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(54) A mass tower and apparatus for the discharge thereof.

(57) The present invention relates to an apparatus for the discharge of a mass tower as used in the pulp and paper industry, which tower is, in use, filled with medium or high consistency pulp. The invention is characterized in that a separate pump (34) is attached to the tower (10) and communicates with the inside of the tower (10) via a suction duct (32, 42) extending to the zone of moving pulp.

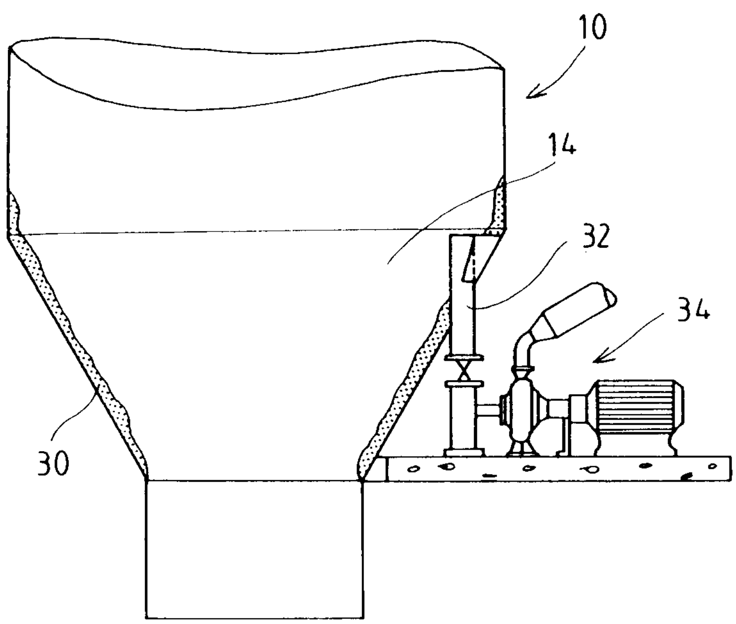

FIG. 3

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The present invention relates to a mass tower or other vessel as used in the pulp and paper industry and which is normally filled with medium or high consistency pulp, and apparatus for the discharge thereof.

Pulp from a high or medium consistency mass tower has hitherto been discharged from the bottom part of the tower by a conventional centrifugal pump, which has required the dilution of pulp usually to a consistency of about 6% maximum. During the last decade a centrifugal medium consistency pump has gained ground in pumping medium consistency pulps, whereby it is natural that the discharge of the mass tower is carried out with said so called MC-pump. The MC-pump may, of course, be positioned at the bottom of the tower and if required also, for example, equipment illustrated in European patent application 87117593 and publication 0323749 may be used to ensure the flow of the pulp to the pump. However, it has been proved that it is more advantageous to arrange an MC-pump to communicate with the wall of the mass tower, whereby it is possible to pump diluted pulp where such is required. By using this kind of arrangement pulp can be discharged from the same tower at least at two different consistencies.

The pump arranged in communication with the mass tower is in most cases attached to the conic wall portion of the mass tower. When pumping pulp with an MC-pump arranged in said manner significant problems arise in time. The output of an MC-pump gradually reduces whereas the energy consumption increases. The deduction is that the pump for some reason does not receive a sufficient amount of pulp anymore, and even the addition of dilution water offers only a temporary solution for the problem.

The arrangement according to the present invention has in the performed tests eliminated or minimized the above described problem, and the characteristics of the invention are disclosed in the appended claims.

The present invention is described more closely below, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is an elevation schematically illustratiug a prior art arrangement for the discharge of a mass tower;

Fig. 2 is a schematical illustration of a theoretical possibility for the generation of a pulp layer in the conical portion of a mass tower or other pulp vessel on which the invention is based;

Fig. 3 is a schematical illustration of an apparatus in accordance with a preferred embodiment of the invention;

Fig. 4 is a schematical illustration of an apparatus in accordance with a second embodiment of the invention;

Fig. 5 is a schematical illustration of a third embodiment of the invention; and

Fig. 6 is a schematical illustration a fourth embodiment of the invention.

