

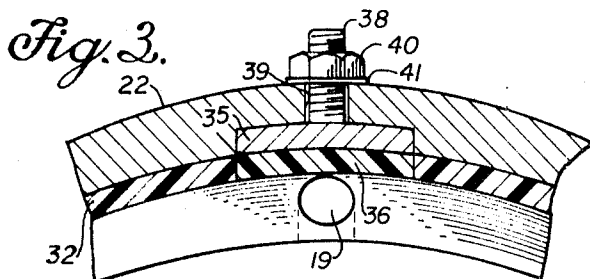
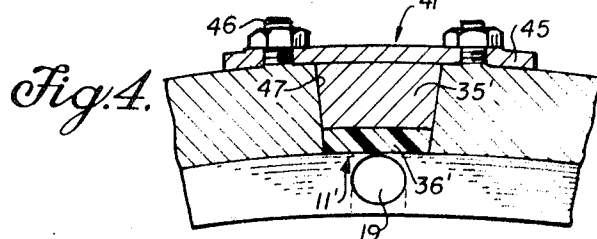
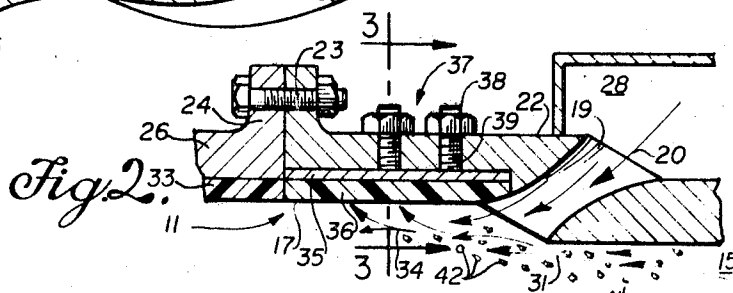
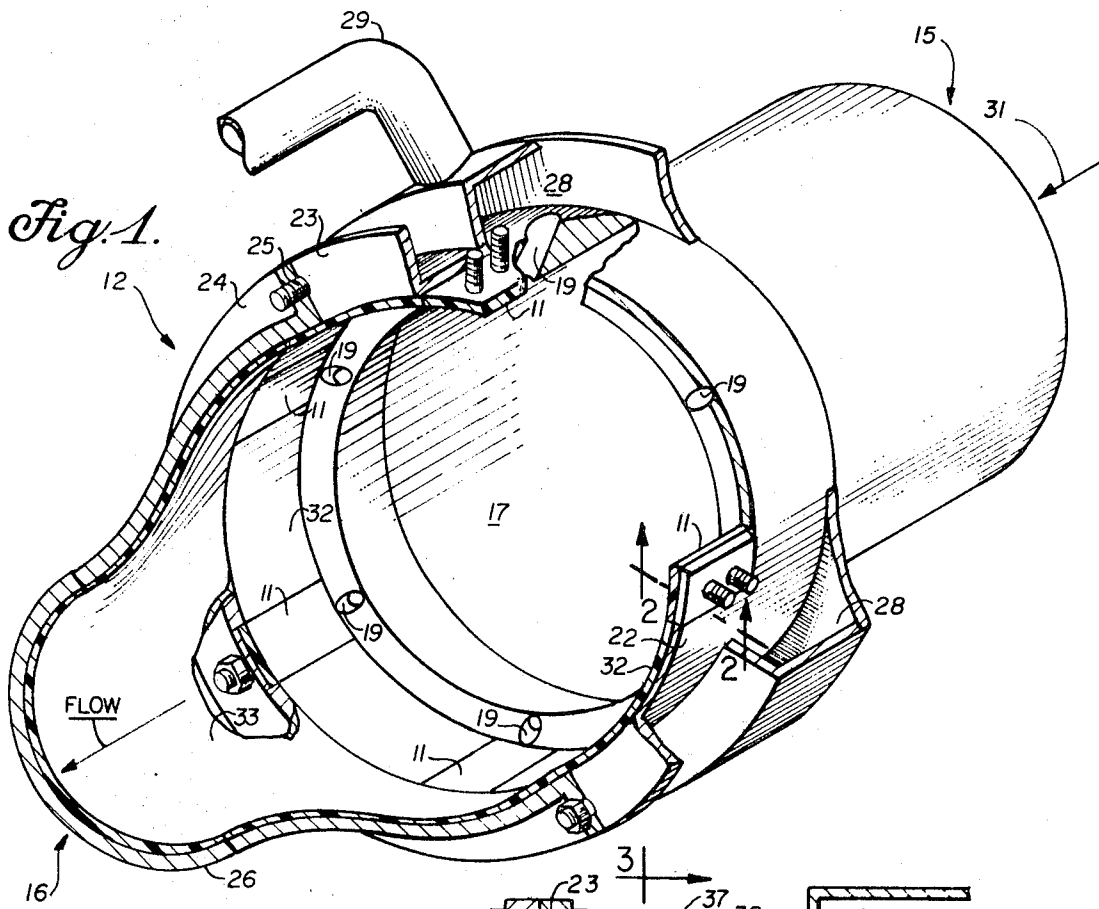
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WEAR RESISTANT SHOE FOR PUMPS

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WEAR RESISTANT SHOE FOR PUMPS

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4 Claims

ABSTRACT OF THE DISCLOSURE

A jet pump having multiple peripheral jet orifices is provided with individually replaceable wear resistant shoes downstream of the jet nozzle at the point of greatest wear to the pump wall due to the abrasive action of particles entrained in the fluid being pumped by the jet of fluid emitted from the nozzles.

