

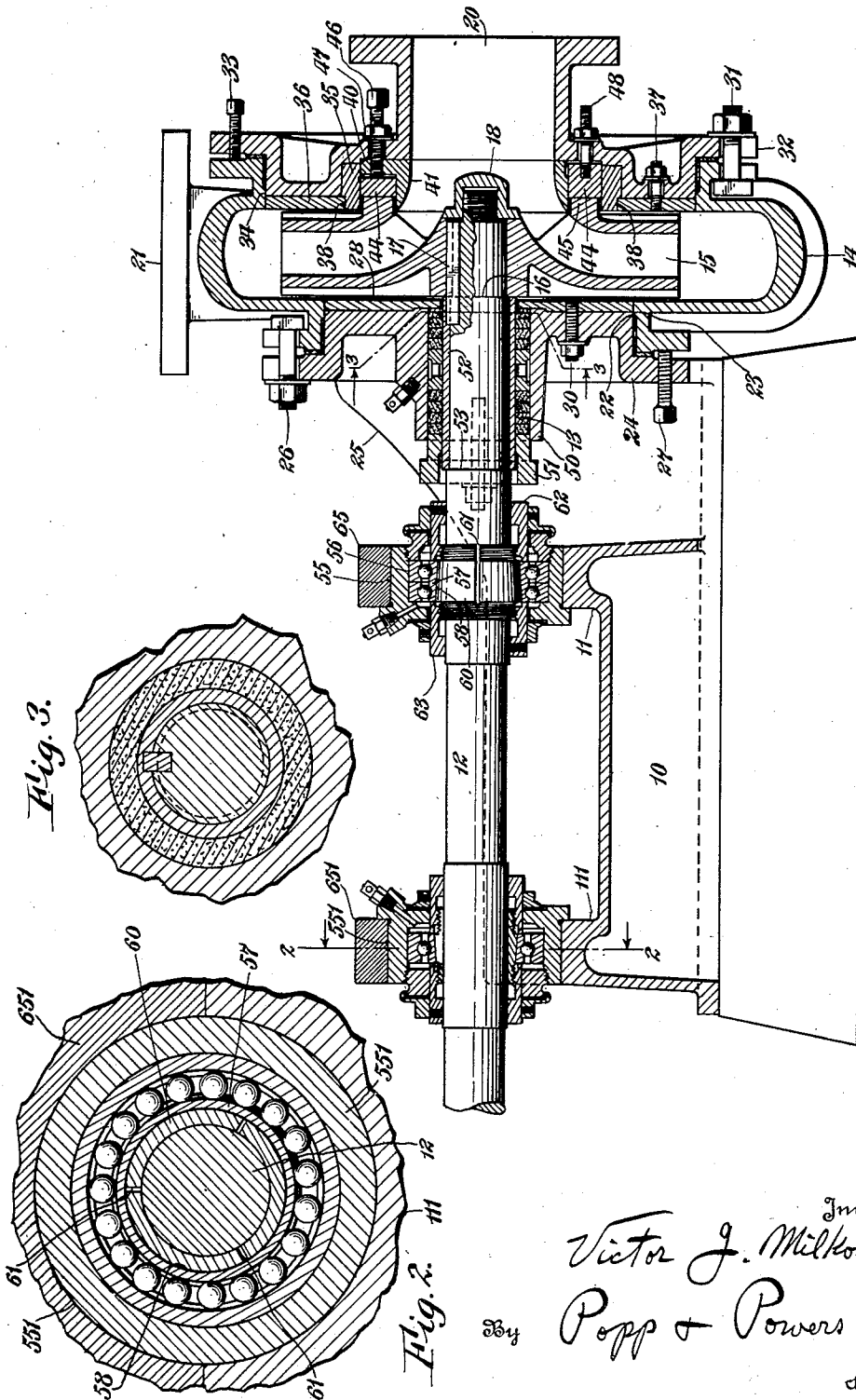
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CENTRIFUGAL PUMP

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UNITED STATES PATENT OFFICE

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CENTRIFUGAL PUMP

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This invention relates to a centrifugal pump, and more particularly to a slurry pump provided with replaceable lining plates, and having a drive shaft journaled in a pair of rigidly aligned bearings which effectively eliminate side thrust of said drive shaft against the walls of the stuffing box where said shaft passes into the pump casing.

