

[54] VACUUM PUMP

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[51] Int. Cl. **E04c 19/00**

[58] Field of Search 230/29, 45; 277/67, 277/133

References Cited

UNITED STATES PATENTS

2,646,999 7/1953 Barske 277/13

1,657,349	1/1928	Eisenhauer	308/127
3,028,181	4/1962	Thompson	277/12
3,043,497	7/1962	Gabbioneta	417/67
3,232,521	1/1966	Dearoff	417/68
3,351,272	11/1967	Jennings	417/68
2,195,174	3/1940	Jennings	417/68
2,815,003	12/1957	Rumm	417/68

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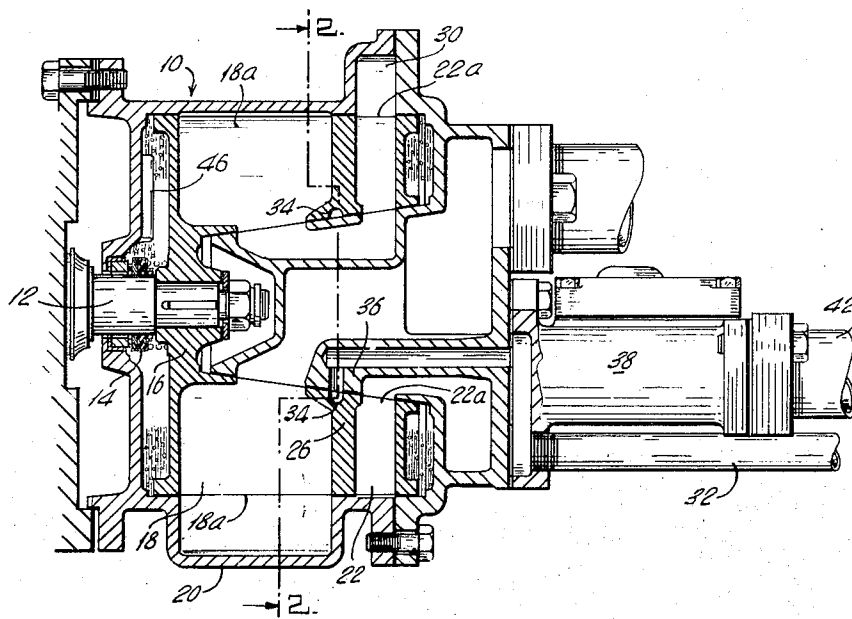
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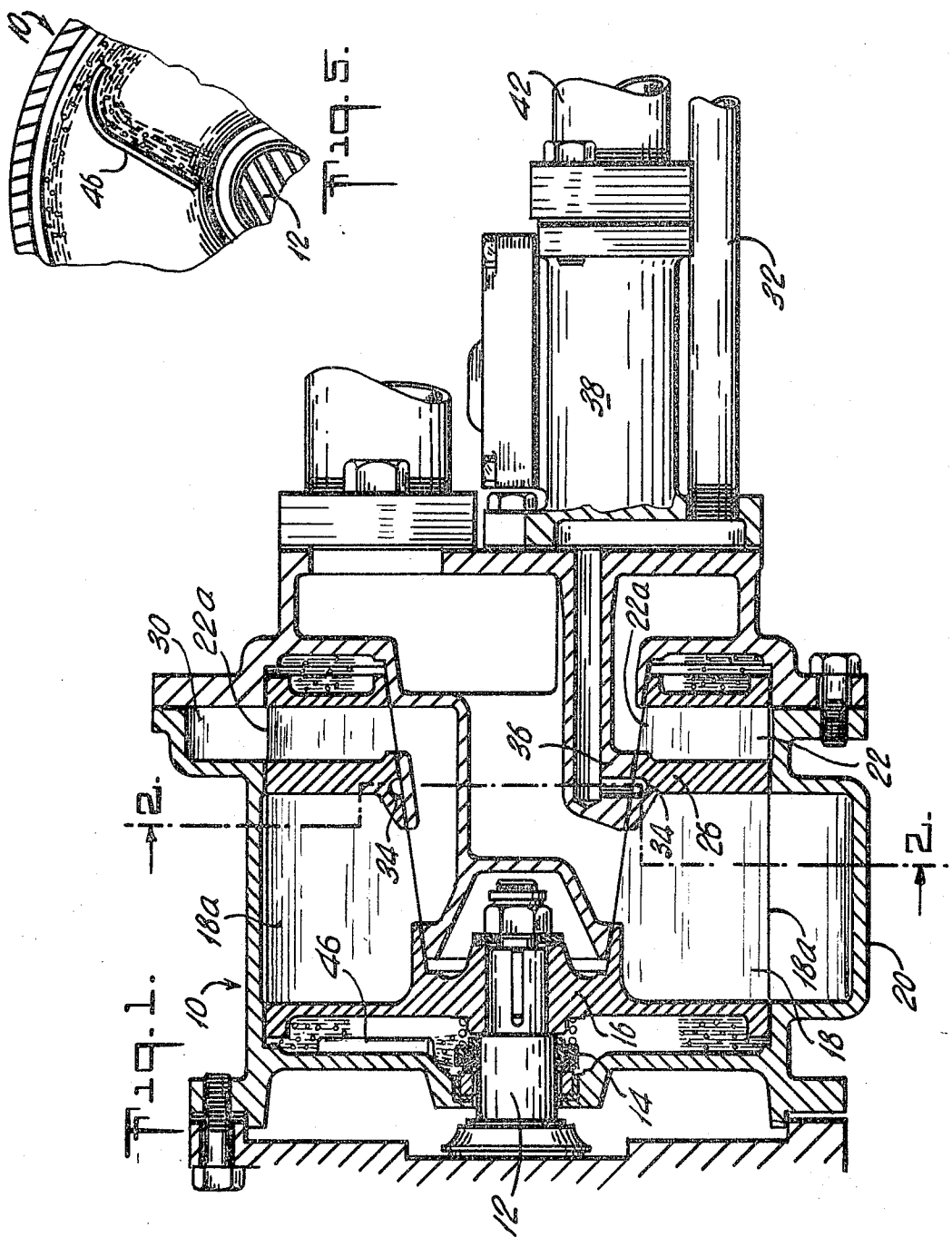
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ABSTRACT

