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CENTRIFUGAL PUMP STRUCTURE
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Fig. 1

Fig. 2

Fig. 3

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This invention relates to pumps and more particularly to pumps of the type which are adapted to handle abrasive mixtures, acids and other materials which may have a harmful effect on the pump parts.

The present application is a continuation in part of my co-pending United States application Serial No. 87,567 filed June 26, 1936.

In describing my invention reference will be made particularly to the type of pump which is designed primarily to handle mixtures of sand, gravel or other solids and water. It will be understood, however, that pumps embodying my invention may be adapted to handle acids or other solids which attack the usual metal pump structure.

It has been proposed to line centrifugal pumps with resilient rubber to reduce the wear on the pump parts caused by the abrasive action of the materials being pumped. It has also been proposed to flush the clearance spaces between the impeller and housing of a centrifugal pump with clear water to prevent the entry of abrasive material into these clearance spaces, thus increasing the life of the pump and maintaining its efficiency.

It is an object of the present invention to provide an improved centrifugal pump having a rotating impeller and having improved means for controlling the flow of clear flushing water through the pump clearances and sealing said clearances against the entry of harmful abrasive material. Other objects of my invention include: the provision of sealing means for centrifugal pumps of the type described in which the pressure of the clear flushing liquid is utilized to assist in creating the desired engagement between a sealing ring member and the pump impeller; the provision of a centrifugal pump for handling abrasive fluids which will give long service with maximum efficiency; the provision of an elastic and resilient sealing ring which closely engages with resilient pressure a surface of the member to be sealed; the provision of a sealing ring which maintains its sealing action both when the pump is operating and when it is stationary; the provision of a centrifugal pump for handling abrasive liquids in which worn parts may be readily and economically replaced in the field without returning the pump to the shop; and the provision of a simple, rugged and efficient sealing mechanism for pumps of the type described.

The above and other objects of my invention will appear from the following description of a preferred form thereof, reference being had to the accompanying drawing, in which—

Figure 1 is a side elevation of a centrifugal pump embodying my improvements, the top half of the pump being illustrated in vertical cross-section.

Figure 2 is an enlarged fragmentary section of the suction side sealing apparatus of the pump shown in Figure 1.

Figure 3 is an enlarged fragmentary vertical section of the shaft side sealing means of the pump shown in Figure 1.

My improved pump (referring particularly to Figure 1) comprises a housing indicated generally at A and an impeller indicated generally at B. The impeller is mounted on a shaft 1 which extends out through a suitable packing 2 in the housing A and has threaded engagement at its inner end with the hub of the impeller B. As seen in Figures 1 and 3 the impeller shaft 1 is formed with a shoulder 14 and is grooved at the base of the threads which engage the impeller housing as seen at 15. A metal disc or washer 13 is disposed between the end of the shaft 1 and the impeller hub and is clamped between the impeller hub and the shoulder 14 of the shaft. A pin or pins 14 are supported in the impeller hub and extend through the rubber covering 11 of the impeller and through the washer 13. The washer 13 serves to hold the rubber impeller cover 15 in position at the hub and the pins 14 prevent rotation of the washer 13 relative to the rubber impeller cover 11 when the shaft 1 is screwed into the impeller hub. A rubber washer 13 lies in the groove 14 and is effective in preventing the entry of water or foreign material into the threads of the shaft 1.

On the opposite side of the housing A is the inlet opening 3 which is preferably provided with a tubular rubber liner 4 having a flanged portion which engages the suction side cover plate 5 of the housing A. The center section of the housing A includes the volute 6 which is lined by the rubber liner 7. The liner 7 has a tubular portion which extends up through the pump outlet. A generally disc shaped rubber liner member 9 covers the shaft side of the housing A and the rubber liner member C covers the suction side plate 5. Thus, the entire inside of the tubular rubber sleeve 4 and the liners C, 7 and 9.

On the suction inlet side of the pump a flushing water chamber 10 is provided and on the shaft side there is a flushing water chamber 11. Clear water is supplied in these chambers.
through the pipes 12 and 13 which are connected to a common supply pipe 14. The water supplied to these chambers is normally maintained under greater pressure than that set up in the pump volute chamber 6 so that a flow of flushing water into the volute 13 is maintained thus effectively preventing the entry of abrasive material into the small clearance spaces of the pump.

10 As is best seen in Figure 2 the suction side seal arrangement includes a resilient radially extending rubber sealing ring member of flange 15. The suction inlet 3 is lined by a rubber liner member 4, as previously explained, which supports a metal ring member 15 for purposes which will be later described.

15 The impeller B may be completely covered with rubber and is provided with an axially extending flange or projection 17 which includes a metal ring member 18 held by screws 19 extending into the metal skeleton 20 of the impeller. This axially extending flange may, of course, in some instances be formed integrally with the metal frame of the impeller and provides a cylindrical sealing surface with which the radially extending sealing ring 15 has sealing engagement. As illustrated, this sealing ring 15 is formed integrally with the impeller and extends radially inwardly from the rubber liner C of the pump housing. The ring 15 is made to have a normally smaller diameter than the diameter of the axially extending flange portion 18 on the impeller and is stretched during installation to fit over the flange 18. Thus, the sealing ring 15 has an inherent pressure equally distributed circumferentially around the flange 18 which maintains an effective seal at all times, regardless of whether the pump is operating or stationary, and prevents the back flow of abrasive material and leakage of high pressure fluid into the inlet side of the pump. This sealing ring 15 is preferably formed with a substantially vertical side 21 and a slanting side 22. By placing the slanting side 22 of the ring 15 on the flushing water side thereof it will be seen that the ring 15 will flex relatively easily toward the impeller thus permitting the passage of flushing fluid into the impeller chamber and will resist bending in the opposite direction due to the action of the slanting side 22 thus assuring the inherent tightness of the sealing ring 15 on the flange 18 in preventing the back flow of abrasive carrying fluid into the clearance spaces of the pump.