BACKGROUND OF INVENTION

This invention relates generally to elements for pumps and in particular to liners and materials for use inside the pump.

Although wear resistant liners have been successfully employed in pumps of the prior art to reduce maintenance problems and to lengthen the pump life, such liners are generally not designed to be either effective against localized wear or readily replaceable.

There are always regions within a pump where turbulence and changes in fluid flow will cause suspended abrasive particles to contact the pump walls and result in localized wear. In jet pumps, especially those used to pump slurries or combined liquids and suspended solids such as occurring in dredging operations, tend to exhibit accelerated wear immediately downstream from the jet nozzles. This wear may be particularly noticeable when the nozzles are located peripherally about a cylindrical pump housing and directed at an angle inwardly into the pumping chamber.

SUMMARY OF THE INVENTION

The wear resistant shoe of the present invention overcomes the problem of maintenance against localized wear and further increases pump life by being placed at the point of greatest localized wear immediately downstream from the jet nozzle. The shoe of the present invention is arranged to be easily replaceable without the necessity of replacing the entire pump liner and uses a wear resistant liner to further aid in resisting abrasive wear.

It is therefore an object of the present invention to provide a wear resistant liner for a pump at points of localized wear.

It is a further object of the present invention to provide a wear resistant liner for a pump at the point of greatest localized wear.

It is still another object of the present invention to provide a pump liner shoe that is resistant to localized wear which is replaceable from the exterior of the pump.

Other and more particular objects of this invention will be manifest upon study of the following detailed description when taken together with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of a partial cut-away section of a jet pump showing the wear resistant shoe of the present invention as it is typically used in a pump.

FIG. 2 is a longitudinal section through the center of a typical wear resistant shoe taken at lines 2-2 in FIG. 1.

FIG. 3 is a lateral section through the wear resistant shoe taken at lines 3-3 in FIG. 2.

FIG. 4 is a lateral section through a second embodiment of the wear resistant shoe of the present invention

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in which the shoe is replaceable from the exterior of the pump.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Typical wear resistant shoes 11 of the present invention are shown in FIG. 1, installed in a jet pump 12 which is typical of most pumps used for pumping slurries or fluids having large amounts of suspended abrasive particles such as sand or small rocks.

Pump 12 comprises, basically, a suction or inlet end 15, a discharge or outlet 16 with a pressure chamber 17 therebetween into which jet nozzles 19 direct a driving fluid, indicated by arrows 20, in a direction toward discharge end 16.

Pressure chamber 17 is enclosed in a housing 22 which is adapted to receive shoes 11 and includes a flange 23 toward the downstream end of chamber 17 adapted to receive a like flange 24 of bell connection member 26. Matching bolt holes 25 are provided in flanges 23 and 24 to establish a rigid connection.

An annular driving fluid supply chamber 28 is arranged circumferentially around housing 22 in order to provide driving fluid to nozzle 19. A supply pipe 29 provides the driving fluid to chamber 28 from a separate pump (not shown) and supply tank (not shown) which do not form a part of the apparatus of this invention.

Pump 12 operates by forcing a driving fluid under pressure through nozzle 19 into pressure chamber 17 wherein the fluid already contained in the chamber is entrained in the jet fluid emitted from the nozzle. The body of fluid in chamber 17 is caused to flow toward discharge end 16 creating a suction at inlet end 15, in turn causing fluid to flow into inlet end 15 as indicated by arrow 31.

When used in a dredging operation, or in an operation in which a slurry is being pumped, the solid particles which are entrained in the fluid and suspended there by its turbulence will tend to abraid against the walls of the pump and cause wear.

To prevent general abrasive wear, wear resistant liner 32 is provided along the inside surface of housing 22 downstream from jet nozzle 19. Bell connection member 26 is also provided with a similar wear resistant liner 33.

Both wear resistant liners 32 and 33 can be fabricated from any hard or resilient materials, such as manganese steel, nickel wear resistant steel, chromium steel, or ordinary rubber or neoprene, but good results have been found when the liner has been fabricated from a resilient material, in particular, urethane. A wide variety of wear resistant metallic alloys and non-metallic materials are well known in the art. The type of material selected will depend upon many factors such as the type and size of particles being pumped and the corrosive or solvent properties of the fluid.

It can be seen that the velocity and turbulence of fluid flowing immediately downstream from nozzle 19 is much greater than the general flow of fluid in chamber 17 due to the proximity of the area to nozzle 19 and to the turbulent flow caused, in part by wall friction and surface roughness and the high velocity fluid jets from nozzle 19 entering the relatively low velocity fluid moving through pressure chamber 17 toward discharge end 16. The particles of abrasive material suspended in the fluid will, because of the turbulence in the immediate downstream area of the nozzle, tend to be driven against the inside surface of housing 22 and cause accelerated wear in that area.

