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M. M. KLOSSON

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PUMP

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2 Sheets-Sheet 2

FIG. 4.

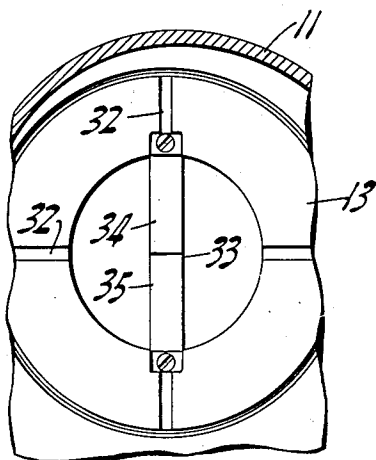


FIG. 5.

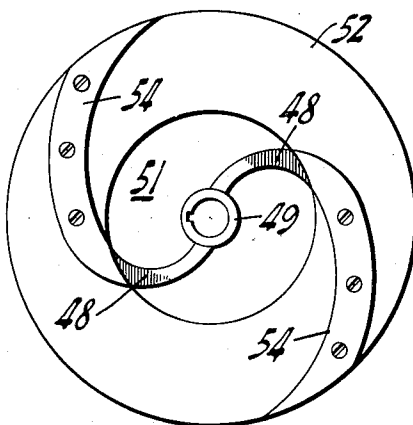


FIG. 6.

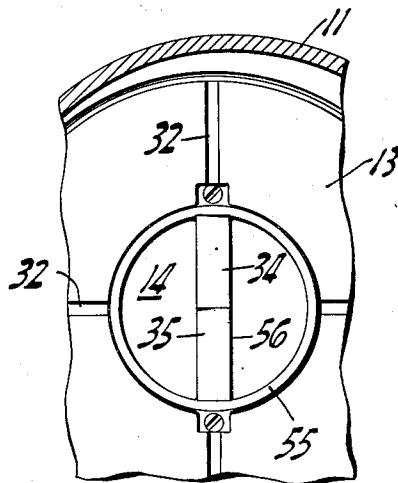
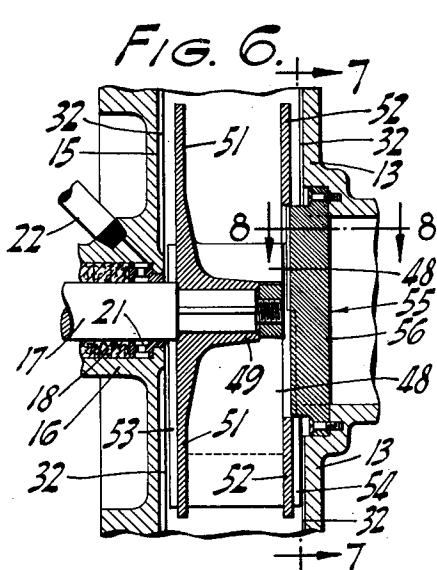
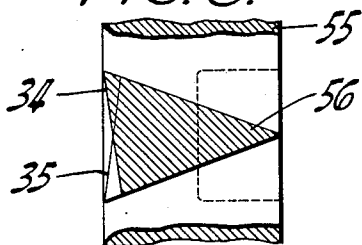


FIG. 7.

FIG. 8.



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7 Claims. (Cl. 103—111)

This invention relates to centrifugal pumps and has particular relation to pumps for liquids embodying means for comminuting solid material in the liquids passing therethrough in order to prevent clogging and binding of the pump and its impeller.

According to the invention, cutter means are provided at the pump inlet for cooperating with the impeller in reducing to small size solid and semi-solid material in the liquid entering the pump; and cutter means are also provided at the throat of the pump for cooperating with the tips of the impeller blades for comminuting material which would otherwise interfere with operation of the pump. It has been found that the inlet cutter means effectively reduces wads of rags and even rags larger than the pump inlet opening into small particles which can easily pass through the pump; and that the throat cutter means produces a further reducing action in preventing long rags, twine and other stringy material from forming into a ball or wad at the throat of the pump and clogging and binding the pump at this point, and also prevents such stringy materials from being wrapped around the impeller and thereby reducing its efficiency.

These and other objects and advantages of the invention will become apparent from the following description of the pump shown in the accompanying drawings, wherein:

Fig. 1 is a transverse sectional view of a pump taken in a plane normal to the axis of the pump impeller shaft;

Fig. 2 is a longitudinal section in the plane of said axis of the pump shaft;

Fig. 3 is a detail sectional view on a larger scale taken along line 3—3 of Fig. 2 through an inlet cutter bar;

Fig. 4 is a fragmentary sectional view of the pump housing taken along line 4—4 of Fig. 2 and showing the throat cutter bar in elevation;

Fig. 5 is an elevation of a closed or shrouded impeller in a modified pump;

Fig. 6 is a fragmentary longitudinal sectional view taken through the modified pump;

Fig. 7 is a fragmentary sectional view taken along line 7—7 of Fig. 6 showing in elevation the throat cutter of the modified pump; and,

Fig. 8 is an enlarged detail sectional view taken along line 8—8 of Fig. 6 through said throat cutter.

