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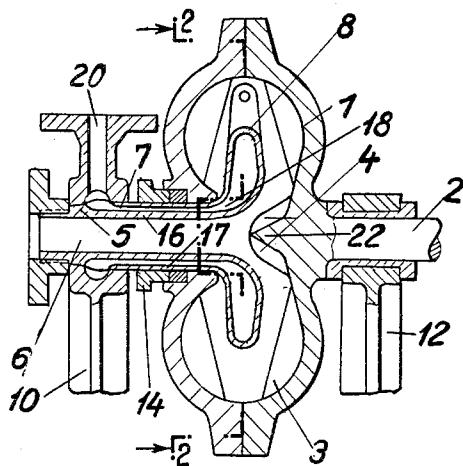


Fig. 1

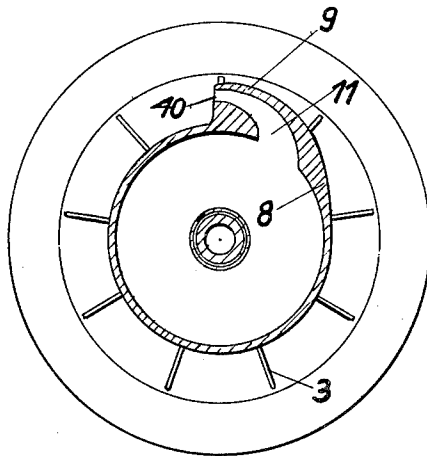


Fig. 2

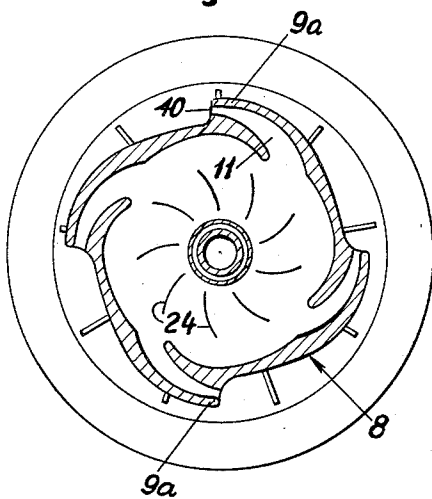


Fig. 4

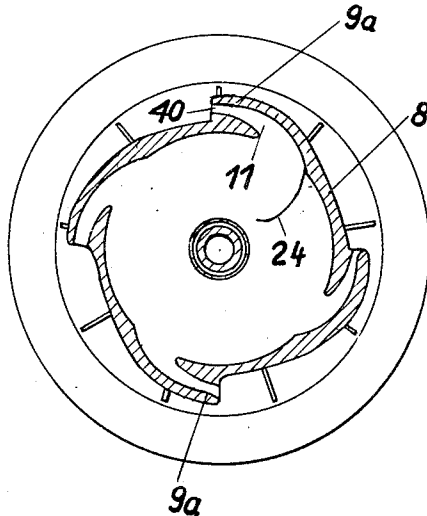


Fig. 3

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This invention relates in general to pumps and in particular to a hollow shaft rotating casing pump in which liquid is drawn in through a central hollow shaft and discharged through stationary scooping elements located within a chamber formed by a rotating casing member.

Prior to the present invention it has been known to provide a rotary pump having a stationary delivery member which includes a plurality of stationary vanes which extend into a hollow shaft and through which liquid is discharged through a high pressure zone in the pumping member. In such constructions the pumping liquid is usually admitted through a short pipe surrounding the hollow shaft. With such constructions, the individual vane or vanes which are utilized by the casing have relatively low resistance when the casing is wide or of great dimension, but can cause considerable resistance in a revolving casing which is of necessity narrow. The casing must be narrow in those instances where high pressures are to be generated and the rotating speed of the pump is very high. In the latter instance, this is necessary in order to avoid the high speed rotation of large masses. The resistance caused by the vanes acts as a brake not only on the revolving casing, but also on the liquid at the edges and at the rear side of the delivery vanes. Such pumps have the disadvantage of requiring high power input for operation and are limited in the output pressure which they might develop.

It has been found by test in accordance with the present invention that in the neighborhood of the delivery vane a current of liquid exists having a component with marked radial inward direction. Such a flow can be explained by the rotating speed of the delivery pumping liquid in the vicinity of the delivery vane. It has, furthermore, been found that in spite of an arrangement for central venting by means of a venting tube extending centrally into the pump casing, it is difficult to completely avoid air accumulation in the center of the casing with its attendant disadvantages such as lower output pressure and the formation of a head wave which wastes the input energy.

The delivery port at the vanes can only extend over a limited length radially. This is due to the fact that the pressure increases with the second power of the radius and a port of great radial length would lead to uneven pressure distribution over the port and to the formation of disturbing secondary currents around the port. On the other hand, a great axial extension of the delivery port requires a relatively thick vane with correspondingly high resistance.

