Jan. 9, 1951 W. H. PFARRER 2,537,084

FABRICATED CENTRIFUGAL PUMP

Filed Sept. 4, 1948 3 Sheets-Sheet 1

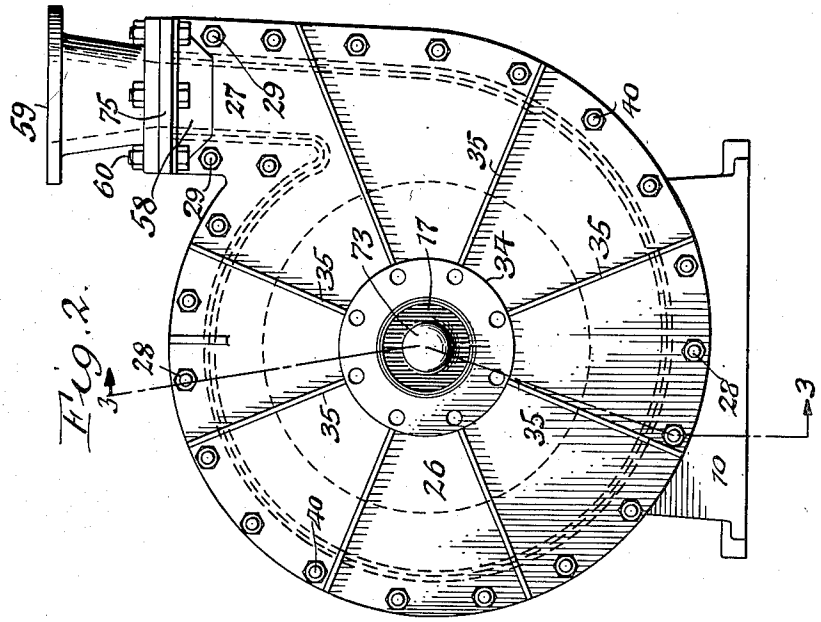


Fig. 2.

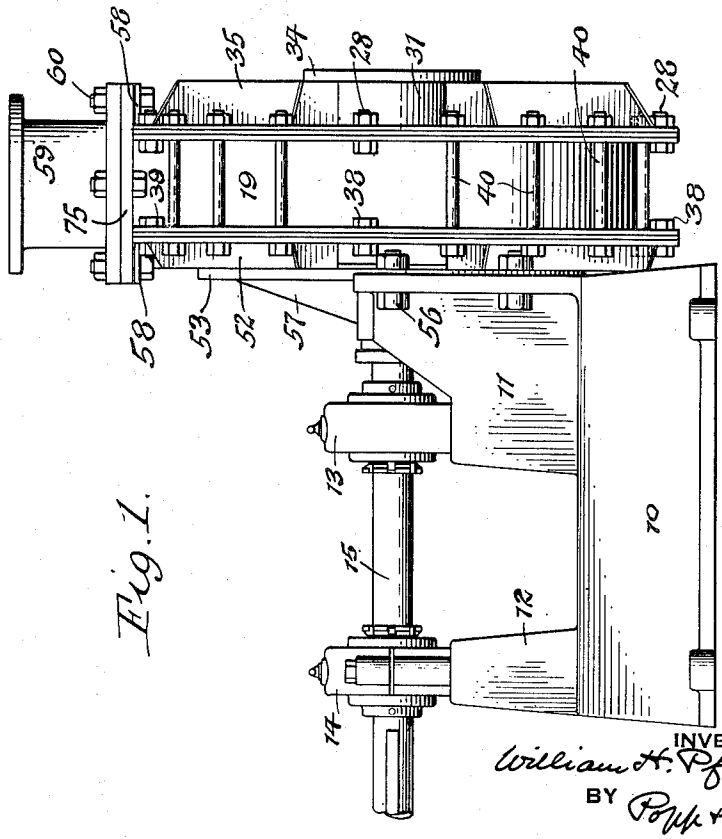


Fig. 1.

