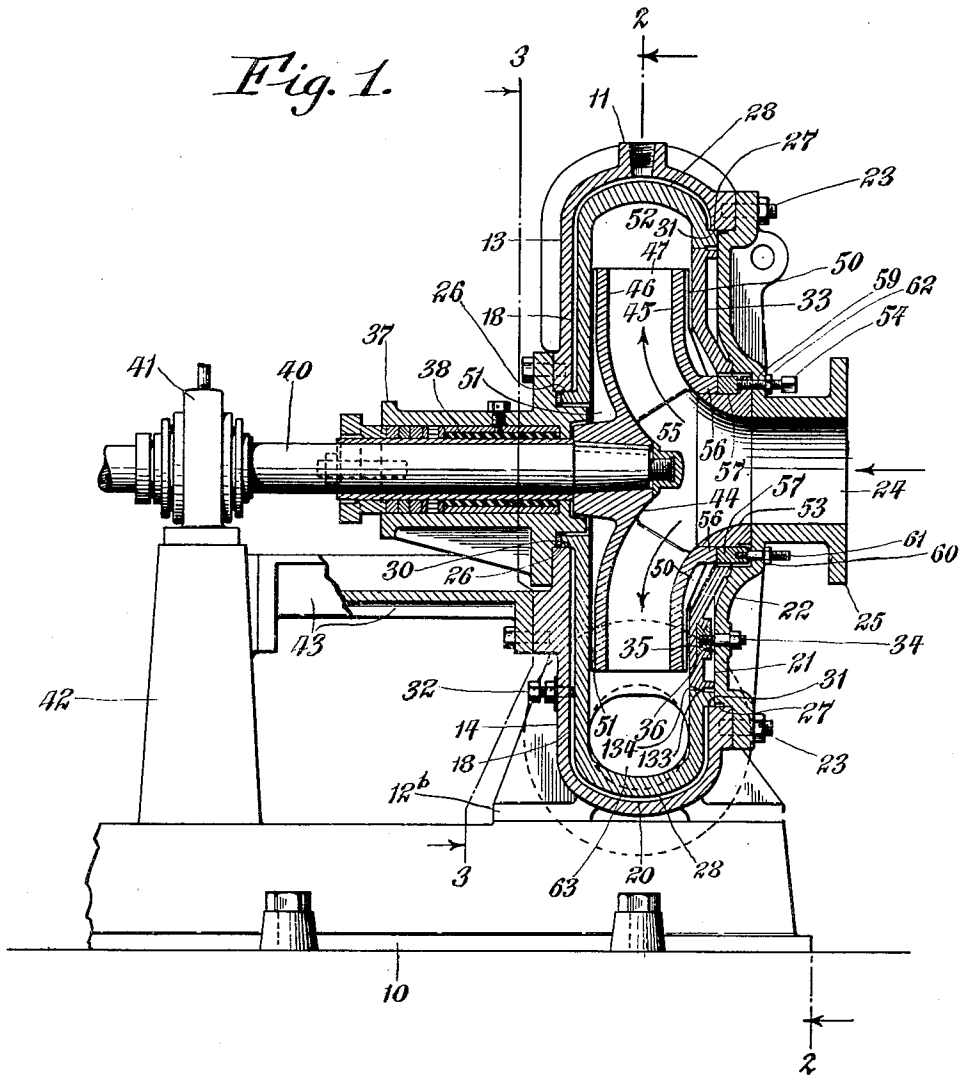
May 8, 1934. V. J. MILKOWSKI 1,958,108

CENTRIFUGAL PUMP

Filed Feb. 15, 1930 3 Sheets-Sheet 1

Fig. 1.