A multi-stage vacuum pump of the liquid ring type having a cold water seal around the inner ring of the water seal and introduced into a groove between successive stages and adjacent to the inner edges of the impeller. The pump is additionally provided with a novel air discharge system for successive stages incorporating a check valve and a deflection blade for the cooling the packing gland about the rotor shaft.

4 Claims, 5 Drawing Figures

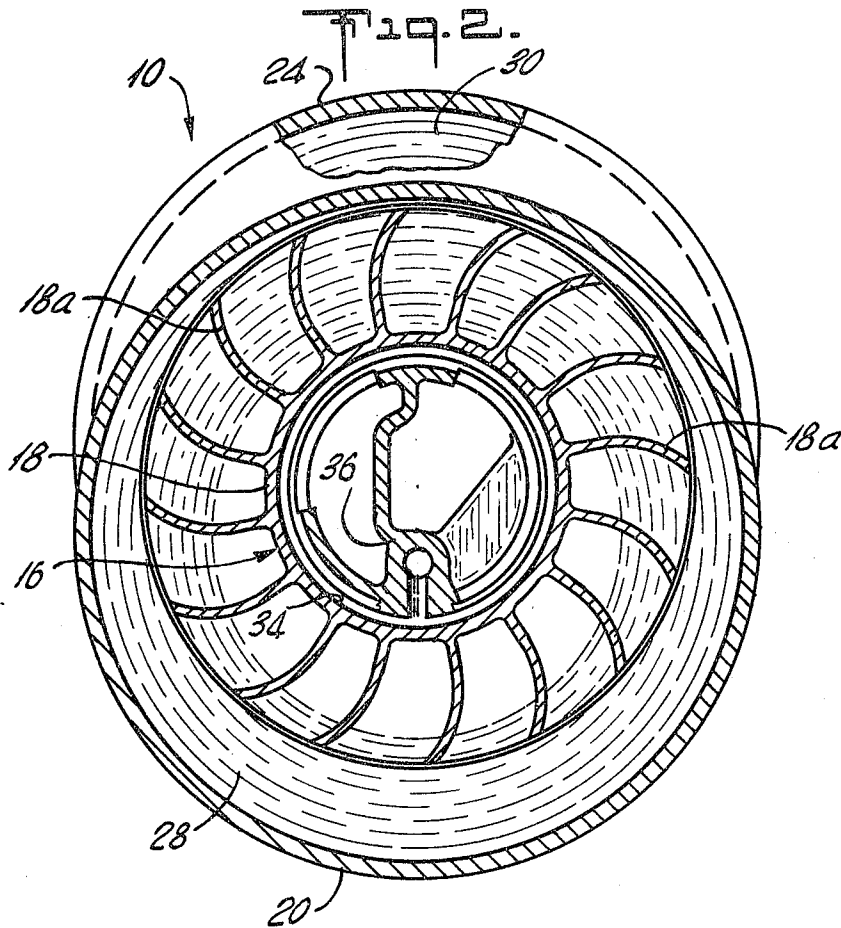




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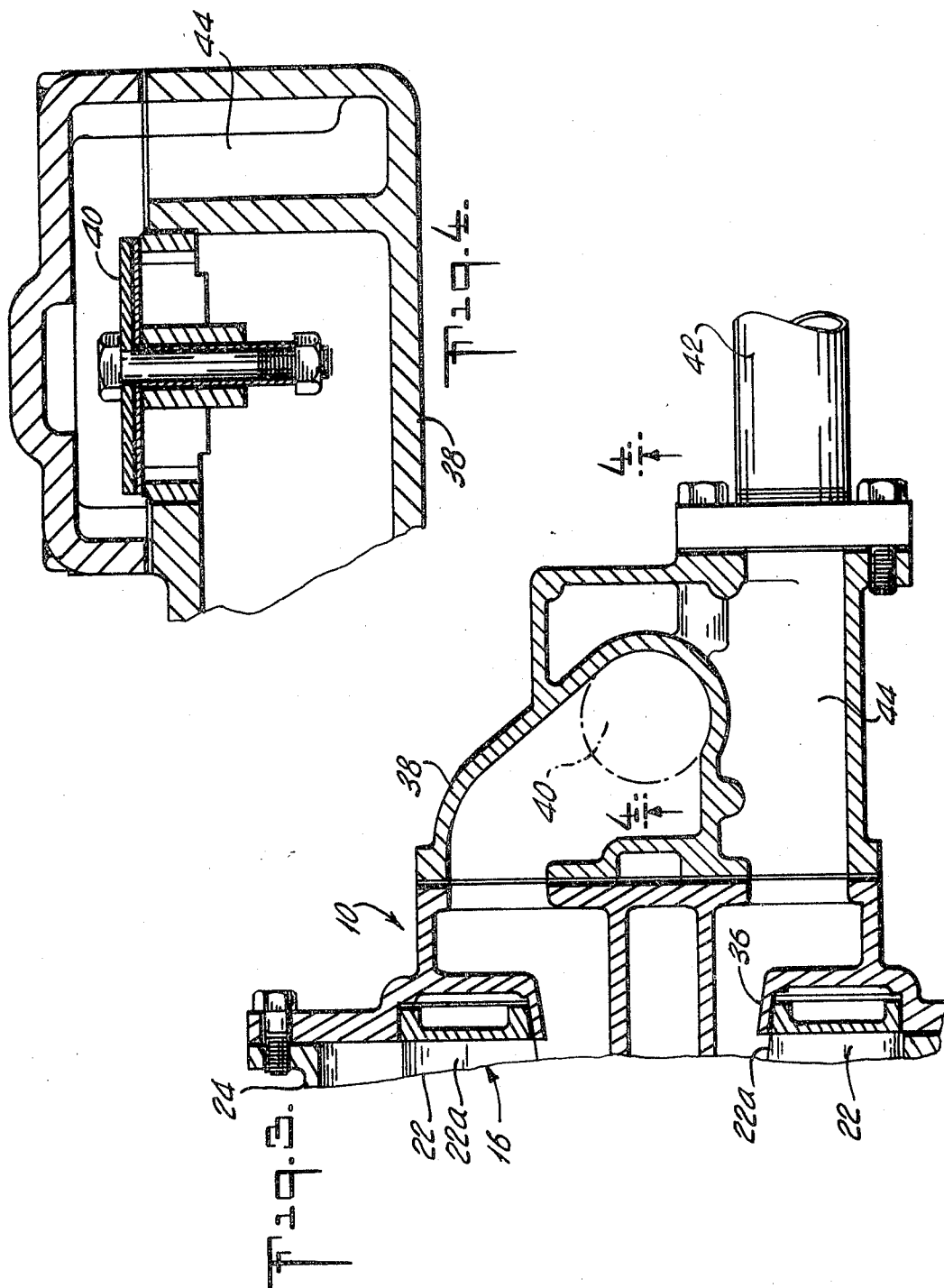
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VACUUM PUMP

