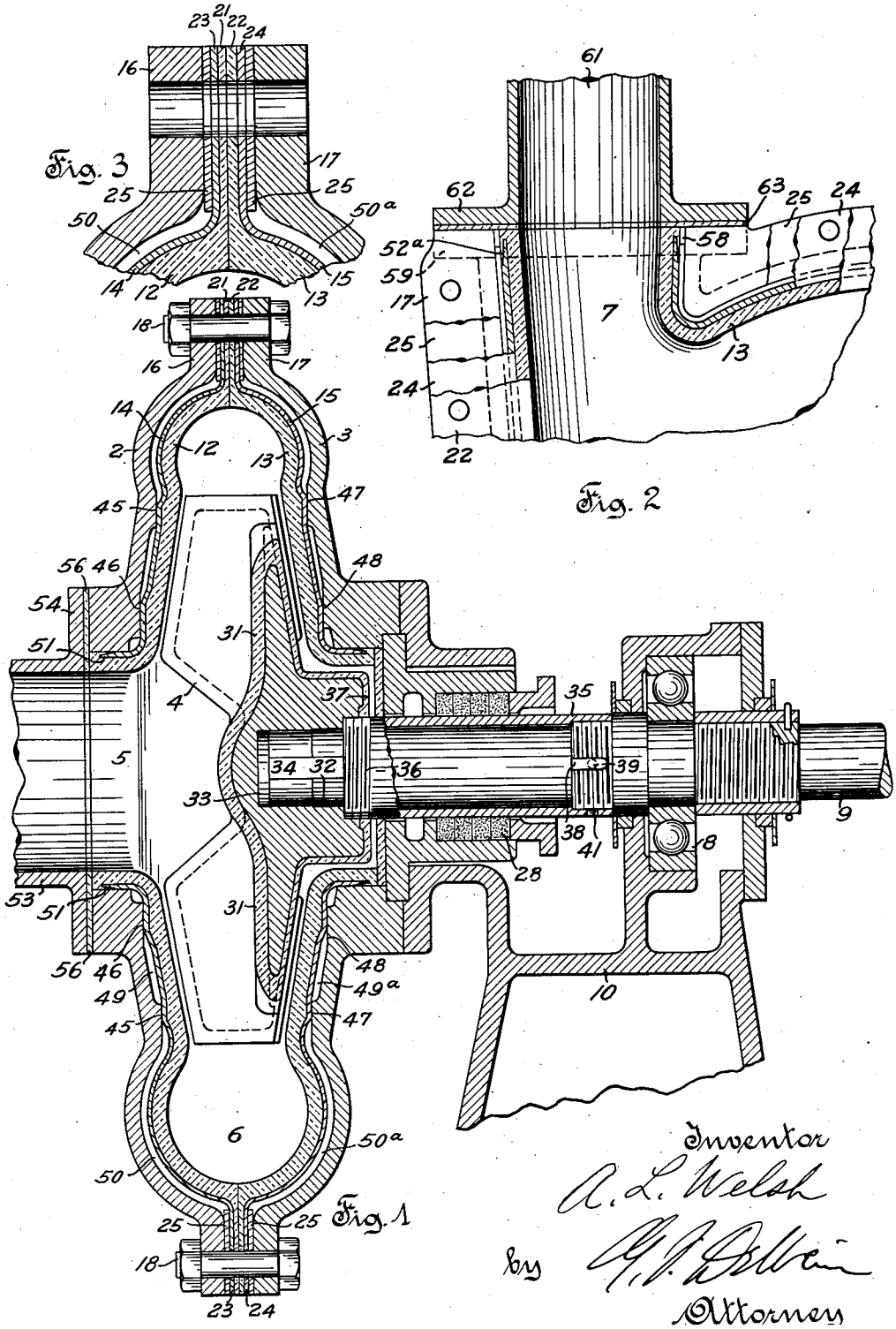
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PUMP OR THE LIKE

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## PUMP OR THE LIKE.

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This invention relates in general to fluid pumping apparatus, or the like, and it has more particular relation to fluid pumps wherein either the rotor, or both the rotor and casing, are provided with a protective coating or liner for the purpose of preventing or reducing erosion of the structure of these elements.