Fig. 1. illustrates a modern discharge arrangement of a high consistency mass tower in accordance with the prior art. A high consistency mass tower 10 consists in the embodiment according to the drawing of three portions: a cylindrical upper portion 12, a conical intermediate portion 14 and a cylindrical bottom portion 16. A conventional centrifugal pump 20 designed for low consistency pulps is attached to the wall of the cylindrical bottom portion 16 of the tower. A feed conduit (not shown) for a dilution liquid and a mixer 22 for mixing the liquid into the pulp to improve the pumpability thereof are arranged in front of the pump 20. The wall in the conical intermediate portion 14 of the tower 10 is provided with an MC-pump 24, by which pulp is pumped without dilution at its original consistency. The MC-pump can also be attached to the cylindrical upper portion 12 of the tower, as illustrated by the alternative upper MC-pump 26 in the drawing.

Fig. 2 illustrates a theory of why the pumping of high consistency pulp is not successful of a period of time, at least from the conical portion of the tower. The broken lines A and B in the drawing show the variations of the levels of the pulp surface on discharging and on filling respectively. It may be noted that always when the height of the surface of the pulp decreases, the pulp surface A in the center part of the tower drops, because the friction alone between the pulp and the walls of the tower causes such effect. On the other hand, the conical portion of the tower in a way also forces the pulp to move towards the center of the tower, which contributes to the deceleration of the downwards movement of the pulp. Further it is known that the pulp thickens adjacent to the tower wall. The reason therefor is that the liquid in the pulp, being more readily moving, tends to flow downwards, whereby liquid is filtered most from the pulp in close proximity of the walls. The greater the level difference between the pulp surface A in the center of the tower and the pulp adjacent to the walls, the greater is the filtering capability and the increase of consistency at the periphery. When the tower is filled the situation reverses, the pulp accumulates into the center of the tower, cf. curves B, but when the surface again decreases, the pulp adjacent to the walls quickly achieves its initial consistency. When the pulp is sufficiently thickened it does not move downwards at all in the conical portion of the tower, but forms a thickened pulp layer into the conical portion 14, which in the course of time continuously thickens. In the experiments it has been noted that the consistency in such layer rises even above 20%. If in these cases an MC-pump 24 having a fluidizing rotor is attached to the conical portion, it pumps well at the beginning, but the pumping capability decreases, because the suction opening of the pump 24 will gradually be surrounded by a pulp collar must at the edge of the influence range of the fluidizing rotor. The less, i.e. the shorter distance, said rotor extends into the vessel, the sooner the pump encounters the difficulty of properly receiving pulp.

Fig. 3 illustrates a solution to the above-mentioned problem. A vertical suction duct 32 is mounted extending through a wall 30 of the downwards, preferably conically, reducing portion 14 of the mass tower 10, the duct 32 extending sufficiently far into the interior of vessel 10 to permit continuous pumping, in other words it extends all the way through even a thick dewatered pulp layer to the zone of moving pulp, and the suction opening of which duct is preferably also open against the flow direction of the pulp, whereby in either case there is no need to doubt the flow of pulp down to the bottom of said suction duct 32, which bottom is provided with a separate pump 34, preferably a so called MC-pump. It must be noted that the realization of the arrangement in accordance with the invention is characterized in that the bottom portion of the tower is provided with a first pump (not shown), by which pulp is pumped substantially continuously from the vessel 10, which causes the continuous flow of pulp past the duct orifice, in other words the so called suction opening, of the suction duct 32 arranged in the conical portion 14. the extension of the suction duct 32 to the inside of the vessel, in other words the distance of the suction duct from the inner surface of the vessel, must be according to the performed experiments at least about 50% of the diameter of the suction duct. Of course, a greater diameter does not disturb, but if the diameter diminishes, problems may be encountered by some easily filtering pulp types.