As shown in Figs. 1 and 2, the housing of the pump may comprise a volute central part 11 provided with a discharge passage 12, an end closure 13 provided with an inlet passage 14, and

an opposite end closure 15 having a stuffing box 16. In the latter, and around the journal portion of an impeller shaft 17, is packing 18 which is compressed by a gland 19. At the inner end of the stuffing box is a fresh water seal 21 supplied with clear water under pressure from a pipe 22 and through a passage 23, for preventing abrasive or corrosive materials in the pump chamber from entering the stuffing box.

The housing part 11 may be provided with plugs 24 which are removable for cleaning the pump. Likewise the housing parts 11 and 13 are provided at their outlet and inlet portions with closures 25, held in place by screws 26, and removable for inspecting and cleaning the pump interior.

Secured and keyed to the inner end of shaft 17 is an open impeller having blades 28, preferably of substantially spiral form, extending from a hub portion 29 and joined to each other by web portions 31. Substantially radial grooves 32 formed upon the inner faces of the housing parts 13 and 15 present shoulders adapted to cooperate with the rotating impeller in the comminution of material which may move into contact therewith.

A cutter bar 33 extends substantially diametrically across the inlet passage 14 with its inner face portions in slightly spaced relation to the plane of the adjacent edges of the impeller blades 28. As indicated in Figs. 2 and 4, and as particularly shown in Fig. 3, the face portions 34 and 35 on the bar at opposite sides of the axis of the shaft preferably are oppositely inclined with respect to a plane normal to said shaft, whereby the faces recede in the direction of rotation of the impeller (clockwise in Fig. 4). The ends of the cutter bar are secured by suitable fasteners in recesses formed in housing section 13.

Secured by suitable means to the housing at the throat of the pump, that is, adjacent the juncture 36 of the volute housing wall and the discharge passage 12, is a plate 37 having a cutter lip 38 extending into adjacency with the cylindrical path of the tips 39 of the impeller blades when the latter are rotating.

The lip 38 and the bar 33 may be made of any suitable wear-resisting material, or, if desired, the edges of these parts adjacent to the impeller may be hardened in a suitable manner to resist the abrasive action thereon of material in the fluid being pumped.

It will be understood that as the shaft and impeller are rotated by suitable drive means con-

nected to the shaft, fluid from a source connected to the inlet passage 14 will be drawn through the latter and discharged through the passage 12 by centrifugal action of the impeller. Solid or semi-solid material passing the bar 33 will be severed by the shearing action of the impeller blades rotating in adjacency to the bar, particularly if such material is of a size preventing it from moving freely past the bar into the spaces in the impeller between blades 28. This shearing action will reduce the material to a size wherein it will pass freely through the pumps, the latter action being expedited by the impeller blades' movement relative to the shoulders of grooves 32, which prevents the material from binding between the side edges of the impeller blades and housing ports 13 and 15.

The flow through the pump of fluid with the comminuted material therein is further expedited by the coaction of the impeller blade tips 39 with cutter lip 38, this action preventing accumulating and gathering into ball-like form of materials at the throat of the pump, and serving to cut or tear into small parts stringy material which otherwise might become wound around the impeller, with resultant impairment of the efficiency of the pump.

In Figs. 5 to 8 inclusive the principal features hereinbefore discussed are shown as applied to a pump having a closed impeller. As appears in Figs. 5 and 6 the hub 49 of the impeller merges into a shroud 51 of substantially disc form and which may be of the same radius as the impeller blades 48. Secured to the edges of the latter opposite to shroud 51 is a shroud 52 in the form of a ring, the central opening of which is preferably of somewhat larger diameter than the inlet passage 14.

Upon the outer faces of shrouds 51 and 52, respectively, are secured or otherwise formed auxiliary impeller blades 53 and 54. These blades cooperate with the shoulders of grooves 32 for preventing accumulations of matter between the impeller and the end walls of the pump housing in substantially the same manner as do the side edges of the impeller blades in the construction shown in Figs. 1 to 4 inclusive.

Secured to the casing part 13 as shown in Figs. 6 and 7 is a ring 55 whose inner surface forms a continuation of the inlet passage 14, the ring extending through the opening in shroud 52 in order to conduct liquid into the shrouded impeller. Extending diametrically across the ring 55 is a cutter bar 56 which in face formation and function is similar to the bar 33 with face formations 34, 35 previously described.