The matter of erosion of parts of fluid pumps and the like has been a serious problem, especially when the material handled is of an acid or a sandy or gritty nature. The latest improvements in connection with apparatus adapted for this general class of work includes the provision of a liner for the casing of the apparatus, or preferably for both the casing and rotor, of a relatively soft, resilient rubber, a material which has decided acid resistant qualities and, further, is highly resistant to the abrading or erosion action of sandy or gritty material. A commercial type of pump of this general character is disclosed in U. S. Patent No. 1,404,717, granted to N. W. Humphrey on Jan. 24, 1922, the pump therein disclosed including liners or coverings of relatively soft rubber for both the casing and impeller, the liner for the casing element being preliminarily assembled on and anchored to a relatively thin, flexible sheet metal backing plate of a configuration closely approximating that of the inner wall of the casing.

One specific feature and object of the present invention is concerned with an improved method and construction for assembling and holding the casing liner in operative position in the casing. Highly satisfactory commercial results are secured in apparatus of this type through the provisions disclosed herein, in accordance with which the flexible rubber liner or the backing plate therefor, both being usually formed in separable sections, or both the liner and backing plate sections, are provided with peripheral flanges which are positioned and held between corresponding peripheral flanges on the sections of the casing. Through this feature of design and construction, the flanges on the liner assist in properly centering or positioning and holding the liner in effective manner in the casing, and they likewise are of utility in effectively gasketing the joint at the flanges on the casing.

This and other objects and advantages are attained by the present invention, various novel features of which will be apparent from the description and drawings, disclosing an embodiment of the invention, and will be more particularly pointed out in the claims.

The present invention finds particular utility in connection with apparatus embodying the inventions of N. W. Humphrey, disclosed in his aforementioned Patent No. 1,404,717, and his Patent No. 1,591,939, July 6, 1926, the latter relating to improvements concerning the sealing of joints or connections of inlet and outlet conduits to the pump casing.

In the accompanying drawings:

Fig. 1 is a vertical section of a rubber-lined pump embodying features of the present invention.

Fig. 2 is a vertical sectional view of the discharge portion of the pump disclosed in Fig. 1.

Fig. 3 is an enlarged vertical section showing a detail of the present invention.

As disclosed in the drawings, the main outer casing of a centrifugal pump is formed in two sections 2, 3, a rotor or impeller 4 within the casing, an inlet or suction passage 5 leading into the casing in line with the center of the impeller, and an annular discharge chamber 6 surrounding the impeller and communicating with a tangential discharge conduit 7.

A bearing 8 for the shaft 9 of the impeller is carried by a base or frame 10, and the casing of the pump is supported from the end of this base or frame. The inner wall of the casing sections 2, 3, are protected by sections of a soft rubber liner 12, 13, respectively, which are preferably preliminarily secured or anchored as by vulcanizing, the metal backing plates 14, 15, respectively. The casing sections with the liner sections assembled therein, are clamped and held together by means of peripheral flanges 16, 17 on the casing sections which are provided with openings for receiving clamping bolts 18 which also pass through flanges 21, 22 of the rubber liner sections and flanges 23, 24 of the metal backing plates, and serve to hold these sections in assembled condition within the casing wherein they form a complete fluid-tight covering for the interior of the casing, the structure being effectively

sealed by these coacting flanges on the parts. The preferred arrangement of the peripheral flanges on the liner sections and the method of securing the same in position between the flanges of the casing sections are disclosed more in detail in Fig. 3. Sheet metal disks or clamping plates 25 may be inserted between the casing flanges and the flanges on the liner sections to prevent distortion of the latter. Removal of the casing section 2 with its liner section permits free access to all portions of the interior of the casing, without necessitating disturbance of the pump supporting section 3.

The impeller 4 comprises a series of outwardly directed vanes extending from the suction passage 5 to the discharge chamber 6, and a hub formed integrally with the vanes and constituting a support therefor. The hub portion of the impeller extends into a tubular portion of the casing section 3 at the inner side thereof opposite the inlet 5, the open end of this tubular portion being closed by a stuffing box 28 through which the shaft of the impeller passes in fluid tight relation. The entire impeller, including the vanes and the hub, is provided with a coating 31 of soft rubber or similar resilient material which is adapted to protect the structure of the impeller against the action of gritty substance or chemicals having an erosive effect, which may be contained in the fluid passing through the pump. The impeller hub is bored to snugly fit the reduced end portions 32, 33 of the impeller shaft, and is drivingly connected to the shaft by means of one or more keys 34 located in suitable key ways in the hub and shaft.