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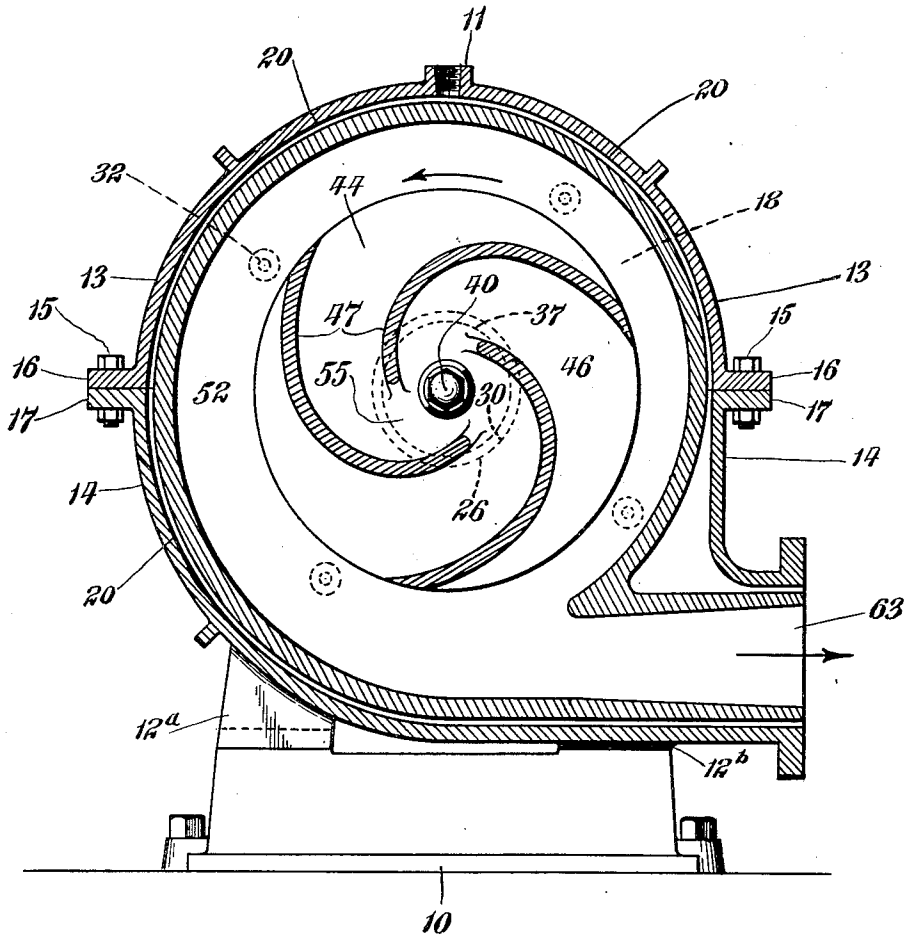
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Fig. 2.



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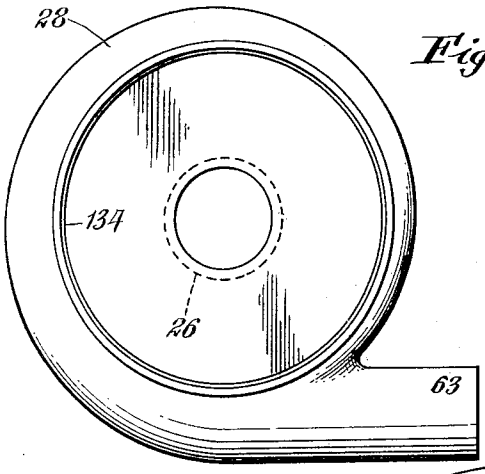


Fig. 5.

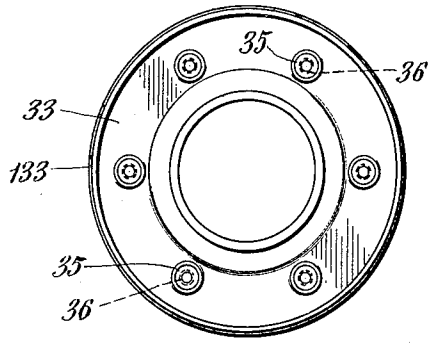


Fig. 6.