The present invention overcomes the above mentioned disadvantages by providing a hollow disc-shaped delivery member at the end of a hollow shaft which is positioned within a rotating casing. The casing is arranged to draw in liquid centrally through the hollow shaft and includes means at the interior end of the shaft to break up and recombine air entrained within the incoming liquid. The liquid is then whirled to the outer periphery of the interior walls of the casing. The disc-shaped member at the end of the hollow shaft is provided with scooping or discharging members located to trap the liquid as it is rotated by the casing and deliver it for discharge through an annular portion of the hollow shaft member. The disc-shaped hollow body formed at the interior of the hollow shaft has the

necessary cross-sectional dimensions for discharging the delivery liquid of the particular pump design. The disc-shaped hollow body is provided with short delivery or impact baffles in the form of radially extending ribs to effect the flow and discharge characteristics desired. It is possible with such a construction to arrange the disc-shaped hollow body with the discharge scoop or opening located above a liquid level which may form inside the revolving casing. Thus, the resistance which would be produced by a head wave of liquid is eliminated. The hollow disc is made so that it has no displacement effect and no resistance due to its shape. It is possible with such a construction to have a sufficiently large number of discharge ports with a sufficiently large overall cross-section to take care of a large design range of capacities. By delivering the liquid through several small openings arranged in the periphery of the disc-shaped hollow body it is possible to make the pump smaller in size and to increase the rotative speed features which contribute to a higher pump efficiency.

The casing is provided with inwardly extending ribs facing the admission port of the disc-shaped hollow body which aids in the inflow of liquid through the central inlet of the hollow shaft and effects atomizing and whirling around of any air bubbles which have entered along with the liquid. The air bubbles are compressed and discharged along with the pumping liquid. By this admission means for the pumping liquid, the formation of a liquid level within the casing is avoided, and a large increase in the use of the pumping liquid for pressure generation is achieved.

In accordance with a feature of the invention the scooping elements on the hollow disc member may be of a cross-section to provide curved diffuser discharge openings and a liquid will be deflected by these openings into the outer hollow portion of the shaft for discharge therethrough.

In accordance with another embodiment of the invention, the interior of the hollow disc member is provided with guide vanes which direct liquid radially inwardly from the scooping element in a smooth path and without permitting rotation of the liquid as it is directed outwardly through the central discharge of the pump. Such a construction insures that there will be no pumping head losses due to the rotation and turbulence of the liquid as it is directed through the scooping element and into the central portion of the pump member.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages, and specific objects obtained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

In the drawings:

FIG. 1 is a transverse section of a rotary pump constructed in accordance with the invention;

FIG. 2 is a section taken on the line 2—2 of FIG. 1;

FIG. 3 is a section similar to FIG. 2 but indicating another embodiment of hollowed disc body member; and

FIG. 4 is a view similar to FIG. 3 of another embodiment of the invention.

Referring to the drawings in particular the invention as embodied therein includes a pair of spaced bearing support members 10 and 12, one of which, 12, supports a shaft 2 which may be advantageously formed integral with a rotating casing member 1. The casing 1 is advantageously formed of two parts to permit access of a hollow body disc member of a hollow shaft body 5. The inner portion of the housing 1 is provided with a hubbed central

portion which rests on the outer wall of the hollow body member 5 and is provided with suitable packing and retaining members 14 at this location.

In accordance with the invention the hollow body member 5 comprises an elongated double walled hollow shaft having a central bore which forms an inlet passage 6. The space between an inner wall 16 and an outer wall 17 defines a discharge passage 18 which communicates with a discharge passage 20 which is formed as an extension of the bearing support 10.

In accordance with the invention the rotating casing 1 is provided with a conical nose or baffle 22 which is arranged at the center of the inner end of the hollow shaft body 5 and is provided with a star shaped vane member 4 which has a whirling action on the incoming liquid and causes rotation of the same. The whirling of vane member 4 produces an atomizing action on any air bubbles which enter along with the liquid and causes them to be recombined and discharged with the liquid. The casing 1 is also provided with a plurality of inwardly extending ribs 3 which cause a whirling and pumping motion of the liquid and directs it through a discharge opening 40 formed in a raised baffle portion 9 of a hollow disc body or collecting ring portion 8 of the body member 5. The discharge opening 40 is preferably located at the top of the hollow disc body 8 and is advantageously provided with outwardly flaring interior diffuser walls 11 formed in the baffle like extensions 9 of the hollow disc body 8. Liquid is directed radially inwardly in the hollow disc body 8 through an annular passage 7 which communicates with a discharge passage 20.

In the embodiment indicated in FIG. 3 a plurality of baffle extensions 9a are provided at circumferentially spaced locations on the hollow disc body 8. In this embodiment one or more of the baffle-like members 9a have interior diffuser passages 11 which discharge against a guide vane 24 to cause the liquid to flow uniformly inwardly into the passage 18 and be discharged outwardly through the passage 20.