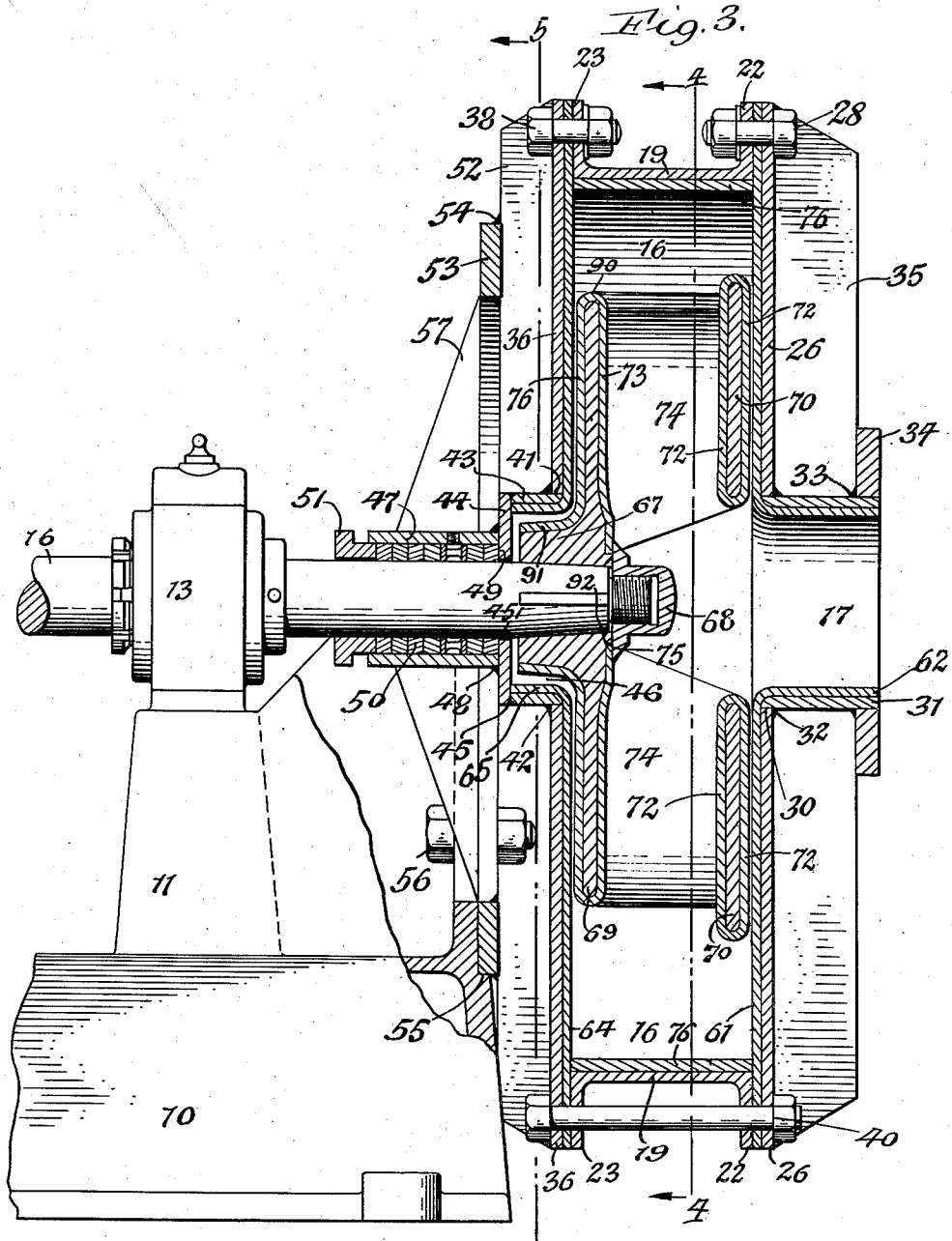
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Fig. 3.



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Fig. 5.