The object of the invention is to eliminate unnecessary expense in the replacement of lining plates; to simplify the means whereby the replaceable stuffing box sleeve is restrained against rotation; to enable the main bearings to be dismounted easily and without injury; and to so machine the base casting as to ensure the accurate coaxial alignment of the principal working parts. Numerous other minor objects of the invention and practical solutions thereof are disclosed in detail in the herein patent specification.

This patent application is a companion to pending application, Serial No. 428,593, filed February 15, 1930 by the same inventor and similarly titled.

In the accompanying drawing:

Fig. 1 is a vertical longitudinal section through the centrifugal pump and its pair of anti-friction bearings mounted on a common base plate.

Fig. 2 is an enlarged, vertical, transverse section through one of said anti-friction bearings and taken on line 2—2, Fig. 1.

Fig. 3 is an enlarged, vertical, transverse section through the stuffing box of the pump and taken on line 3—3, Fig. 1.

In the following description, similar characters of reference indicate like parts in the several figures of the drawing.

My invention may be embodied in various forms and in centrifugal pumps of various constructions, and the present application is therefore to be regarded merely as one organization which satisfactorily carries out the invention in practice. As here shown the same is constructed as follows:

Extending vertically upward from, and formed preferably integrally with, a base plate 10 is a pair of bearing supports 11 and 111 in which is journaled a main or drive shaft 12 which is adapted to be rotated by

any suitable source of power such as an electric motor or the like. The outboard end of said drive shaft 12 extends through a stuffing box 13 and into a spiral centrifugal pump casing 14. The extreme end of said drive shaft 12 which extends into said pump casing 14 is secured to the usual form of centrifugal impeller 15, the latter bearing against a shoulder 16 formed on said drive shaft and secured thereto by a longitudinal "square" key 17 and clamping nut 18. When this impeller 15 is rotated, it operates in the usual and well known manner to draw in slurry or other semi-liquid material through the coaxial inlet duct 20 and to discharge the same through the usual tangential discharge duct 21.

The pump casing 14 is suitably bored out at 22 so as to be accurately located coaxially upon the periphery of the annular machined surface 23 of a fixed, vertical, rear casing wall 24, which is preferably formed integrally upon the base plate 10 and is suitably braced thereto by flying abutments 25 or otherwise. Said pump casing 14 is secured to said rear casing wall 24 by means of clamping bolts 26 and is adapted to be released therefrom (when being dismounted) by push screws 27. The interior, exposed face of said rear casing wall 24 is protected by a replaceable casing-wall lining plate 28, which is clamped to said rear casing wall by means of stud bolts 30.

Detachably secured by clamping bolts 31 to the front face of the pump casing 14 is a front casing wall 32, which is adapted to be released therefrom (when being dismounted) by push screws 33. This front casing wall 32 is accurately turned or annularly machined at 34 so as to be in exact axial alignment with the main pump casing 14. The central, interior face of said front casing wall is provided with a suitable annular seat which snugly receives an inner lining plate 35 so that the latter is maintained accurately coaxial with the front casing wall 32 and hence also with the main pump casing 14 and with the fixed casing rear wall 24. Said inner lining plate 35 is axially held in position by an outer lining plate 36, the latter

being clamped to the front casing wall 32 by stud bolts 37 and its inner portion fitting into a suitable rabbet 38 formed on the peripheral, inner end of said inner lining plate.

5 This rabbet enables said outer lining plate 36 to bear coaxially forward against said inner lining plate 35 and to thereby hold the latter securely in position.