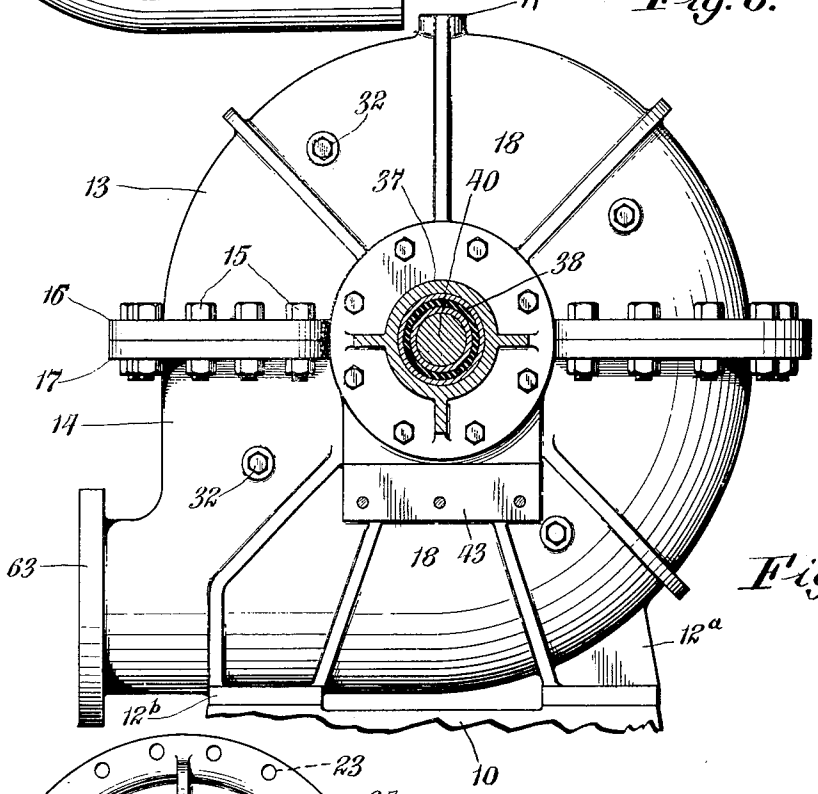


Fig. 3.

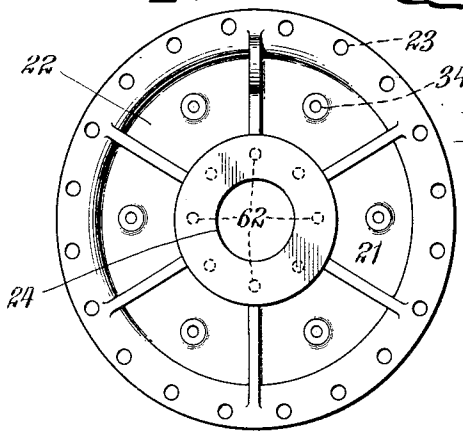


Fig. 4.

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UNITED STATES PATENT OFFICE

1,958,108

CENTRIFUGAL PUMP

Victor J. Milkowski, Baldwinsville, N. Y.

Application February 15, 1930, Serial No. 428,593

1 Claim. (Cl. 103—114)

This invention relates to a centrifugal pump and particularly to a pump of this character adapted to pump material of a gritty or abrasive character.

One object of the invention is to provide a centrifugal pump having a lining, the main body of which is made in one piece, and which, when worn, can be easily and accurately replaced. A further object of the invention is to instantly eject any harmful material which may lodge between the impeller and the lining of the pump. Another object of the invention is to enable stud bolts to be connected with parts constructed of very hard and almost unmachineable material, without requiring the tapping of screw threads therein. A still further object of the invention is to provide an improved construction of sealing ring and pump shell cover, whereby the joint between the shell and the hub of the impeller is rendered leak-proof and the wearable parts capable of being replaced inexpensively.

In the accompanying drawings:

Figure 1 is a vertical, longitudinal, axial section through the pump.

Figure 2 is a vertical, transverse medial section thereof taken on line 2—2, Fig. 1.

Figure 3 is a vertical transverse section through the pump taken on line 3—3, Fig. 1.

Figure 4 is a front elevation on a reduced scale of the pump casing cover.

Figures 5 and 6 are front elevations respectively on a reduced scale of the main body and the lining plate of the pump lining.

Similar characters of reference indicate like parts in the several figures of the drawings.

To the upper face of a foundation frame or sub-base 10 is secured an annular main casing or pump shell 11 which is preferably provided with downwardly and outwardly projecting integral feet or base flanges 12^a and 12^b whereby it is suitably secured to the sub-base 10. Said pump shell, as best shown in Fig. 3, is made up of two sections; viz, an upper shell section 13 and a lower shell section 14, the joint or division line between the same being horizontal and in a plane with the axis of the built up shell 11 taken as a whole. Said upper and lower shell sections are detachably secured together by securing bolts 15 which pass vertically through suitable, outwardly projecting, flanges 16 and 17 formed integrally with their respective shell sections adjacent their meeting edges.

The vertical, flat, rear wall 18 of said pump shell 11 comprises upper and lower sections which are formed integrally with said shell sections 13 and 14 respectively, as is likewise the peripheral or cylindrical shell wall 20. The vertical flat front wall 21 of the shell is, however, separate from said shell sections and constitutes the inner wall or rear portion of a closure member or shell cover 22, the same being suitably and detachably secured to said shell sections by means of an annular row of stud bolts 23 which pass through suitable holes in said shell cover and are threaded into the shell sections. The central part of said shell cover 22 is axially tubular and constitutes an inlet duct 24 which communicates at its rear or inner end with the hollow interior of the pump while its forward end is flanged at 25, or is otherwise rendered capable of being tubularly connected with a suitable suction pipe line adapted to supply the pump with the fluid (and more or less gritty) material being pumped.