Fig. 4 illustrates an additional possibility of arranging a suction duct 36 at right angles against the conical wall 30. An additional advantage for both arrangements is that the fluidizing MC-pump 34 or possibly the means disclosed in Fig. 7 of European patent application 88312336 can be arranged on a conventional basis in the bottom, and not be hung on the wall of the mass tower, as is characteristic of the previous technique.

Figs. 3 and 4 additionally illustrate an apparatus to be preferably added to communicate with suction duct 32, 36, namely a rollar or baffle plate 42, the purpose of which is to cover a pocket otherwise formed between the suction duct and the tower wall, to which pocket the downward flowing pulp is liable to accumulate. The collar plate 42 is preferably formed to pass or deflect as well as possible the pulp to the sides of the suction duct so that the generation of a pulp layer on the collar plate itself is substantially prevented.

Fig. 5 illustrates an open screw 40 arranged in front of the opening of an upright suction duct 38 to prevent the generation of a thickened pulp layer in front of the suction duct 38 and to transfer pulp towards the orifice of the suction duct 38. Fig. 6 illustrates a similar arrangement to Fig. 5 applied in front of the orifice of a discharge duct for pulp located perpendicular to in the conical portion. The purpose of the screw 40 is, as mentioned, to feed pulp towards the wall of tower/mass tower 10 and thus prevent the generation of a pulp layer otherwise tending to accumulate on the wall. The screw does not actually operate as a feeding apparatus for the suction duct, but as was stated above, it prevents the thickening of the pulp on the surface of the mass tower by feeding the pulp against the wall of the vessel. A rotating scraper may also or alternatively be used for a similar purpose, which scraper mechanically loosens the pulp layer accumulated on the wall.

As can be seen in the above-mentioned description a new arrangement has been developed for a reliable and safe discharge of mass towers or other vessels without a need to dilute the pulp. It must be noted that the above description discloses only a few embodiments of the invention. In reality the apparatuses may deviate considerably from the above described embodiments whilst still being within the scope of the accompanying patent claims, which claims alone define the scope of invention. Thus, it is quite possible that the suction duct in accordance with the present invention be arranged either is a perpendicular or inclined position relative to the cylindrical portion of-the mass tower, or that the screw shown in the drawings is positioned to some other position other that a completely horizontal position or that the vessel is completely cylindrical or of some other form appropriate for the purpose, or that the suction duct of the vessel has been extended deep into the vessel, for example through the bottom of the vessel, to mention some of the possible variations of the invention.

Claims

1. A mass tower or other pulp vessel and apparatus for the discharge of high or medium consistency pulp when contained therein, in which a bottom portion of said pulp vessel is provided with a first pump for removing pulp from the tower, **characterized** in that a second and separate pump (34) communicates with the inside of the vessel via a suction duct (32, 42) having an inlet orifice spaced from the inside wall of the vessel with the duct thus, in use, extending to a zone of moving pulp.

2. Apparatus in accordance with claim 1, **characterized** in that the distance of the suction opening of the suction duct (32, 36) from the inner surface of the tower (10) is at least 0.5 times the diameter of the suction opening.

3. Apparatus in accordance with claim 1, **characterized** in that the mass tower (10) comprises in

addition to the bottom portion (16) a substantially cylindrical upper portion (12) and a conical intermediary portion (14).

4. Apparatus in accordance with claim 3, **characterized** in that the suction duct (32, 36) is located in the conical intermediary portion (14).

5. Apparatus in accordance with claim 4, **characterized** in that the suction duct (32) extends at an inclined position relative to the wall of the tower (10).

6. Apparatus in accordance with claim 4, **characterized** in that the suction duct (36) is in an upright position against the wall of the tower (10) or extends at right angles to the wall.