In the embodiment shown in FIG. 4, the hollow disc body is provided with a plurality of guide vanes 24 which are arranged around the periphery to direct liquid which is drawn through the baffle extension 9a in a uniform spiral path to the center of the hollow disc body 8 for discharge through the annular passage 7 and discharge passage 20. In the embodiment illustrated in FIG. 4, since there are several baffle extensions 9a, the guide vanes 24 are distributed around the interior of the disc body 8. In those instances where only a single baffle extension 9 is provided as in the embodiment illustrated in FIGS. 1 and 2, guide vanes 24 such as shown in FIGS. 3 and 4 could also be employed to direct the liquid inwardly in a uniform flow path to the annular passage 7. The vanes 24 are arranged so that the flow is forcibly directed inwardly toward the passage 7 and there is no tendency for the liquid to rotate and form turbulence at this portion of the pump and cause pressure losses.

Thus, the invention provides a pump in which liquid is taken inwardly through a central bore of a double walled hollow shaft by the force of a rotating casing. The casing includes means at the inner end of the hollow shaft to atomize and recombine air entrained within the liquid and cause its discharge along with the liquid through baffle-like extensions of a hollowed disc body formed at the end of the hollow shaft. The liquid is delivered at increased pressure through an entrance of a diffuser passage and discharged between the two walls of the shaft member at increased pressure.

While one embodiment of the invention has been shown and described to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A rotary pump particularly for high pressures com-

prising wall means defining a central liquid intake passage, a substantially toroidal shaped hollow discharge member surrounding the inner end of said passage, said member having a radially outwardly extending portion having a discharge opening, discharge passage means exteriorly coaxial of said intake passage in communication with said discharge member, a rotating casing member surrounding said intake passage and said discharge member, said casing member including a central vane free inner peripheral portion and inwardly extending vane portions arranged on each side of said peripheral portion to draw liquid in through said liquid intake passage and deliver it at increased pressure through said discharge opening and rotary seal means between the exterior of said discharge passage means and said casing member.

2. A rotary pump according to claim 1, including vane means on the interior of said rotating casing extending inwardly therefrom at the inner end of said intake passage whereby to impart rotation to the liquid immediately upon admission into said casing and to atomize any accompanying air bubbles in said liquid and to cause its discharge along with said liquid.

3. A rotary pump according to claim 1, wherein said discharge member is provided with a plurality of radially outwardly extending portions each having a discharge opening.

4. A rotary pump according to claim 1, wherein said discharge opening of said radially outwardly extending portion of said hollow discharge member is provided with an internally curved diffuser portion.

5. A rotary pump particularly for high pressures comprising a hollow double wall body member having a central bore defining an inlet portion and an outer discharge passage defined between the double walls thereof, said body member having a disc-shaped portion formed at one end of said double walled body member, a rotating casing member encompassing said disc-shaped portion and the adjacent portion of said body member and having inwardly extending ribs, said disc-shaped portion of said body member having a radially outwardly extending portion having a discharge opening communicating with the discharge passage of said body member, rotary seal means between the body member outer discharge passage and said casing member, a multi-blade conical baffle upon a central axes of said casing arranged opposite said central bore, and means to rotate said casing whereby to direct liquid inwardly through the central bore of said body member to the outer periphery of said casing and through the discharge opening of said disc-shaped portion and through the discharge passage between the double walls of said body member.

6. A rotary pump according to claim 5, wherein said discharge opening includes a flared diffuser passage.

7. A rotary pump according to claim 5, including a baffle arranged at the end of said diffuser discharge passage.

8. A rotary liquid pump particularly for developing high pressures comprising a hollow double walled body member having a central bore defining an inlet passage extending therethrough and an outer discharge passage defined between the double wall thereof, said body member having a hollow disc-shaped portion formed at one end with the interior thereof in communication with said discharge passage, a baffle extension formed radially on the periphery of said disc-shaped member having a flow passage defined therein, and a rotating casing surrounding said disc-shaped portion having means to direct liquid inwardly through said central bore through said flow passage and out said discharge passage, said means including a conical star vane member arranged opposite said central bore and seal means between said rotating casing and the exterior of said outer discharge passage so that all of the liquid entering said casing through the inlet passage will be expelled at a higher pressure through said discharge passage.

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9. A rotary pump according to claim 8, including a deflector vane formed on the interior of said disc-shaped portion to direct liquid radially inwardly from said flow passage to said discharge passage.

10. A rotary pump according to claim 8, including a plurality of raised baffle extension portions defined on said disc-shaped portion each having a flow passage defined therein, and a plurality of baffle guide plates defined on the interior of said disc-shaped member to direct liquid from said flow passage to said discharge passage in a uniform stream.

318,884
2,673,075
2,698,745
2,733,725

34,133
737,933
926,219

6

References Cited in the file of this patent

UNITED STATES PATENTS

Dwight	May 26, 1885
Borck	Mar. 23, 1954
Boucher	Jan. 4, 1955
Zachariassen	Feb. 7, 1956

FOREIGN PATENTS

Sweden	Jan. 2, 1913
Great Britain	Oct. 5, 1955
Germany	Apr. 7, 1955