June 21, 1938. J. A. BUECHLER 2,121,068

PUMP LINING

Filed July 16, 1937 2 Sheets-Sheet 1

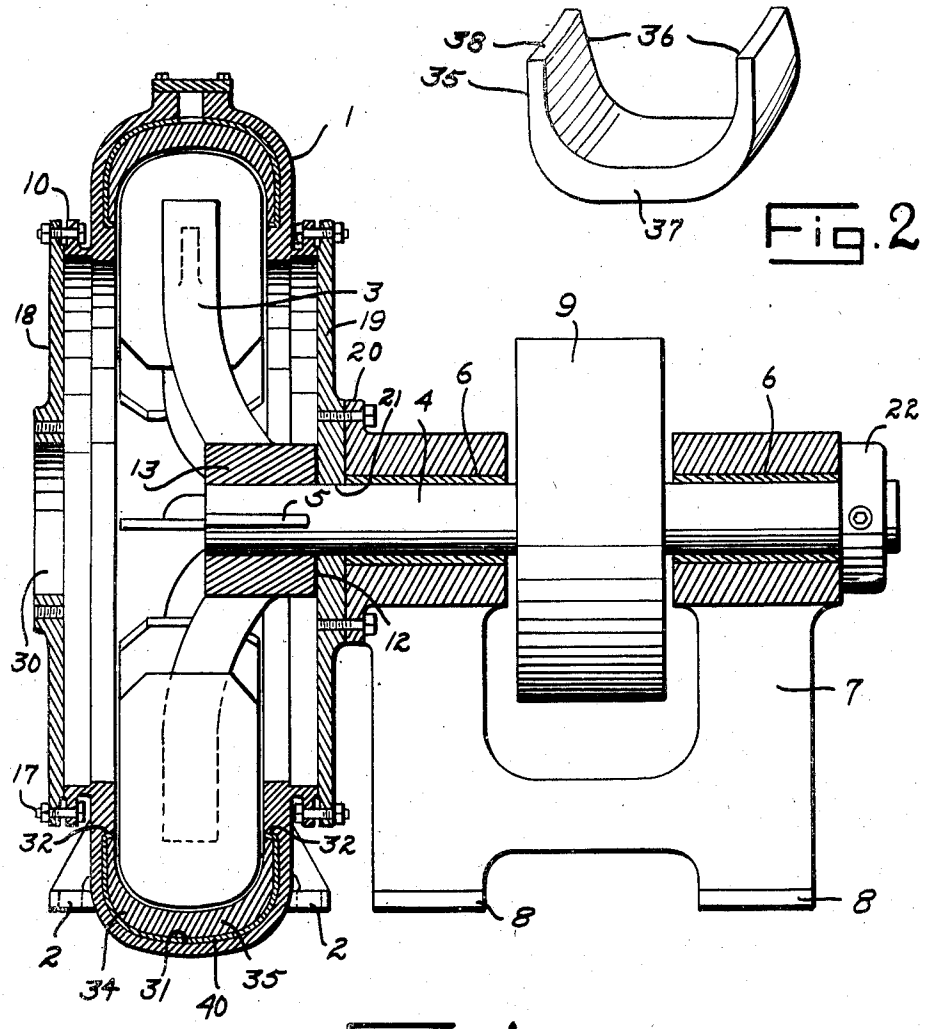

Fig. 2.

Fig. 1.

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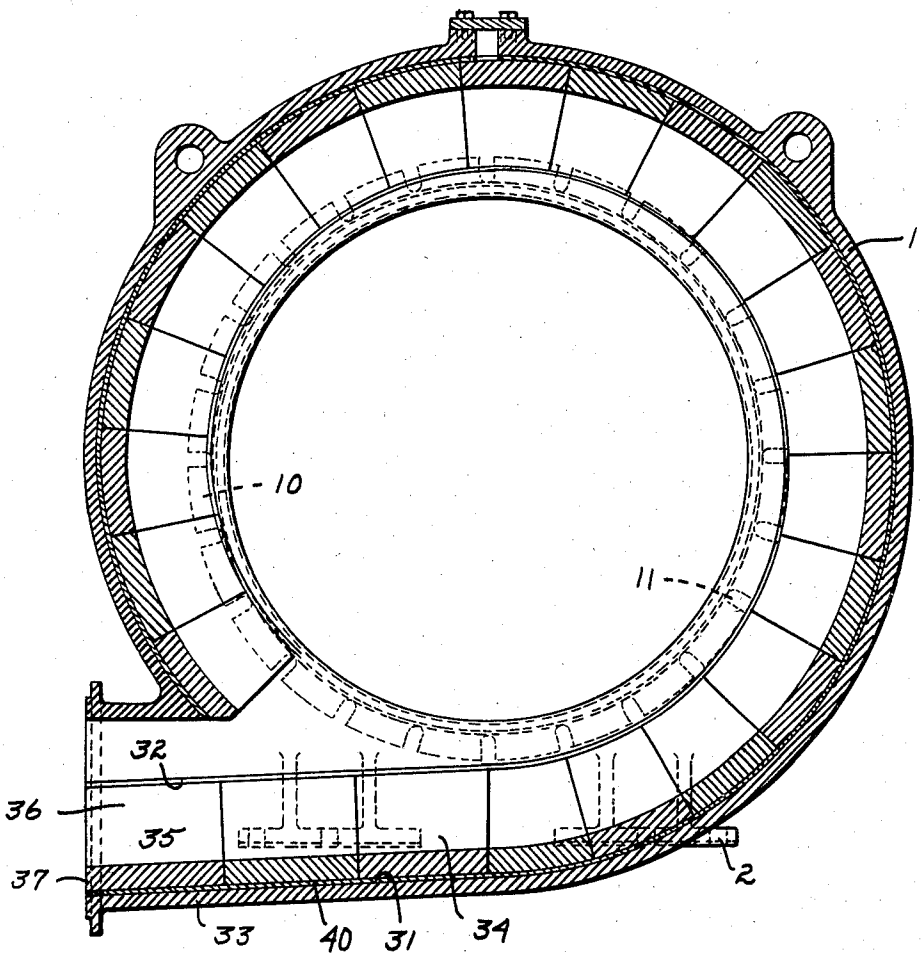