This is a continuation of application Ser. No. 853,618 filed Aug. 22, 1969, now abandoned, which in turn is a continuation of application Ser. No. 711,370 filed Mar. 7, 1968, also now abandoned.

This invention relates to a sealing construction for a multi-stage rotary vacuum pump of the liquid ring type in which cold sealing water is introduced directly to grooves formed in the cone or partition wall between successive stages of the impeller means.

Heretofore, as set forth in U.S. Pat. No. 3,351,272 dated Nov. 7, 1967, the sealing liquid was taken from the lobe of a rotary pump to seal successive stages of the impeller means. This liquid is relatively warm and is likely to flash into vapor thereby seriously cutting down the vacuum in the pump.

In accordance with the teachings of the present invention the cold sealing liquid is introduced to the cone adjacent to the interior circumference of the impeller means directly from an external supply source. This construction has advantages over the prior art construction in that when cold liquid is introduced along the sides of the surfaces of the cone adjacent to the interior circumference of the impeller means to form a seal it spreads out over the interior surface of the revolving liquid. Accordingly, a higher vacuum can be achieved because the liquid is less likely to flash at the inlet and thereby permits a higher vacuum in the pump which counteracts the reduction of pump air capacity due to vapor flashing. Thus, by having cold water or other cold liquid around the inner ring of the seal a much higher vacuum is possible than in the prior art structures. In addition, the sealing water or liquid introduced at the particular location between successive stages of the impeller means results in effective sealing of the successive stages of the impeller means in a multi-stage rotary vacuum pump.

An object of the present invention is to provide a multi-stage vacuum pump of the liquid ring type with a cold water seal in a central groove between successive stages and adjacent to the inner edges of the impeller means.

Another object of the present invention is to provide a novel air discharge system from successive stages incorporating a check valve for cutting out the first stage and cutting in the second stage upon the attainment of a certain vacuum level.

A further object of the present invention is to provide a novel deflector blade for cooling the packing gland about the rotatable shaft.

In the drawings:

FIG. 1 is a partly sectional and a partly elevational view of the sealing construction for a multi-stage liquid ring rotary vacuum pump embodying the present invention;

FIG. 2 is a cross-sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a partial sectional view of the rotary pump illustrating details of construction thereof;

FIG. 4 is an enlarged partial sectional view of the check valve indicated in FIG. 3 taken along the lines 4—4 of FIG. 3; and

FIG. 5 is a partial sectional view of a detail of construction of the deflector blade shown in FIG. 1.

Referring to the drawings, FIG. 1 shows a two stage liquid ring rotary vacuum pump of the type described, for example, in U.S. Pat. No. 3,351,272 dated Nov. 7,

1967. The pump comprises a casing referred to generally by the numeral 10. A rotatable shaft 12 is operatively connected to a drive motor (not shown). At least part of the shaft 12 projects into the casing 10 through a packing gland 14. The rotor 16 is secured to the rotatable shaft 12. The first stage impeller means 18 is positioned within the casing 10 along with crescent-shaped lobe 20. The second stage impeller means 22 together with the crescent-shaped lobe 24 is separated from the first stage by means of a partition wall 26. As seen in FIG. 2 a pumping action is secured by means of a liquid seal 28 revolving in a circular or elliptical path within the lobe 20 by the actions of the vanes 18a of the first stage impeller 18, and a similar pumping action is secured by a liquid seal 30 revolving in a circular or elliptical path within the lobe 24 by the action of the vanes 22a of the second stage impeller 22.