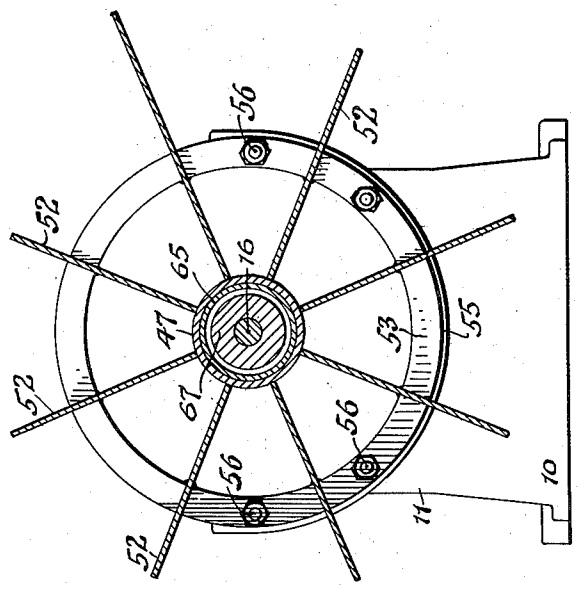


Fig. 4.

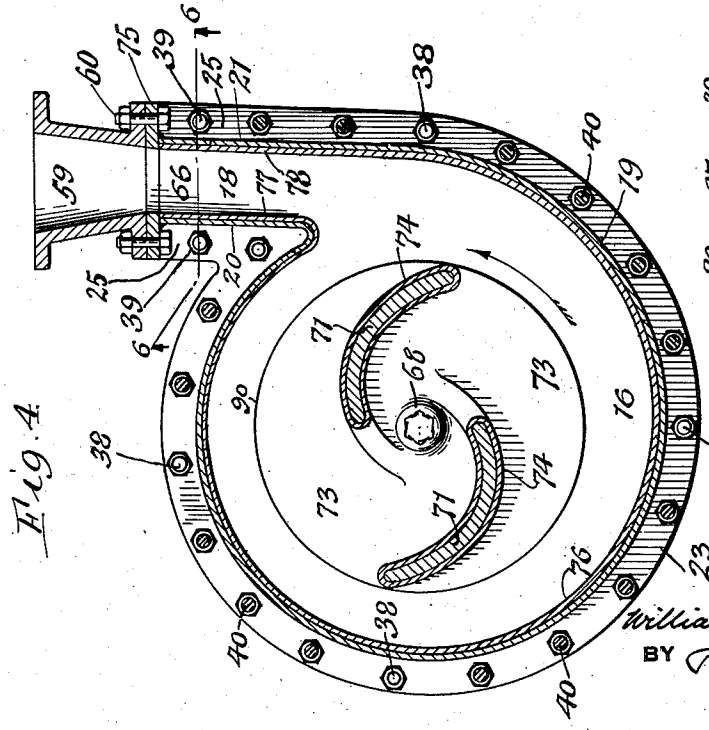
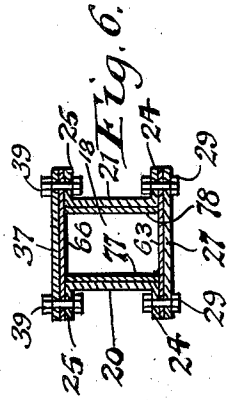


Fig. 6.



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2,537,084

FABRICATED CENTRIFUGAL PUMP

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1 Claim. (Cl. 103—103)

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This invention relates to a centrifugal pump and more particularly to a pump of this type which is constructed mainly of members which are fabricated of flat sheet or rolled metal and are connected with one another by welding, such members being generally known in the industry as "weldments."

Heretofore the main members of such pumps have been made of cast metal which necessitated making patterns for use in producing the molds in which these members were cast, which operation involves considerable expense. The production of the pumps in this manner also requires considerable machining for the purpose of finishing the parts before they can be used.

One of the objects of this invention is to provide a centrifugal pump, the principal members of which are constructed from metal sheets or the like which have been rolled and from which these members can be cut by means of a flame or the like and connected with each other partly by welding and partly by means of bolts or similar means, thereby enabling the pump to be manufactured and assembled with a minimum of machining and also permitting the several parts of the pump to be easily and conveniently assembled and disassembled for inspection, adjustment and repairing.

A further object of this invention is to so organize a pump of this character that the interior of the same may be readily provided with a protecting lining, such as rubber, metal or the like, for use in pumping liquids containing abrasives and also liquids of a corrosive character, some of these lining members also serving as gaskets for producing leak-tight joints between the members of the pump casing.

In the accompanying drawings:

Fig. 1 is a side elevation of a centrifugal pump embodying these improvements.

Fig. 2 is an elevation of the same viewed from the front end thereof.