The rear vertical wall 18 of the shell is bored out or otherwise machined at its inner part so as to provide a rear, cylindrical female centering surface 26 which is longitudinal and coaxial with the axis of the pump shell 11. The outer front part of said pump shell is also bored out or otherwise machined to provide a similar, but larger diametered, front, cylindrical, female centering surface 27 which, incidently, serves to center the cover 22. Disposed within the pump shell is an annular lining which is constructed of very hard material, so as to withstand the heavy abrasion which is inevitably incident to the pumping of gritty material. This lining consists of a main lining body 28 and a lining plate 33. The main body 28 of the lining covers over and thereby protects the rear, flat, vertical wall 18 of the pump shell and also the peripheral wall 20 thereof. Said main lining body 28 is adapted to be replaced when excessively worn, this being accomplished by first lifting off the upper shell section 13 from the lower shell section 14 and then taking out said main lining body 28 and replacing it with a new one. Said main lining body is provided on its outer rear face with a rearwardly projecting, coaxial flange whose outer cylindrical surface constitutes a rear, male, centering surface 30 which is adapted to be received within and centered by the aforesaid rear female centering surface 26 of the pump shell 11. The outer, front end of said main lining body is similarly provided with a front, outwardly projecting, coaxial, male, centering surface 31 which is received by the aforesaid front, female, centering surface 27 of said pump shell. By reason of these two pairs of centering surfaces, the main lining body is easily and definitely positioned so as to

be accurately located coaxially within the pump shell.

The vertical, annular front flange face of said main lining body 28 is finish-machined and bears against the inner or rear vertical face of the shell cover 22, and is held firmly in engagement thereagainst by means of an annular row of clamping screws 32 which are longitudinally and forwardly threaded through the vertical rear wall 18 of the pump shell (see Figs. 1 and 3) and bear with their front ends against the adjacent vertical rear face of said main lining body 28. The front wall 21 of the shell (i. e., the inner portion of the cover 22) is protected by a lining plate 33 which is located in its proper coaxial or centralized position by means of its finish machined outer, annular edge 133 which is snugly received within the finish-machined bore 134 of the vertical front flat wall of the main lining body 28.

Said lining plate 33 is secured to the cover by an annular row of stud bolts 34, whose inner ends are secured to said lining plate and whose shanks pass through said cover with their stud nuts bearing against the outer face of said cover. But this lining plate (as also the main lining body 28) is constructed of very hard and tough material, such as manganese steel, and it is, therefore, uneconomic to tap screw threads into the same. Because of this difficulty, resort is had to an annular row of drawing heads 35 which are constructed of relatively soft material which may be easily tapped. Each drawing head is cast in a companion locking hole 36 in the outer or front face of said lining plate 33. Thereby each of said soft drawing heads 35 is made an integral part of said lining plate. The central part of each drawing head 35 is provided with an internal screw thread which receives the rear or inner end of its companion stud bolt 34, thereby securing said stud bolt to the lining plate 33, the latter being thereby detachably secured to the shell cover 22.

Secured coaxially to the rear central part of the pump shell 11 is a bearing sleeve or hub 37 within whose bore is disposed preferably a special type of bearing 38 constructed of rubber composition as shown. Rotatably arranged within said bearing is an impeller shaft 40, the end thrust of which is carried by an outboard thrust-and-radial bearing 41 mounted on a base or pedestal 42. To obtain absolute rigidity, the latter is secured both to the subbase 10 and also (through the intermediary of a brace connection or spacer 43) to the pump shell 11.

Secured to the front end of said impeller shaft 40 (and preferably in the manner shown, with the taper, key and lock nut) is an impeller 44 comprising annular and laterally extending, front and rear impeller flanges 45 and 46, and spiral impeller vanes 47 which are formed integrally and longitudinally between said flanges in the usual and well known manner.

