the first segment 36, the angular direction of the segment 38 being in the direction of rotation of the blade assembly, i.e., in the direction of arrow 40.

The outer edges of blades 34 also operate in close tolerance to the interior surface of the housing as best seen in FIG. 2 and the lower end of hub 26 has an annular flange 42, FIG. 3, to thus form a pumping and comminuting chamber which confines any coarse material in the liquid, such as straw, to the pump chamber and prevents such material from getting between rotating parts.

The housing has an inlet opening 46 and an outlet opening 48 in its side wall 10, a suitable discharge pipe 50 leading from such outlet opening.

Mounted on the far side edge of the inlet opening 46, as concerning the direction of rotation of the blade assembly, and extending parallel to the axis of the hub 26 is a shear plate 54 having a shearing edge 56 arranged to cooperate with the outer cutting edges of the blades 34. Material such as straw or other bedding which is drawn into the pump is comminuted as it enters the pump by the rotating blades 34 cooperating with the shear plate. The speed of rotation of the blade assembly is such as to reduce material in the liquid to a fine state, comprising a condition which permits it to flow freely and be ejected by spray apparatus. In this regard, when the pump is utilized in connection with a manure disposed tank, the latter is pro-

vided with sufficient water to liquefy the manure. The pump has been found to operate satisfactorily at approximately 800 r.p.m., although a greater or lesser speed may be used.

In a preferred arrangement, shear plate **54** is supported on a turned back flange portion **58** of the pump chamber wall. This plate has slots **60** extending at right angles to the axis of the hub **26** for receiving attaching screws **62** threaded in the flange portion **58**, the slots **60** being slightly elongated to facilitate adjustment of the plate **54** with relation to the edges of the cutter blades **34**.

As best apparent in FIG. 2, the outlet **48** is located in close proximity to the inlet opening **46**. More particularly, the far side or cut-off edge of the outlet opening is located about 90° around the side wall of the housing from the far side edge of the inlet opening in the direction of travel of the blades **34**. Such spacing has been found to contribute greatly to the efficiency of the pump, although a slightly lesser or greater spacing may be used.

Referring now to FIGS. 4 and 5, a modified form of shear plate and cutter blade assembly is illustrated. In this embodiment, a shear plate **54***a*, which is connected to the housing in a manner similar to the FIG. 1 embodiment, has a cutting edge **66** angularly disposed with relation to the axis of the hub. Cutting blades **34***a* secured on the rotatable hub are spiraled and their cutting edges are angled in a direction opposite from that of edge **66** in order that said blades cooperate with the shear plate in a shearing rather than a chopping action. Preferably, the cutting edges of members **54***a* and **34***a* are angularly disposed such that the meeting angle therebetween is 45°. This may be accomplished by oppositely inclining each of the cutting edges 22½° as shown, or by inclining one of them 45°. This meeting angle has been found to contribute to a greater efficiency and smoother operation of the pump in that coarse material in the liquified mass is smoothly sheared and not chopped.

The following features contribute to the smooth and efficient operation of the present pump:

(1) The relative location of the inlet and outlet openings, i.e. on the wall in close proximity, wherein the coarse material in the liquid after being reduced to a finer state is almost immediately discharged rather than churned in the pump chamber;

(2) The specific location of the inlet and outlet openings in the pump chamber, i.e. in the peripheral wall wherein pumped material is readily admitted and discharged;

(3) The angular shape of the cutter and pumping blades **34** in the FIGURE 1 embodiment which causes the blades to efficiently reduce coarse material and to convey it in liquid suspension to the outlet; and

(4) The upper and lower flange portions **32** and **42** respectively and the close tolerance of these flanges as well as the blades **34** with the pump chamber to prevent coarse material from getting between working parts.

It is to be understood that the forms of my invention herein shown and described are to be taken as preferred examples of the same and that various other changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. A comminuting pump comprising a vertical housing having a cylindrical side wall and upper and lower closure plates, means secured to said housing for suspending the latter in a liquified mass, a rotatable hub coaxially disposed in said housing, cutter and pumping blades projecting radially from said hub and having outer axially extending cutting edges disposed for movement in a path in close proximity to the inner surface of said side wall, top and bottom annular flanges secured to said hub at the top and bottom of said blades to confine coarse material in the liquid being pumped in a pump chamber formed between said annular flanges and the side wall of the housing, said cutting edges extending between said annular flanges, means in said side wall defining spaced inlet and outlet openings providing substantially horizontal intake and outlet of material to be pumped, said inlet opening having an axially extending far side edge in the direction of rotation of the cutter and pumping blades, said outlet opening having a cut-off edge located approximately 90° around the side wall of the housing from the far side edge of the inlet opening in the direction of travel of said cutter and pumping blades, and a shear plate on the far side edge of said housing intake and extending axially the full height of said intake opening, and cooperating with the axially extending cutting edges of said cutter and pumping blades to comminute the material being pumped.

2. The comminuting pump of claim 1 wherein the vertical spacing of said top and bottom annular flanges is greater than the vertical height of said inlet opening and said axially extending cutting edges of the cutter and pumping blades extend vertically on opposite sides of said inlet opening.

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