7. Apparatus in accordance with claim 1, **characterized** in that a member (40) is arranged adjacent to the suction duct (32, 36), by which the generation of a fiber layer is prevented in front of a suction opening and around it.

8. Apparatus in accordance wich claim 1, **characterized** in that a member (40) is arranged adjacent to the suction duct (32, 36), and by means of which there is prevented generation of a fiber layer walls of the mass tower (10) in front of the suction opening of the suction duct (32, 36) and around it by feeding the pulp against the wall of the tower (10).

9. Apparatus in accordance with claim 7 or 8, **characterized** in that the member (40) is a screw.

10. Apparatus in accordance with claim 7, **characterised** in that the member (40) is a rotary scraper or the like.

11. Apparatus in accordance with claim 1, **characterized** in that the suction duct extends into the inside of the tower (10) through the side wall of the tower.

12. Apparatus in accordance with claim 1, **characterized** in that the section duct extends into the inside of the tower (10) through the bottom of the tower.

13. A method of discharging high of medium consistency pulp from a mass tower or like pulp vessel comprises removing pulp continuously from the vessel by means of a first pump so as to cause a continuous flow of pulp past the inlet orifice of an extraction duct located upstream and spaced from the inside wall surface of said vessel so as to be in the region wherein pulp continuously thus flows, and pumping pulp from said duct by means of a second pump.

14. A method as claimed in claim 13, in which pulp is additionally displaced adjacent said orifice to prevent the generation of a static layer in front of the inlet orifice.