Means are provided to permit adjustment of the impeller 4 relative to the casing sections after the pump is assembled, these means being operable from the exterior of the casing and, besides performing this adjustment function serving to effect removal of the impeller from its shaft, when the casing section 2 is removed. This impeller adjusting and removing means comprises an annular sleeve 35 surrounding the shaft and extending through the stuffing box 28. The end of the sleeve adjacent the hub is provided with an external left hand screw thread 36 coacting with an internal screw thread on the hub. The portion 37 of the coating 31 at the inner side of the hub snugly fits the peripheral surface of the sleeve 35, thereby preventing fluid from entering the screw thread 36. The end of the sleeve 35 remote from the impeller is provided with an internal right hand screw thread coacting with an external screw thread on the adjacent portion of the shaft. This threaded portion has a series of longitudinal recesses 38 within one of which a set screw 39, passing transversely through the sleeve, may coact to lock to the shaft in adjusted position. The internally threaded end of the sleeve 35 is located between the gland of the stuffing box and the bearing, and is provided with one or more holes 41 to receive a tool for rotating the sleeve relative to the shaft, when the set screw 39 is removed. The sleeve 35, besides serving for adjusting and removing the impeller 4, is preferably formed of suitable wear-resisting material so as to provide protection for the portion of the shaft within the sleeve.

Instead of having the side walls of the backing plates for the liner sections supported throughout the entire surface thereof on the inner wall of the casing sections, the sections of the backing plates engage and are supported by the casing only at spaced points which are preferably accurately machined to provide close engagement and efficient support of the liner by the casing. These surfaces or pads on the casing sections with which the cooperative surfaces on the backing plates engage, are indicated at 45, 46 on the casing section 2 and at 47, 48 on the casing section 3, and they are preferably of annular form and, hence, may be readily machined, and they may be considered as gauge points for properly positioning the liner sections. The backing plates may be made of the same size as or slightly larger than the interior of the pump, and being comparatively thin and flexible, they will readily snugly seat themselves on the pump casing, properly conforming in shape to that of the interior of the casing and thus leaving annular spaces 49, 50 and $49^a$, $50^a$ between themselves and the casing.

When the casing sections are secured together by means of the bolts 18 passing through the casing flanges and the flanges of the liner sections, the coacting portions of the liner sections are effectively brought into engagement with and are supported by the gauge points or machined pads on the inner wall of the casing sections. If desired, the spaces between the metal backing plates of the liner section and the inner wall of the casing may be filled with an initially plastic material, preferably one adapted to resist the action of any acid or other deleterious substance in the fluid passing through the pump.

It will be apparent that the provision of suitable seats or finished high spots or surfaces of engagement between the backing plates of the liner sections and the inner wall of the casing sections greatly reduces the cost of manufacture and it cooperates with the provision of coacting peripheral flanges on the liner sections in securing accurate centering and in insuring the obtaining and maintaining of proper clearances.

As indicated more in detail in Fig. 3, the tubular portion of the backing plate section 14 for the rubber liner section 12 is tapered

along its outer wall at the inlet 5, as indicated at 51, and the rubber liner extends axially beyond the end of this tubular portion of the backing plate, preferably to or beyond the outer surface of the inlet portion of the casing section; and the material of the rubber liner at this point surrounds the beveled portion of the backing plate, the effect being that the outer tubular end of this backing plate section is embedded in the rubber material of the liner, being anchored therein as by initial vulcanizing. The material of the liner is in substantial engagement at this point with the body portion, or pads thereon, of the wall of the inlet portion 5 of the casing section.

The pump is connected to an inlet conduit 53, preferably by means of an end flange 54 on the conduit and a soft rubber or other resilient gasket 56 disposed between the flange 54 and the outer surface of the tubular portion 26 of the rubber liner and the tubular inlet 5 of the casing. When the inlet conduit is bolted or otherwise clamped in operative position through its flange, the parts effectively seal and prevent the entrance of fluid to the space between the liner and its backing plate and the inner wall of the casing section.

At the tangential discharge 7 of the pump casing, the semi-circular ends of the casing sections and the liner therefor are clamped in operative position by means of the peripheral flanges on the casing and the corresponding flanges on the liner sections which are held between the casing flanges. As indicated at $52^a$ in Fig. 2, the outer end of the tubular portion of the backing plate sections is beveled and terminates short of the corresponding portion of the rubber liner sections, the latter being so formed as to extend outside of and surround the beveled end portion of the backing plate sections, as at the inlet conduit, these latter portions being anchored, as by vulcanizing, within the rubber portions. This outer tubular portion of the liner sections is positioned and supported in the discharge 7 preferably through engagement with an interior annular rib or spaced lugs 58 on the inner surface of the casing adjacent the flange portions 59. The rib or lugs 58, and the engagement between the same and the liner sections may be considered the equivalent of additional gauge points for positioning the liner sections within the casing.