Fig. 3.

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PUMP LINING

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2 Claims. (Cl. 103—114)

The invention relates to centrifugal pumps and more particularly to pumps of the type that are utilized for moving liquids containing abrasive materials.

It is an object of the invention to provide a method of lining centrifugal pumps to resist abrasion by the pumped material.

It is also an object to provide a centrifugal pump having an abrasion resistant lining applied in such a manner that the pump may be relined at small cost and the life of the pump casing indefinitely extended thereby.

A further object of the invention is to provide a peripheral wear resistant lining in a centrifugal pump casing to minimize the wear in that portion of the casing where the hydraulic pressure and fluid velocity are greatest.

Still another object is to provide a centrifugal pump casing having a peripheral recess which is coextensive with the tangential outlet from the casing whereby a wear resistant lining may be inserted through the outlet and fixed in place within the recess by a low melting point material between the lining and the casing walls.

Other objects, together with the foregoing, will be apparent from the following description taken in connection with the drawings, in which:

Fig. 1 is a sectional view of a centrifugal pump embodying the invention.

Fig. 2 is a perspective view of a segment of the lining used in the invention.

Fig. 3 is a central sectional view of a turbine casing embodying the invention.

In the embodiment shown in Fig. 1 the pump casing 1 is provided with supporting flanges 2 whereby the casing may be anchored to a suitable foundation (not shown). The pump impeller or runner 3, which rotates within the casing 1, is fixed to a shaft 4 by means of key 5. The shaft 4 is rotatably mounted in bearings 6 in pedestal 7, having supporting flanges 8 which may likewise be secured to the supporting foundation. A pulley 9 is fixed to shaft 4 between the bearings 6 whereby the impeller may be driven from a suitable source of power (not shown).

The opposite walls of casing 1 are flanged at 10, these flanges being provided with radial slots 11 (see Fig. 3) to receive the bolts 17 which pass through the casing-heads 18 and 19 whereby the walls are secured in place to form a composite casing. The inner casing head 19 is secured to a flange 20 upon pedestal 7 and has a central opening 21 through which shaft 4 passes. A radial face 12 on the hub 13 of the impeller 3 serves as a thrust face to contact the inner wall of the casing head 19. At its opposite end shaft 4 is provided with a thrust collar 22 fixed to the shaft 4. With this arrangement it is obvious that the shaft 4 and its associated impeller are restrained from axial displacement.

The casing head 18 is provided with a central opening 30, which serves as an inlet opening for the pumped fluid. It is well known that the pressure at the axial inlet of a pump of this type is relatively low and may be below atmospheric pressure. The abrasive material does not therefore materially abrade the metal about the inlet opening 30. However, as the pumped material moves outwardly within the casing 1 the hydraulic pressure increases and reaches a maximum at the inner peripheral walls of the casing.

It is in this portion of the casing that the abrasion is maximum and it is the primary object of the invention to minimize the effects of this abrasion, as well as to make it possible to renew the parts subjected to the abrasive effects of the pumped materials. The method of attaining this primary object will now be described.

By reference to Figs. 1 and 3, it will be noted that the inner peripheral wall of the casing is provided with a U-shaped recess 31, which terminates in the side walls of the casing in outwardly facing shoulders 32. The recess 31 continues throughout the periphery of the casing 1 and is coextensive with a like recess in the tangential discharge outlet 33 of the pump.

To minimize the abrasion of the peripheral inner wall of the casing 1 recess 31 is provided with an annular lining 34 of abrasion resistant material, such lining having U-shaped cross section and comprising a plurality of sectors 35, one of which is shown in perspective in Fig. 2. The material comprising the sectors 35 may be of any suitable abrasion resistant alloy such, for example, as manganese steel. This suggested material is to be considered as illustrative only and not as limitative of the invention, as any suitable abrasion resistant material may be used. It may also be noted that it is not intended that the invention shall be limited to the use of alloys for certain of the metals as, for example, white cast iron may be utilized without departing from the spirit of the invention.