Particularly when the pump ceases operation, a certain amount of abrasive material is apt to drop in between the outer faces of the impeller flanges 45, 46 and the inner faces of the pump lining (comprising the main lining body 28 and the lining plate 33). Under these circumstances and if the construction is such that the clearance between these faces is very small, then, when the pump is started up, the abrasive is dragged around a considerable length of time before being expelled, and this causes a considerable amount of destructive abrasion. The present invention avoids this difficulty by providing an adequately large (though not very considerable) clearance between the said impeller flanges 45, 46 and the inner faces of the pump lining and, at the same time, providing a set of shallow but effective front and rear ejection vanes 50 and 51 which are of the same spiral form (as shown in Fig. 2) as the main impeller vanes 47, and are formed integrally on the outer faces of the front and rear impeller flanges, 45 and 46 respectively. These ejection vanes operate in the same manner as the main impeller vanes 47 except that they do not handle any considerable quantity of material. The interior of the pump lining lying circumferentially outside of the impeller may be denominated the volute chamber 52 which is under pressure when the pump is in operation and this pressure is prevented from working inwardly between the impeller and the pump lining by reason of the centrifugal action of said ejection vanes, which clear their paths of and throw out all liquid and solid matter, whenever the pump is operating. This construction also prevents any viscous friction due to the presence of liquid between the impeller and the pump lining, the overall length of the entire impeller including the "depths" of these two sets of ejection vanes being approximately equal to the width of the said volute chamber, so that liquid or other material thrown out by said ejection vanes is centrifugally discharged directly into said volute chamber.

A replaceable annular throat liner or filler ring 53 is pressed longitudinally forwardly against and rigidly secured to the rear face of the pump cover 22 by means of an annular row of longitudinal adjusting screws 54, the bore of said filler ring being flush with the inlet duct 24 of said cover and being curved to direct the material from said inlet duct rearwardly and outwardly into the central part or receiving opening 55 of the impeller. The forward, central part of the impeller is provided with a forwardly projecting, coaxial, annular flange 56 which embraces the rear part of the periphery of the filler ring 53. A packing or sealing ring 57 is arranged with a "push" fit on the periphery of said filler ring, its rear flat face being disposed transversely of the pump axis and bearing against the flat, front face of the flange 56 of the impeller. Said sealing ring is not rotatable, but is capable of being adjustably moved longitudinally toward or away from the front face of said impeller flange 56 of the impeller. For advancing or moving inwardly said sealing ring 57 the lock nuts 60 of the draw screws 61 and the lock nuts 62 of the adjusting screws 54 are first slackened. Then the adjusting screws 54 are tightened until said sealing ring bears rearwardly sufficiently hard against the front face of the impeller flange 56 so as to make a fluid-tight joint therewith. This action of the adjusting screws is due to the fact that the inner ends or faces of the adjusting screws 54 bear against the front face of said packing ring, while their inner periphery portions are in screw threaded engagement with the filler ring 53. The central portions of said adjusting screws are slidably received within suitable holes 59 which pass longitudinally through the wall of the casing cover 22. Thus when the adjusting screws 54 are advanced, their inner ends force the sealing ring 57 rearwardly relative to the filler ring 53, and then when the adjusting screw lock nuts 62 are drawn up tight, they act to solidly clamp the said filler ring outwardly against the inner face of the casing cover 22. When it is

desired to loosen or retract the sealing ring 57, the adjusting screws 54 and their lock nuts 62 are first slackened, and then the lock nuts 60 of the draw screws 61 are then tightened until the desired outward movement of said sealing ring has been obtained. Thereupon the adjusting screws 54 are again advanced, to act now in the capacity of set screws whereby said sealing ring, packing ring and cover are all clamped solidily together.

The operation of the pump is as follows:

The fluid (and more or less gritty) material being pumped enters the pump through the inlet duct 24 and is thrown outwardly by the impeller 44 into the volute chamber 52 and thence into discharge duct 63. The prevention of leakage between the outer, front face of the impeller 44 and the said inlet duct 24 is effected by means of sealing ring 57 which may be adjustably moved toward or from the front, flat face of the impeller flange 56, by screws 54 and 61. Wear between the impeller and the filler ring 53 and between the latter and the sealing ring 57 is cared for by merely inexpensively replacing said filler ring 53 without requiring that the entire casing cover 22 be replaced. Any material which may accidently fall in between the impeller 44 and the lining is instantly thrown out by ejection vanes 50 and 51. The main pump lining body 28 and the lining plate 33 are so constructed that they have no lateral or transverse joints which would operate to interfere with the flow of material through the pump. The main pump lining body 28 is easy to replace as it is centralized at opposite ends by the companion front centering surfaces 27 and 31 and companion rear centering surfaces 26 and 30 in which position it is then clamped by clamp screws 32.

I claim as my invention:

A centrifugal pump comprising a shell; an impeller arranged therein; a lining plate constructed of hard material and having a locking hole; a draw screw threaded through said shell and having its inner threaded end disposed within but not touching the sides of said locking hole; and a drawing head constructed of relatively soft material and disposed between the interior face of said hole and the exterior threaded face of said draw screw.

VICTOR J. MILKOWSKI.