

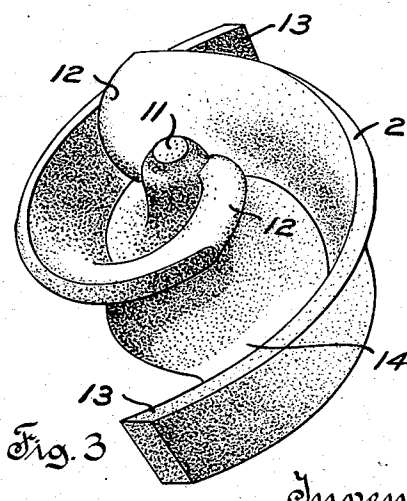
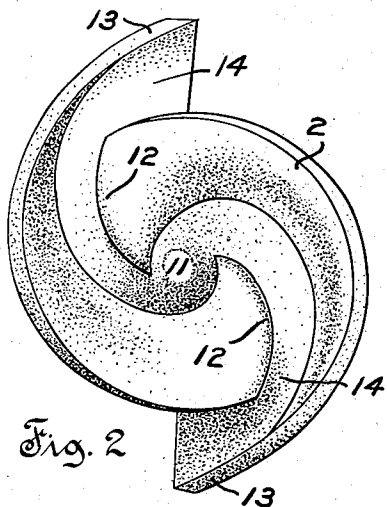
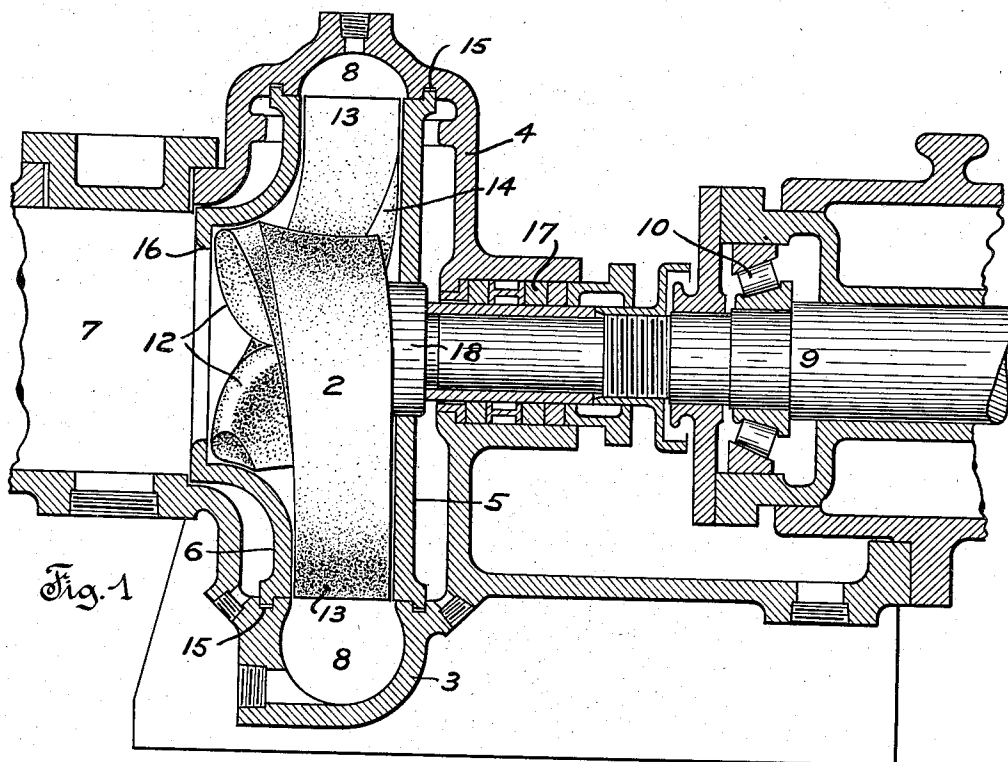
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The present invention relates in general to improvements in hydraulic machines, and relates more specifically to improvements in the construction and operation of rotary pumps especially adapted to operate upon relatively heavy fluids or liquids containing solid matter in suspension.

An object of the invention is to provide a centrifugal pump for handling liquids having solid substances in suspension, which is simple in construction and efficient in operation. Another object of the invention is to provide a rotary pump which will not clog due to the presence of solid particles in the liquid passing through the pump rotor. A further object of the invention is to provide a compact pump structure wherein the parts which are subjected to excessive wear may be readily replaced. Still another object of the invention is to provide an improved rotor for centrifugal pumps or the like. These and other objects and advantages will appear from the following description.

A clear conception of an embodiment of the invention and of the manner in which devices constructed in accordance therewith are adapted to operate, may be had by referring to the drawing accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the several views.

Fig. 1 is a longitudinal vertical section through a centrifugal pump structure, showing the pump impeller in elevation.

Fig. 2 is an end view of the improved pump impeller.

Fig. 3 is a perspective view of the improved pump impeller.