Sectors 35 are not uniform in thickness, the side walls 36 thereof being materially thinner than the bottom portion 37. The thickness of side walls 36 is such that the upper faces 38 are the same width as are the outwardly facing shoulders 32 in the casing 1. The increased thickness in the portion 37 is due to the fact that the maxi-

mum abrasion occurs at the extreme periphery of the casing 1 where hydraulic pressure and velocity are the greatest. Consequently, this portion of the casing is subjected to the greatest wear.

A novel and important feature of the invention is the manner of positioning the liner 34 within the casing and fixing the liner therein in such a manner as to resist the stresses that may occur during the normal operation of the pump. These sectors 35 are introduced sequentially into the recess 31 of the mouth of the discharge outlet 33 until a complete liner is provided. In the present preferred practice a limited number of these sectors are inserted in the recess 31 in end-to-end relation and are moved to the farthermost end of the recess. Each of the sectors is then wedged inwardly to bring the faces 38 of the sectors against the shoulders 32 in the casing walls. This wedging action is effected by any suitable wedging means. The casing 1 is then so oriented that liquid will flow by gravity into the annular space between the sectors 35 and the casing 1. A suitable metal of relatively low melting point, such as brass, zinc, or bronze is then put into the annular space to form the bonding metal 40 to retain the sectors 35 in place within the casing. A second group of sectors is then inserted and the casing is again oriented so that bonding metal 40 may be poured behind the lining sectors to fix such sectors in place. This sequence is repeated until a complete liner 34 is provided within the recess 31 of the casing.

While specific metals have been suggested for use as the bonding metal 40, the invention is not limited to the use of those metals but it is contemplated that the use of any metal may be used which has sufficient resistance to flow under pressure as to withstand the stress to which the sectors 35 are subjected when the pump is in use. At the same time the preferable metal will have a sufficiently low melting power and a sufficiently low latent heat of fusion that the casing 1 will not be deleteriously affected during the cooling of the metal within the annular space between the liner 34 and the casing 1.

When a pump casing is lined in accordance with the procedure just described it has been found that after a long period of use the sectors 35 will wear through at the thickened portions 37. If such wear is nonuniform throughout the periphery of the casing, the sectors may be severed as by means of a blow torch and the respective parts of the lining may then be removed from the recess 31. Bonding metal 40 is of a sufficiently limited volume and a sufficiently low melting point that only superficial interfusion of metals occurs. Hence the segments of the severed sectors and the bonding metal may be readily removed and the recess 31 again prepared for a replacement liner. A single liner applied in accordance with the invention will withstand severe operating conditions. The lining may then be replaced at a small fraction of the expense that would be necessary in replacing the entire casing. Furthermore, it has been found that as many as five replacement liners may be used in a single casing before it is necessary to replace the casing itself. It is thus apparent that the life of a casing is materially increased and maintenance costs are reduced to a minimum.

It is relatively unnecessary to touch upon the mode of operation of the disclosed device when addressing the description to those skilled in the art. It will be pointed out, however, that when the impeller 3 is driven through the rotation of shaft 4 fluid is drawn to the casing 1 in the inlet opening 30. This fluid is forced radially outward by the impeller 3 and moves along the liner 34 at high velocity and pressure. Abrasive material contained in the liquid hence effects material abrasion of the liner which may subsequently be replaced as above described.

Bonding metal 40 is necessarily sufficiently resistant to flow under pressure that the liner sectors 35 will be retained in a fixed position within the casing 1 throughout the useful life of the sectors 35.

From the foregoing it is believed that the objects of the invention are apparent and that the construction and arrangement of the parts as disclosed in connection with the preferred embodiment of the invention effects the objects in a novel and economical manner. The initial cost of the production of a centrifugal pump embodying the invention is not increased and at the same time the life of a single liner increases the life of the pump, while the ultimate life of the pump casing may be increased many fold by replacing the lining in accordance with the invention.

Furthermore, it is apparent that the method of the invention obviates deleterious warping and change in metal structure of the casing walls such as results when a wear resistant coating is applied by use of the acetylene torch or electric arc. The invention also obviates provision of bolt holes in the casing with their attendant difficulties in maintaining a prime.

What is claimed is:

1. In a centrifugal pump, a circular casing having an axial inlet and a tangential outlet, an annular fluid channel in said casing, said channel having annular shoulders forming the inner limits thereof, said shoulders extending around the interior of said casing and through said outlet to receive liner sections therein, liner sections slidable into said outlet and about said casing to form a wear surface for said channel, said sections in said channel being of approximately uniform shape and size, and means to retain said liner sections in assembled position.

2. In a centrifugal pump, a circular casing having an axial inlet and a tangential outlet, an annular fluid channel formed on the inner periphery of said casing with inner shoulders integral with said casing forming the inner boundary of said channel, said shoulders extending to the outer end of said outlet, U-shaped liner sections of wear resisting material slidable into said channel through said outlet and surrounding said shoulders, said sections being of approximately uniform size, and a bond of soft metal securing said sections in position.

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