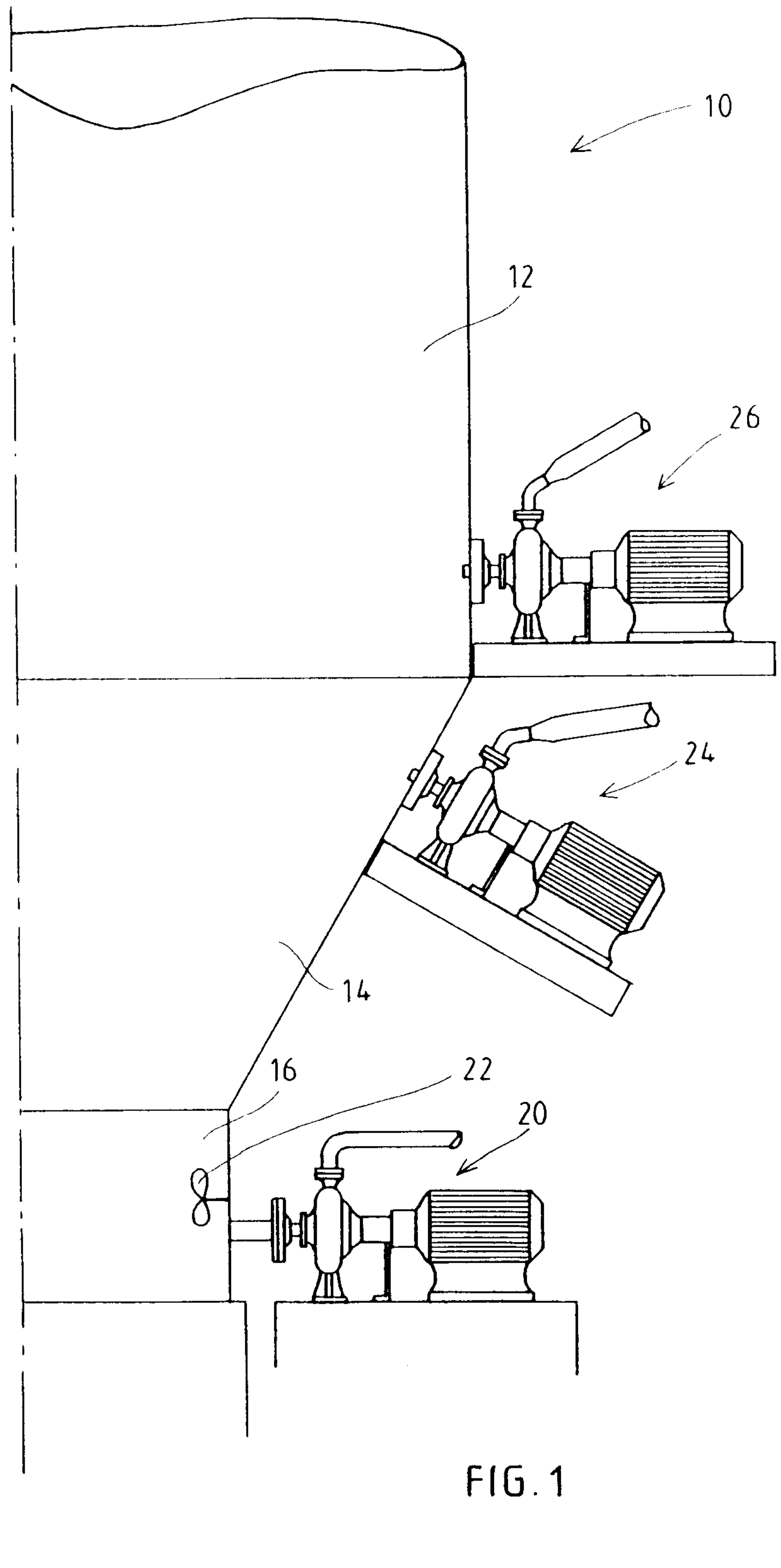

FIG. 1

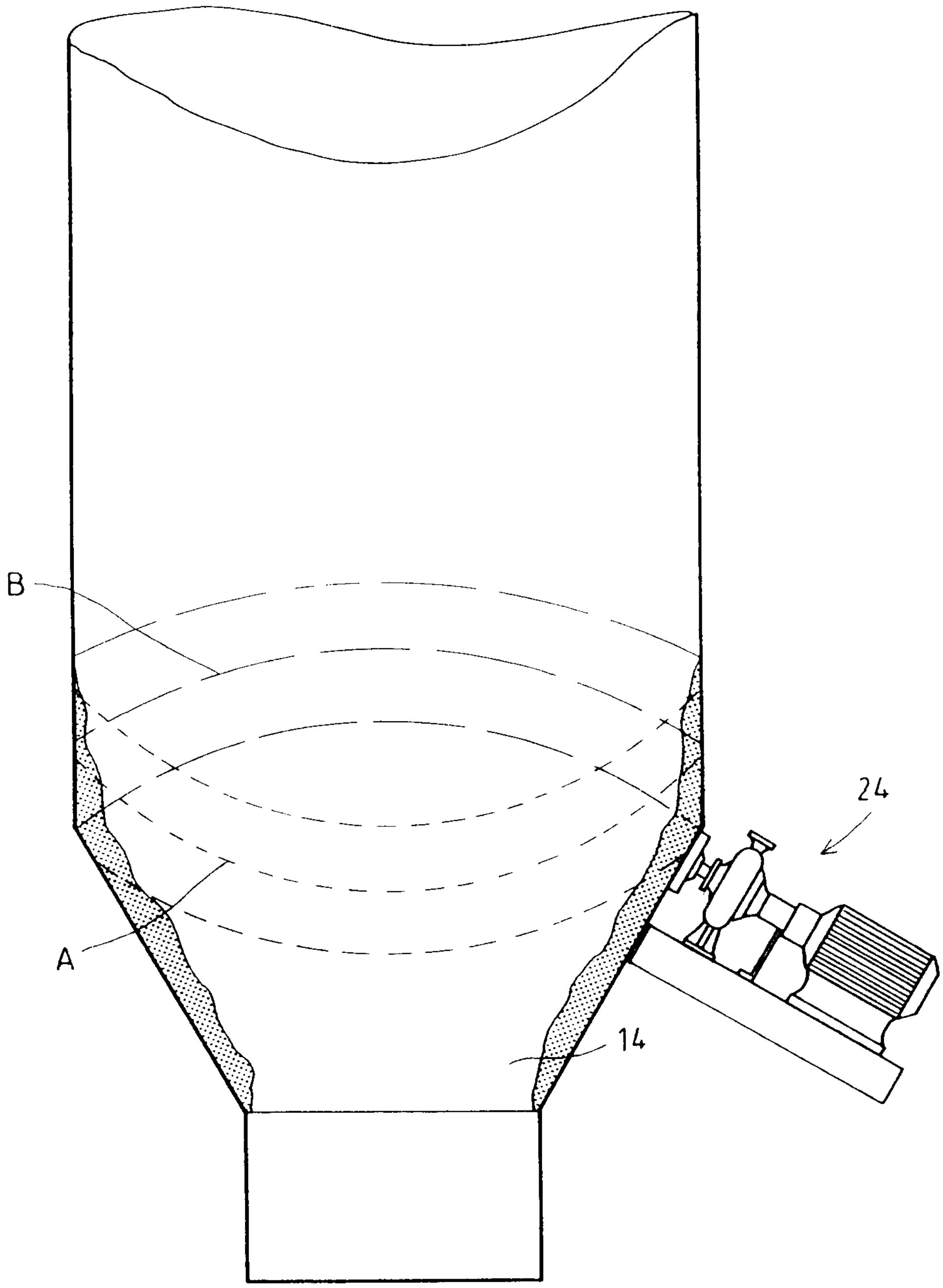

FIG. 2