Fig. 3 is a fragmentary vertical longitudinal section, on an enlarged scale, taken on line 3—3, Fig. 2.

Figs. 4 and 5 are vertical cross sections, on a reduced scale, taken on the correspondingly numbered lines of Fig. 3.

Fig. 6 is a horizontal section taken on line 6—6, Fig. 4.

In the following description similar characters of reference indicate like parts in the several figures of the drawings:

The numeral 10 represents the base of the main frame of the pump which may be of any

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suitable construction and which is provided on the upper side of its front and rear ends with front and rear standards 11, 12. The tops of these standards are provided, respectively, with front and rear bearings 13, 14 in which is journaled a horizontal longitudinal driving shaft 15 which forms part of the means for operating the pump. This shaft may be driven by power derived from any suitable source.

In general the pump proper of this invention comprises a casing which contains a pressure chamber 16 having the form of a volute, an inlet eye 17 arranged centrally on the front side of this chamber and axially in line with the driving shaft, and an outlet spout 18 extending tangentially from a peripheral part of the pressure chamber, and a rotary impeller or runner arranged within the pressure chamber and mounted on the front end of the driving shaft and adapted to draw the fluid to be pumped axially inward through the inlet eye 17 into the pressure chamber 16, rotate the same circumferentially within the latter and then discharge it tangentially therefrom through the peripheral outlet 18.

The main members which form the enclosure or housing of the casing include a circumferential wall, a front transverse side wall and a rear transverse side wall. The circumferential wall of the pressure chamber is preferably made from a bar or strip of weldable metal which is rolled so that it is channel shape or U-shape in cross section and bent so as to form a peripheral wall 19 which is of substantially cylindrical shape but is open or split at one part thereof and terminates at its ends on opposite sides of this split in two tangential wings 20, 21 which are spaced apart transversely and form two longitudinal wall sections of the enclosure constituting the tubular outlet spout 18 of the casing, as shown in Fig. 4. At its front and rear edges this peripheral wall of the pressure chamber is provided with outwardly projecting flanges 22, 23 and at their front and rear edges the outlet spout walls 20, 21 are provided with outwardly projecting coupling flanges 24, 25, respectively.

The front wall of the pump casing comprises a flat main section 26 which is generally of disk form and secured at its edge to the front coupling flange 22 of the peripheral wall of the pressure chamber and is provided at one part of its peripheral edge with a tangential cheek 27 of flat form extending across the space between the outer and inner wings or spout walls 20, 21 and secured to the front flanges 24 of these wings. The main disk section 26 of the front casing wall

and its tangential cheek 27 are preferably formed integrally from a single plate or sheet of weldable metal.

The edge of the front casing wall is detachably connected with the front coupling flanges 22 of the peripheral wall by means of bolts 26, and the opposite edges of the cheek 27 are likewise connected with the corresponding coupling flanges 24, 24 at the front edges of the longitudinal wings or walls 20, 21 of the discharge spout 18 by means of bolts 29.

Axially in line with the driving shaft the disk section 26 of the front casing wall is provided with an opening 30 in which the rear end of a metal tube 31 is secured by welding 32, this tube forming the main part of the eye or inlet 17 through which the fluid to be pumped is conducted into the pressure chamber of the pump. At its front or outer end this metal inlet tube has secured to its periphery by welding 33 a coupling flange 34 of metal whereby the inlet tube of the casing is coupled with suitable piping through which the liquid to be pumped is supplied to the casing.

For the purpose of maintaining the front wall of the casing in a flat condition and preventing the same from being distorted by pressure within the casing, means are provided for strengthening the same, this being preferably accomplished by a plurality of radial stiffening or reinforcing ribs 35 which are secured to the outer side of the front casing wall 26 and to the adjacent external surfaces of the inlet tube 31 and its coupling flange 34 by means of welding. These stiffening ribs are also constructed of strips of flat metal which have been rolled and cut into the required shape.