Due to the provision of a sealing ring 18 which is smaller in diameter than the axially extending surface which it engages, the necessity of providing an accurate fit between the sealing ring and the other member is eliminated and proper sealing contact is maintained regardless of any minor eccentricities of the pump shaft or the like.

60 The ring member 23 of Figure 3 is constructed and operates in substantially the same manner as the ring member 15 of Figure 2. Although I have shown the ring 15 engaging the outer edge of the metal ring 18 it will be understood that in some instances it may be desired to have the ring member 15 engage a rubber surface on the Impeller B and this can be readily effected by providing an axially extending rubber covering for the cylindrical surface of the metal ring 18.

70 The rubber housing lining C is held in position by a metal plate 24 secured by suitable screws 25, and is provided with an inner sealing portion 26. As is clearly seen in Figure 2 this portion 26 is disposed directly opposite the metal ring member 15 which is held in place in the Inlet liner 4.

The sealing member 26 is thus supported so that it will not exert undesired pressure against the rubber liner member 4. Pressure of the gritless flushing water which enters the chamber 10 through the pipe 12 will cause the resilient outer lip of the sealing member 26 to engage the radially extending sealing surface of the flange 18 of the pump impeller thus completing the seal. The face of the sealing member 26 which engages the flange 18 is provided with circumferentially spaced radially extending slots 26a to facilitate the flow of gritless water over the impeller chamber through the clearance spaces 27 and to maintain a film of gritless fluid between the seal and impeller sealing surface and thus insure effective lubrication of the contacting surfaces. By combining the tensioned resilient rubber sealing member 18 engaging an axially extending surface of the impeller, which because of its shape permits the flow of flushing water into the pump chamber while retarding the flow in the opposite direction, with the sealing member 26 engaging a radially extending surface of the impeller, which effectively seals the low pressure side of the impeller, a simple and very efficient seal is provided, which, due to the arrangement of parts and the resilient nature of the seal members accurately follows any vibrations, both axial and radial, of the impeller when rotating at high speeds. In like manner, the radially extending sealing ring 23 which co-acts with the axially extending surface of the impeller hub and which is stretched thereover to have a resilient evenly distributed circumferential pressure thereagainst, provides an effective seal on the shaft side of the impeller.

Although I have described the illustrated embodiments of my invention in considerable detail it will be understood by those skilled in the art that variations and modifications may be made in the form of my improved pump structure without departing from the spirit of my invention. I do not, therefore, wish to be limited to the specific embodiments herein described, but claim as my invention all embodiments thereof coming within the scope of the appended claims.

I claim:

1. A centrifugal pump comprising an impeller having, on its suction side, a ring provided with an axial sealing surface, and another sealing surface, a housing for the impeller having a suction inlet and an annular recess surrounding the inlet and opposed axially to said ring, inner and outer resilient seals defining said recess in part, the outer seal surrounding said axial sealing surface of the ring and having a normal inside diameter smaller than the diameter of said axial sealing surface, the inner seal engaging the said other sealing surface of the ring, and means for delivering liquid under pressure into said recess.

2. A centrifugal pump comprising an impeller having, on its suction side, a ring provided with an axial sealing surface, and another sealing surface, a housing for the impeller having a suction inlet and an annular recess surrounding the inlet and opposed axially to said ring, inner and outer resilient seals defining said recess in part, the outer seal surrounding said axial sealing surface of the ring and having an axially extending portion and a radially projecting portion having a normal inside diameter smaller than the diameter of said axial sealing surface, the inner seal engaging the said other sealing surface of
the ring, and means for delivering liquid under pressure into said recess.

3. A centrifugal pump comprising an impeller having, on its suction side, a ring provided with an axial sealing surface and a radial sealing surface, a housing for the impeller having a suction inlet and an annular recess surrounding the inlet and opposed axially to said ring, inner and outer resilient seals defining said recess in part, the outer seal surrounding said axial sealing surface of the ring and having a normal inside diameter smaller than the diameter of said axial sealing surface, the inner seal engaging said radial surface of the ring, and means for delivering liquid under pressure into said recess.

4. A centrifugal pump comprising an impeller having, on its suction side, a ring provided with an axial sealing surface and another sealing surface, a housing for the impeller having a suction inlet and an annular recess surrounding the inlet and opposed axially to said ring, inner and outer annular resilient seals defining said recess in part, said outer seal being axially disposed, having an annular surface engageable with the axial sealing surface of said ring and being secured against rotation to the housing axially remote from said ring, said outer seal being movable non-rotatively by and with said ring when the latter is rotating, said inner seal engaging said other sealing surface of the ring, and means for delivering liquid under pressure into said recess.