It is at this point of greatest wear that shoe 11 is installed as can be seen from FIG. 2. The flow of fluid out of nozzle 19, as indicated by arrow 20, entrains the fluid from inlet 15 to outlet 16, as indicated by arrows 31. The turbulent flow in the region immediately downstream of nozzle 19, as indicated by arrows 34, thus causes entrained

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and suspended abrasive particles 42 to impinge against the interior surface of shoe 11.

Replaceable shoes 11 of the present invention thus perform the function of absorbing this rapid localized abrasive wear and, as shown in FIGS. 2 and 3, comprises a backplate 35 on the face of which is attached a wear resistant liner 36 and on the back of which is attached a means 37 for fastening the shoe to housing 22. Wear resistant liner 36 may be fabricated from resilient materials such as ordinary rubber or neoprene, but good results have been found using urethane. Hard wear resistant materials such as manganese steel and the like, mentioned above, may also be used.

In the present embodiment, a pair of studs 38 passing through holes 39 in housing 22 are provided with nuts 40 and washers 41 for the purpose of attaching shoes 11 to housing 22. Other fastening means could be used, such as tongue and groove slots along the edges of shoe 11 (not shown), or the like.

For jet pumps having a throat diameter of 16" or larger, shoes 11 may be replaced without disassembly of the pump simply by cooperation of a workman crawling inside the pump to insert shoe 11 with one outside the pump to tighten nut 40.

However, for jet pumps having a diameter less than about 16", replacement of shoes 11 requires the removal or displacement to one side, of bell member 26 necessitating removal of bolts from flanges 23 and 24.

A second embodiment of the resilient wear resistant shoe of the present invention is illustrated in FIG. 4 whereby the shoe is replaceable from outside housing 22.

In this embodiment, the basic elements of the shoe are similar to the embodiment shown in FIGS. 2 and 3.

Shoe 11' comprises basically a backplate 35' on the face of which is attached wear resistant liner 36' and on the back of which is attached means 41' for attaching shoe 11' to housing 22.

Means 41' comprises a strong back 45, attached to backplate 35', as by welding, brazing, or the like, and bolts 46 which attach strong back 45 to the outside of housing 22 and which are also easily accessible from the outside of housing 22.

In the embodiment illustrated for shoe 11', an opening 47, adapted to receive shoe 11', must be provided in housing 22. This opening may be tapered to provide a seat upon which the edges of shoe 11' may engage, or a gasket or seal (not shown) may be installed to provide a fluid-tight assembly.

Although the two embodiments of wear resistant shoes illustrated and described herein are shown flush with the interior surface of housing 22, the shoes may also be situated in pump 12 projecting away, or spaced apart, from the interior surface of housing 22 to act as wear absorbing members which shield other parts of pump 12 from accelerated wear.

I claim:

1. In a jet pump assembly comprising an open ended housing having an upstream suction end, a downstream discharge end, a pressure chamber therebetween, and a multiplicity of nozzles arranged around the suction end of the pressure chamber for injecting a fluid into said pressure chamber in a downstream direction, a multiplicity of wear resistant shoes disposed downstream of said jet nozzles at the points of greatest localized wear caused

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by said fluid jets from said nozzles, said housing having recesses formed in the internal wall of the pressure chamber to receive said shoes with the wear surface there fitting flush with the internal wall of said pressure chamber, the wear surface of said shoes forming a continuation of the curvature of the internal wall of the pressure chamber, and means holding said shoes in place.

2. The wear resistant shoes of claim 1 wherein said means for holding said shoes in place includes at least one aperture through the wall of the pressure chamber in each of said recesses, at least one stud secured to each of said shoes and projecting through said respective apertures, and means engaging said studs outside said pressure chamber and holding said wear resistant shoes in said recesses.

3. In a jet pump assembly comprising an open ended housing having an upstream suction end, a downstream discharge end, a pressure chamber therebetween, and a multiplicity of nozzles arranged around the suction end of the pressure chamber for injecting a fluid into said pressure chamber in a downstream direction, a multiplicity of wear resistant shoes disposed downstream of said jet nozzles at the points of greatest localized wear caused by said fluid jets from said nozzles, said housing having openings formed through the wall of the pressure chamber to receive said shoes with the wear surface thereof fitting flush with the internal wall of said pressure chamber, said openings having at least two tapered walls converging toward the internal surface of said pressure chamber, said wear resistant shoes including tapered sides for mating with the walls of said openings to position said shoes with respect to the internal wall of said pressure chamber, the wear surface of said shoes forming a continuation of the curvature of the internal wall of the pressure chamber, and means holding said shoes in position.

4. The wear resistant shoes of claim 2 wherein said means for holding said shoes in position includes at least one pair of studs projecting from the outside of said pressure chamber housing on opposite sides of each of said openings, and strap means extending across said openings and held against said wear resistant shoes by means engaging said studs and said strap means.

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