It will be understood that the pump shown in Figs. 4 to 8 inclusive may include the cutter lip 38 for cooperating with the impeller tips, and that the operation of the pump will be substantially the same as that previously described in connection with the embodiment of the invention illustrated in Figs. 1 to 4 inclusive.

It will be understood further that the pumps herein shown and described are merely illustrative of the inventive principles involved, and that these may be otherwise embodied without departing from the spirit of the invention or the scope of the appended claims.

What is claimed is:

1. In a centrifugal pump for pumping liquids containing solids or semi-solids, a housing having a volute part with a discharge passage extending substantially tangentially therefrom and an inlet passage opening axially thereinto, a bladed

impeller mounted for rotation in the housing, a bar extending substantially diametrically across said inlet passage and a lip extended toward the impeller from said volute part at the throat of the pump, said bar and lip cooperating with the side edge portions and blade tip portions, respectively, of the impeller for comminuting materials carried by liquids passing through the pump, and substantially radially extending shoulders on the walls of the said housing adjacent the side edges of the impeller blades.

2. In a centrifugal pump for pumping liquids containing solids or semi-solids, a housing having a volute part with a discharge passage extending substantially tangentially therefrom and an inlet passage opening axially thereinto, a bladed impeller mounted for rotation in the housing, a bar extending substantially diametrically across said inlet passage and a lip extended inwardly toward the impeller from said volute part at the throat of the pump, said bar and lip cooperating with the side edge portions and blade tip portions, respectively, of the impeller for comminuting material carried by liquids passing through the pump.

3. In a centrifugal pump for pumping liquids, a housing and a bladed impeller mounted for rotation therein, said housing having an inlet passage in substantially axial alignment with said impeller, the latter having circular shrouds on the opposite sides of the blades thereof, the shroud adjacent said inlet passage having an opening therethrough in alignment with the passage, a ring comprising a continuation of the passage and extending into said opening, and said ring having a part extending substantially thereacross in slightly spaced relation to the path of rotation of the adjacent edges of said blades for cooperating therewith to comminute materials carried by the liquid entering the pump.

4. In a centrifugal pump for pumping liquids, a housing having a volute part with a discharge passage extending therefrom, a bladed impeller mounted for rotation within said volute part, a cutter lip adjacent the throat of the pump extending into adjacency with the path of movement of the blade tips of the impeller for cooperating therewith to comminute solids or semi-solids in liquid passing through the pump.

5. In a centrifugal pump for pumping liquids, a housing and an impeller mounted for rotation therein, said impeller comprising spaced circular shrouds in spaced relation to the end walls of the housing and blades extending between said shrouds, said housing having an inlet passage in substantially axial relation to said impeller, and the shroud adjacent the passage having an opening in alignment therewith, said inlet passage having at its inner end an annular portion entering into said opening in the shroud for conducting fluid entering the pump into the impeller, a cutter member extending across said annular portion for cooperation with the adjacent edges of said impeller blades in the comminution of materials carried by said entering fluid, and auxiliary blades on the outer faces of said shrouds for discharging such material from the spaces between said faces and the adjacent end walls of the housing.

6. In a centrifugal pump for pumping fluids, a housing having a volute part with a discharge passage extending substantially tangentially therefrom and an inlet passage opening axially thereinto, an impeller mounted for rotation in the housing and comprising spaced circular

shrouds and blades extending between said shrouds, the shroud adjacent said inlet passage having an opening in alignment therewith and the housing having an annular part extending into said opening and comprising a continuation of said inlet passage, a member extending across said passage continuation, and a lip extended toward the impeller from the housing at the throat of the pump, said member and said lip cooperating with side edge portions and blade tip portions respectively of the impeller for comminuting materials carried by fluids passing through the pump.

7. In a centrifugal pump for pumping fluids, a housing having a volute part with a discharge passage extending substantially tangentially therefrom and an inlet passage opening axially thereinto, an impeller mounted for rotation in the housing and comprising spaced circular shrouds and blades extending between said

shrouds, the shroud adjacent said inlet passage having an opening in alignment therewith and the housing having an annular part extending into said opening and comprising a continuation of said inlet passage, a member extending across said passage continuation, a lip extended toward the impeller from the housing at the throat of the pump, said member and said lip cooperating with side edge portions and blade tip portions respectively of the impeller for comminuting materials carried by fluids passing through the pump, the end walls of said housing adjacent the outer faces of the shrouds having substantially radially extending shoulders and said outer faces of the shrouds being provided with auxiliary blades for cooperating with said shoulders for further comminution of such materials and the discharge thereof from the spaces between said end walls and said shrouds.

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