A cold seal water pipe 32 is clearly seen in FIG. 1 connected to the groove 34 in the rotor partition wall 26. Thus, the direct sealing at this point in the structure effectively seals the first and second stages from each other. An efficient seal between the stages is of great importance inasmuch as the vacuum in the first stage is in the order of 3 inches absolute while in the second stage, in the area of the discharge to the atmosphere, there is a pressure in the order of 30 inches absolute.

The seal water for both stages preferably flows completely around the rotor 16 as clearly seen in FIG. 2. Therefore, the coldest water is introduced along the sides into the interior of the pump and spreads out over the interior surface of the other water revolving therein. This permits a higher vacuum since the water is less liable to flash at the inlet. It should be apparent that the use of cold water around the inner ring of the water seal results in a much higher vacuum than would be possible if the water was injected in the pump elsewhere.

FIGS. 3 and 4 show a section of the pump in which air is discharged from the first stage of the rotary pump through the check valve casing 38 and the check valve 40 to the outlet pipe 42 through passage 44. When the vacuum in the first stage of the pump reaches a certain predetermined level where the second stages can become operative the check valve 40 closes and air from the first stage is discharged through the second stage directly into the passage 44 and the outlet pipe 42. It should be noted that the second stage of the pump operates at all times by taking air from the discharge of the first stage and becomes effective when the first stage reaches a high vacuum and its discharge is reduced to a capacity equal to or less than the capacity of the second stage. At that time the second stage begins to pull a vacuum on the first stage.

FIGS. 1 and 5 show a device to cool the packing gland or mechanical seal 14. The device takes the form of a stationary deflector blade 46 mounted on the casing 10 adjacent to the packing gland 14. In operation, the rotor and associated structure revolves a ring of water. As seen in FIG. 5, a portion of this water is picked up by the blade 46 and due to its configuration directs this water portion against the packing gland 18 to thereby cool the same.

I claim:

1. A multi-stage liquid ring pump comprising a casing, a rotatable drive shaft at least partly in said casing, a plurality of lobes in said casing and mounted in stages in the direction of the longitudinal axis of said drive

shaft, a rotor on said drive shaft a port member disposed in a central opening of said rotor, a fluid entry means in said casing, communicating with an external cold seal liquid source, a fluid outlet means in said casing, a plurality of impeller means in successive stages mounted on said rotor, a separating member on the rotor between two successive stages of said impeller means, said separating member having an inner peripheral edge defining a running clearance with an adjacent port member surface, a substantially annular groove in said separating member edge, said groove being connected to said fluid entry means whereby cold seal liquid is introduced from said external source to the interior surfaces of said impeller means under relatively small pressure, to flow over the surface of the liquid of the liquid ring in the first stage of the pump in order to effectively seal the high and low vacuum areas of successive stages of said impeller means and to create a higher vacuum in the pump and reduce flashing between said fluid entry means and said fluid outlet

means.

2. A multi-stage rotary vacuum pump as claimed in claim 1, wherein the cold seal liquid introduced to the interior surfaces of said impeller means is under pressure greater than atmosphere.

3. A multi-stage rotary vacuum pump as claimed in claim 1, wherein said cold seal liquid is water.

4. In a multi-stage rotary vacuum having a casing, a rotatable drive shaft at least partly in said casing, a plurality of lobes in said casing and mounted in stages in the direction of the longitudinal axis of said drive shaft, a rotor on said drive shaft and a packing for said drive shaft, the improvement comprising: a curved stationary deflector blade mounted on said casing and positioned outside of said lobes whereby at least some of the fluid agitated by said rotor is directed to the curved portion of said deflection blade which deflects said fluid inwardly against said packing.

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