

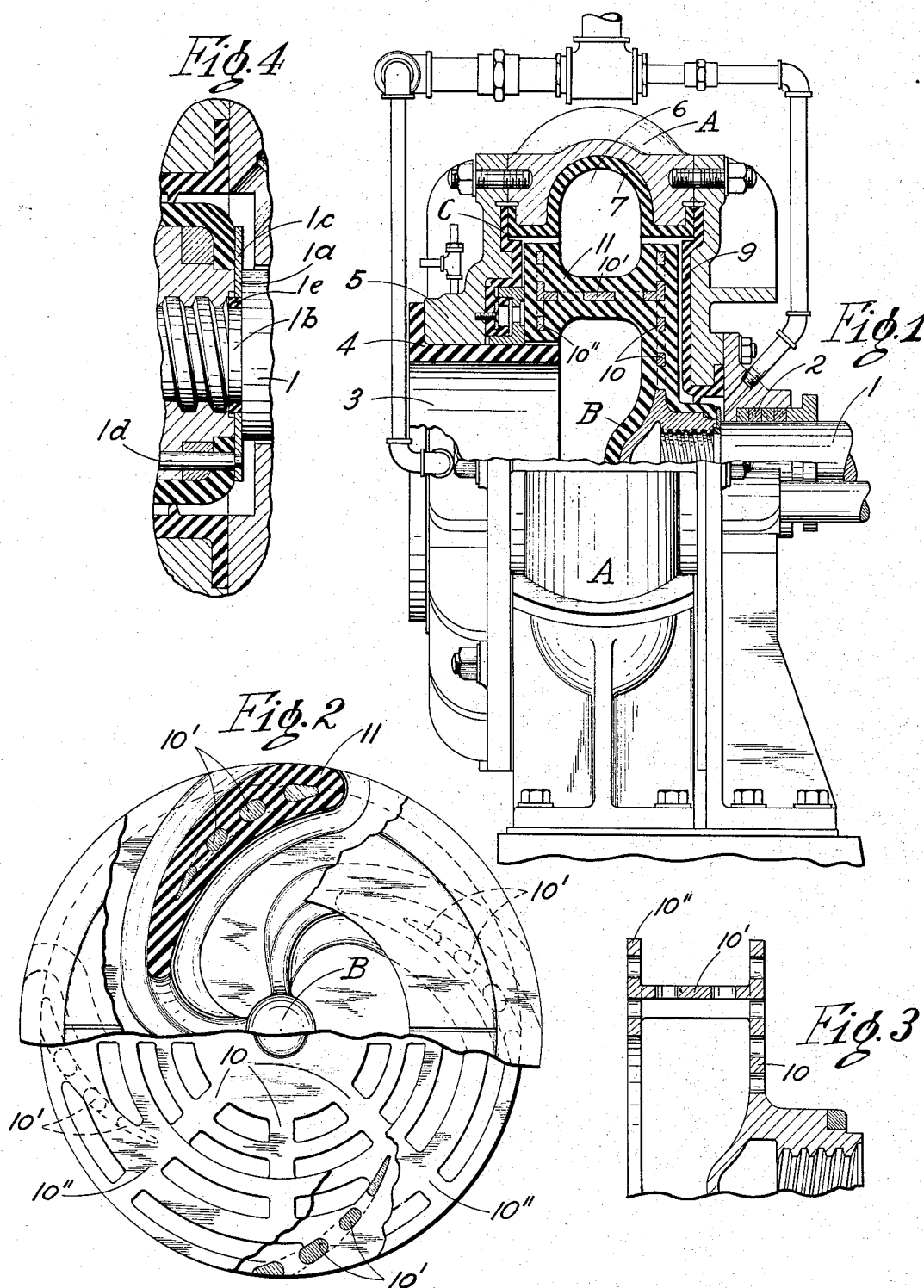
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IMPELLER FOR CENTRIFUGAL PUMPS

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IMPELLER FOR CENTRIFUGAL PUMPS

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2 Claims. (Cl. 103—115)

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

The present application constitutes a division of my co-pending United States patent 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 or gravel and water. It will be understood, however, that pumps embodying my improvements may be adapted to handle acid or other solutions which attack the usual metal pump.

It has been proposed to line centrifugal pumps with 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 and thus increase the life of the pump and maintain its efficiency.

It is an object of the present invention to provide an improved rubber lined centrifugal pump having an improved type of rubber covered impeller; the provision of an improved rubber covered pump impeller structure and method of making same; and the provision of a centrifugal pump for handling abrasive or other liquids which may be harmful to metal parts which will have a long trouble-free life and be economical to manufacture.

The above and other objects of my invention will appear from the following description of one embodiment thereof, reference being had to the accompanying drawing in which:

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

Fig. 2 is an end view of the pump impeller taken from the suction side of the pump, the lower half of the figure showing the uncovered impeller frame, and the upper half showing the rubber cover vulcanized on. Parts of the impeller are broken away for clearer illustration;

Fig. 3 is a fragmentary cross section through the impeller frame shown in Fig. 2;

Fig. 4 is an enlarged cross sectional view of the shaft end of the impeller.

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 ex-

tends 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 4 the impeller shaft 1 is formed with a shoulder 1^a and is grooved at the base of the threads which engage the impeller as seen at 1^b. A metal disc or washer 1^c is disposed between the end of the shaft 1 and the impeller hub and is clamped between the impeller hub and the shoulder 1^a of the shaft. A pin or pins 1^d are supported in the impeller hub and extend through the rubber covering 11 of the impeller and through the washer 1^c. The washer 1^c serves to hold the rubber impeller cover in position at the hub and the pins 1^d prevent rotation of the washer 1^c relative to the rubber impeller cover 11 when the shaft 1 is screwed into the impeller hub. A rubber washer 1^e lies in the groove 1^b 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 pump housing is lined with rubber by the tubular rubber sleeve 4 and the liners C, 7 and 9.