Formed in the front casing cover 32 at the rear end of the inlet duct 20 is a coaxial rabbet 40 which receives the peripheral edge of an annular filler piece or throat ring 41, the bore of the same being coaxial with and extending flush inwardly from the bore of said inlet duct 20 and being suitably curved to deflect the incoming slurry toward the blades of the impeller 15. By reason of this rabbet 40 said throat ring is maintained in accurate coaxial alinement with respect to said outer casing cover 32. Said throat ring is longitudinally clamped to said outer casing cover 32 in the manner hereinafter to be described.

Disposed snugly between the rear peripheral surface of said throat ring 41 and the bore of aforesaid inner lining plate 35 is a sealing ring 44. This sealing ring is adapted to be longitudinally and adjustably moved rearwardly against the outer transverse face of the annular hub flange 45 of the impeller 15 so as to form a liquid-tight joint between said throat ring 41 and said impeller 15, the joint as hereinbefore mentioned between said sealing ring 44 and said throat ring 41 being a close fitting joint and not being required to be a running fit. The longitudinally adjustable position of said throat ring 41 is effected by means of a number of push screws 46 which are threaded through the throat ring 41 and bear against the outer face of said sealing ring and are locked in adjusted position by suitable lock nuts 47. Said sealing ring is adapted to be longitudinally pressed firmly rearwardly against said push screws 46 by means of draw stud bolts 48. By thus bearing longitudinally forwardly against said push screws 46, the throat ring 41 in which said push screws are threaded is likewise forced firmly forward against the transverse rear face of the outer casing wall 32 adjacent the rabbet 40.

It is desirable that there be a certain amount of clearance between the periphery of the throat ring 41 and the bore of the hub flange 45 of the impeller 15, and also between the periphery of said hub flange 45 and the bore of the inner lining plate 35. By reason of the fact that there are such clearance spaces and the fact also that pumps of this type are used to pump liquids containing much gritty material, it naturally follows that considerable wear at these points is continually occurring so long as the pump is in operation. To remedy this, the present invention is so constituted that such wear surfaces are formed on relatively small parts

which may be readily replaced separately from the other parts of the pump which do not require such frequent replacement. For instance, the inner lining plate 35 is subjected to considerably more wear than the outer lining plate 36. Heretofore, both of these plates were made in one integral piece, the whole of which required replacement when only its hub portion became excessively worn. In the present invention the inner lining ring 35 may be replaced, when excessively worn down, without necessitating the concomitant replacement of the outer lining plate 36. This arrangement considerably reduces the maintenance cost of such a pump.

The fixed rear casing wall 24 is provided with the hub 50 which contains the stuffing box 13 and adjustable stuffing box gland 51. It is assumed that no very marked lateral pressure is to be carried by said stuffing box from the shaft 12 inasmuch as said drive shaft is rigidly held in alinement by suitable anti-friction bearings about to be described. Nevertheless, said stuffing box does cause considerable friction and wear, particularly in view of the gritty material which such a slurry pump very frequently has to handle, and therefore a replaceable wear sleeve 52 is employed which encircles said drive shaft interiorly of said stuffing box 13 and bears against a suitable shoulder 53 formed on said drive shaft. Said wear sleeve is prevented from turning with respect to said drive shaft by means of the aforescribed key 17 which extends rearwardly beyond the rear edge of the impeller 15 and enters a suitable key slot cut in the front end of the bore of said wear sleeve. By this construction only the one key 17 is required to restrain both said impeller 15 and said wear sleeve 52 against rotation on said drive shaft, thereby constituting a simple and yet highly efficient arrangement of these parts.

