Feb. 17, 1953 D. MURPHY 2,628,745

PUMP APPARATUS

Filed Jan. 12, 1946 2 SHEETS—SHEET 1

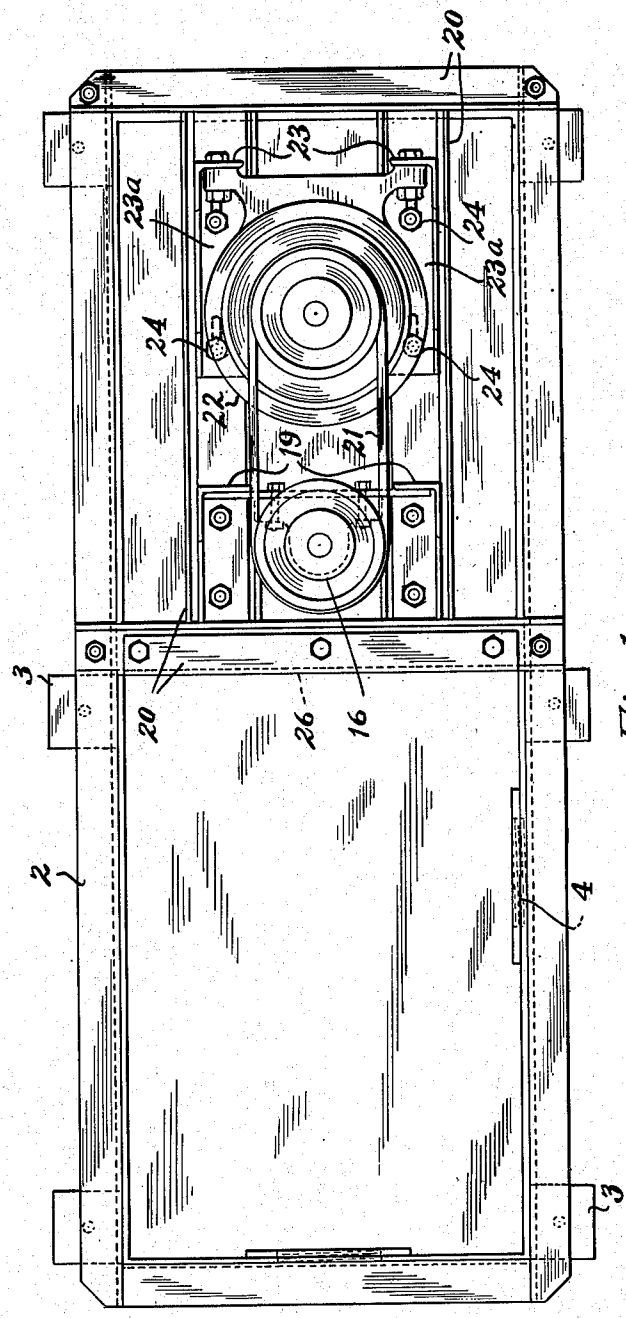

Fig. 1.