The rear side wall of the casing of the pressure chamber and its discharge spout are also constructed from a single sheet of plate metal which has been rolled and cut into shape so as to form a main disk section 36 which is arranged transversely in rear of the peripheral wall 19 of the casing and a tangential cheek or section 37 which extends transversely across the rear edges of the longitudinal walls or wings 20, 21 of the discharge spout 18. The driving shaft extends through the central part of this disk of the rear wall and is operatively connected at its front end with the impeller which is arranged within the pressure chamber of the casing. The edge of the disk of the rear wall is connected by bolts 38 with the rear coupling flange 23 on the peripheral wall of the casing and the transverse cheek 37 of this rear wall is also connected by means of bolts 39 with the flanges 25, 25 on the rear edges of the longitudinal walls or wings 20, 21 of the discharge spout or outlet, as shown in Figs. 2, 4 and 6.

The numeral 40 represents tie bolts passing through the edges of the disks 26, 36 of the front and rear casing walls and the flanges 22, 23 of the peripheral or circumferential wall 19 of the case and having the heads and nuts at opposite ends of the bodies of these bolts bearing, respectively, against the outer sides of these walls for the purpose of tying the several walls of the casing firmly together, as shown in Fig. 3.

In its central part the disk section of the rear casing wall is provided with an opening 41 in which is secured, by welding 42, a tubular neck 43 of weldable metal which is axially in line with the driving shaft and surrounds the adjacent portion of the same and forms part of the casing. The numeral 44 represents an annular head secured at its periphery by welding 45 to the rear end of the casing neck 43 while its central part is provided with an opening 451 for the passage of the adjacent part of the driving shaft, as shown in Fig. 3. This casing head 44 together with the casing neck 43 form a recess or pocket 46 on the inner side of the rear casing wall which opens into the pressure chamber and is adapted to receive part of the hub 67 of the impeller.

On the outer side of the casing head a stuffing box is mounted which receives a packing and the adjacent part of the driving shaft and forms a joint therebetween for preventing leakage from the interior of the pressure chamber to the exterior of the same. This stuffing box, as best shown in Fig. 3, comprises a housing tube 47 of sheet metal surrounding the driving shaft and having its front end secured by welding 48 to the outer side of this head 44 and having its bore spaced from the periphery of the driving shaft so as to form an annular packing space therebetween, and an outwardly facing internal shoulder 49 on the outer side of the head 44, as shown in Fig. 3. The tube 47 is filled with a lubricating packing 50 of any suitable character and this is pressed inwardly toward the shoulder 49 by a gland 51 projecting into this tube and held in place in any suitable manner.

Strengthening of the rear casing wall, for the purpose of preventing pressure within the chamber 16 from distorting this wall, is preferably accomplished by means of a plurality of stiffening or strengthening ribs 52 of flat metal arranged radially around the outer side of the rear casing wall 36 and secured by welding to the outer side of this rear wall and the adjacent part of the casing neck 43 and the casing head 44, as shown in Fig. 3.

Various means may be employed for mounting the casing of the pump on the main frame but those shown in the drawings are preferred and constructed as follows:

The numeral 53 represents a supporting ring of weldable metal which is arranged concentrically around the driving shaft and associated parts and is secured by welding 54 to the several ribs 52 of the rear casing wall plate. This supporting ring together with the pump casing is detachably connected with the main frame of the pump by engaging the lower edge portion of the supporting ring 53 with a semi-circular seat or shoulder 55 on the front part of the main frame and detachably connecting this ring with the respective part of the main frame by a plurality of bolts 56, as shown in Figs. 1, 3 and 5. By these means the pump casing can be readily mounted on the main frame when originally installed and also quickly removed therefrom for inspection, adjustment and repairing whenever this is required. The supporting ring 53 is reinforced by stiffening ribs 57 of metal secured to the outer side of this ring by welding.

Means are provided which embody this invention whereby the tangential outlet or discharge spout 18 of the pressure chamber is connected with a delivery piping or conduit for carrying the liquid which has been pumped to the desired destination. The preferred means for this purpose which are shown in Figs. 1, 2 and 4 are constructed as follows:

The numeral 75 represents an annular coupling flange which has its inner side secured by welding to the outer edges of the transverse walls 27, 37 and the longitudinal walls 20, 21 of the delivery spout 18, this coupling ring being also connected

by welding to metal brackets 58 which are welded to the outer side of the transverse walls 27, 37.