The bearing supports 11 and 111 are suitably bored out to receive bearing collars 55 and 551. The front bearing collar 55 is coaxially machined to receive the peripheral face of a pair of outer, anti-friction ball races 56 of the usual and well known combined radial and thrust, ball bearing type. The inner bearing race 57 is provided with a tapered bore 58 which slopes rearwardly and outwardly. Interposed between said inner bearing race 57 and the periphery of the drive shaft 12 is a split bearing sleeve 60 whose central peripheral portion is tapered to engage with the tapered bore of said inner bearing race 57. Said bearing sleeve 60 is provided with a plurality of longitudinal cuts or splits 61. The inner bearing race 57 is forced rearwardly upon the tapered periphery of said bearing sleeve 60 by means of a jam nut 62 which is threaded onto the front end of said bearing sleeve 60 and which not only forcibly clamps said inner bearing race to said bearing

sleeve but also clamps said bearing sleeve rigidly to the drive shaft 12, the latter being effected by the splits 61 which enable said sleeve to be contracted until a firm engagement is obtained. Such a split construction permits of generous working—dimensional tolerances in the manufacture of the parts affected and at the same time ensures that the inner bearing race 57 will be exactly concentric with the drive shaft 12.

Threaded onto the rear end of the split bearing sleeve 60 is a retraction nut 63 which is adapted to force the inner bearing race 57 forwardly from the split bearing sleeve 60 whenever the bearing is to be dismounted. To be able to accomplish this result the jam nut 62 is of course first slackened off. Such a construction has been found to be very valuable in actual practice, as the inner bearing race 57 tends to become "frozen" to its companion tapered bearing sleeve 60, and requires a very high force to effect its removal. In the present invention this bearing may be readily disassembled without danger of cracking or marring the inner bearing races by reason of the fact that the tremendous force, which is sometimes required, is applied gradually and uniformly over the entire rear end surface of said inner bearing race. When the bearing is again to be assembled, the retraction screw 63 is first backed up and then the jam nut 62 tightened until the inner bearing race 57 is securely clamped to the drive shaft 12.

The same procedure is adopted if a plain (instead of ball or other "rolling") bearing is employed but the arrangement is of particular value where such "rolling" bearings are desired.

It will be noticed that the bearing standards 11 and 111 are formed integrally with the fixed, rear casing cover 24 inasmuch as both of said bearing standards and said rear cover are formed integrally upon the base plate 10. It is very desirable that these various parts be machined as exactly in correct axial alignment as possible. This is accomplished in the manufacture of the present invention by finish-machining said bearing supports 11 and 111 with bearing caps 65 and 651 in place) and the rear casing cover 24 in one set up—a multiple-cutter boring bar being the major tool used in this operation. By this method exact alignment is assured, as well as quietness and long life of operation, when the pump is put into service.

I claim:

1. A centrifugal pump comprising a casing having an inlet duct; an impeller rotatably arranged within said casing; a throat ring coaxially disposed within said casing at the inner end of said inlet duct; an inner lining plate disposed within said casing and engaging the periphery of said throat ring; and an outer lining plate having an outer diam-

eter approximately that of the impeller disposed within said casing and engaging the periphery of said inner lining plate.

2. A centrifugal pump comprising a casing; an impeller arranged within said casing and having a hub flange; an inner lining plate disposed within said casing and receiving within its bore the peripheral surface of said impeller hub flange; and an outer lining plate having an outer diameter approximately that of the impeller disposed within said casing and engaging the periphery of said inner lining plate.

3. A centrifugal pump comprising a casing having an inlet duct; an impeller rotatably arranged within said casing and having a hub flange; a throat ring arranged within the bore of said impeller hub flange; an inner lining plate having its bore receiving the periphery of said throat ring; and an outer lining plate having an outer diameter approximately that of the impeller having its bore receiving the periphery of said inner lining plate.

4. A centrifugal pump comprising an annular casing having a coaxial inlet duct; an impeller rotatably arranged in said casing and having an annular, coaxial, hub flange; a throat ring secured to and coaxially centered by said casing and having its rear end disposed within the bore of said impeller hub flange; an inner lining plate coaxially arranged within said casing; a sealing ring snugly disposed between said inner lining plate and said throat ring and adjustably moved toward and from the hub flange of said impeller; and an outer lining plate retaining said inner lining plate coaxially in position and having its bore receiving the periphery of said lining plate.

In testimony whereof I hereby affix my signature.

VICTOR J. MILKOWSKI.