The impeller B comprises a metallic skeleton or frame (illustrated in detail in Figures 2 and 3) which is molded into the soft, resilient, stretchable rubber sheath 11. The impeller frame includes a perforated shaft side shroud plate 10, transversely extending perforated blade supporting portions 10' and a perforated inlet side shroud plate 10''. The blade members 10' and the plates 10 and 10'' are perforated so that the rubber cover may be securely attached. In making the impeller the frame is preferably placed in a suitably formed mold and surrounded by raw rubber of suitable composition. When the rubber is vulcanized under pressure a firm bond is secured between the skeleton and the covering and, as the holes and spaces in the skeleton are filled with rubber, the danger of the rubber cover coming loose is completely eliminated. The metal frame forms a rigid support for the impeller sides and blades and holds the relatively soft rubber covering in the desired form.

Referring particularly to Figures 1, 2 and 3 it will be noted that the shroud plates 10 and 10' and the blade portions 10' are perforated. In the embodiment illustrated the perforations in the shroud plate take the form of elongated arcuate slots which slots are spaced relatively close together in a radial direction. In the blade members the perforations take the form of holes arranged in rows in the blade supporting portions of the frame.

These perforations have a special function in my improved rubber covered pump impeller. I have found that when soft rubber, or like resilient material of the type preferably employed in lining my pumps, is placed under tension and is then subjected to the abrasive action of sand, gravel or other abrasives, it wears away much more rapidly than is the case when the rubber covering or lining is inert or in unstretched condition. I believe that the relatively rapid wear which occurs when the rubber is stretched is due to the fact that when under tension any minute abrasions which may occur on the surface of the rubber are immediately stretched and held open and consequently enlarged by the impact of succeeding abrasive particles. However, when the rubber is inert the impact of a particle against the surface of the rubber does not tend to break the surface and cause resulting wear as readily as when the rubber is under stress. Also, even if a break occurs, it is not held open to cause a rough spot which will be subject to relatively rapid additional wear. Therefore, by providing an impeller frame to which the rubber covering is integrally molded and providing a relatively close spacing, particularly in a radial direction, of the perforations through which the rubber cover extends, I have produced a rubber covered impeller in which, under all operating conditions, the surface of the rubber will be substantially inert or unstretched. This overcomes the difficulties experienced with other types of rubber covered impellers in which the rubber covering may be molded to a frame but in which the rubber covering is not attached or locked to the frame at closely spaced radial intervals.

It will be understood that when the impeller is rotating, centrifugal force tends to act radially on the rubber covering and stretch the covering between points of positive attachment to the metal backing. By placing the points of attachment to the backing so close together that substantial stretch of the rubber cover therebetween, due to centrifugal force, is positively prevented I have produced an impeller having a maximum life and resistance to abrasive wear. This feature of my invention has proved very successful in actual use and I have found that my rubber surfaced impellers, in which the rubber surface is positively held against stretch due to forces imposed thereon during operation, wear much longer, under the same operating conditions, than other types of rubber covered impellers.

Although I have illustrated and described only

one embodiment of my improved pump impeller, it will be understood by those skilled in the art that variations and modifications may be made from the specific disclosure made herein without departing from the spirit of my invention. I do not, therefore, wish to be limited to the particular form of my invention herein illustrated and described. I claim as my invention all forms thereof coming within the scope of the appended claims.

I claim:

1. An impeller for a centrifugal pump for liquids containing abrasive solids, comprising a one-piece metal skeleton and a rubber covering therefor, said skeleton consisting of a shroud plate, a shroud ring and a plurality of arc shaped blades therebetween, said shroud disc having a central portion provided with a forwardly projecting dome and a rearwardly projecting, threaded, shaft receiving hub and having in the portion outside of said central portion circumferentially extending openings arranged in a plurality of concentric rows, said shroud ring having a central inlet passage and circumferentially extending openings arranged in a plurality of concentric rows, each of said blades having a length as measured radially of said skeleton which is less than the radial width of the shroud ring and having a plurality of openings arranged in rows extending lengthwise thereof, said covering consisting of a single piece of soft, resilient and stretchable rubber which covers the disc, ring and blades of the skeleton and fills the said openings therein, said openings being so numerous and so disposed in the plate, ring and blades that they maintain the surface of the covering in substantially unstretchable condition when the impeller is in use, the blade coverings extending inwardly to the inner edge of said shroud ring and then curving sharply and decreasing in circumferential width and axial height until they merge with the covering of the dome of the shroud also.

2. An impeller for a centrifugal pump for liquid containing abrasive solids, comprising a one-piece metal skeleton and a rubber covering therefor, said skeleton consisting of a shroud plate, a shroud ring and a plurality of arc shaped blades therebetween, said shroud disc having an imperforate central portion and an outer portion, said shroud ring having a central opening, both the ring and the outer portion of the disc having a plurality of concentric rows of circumferentially extending openings, each of said blades having a plurality of openings arranged in rows extending lengthwise thereof, said covering consisting of a single piece of soft, resilient and stretchable rubber which covers the disc, ring and blades of the skeleton and fills the said openings therein, said openings being so numerous and so disposed in the plate, ring and blades that they maintain the surface of the covering in substantially unstretched condition when the impeller is in use.

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