The numeral 59 represents an adaptor tube which may form part of the piping whereby the liquid being pumped is carried away from the discharge spout and which, as shown in Figs. 1, 2 and 4, may be connected with this discharge spout 18 by means of bolts 60 passing through external coupling flanges on the inner end of this adaptor tube and the coupling flange 75 which is permanently connected with the discharge spout.

The impeller whereby the fluid to be pumped is drawn into the casing through the inlet eye 17 of the same and discharged through the tangential outlet 18 thereof may be variously constructed, that form shown in Figs. 2, 3 and 4 being constructed as follows:

The numeral 67 represents the hub of the impeller which is provided with a conical bore engaging with the conical front end of the driving shaft and held thereon by a retaining nut 68 screwed onto the driving shaft and bearing against the inner end of this hub. From the inner part of the impeller hub a rear shroud 69 of disk shape projects transversely therefrom. Within the front part of the pressure chamber is arranged a front shroud 70 having the form of a ring, the central opening of which registers with the inlet eye 17 of the pump casing and admits liquid therefrom to the space between the front and rear shrouds.

The numeral 71 represents a plurality of curved impeller vanes or blades which extend across the space between the front and rear shrouds and are preferably integrally connected therewith. As this impeller rotates in the direction of the arrow indicated in Fig. 4, the liquid in the pump is drawn through the inlet eye 17 into the space between the shrouds of the impeller and then this liquid is rotated in the pressure chamber and discharged therefrom through the tangential outlet thereof in a manner common to this type of pump.

In order to protect the internal surfaces or parts of the pump against wear and corrosion when the same is utilized for pumping liquids containing abrasive materials or chemicals which have a destructive effect on iron or steel, of which the main parts of the pump are constructed, the inner surfaces of the pump are provided with protective linings or coverings of a character which will resist wear or corrosion depending upon the character of the material which is being pumped.

The means for thus protecting the internal surfaces of the pump against wear or corrosion are constructed as follows:

The numeral 61 represents a protecting lining section having the form of a flat disk which is secured to the inner side of the front casing wall 26 and provided centrally with a forwardly projecting protecting lining tube 62 which is arranged in the bore of the inlet tube 31 of the casing. At its periphery this lining disk 61 is provided with a tangential protecting tab 63 which covers the inner side of the tangential cheek 27 forming the front wall of the discharge spout 18. The edges of the lining disk 61 and the lining tab 63 are arranged between the flanges 22 and 24 on the front edges of the cylindrical casing wall 19 and its wings 20, 21 and these members are connected by bolts 28, 29, whereby these parts of the lining also form gaskets or packings and produce a tight joint between the respective parts of the casing.

The numeral 64 represents the flat disk section of a protecting lining secured to the inner side of the rear casing wall 36 and provided centrally with a rearwardly projecting tube 65 which is arranged in the bore of the tubular neck 43 so as to form a protecting lining therefor.

At one part of its peripheral edge the rear lining disk 64 is provided with a tangential tab 66 which extends across the flanges 25, 25 on the rear edges of the wings 20, 21 of the discharge spout and forms a protecting lining for the rear cheek 37 of the rear casing wall 36. The edge portions of the disk 64 and its tangential tab 66 are arranged, respectively, between the flanges 23, 25 on the rear edges of the cylindrical wall section 19 and its wings 20, 21 and the edges of the rear wall disk 36 and its cheek 37 and clamped between the same by bolts 40, 39 so that the lining sections 64, 66 serve as a gasket between the respective parts of the pump casing whereby leakage from the interior of the pressure chamber to the exterior of the pump is prevented.

The numeral 76 represents a protecting lining section having the form of a split cylinder and covering the inner side of the cylindrical peripheral wall 19 of the casing and having its ends on opposite sides of its split part provided with inner and outer tangential flaps 77, 78 which are arranged lengthwise and cover the inner sides of the longitudinal wings 20, 21 of the casing outlet spout 18, as shown in Fig. 6. The cylindrical lining section 76 engages its front and rear edges with inner opposing sides of the marginal parts of the front and rear protecting disk lining sections 61, 64, as shown in Fig. 3, and the front and rear edges of the inner and outer lining flaps 77, 78 of this cylindrical lining section engage with the vertical edge portions of the front and rear lining tabs 63, 66 of the outlet spout 18, as shown in Fig. 6.