A discharge conduit 61 is secured in operative position relative to the tangential discharge 7 of the casing, preferably by means of a flange 62 on the conduit and an intermediate rubber or other flexible gasket 63 which covers the enlarged outer end of the rubber liner sections and the flange 59 on the casing sections at this point, the arrangement being such as to force and hold the parts in such secure and fluid-tight manner as to prevent the leakage of fluid to the space between the backing plates of the liner sections and the inner wall of the pump casing.

As indicated, effective fluid-tight closure of the space between the liner and the casing wall, at the tubular portion of the casing at the inner side thereof, is secured by embedding the beveled end of the tubular portion of the backing in the rubber liner, a rubber or similar resilient gasket being inserted and held between the end of the rubber liner and the inner end of the stuffing box 28.

The features described herein as to terminating the metal backing plate short of the end of the rubber liner at the tubular inlet and discharge portions thereof and embedding the end of the backing plate in the rubber liner at these points are more specifically claimed in the aforementioned patent of N. W. Humphrey No. 1,591,939, July 6, 1926.

During the normal operation of the pump, the impeller is rotated within the casing, thereby causing the impeller vanes to deliver fluid into the discharge chamber 6 from which the fluid is discharged through the tangential discharge conduit 7. The fluid thus passing through the impeller is delivered from the suction passage 5 directly against the end of the impeller hub which is formed to deflect the flow and to direct the water toward the impeller vanes. The soft rubber liner sections of the casing and the coating 31 of the impeller serve to resist the destructive action of gritty substances or chemicals contained in the fluid, upon the pump elements. The protective liner sections and the coating on the impeller may be readily replaced when worn, free access to the interior of the pump for purpose of inspection or removal of coated elements being affected by removal of the bolts 18 of the casing section 2. The adjusting and removing device for the impeller and its shaft is readily operable from the exterior of the pump casing and entirely avoids the necessity of puncturing or perforating the coating 31 of the impeller. It will be apparent that the adjustable mounting of the impeller on the shaft enables rapid adjustment and removal of the impeller and permits the latter to be entirely removed without necessitating removal of the shaft 9 or the sleeve 35. This sleeve, moreover, provides efficient protection for that portion of the shaft located within the sleeve.

It will be apparent that the invention claimed is not limited to the exact details of construction shown and described, for obvious modications will be apparent to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. In a centrifugal pump, a casing having an axial inlet and a peripheral outlet,

said casing being divided on a central plane substantially at right angles to the axis and having flanges for securing the two parts together, a lining for the interior of the pump comprising a relatively thin flexible sheet metal backing and a rubber facing adapted to be pressably seated, said sheet metal backing being divided on substantially the same plane and provided with peripheral flanges at said divide, said latter flanges being clamped between the flanges of said casing, and serving as centering means for said backing and said rubber facing.

2. In a pump for pumping abrasive material, a casing being divided on a plane substantially at right angles to the axis and having flanges for securing the two parts together, a protective covering for the interior of said pump comprising a pressably seated sheet metal backing and a rubber facing, said said sheet metal backing being divided on substantially the same plane and provided with flanges for clamping between said casing flanges, said rubber facing being continued outwardly at said divide and providing a flange to lie between said sheet metal backing flanges whereby the casing divide is provided with a gasket, the flanges of said sheet metal backing serving as centering means for said protective covering as said sheet metal backing is pressably seated within said casing.

3. In a pump for pumping abrasive material, a casing being divided on a plane substantially at right angles to the axis and having flanges for clamping the two parts together, a protective lining for the interior of the pump comprising a relatively thin sheet metal backing being stamped to conform to said interior, a plurality of finished surfaces on said interior for forming a seat for said metal backing, flanges formed on said sheet metal backing on substantially the same plane, said casing flanges being gasketed by the last said flanges and when clamped together compressibly seating said backing in said casing.

4. In a pump for pumping abrasive material, a casing divided on a plane at substantially right angles to its axis and having peripheral flanges, means for clamping the casing parts together, a protective lining for the interior of the pump comprising a relatively thin sheet metal backing and a rubber facing each having a peripheral flange lying in the plane of division of the casing and clamped between the casing flanges by said clamping means, said lining being centered by the pump parts and pressably seated within the casing by said clamping means.