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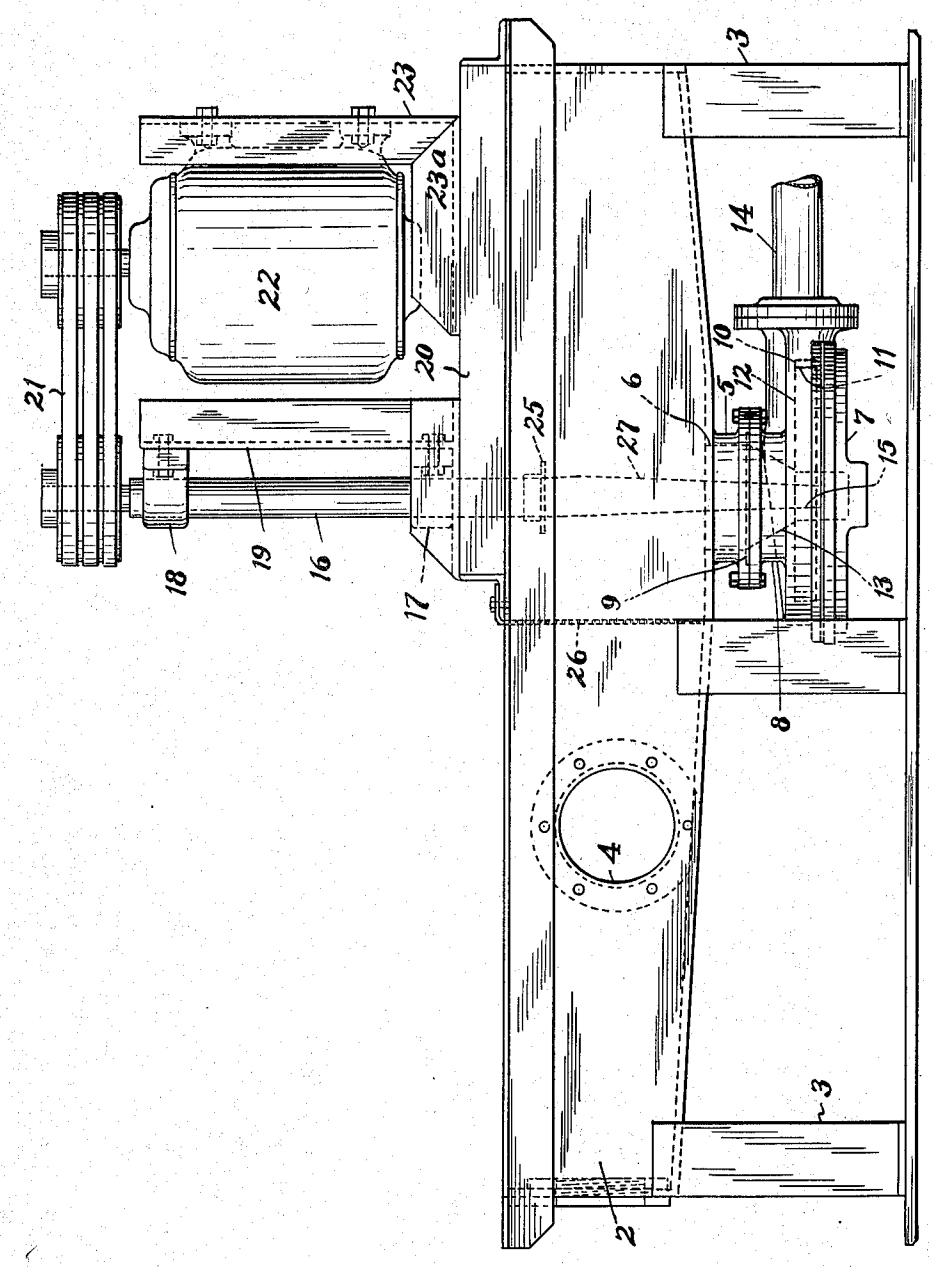

Fig. 2.

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PUMP APPARATUS

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2 Claims. (Cl. 222—383)

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This invention is for a pump apparatus or system, particularly but not exclusively designed for pumping a liquid carrying abrasive particles, such a liquid as the so-called slip used in the modern potteries, or the liquid containing pigment and vitreous particles used in the manufacture of vitreous enamel ware and the like.

The apparatus essentially comprises a rotary impeller pump, and the problem in the pumping of such abrasive-containing liquids has always hitherto consisted in the maintenance of the bearings and packings of the rotary drive shaft of the pump. The bearings and packing, being subject to the abrasive action of the particles in the liquid, would fail after a relatively short period of service and have to be renewed.

In accordance with this invention, the bearing or bearings of the drive shaft of the pump are arranged out of contact with liquid being pumped, and the need for packings is entirely avoided, whereby the pump may be known as a "packless" pump.

In all rotary impeller pumps, particularly in those pumps in which the impeller is mounted on a free or "floating" end of a shaft that is spaced an interval from the shaft bearing, there is a tendency for the rotating shaft in service to vibrate or "whip." This invention embodies an improvement in the form and structural organization of an impeller drive shaft whereby such vibration or whipping of the shaft is substantially eliminated.