By these means virtually the entire inner surfaces of the casing are covered with protecting material.

When this pump is used for propelling liquids of an abrasive character these lining members are preferably constructed of rubber or similar resilient material which is wear resistant and when rubber is used as a protecting lining these several members are connected with respective metal parts of the pump by vulcanization. When, however, this lining is composed of material which is intended to render the internal surfaces of the pump corrosion resistant these protecting members may be constructed of lead or other metal or material best suited to the particular liquid which is being pumped. Metallic linings may be secured to the inner surfaces of the respective pump members by welding or any other suitable method.

For the purpose of protecting the main surfaces of the impeller which come into immediate contact with the liquid which is being pumped and thereby save them from undue wear or corrosion the following means are provided:

The numeral 72 represents a protecting covering of rubber or equivalent material which completely covers or envelopes the opposite flat sides and edges of front shroud 70, as shown in Fig. 3.

Each of the impeller blades or vanes 71 is completely covered on its opposite curved sides and on its edges by a protection covering 74 of rubber or the like, as shown in Figs. 3 and 4.

The rear shroud 69 of the impeller is protected by a covering of rubber or similar material which comprises an inner disk shaped lining section 73

secured to the inner side of the rear shroud and provided centrally with an opening 75 through which the front end of the driving shaft projects, an outer disk shaped lining section 76 secured to the outer side of the rear shroud and connected at its peripheral edge with the corresponding edge of the inner lining section by a web 90 extending over the peripheral edge of the rear shroud, and a tubular collar 91 projecting rearwardly from the central part of the outer lining section 76 and secured to the periphery of the impeller hub 67.

At its front end the hub of the impeller is provided with an annular shoulder or rabbet 92 which projects forwardly through the central opening 75 of the inner lining section of the rear shroud. Upon tightening the screw nut 68 on the impeller shaft the central part of this nut bears against central part of the impeller hub and the peripheral part of this nut bears against the inner edge portion of the lining section 73 around the central opening 75 thereof and presses same firmly against the impeller hub, as shown in Fig. 3.

As a whole the several parts of this pump are extremely light thereby permitting the same to be easily handled for transportation and for lining and relining. The interior of the pump is readily accessible for lining or relining and also enables a better and more reliable bond to be obtained between the lining sections and the metal members of the pump to which they are attached. Inasmuch as most of the several members of this pump are made of sheet metal, such as steel or an alloy, these members can be economically pre-fabricated by cutting or stamping, thereby eliminating the high costs attending the manufacture of pumps as heretofore constructed and also permitting of readily applying natural rubber or synthetic rubber to those surfaces which are engaged by the stream of liquid which is being pumped. Moreover, by making the main parts of this pump of sheetlike or rolled metal, comparatively smooth surfaces are presented on the inner side of the pump for attachment of the protecting linings thereto which can be accomplished more readily than attaching such linings to the rough surfaces of castings.

The use of sheet metal for making the major parts of this pump instead of using castings has the further advantage that it eliminates to a very large extent machine work which is required when making parts of cast iron as has been the practice heretofore.

I claim as my invention:

A centrifugal pump comprising a casing containing a pressure chamber, an axial inlet on one side of said chamber and a tangential outlet on the periphery of said chamber, and an impeller rotatable in said chamber; said casing including a split cylindrical section forming a peripheral wall of said pressure chamber and two wings at opposite ends of the cylindrical section and forming the longitudinal walls of said outlet, a front transverse wall plate having a front main disk section secured at its edge to the front edge of said cylindrical section and forming the front wall of the pressure chamber, and a tangential front cheek arranged on the edge of said front disk section and secured to the front edges of said wings and forming the front wall of said outlet, a rear transverse wall plate having a rear main disk section secured at its edge to the rear edge of said cylindrical section and forming the rear wall of the pressure chamber, a tangential rear cheek arranged on the edge of said rear disk and secured to the rear edges of said wings and forming the rear wall of said outlet, stiffening ribs secured to the outer side of said rear wall disk section, a main frame having a seat, and means for mounting said casing on said frame including a supporting ring secured permanently to said stiffening ribs and engaging said seat, and bolts detachably connecting said supporting ring with said frame.

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