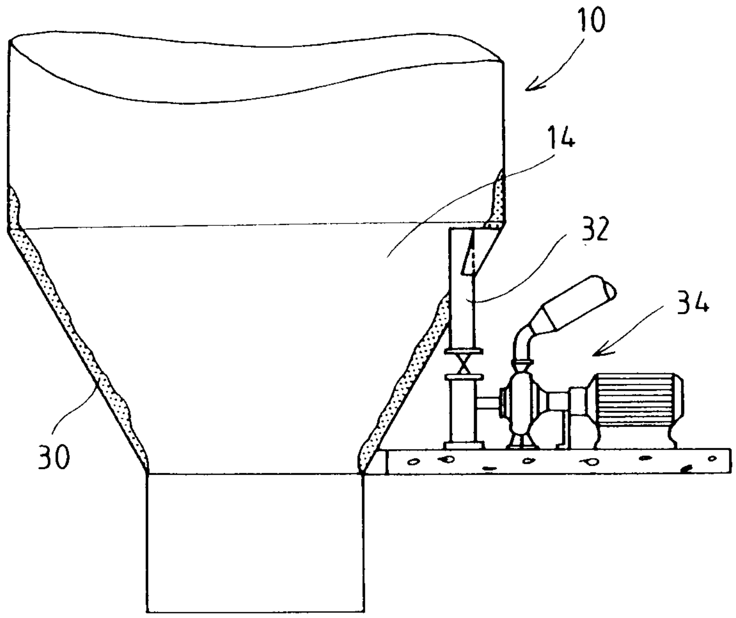

FIG. 3

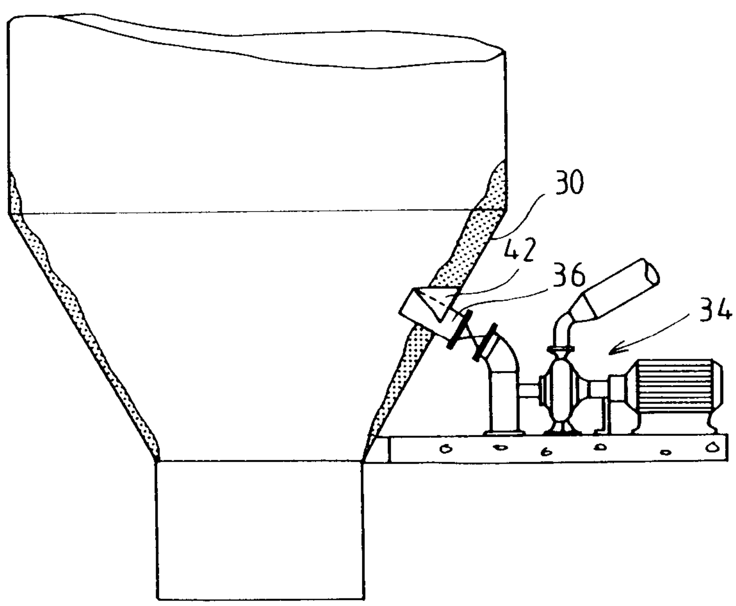

FIG. 4