The centrifugal pump shown in detail in Fig. 1, comprises in general a casing consisting of a lower or base section 3, and an upper or cover section 4 cooperating therewith to form a housing for the impeller or rotor 2 which is carried by a main shaft 9 supported in a suitable bearing 10. The pump casing is provided at one end with a tubular extension which forms a suction passage 7 disposed coaxial with the rotor 2. Located within the casing sections 3, 4 is a set of annular liners 5, 6, each of which is

formed as a single complete ring held in place by the assembled casing sections 3, 4, the latter being provided with annular grooves cooperating with annular projections 16 formed on the ring liners. The liner 6 is provided with an inwardly projecting annular flange 16 forming an inlet eye communicating directly with the axial suction opening of the rotor 2. The casing sections 3, 4 are also provided with cooperating passages 8 which form a spiral delivery conduit in open communication with the peripheral discharge openings of the impeller 2. The main shaft 9 may be connected to any suitable driving means such as an electric motor or a pulley, and extends into the pump casing through a suitable stuffing box or packing 17 coacting with the base and cover sections 3, 4.

The improved impeller or rotor 2 forming an important part of the present invention, comprises a conical hub 11 and a pair of diametrically opposite vanes each of which extends spirally about the hub. The inlet edges 12 of the vanes diverge away from the hub and from the rotor axis, in order to provide an unobstructed axial suction opening leading into the impeller. The spiral fluid impelling surfaces of the vanes, are laterally inclined relative to the axis of the rotor, adjoining the inlet edges 12, and gradually approach axial parallelism at the discharge portions 13 of the vanes. The vane discharge portions 13 are connected to the conical central hub 11 by means of end walls 14 located remote from the suction side of the impeller, and the conical hub 11 has a bored projection 18 which is rigidly attached to the end of the main shaft 9. The formation of the impeller vanes is such that one side of the rotor is entirely open and the suction opening is free from obstruction, and is also such that the entering material is gradually deflected from axial flow to outward flow by the spiral vane surfaces, without permitting any of the material to cling to the impeller structure. While the vanes of the rotor 2 are disclosed as extending about the impeller axis, a distance more than 180°, this length may be materially reduced in some cases.

During normal operation of the pump the impeller 2 is rotated by means of the main shaft 9 in a counter-clockwise direction as viewed in Fig. 2, and the rotating spiral vanes cause the fluid to enter the suction opening from the inlet passage 7 and to travel along the internal surfaces of the impeller vanes until it is eventually delivered from the discharge portions 13 to the spiral discharge conduit 8. By virtue of the divergence of the inlet edge 12 and of the adjoining guiding surfaces of the vanes, solids which may be suspended in the liquid being pumped, are prevented from clinging to the rotor and thereby clogging the suction opening. Any solids entering the pump, quickly pass through the impeller passages, and are delivered from the rotor 2 through relatively wide openings at the periphery of the rotating structure. The fluid thus delivered from the rotor to the conduit 8 is discharged under pressure from the final discharge opening of the casing.

It will be noted that by utilizing only two vanes and by causing these vanes to extend spirally about the hub and about the impeller axis a comparatively great distance, relatively long impelling surfaces adapted to gradually change the direction of flow from axial to radial, are provided. The impeller by virtue of its formation with one side completely open, may be readily constructed and machined to provide smooth surfaces for the vanes. The wearing plates 5, 6 cooperate with the sides of the rotor 2 to provide for proper confinement of the liquid being pumped, and the inlet eye produced by the flange 16 of the plate 6 insures delivery of the fluid to the pump impeller without permitting particles to lodge at the relatively moving sealing surfaces. The formation of the inlet edges 12 of the vanes also provide a relatively unobstructed suction opening within the rotor, thereby positively eliminating danger of clogging. The liner plates 5, 6 are readily removable by virtue of the sectional construction of the pump casing and are effectively retained in normal position by the annular projections 15 cooperating with the casing recesses. These liner plates by virtue of their ring structure also tend to eliminate clogging by presenting smooth annular guiding surfaces, and additionally enhance the rigidity of the pump structure. Pumps constructed in accordance with the present invention have been producing efficiencies of over 80 per cent under the severe conditions of operation, without clogging.

It should be understood that it is not desired to limit the invention to the exact details of construction herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. A pump impeller comprising, a conical hub, and vanes extending spirally along and about the axis of said hub, the inlet edges of said vanes extending spirally and outwardly away from the smaller end of said hub to provide an unobstructed axial suction opening in advance of the hub apex, and the spiral fluid impelling surfaces of said vanes being laterally inclined relative to said axis adjoining said edges and gradually approaching axial parallelism at the discharge portion thereof.

2. A pump impeller comprising, a conical hub, and a pair of diametrically opposite vanes each extending spirally and outwardly away from the smaller end of said hub to provide an unobstructed axial suction opening in advance of the hub apex, and the spiral fluid impelling surfaces of said vanes being laterally inclined relative to said axis adjoining said edges and gradually approaching axial parallelism at the discharge portion thereof.

3. In a pump, a rotary conical hub, vanes rotatable with and extending spirally along and about the axis of said hub to form an impeller, the inlet edges of said vanes extending spirally and outwardly away from the smaller end of said hub to provide an unobstructed axial suction opening within said impeller and in advance of the hub apex and the spiral fluid impelling surfaces of said vanes being laterally inclined relative to said axis adjoining said edges and gradually approaching axial parallelism at the discharge portions thereof, a casing enclosing said impeller and having a suction opening communicating therewith, and a stationary renewable side plate secured to said casing and cooperating with said impeller to provide an unobstructed opening of less diameter than the suction opening of said casing communicating directly with the suction opening of said impeller.

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

FRANK H. PAATSCH.