5. In a centrifugal pump, a casing having an axial inlet and a peripheral outlet, said casing being divided on a central plane substantially at right angles to the axis and having flanges for securing the two sections of the casing together, and a lining for the interior of said casing comprising a relatively thin metal backing and a rubber facing therefor, said metal backing being divided on substantially the same plane as the casing and provided with peripheral flanges at said divide, said rubber facing provided with a peripheral flange adapted to lie between the peripheral flanges of said metal backing and to serve as a seal for the seam formed at the flanges of said casing sections, the flanges of said backing serving as centering means for properly seating the rubber facing when said latter flanges are clamped between the flanges of said casing sections.

6. In a pump for pumping abrasive material, a casing divided on a plane substantially at right angles to the axis and having flanges and clamping bolts for securing the two sections of the casing together, and a protective lining for the interior of the pump comprising a relatively thin sheet metal backing and a rubber facing therefor each having peripheral flanges adjacent the plane of division between the casing sections, said peripheral flanges of said lining lying between the casing flanges whereby said clamping bolts pass therethrough and serve to draw the flanges of said sheet metal backing and said rubber facing into position between said peripheral casing flanges for centering said protective lining as it is pressably seated within said casing by said clamping action.

7. In a pump for pumping abrasive material, a casing divided into a plurality of sections having flanges for facilitating securing said sections together, and a protective lining for the interior of said casing comprising a relatively soft rubber facing and a relatively thin sheet metal backing secured to said facing, said lining being divided in sections corresponding to said casing sections, and said sheet metal backing being provided with flanges for clamping between the casing flanges and serving to center said lining as the latter is seated in said casing.

8. In a pump for pumping abrasive material, a casing divided into a plurality of sections having flanges for facilitating securing said sections together, and a protective lining for the interior of said casing comprising a relatively soft rubber facing and a relatively thin sheet metal backing secured to said facing, said lining being divided in sections corresponding to said casing sections, and said rubber facing being provided with flanges for clamping between said casing flanges and serving to seal the joint between the casing sections in a fluid-tight manner.

9. In a pump for pumping abrasive material, a casing divided into a plurality of sections having flanges for facilitating securing said sections together, a protective lin-

ing for the interior of said casing comprising a relatively soft rubber facing and a relatively thin sheet metal backing secured to said facing, said lining being divided in sections corresponding to said casing sections, and said rubber facing and said sheet metal backing being provided with flanges for clamping between said casing flanges and serving to position said lining as the latter is seated in said casing and to seal the joint between the casing sections in fluid-tight manner.

10. In a centrifugal pump, a casing divided into a plurality of sections having flanges for facilitating securing said sections together, and a protective lining for the interior of said casing comprising an erosion-resisting composition facing and a relatively thin sheet metal backing secured to said facing, said lining being divided in sections corresponding to said casing sections, and said sheet metal backing being provided with flanges for clamping between the casing flanges and serving to center said lining as the latter is seated in said casing.

11. In a centrifugal pump, a casing divided into a plurality of sections having flanges for facilitating securing said sections together, and a protective lining for the interior of said casing comprising an erosion-resisting composition facing and a relatively thin sheet metal backing secured to said facing, said lining being divided in sections corresponding to said casing sections, and said composition facing being provided with flanges for clamping between said casing flanges and serving to assist in sealing the joint between the casing sections in a fluid-tight manner.

12. In a centrifugal pump, a casing divided into a plurality of sections having flanges for facilitating securing said sections together, and a protective lining for the interior of said casing comprising an erosion-resisting composition facing and a relatively thin sheet metal backing secured to said facing, said lining being divided in sections corresponding to said casing sections, and said composition facing and said sheet metal backing being provided with flanges for clamping between said casing flanges and serving to position said liner as the latter is seated in the casing and to assist in sealing the joint between the casing sections in a fluid-tight manner.

13. In a pump for pumping abrasive material, a casing, a protective lining for the interior of said casing, said lining comprising a facing of soft resilient material and a resilient supporting backing therefor, said casing being divided into sections to permit lateral removal of said lining, flanges formed on said casing at said divide, and a resilient extension formed on said protective lining to serve as a gasket between adjacent sections of said casing.

In testimony whereof, the signature of the inventor is affixed hereto.

ALFRED L. WELSH.