The invention will be understood upon reference to the accompanying drawings, in which:

Fig. 1 is a view in plan of pump apparatus in which the invention has in exemplary way been embodied; and

Fig. 2 is a view in side elevation of the same.

The apparatus of the invention comprises a tank 2 constructed of plate steel and mounted upon legs 3. The slip or vitreous enameling liquid is mixed in the usual compounding and mixing apparatus (not shown), and, when ready for distribution to various stations where it is to be used in the pottery or enameling plant, the liquid is delivered into the tank 2, say through a duct connected to an inlet 4 in the side of the tank. The floor of the tank slopes towards an outlet, consisting in this case of a flanged steel connection 5 welded to the rim of an orifice 6 formed in the floor of the tank. To this flanged outlet 5 an impeller pump 7 is bolted, the inlet passage of the pump being within a flanged adapter 8 provided with an annular shoulder 9

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that fits a correspondingly shaped recess in the connection 5 and insures proper alignment of the assembly. A filter or strainer screen 26 is arranged across the tank between the inlet 4 and outlet 6, to prevent large particles or lumps of material, which may have unintentionally been delivered to the tank, from reaching and entering the pump.

The pump 7 is, but for the features described below, of substantially conventional and well-known construction, including in its body an involute impeller chamber 10 in which an impeller 11 is mounted to rotate. In general the impeller may be of the type disclosed in Letters Patent No. 2,128,496, granted August 30, 1938, consisting of a plate-like body having curved radial vanes on its side adapted to cooperate with the wall of the pump body through which the inlet of the pump opens. This is all known structure to the art, and for present purposes it will suffice to note that, contrary to the showing of said earlier Letters Patent, the pump 7 is arranged with its impeller to rotate in a horizontal plane. The edges of the impeller vanes (not shown) cooperate with the face 12 of the impeller chamber wall through which the inlet passage 13 opens at the center of the impeller chamber. The outlet passage of the pump opens tangentially from the periphery of the impeller chamber into the discharge pipe or passage 14 that leads to the desired point or points of delivery. Again refer to the earlier Letters Patent for details.

The impeller is mounted upon the end 15 of a drive shaft 16, rotatably supported in two bearings 17 and 18 carried upon a standard 19 that rises from a frame or base 20 mounted upon the rim of the tank, and connected by a belt drive 21 to an electric motor 22. The motor 22 is borne by an L-shaped bracket or support 23 that is secured by bolts 24 to the frame 20. The holes through which the bolts 24 extend are slotted, and thus the motor-supporting bracket is arranged for sliding adjustment in the direction of extent of the horizontal members 23*a* of the L-shaped bracket, whereby the tension of the belt drive 21 may be adjusted as need be.

From the foregoing description it will be understood that the liquid to be pumped from the pool in tank 2 flows under the effects of gravity and of the suction of the rotating impeller into the impeller chamber, whence it is impelled through pipe 14 to the desired point of delivery. The level of the liquid in the tank never is permitted to reach the rim of the tank, and nor-

mally is maintained below the slinger ring 25 which is secured on the impeller shaft, to prevent liquid from rising on the shaft in rotation and entering the bearing 17. In the event, however, that the delivery of liquid through inlet 4 should exceed the amount removed by pump 7, the level of the pool in tank 2 may rise, as is manifest in Fig. 2, above the slinger ring 25 and overflow the rim of the tank without subjecting the lower bearing to the liquid. Thus, the general utility of the apparatus will be understood, and consideration will be now given to the features in which the invention is particularly centered.

It will be perceived that the drive shaft 16 of the impeller is arranged vertically, and that it extends at its lower end through the wall of the pump body for supporting the impeller 11 in the chamber 10. More particularly the vertical drive shaft 16 extends through the inlet passage 6, 13 without touching the body of the pump at all in this case, and in any case there is no packing or stuffing box required for the shaft. The bearings 17 and 18 for the shaft are entirely out of contact with the liquid being pumped and there simply is no problem of attrition of bearings or packings due to the abrasive particles in the liquid being pumped.