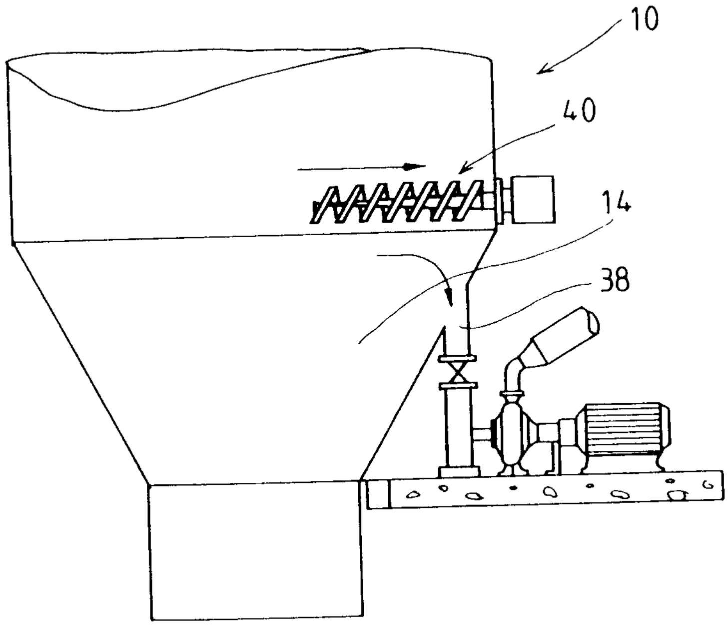

FIG. 5

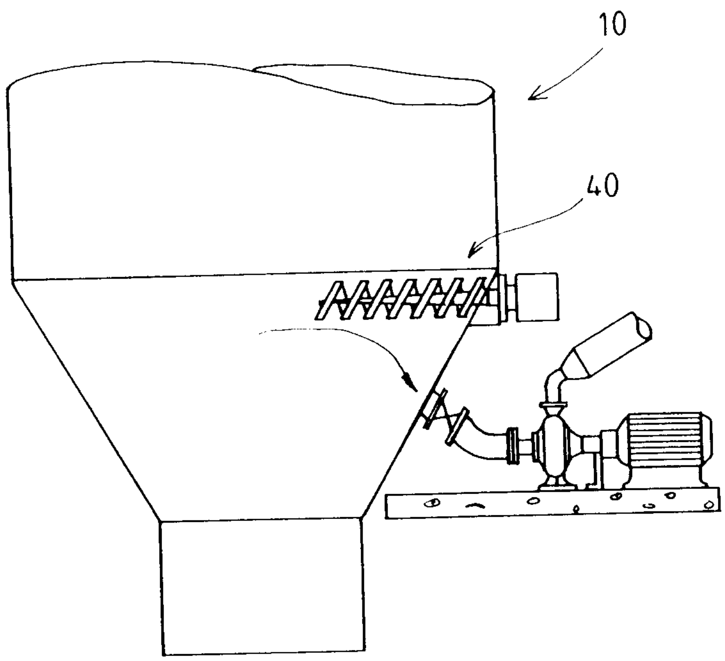

FIG. 6