It will be perceived that the inlet of the pump comprises an orifice or passage 6, 13 that lies below the surface of the pool of liquid to be pumped from the container or tank 2. The vertical drive shaft 16 extends into this body of liquid and at its one end—the lower end—supports the impeller 11, and at its other end—the upper end—extends free of said body of liquid. And means are provided at the free end of the shaft for rotatably supporting it, such means comprising the two bearings 17 and 18 which are spaced apart axially of the vertical shaft.

In the extent of the vertical drive shaft 16 between the lower or proximate bearing 17 and the impeller 11, the body of the shaft is tapered, as shown at 27. It is remarkable that such tapering of the shaft substantially eliminates all tendency for the shaft to whip during rapid rotation. The smoothness of operation is controlled to such nicety that an operating clearance of .005" may be maintained between the edges of the impeller vanes and the face 12 of the impeller chamber. This is a feature that will prove valuable in many different apparatus and machines in which a rotating drive shaft tends to whip or chatter when it drives a rotating member, although it must be noted that this feature is particularly applicable to installations such as that described herein, where the unsupported lower end of a shaft extends into and through the body of liquid. As shown in Fig. 2, the tapered portion of the shaft need not extend all of the interval from the impeller 11 to the bearing 17, but in the apparatus illustrated may extend from the impeller to the slinger ring 25. One thing more may be noted of the tapered shaft: The downward taper—the taper converging toward and through the inlet passages leading to the impeller chamber 10—facilitates or assists the flow of liquid into the pump.

Many modifications of the structure and structural organization described may be practiced without departing from the essence of the invention defined in the appended claims.

I claim:

1. A pumping system for liquid containing abrasive particles, said system comprising a tank for a pool of liquid to be pumped and from which the liquid may overflow, a filtering screen in said tank, an inlet for liquid on one side of said screen, and an outlet opening in the bottom of the tank on the opposite side of said screen, a rotary pump for propelling liquid from said pool, said pump having a body mounted beneath said tank and having an inlet connected to the outlet of said tank, a discharge passage extending from the pump body, an impeller in said pump body, a vertical drive shaft mounted in vertically spaced-apart bearings borne by said tank above pool level, said drive shaft extending entirely through said pool to said pump body for supporting said impeller for rotation in the pump body with all bearings above the overflow level and out of contact with the liquid in said pool, said drive shaft having a downwardly tapered lower end portion immersed in said pool, and means mounted on said tank above pool level for rotating said shaft and the impeller supported thereby.

2. A pumping system for liquid containing abrasive particles, said system comprising a tank for a pool of liquid to be pumped and from which the liquid may overflow, a filtering screen in said tank, an inlet for liquid on one side of said screen, and an outlet opening in the bottom of the tank on the opposite side of said screen, a rotary pump for propelling liquid from said pool, said pump having a body mounted beneath said tank and having an inlet connected to the outlet of said tank, a discharge passage extending from the pump body, an impeller in said pump body, a base mounted on said tank, a standard rising from said base, two bearings supported by said standard in vertically spaced relation above the overflow level of the pool, a vertical drive shaft rotatably supported in said bearings and extending downwardly through said pool said drive shaft having a downwardly tapered lower end portion for supporting said impeller for rotation in said pump body, a motor mounted on said base above pool level, and driving connections between said motor and said drive shaft.

DANIEL MURPHY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,178,994	Inglis	Nov. 7, 1939
2,181,973	Jasberg	Dec. 5, 1939
2,250,306	La Bour	July 22, 1941
2,258,481	Betterton	Oct. 7, 1941
2,294,280	Carrington	Aug. 25, 1942
2,310,409	Ellman	Feb. 9, 1943
2,355,472	Ruthman	Aug. 8, 1944
2,394,154	Curtis	Feb. 5, 1946

FOREIGN PATENTS

Number	Country	Date
740,132	France	1932