

Oct. 8, 1940.

F. E. BRADY

2,217,211

ROTARY PUMP

Filed Sept. 11, 1937

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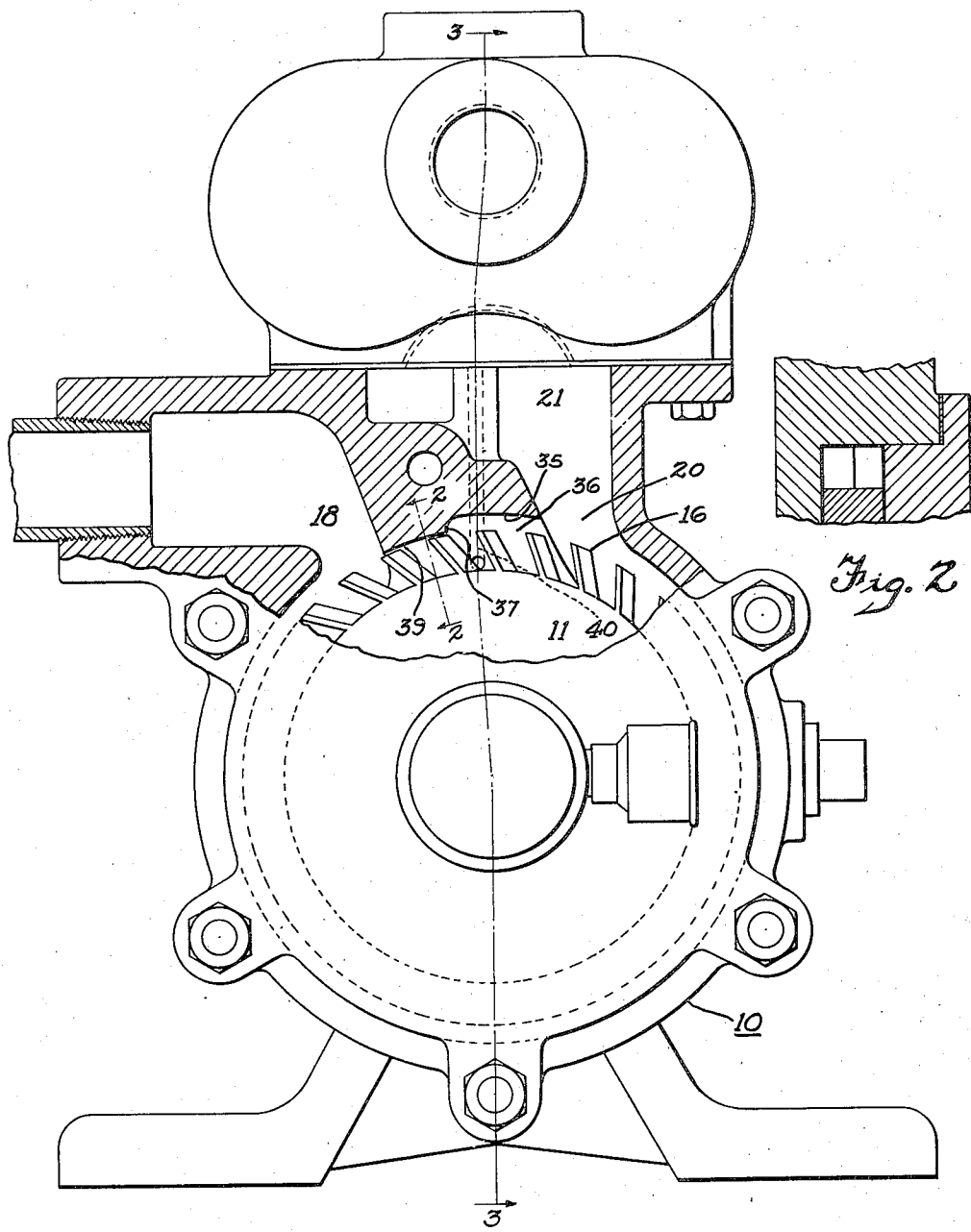


Fig. 1

Fig. 2

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3 Sheets-Sheet 2

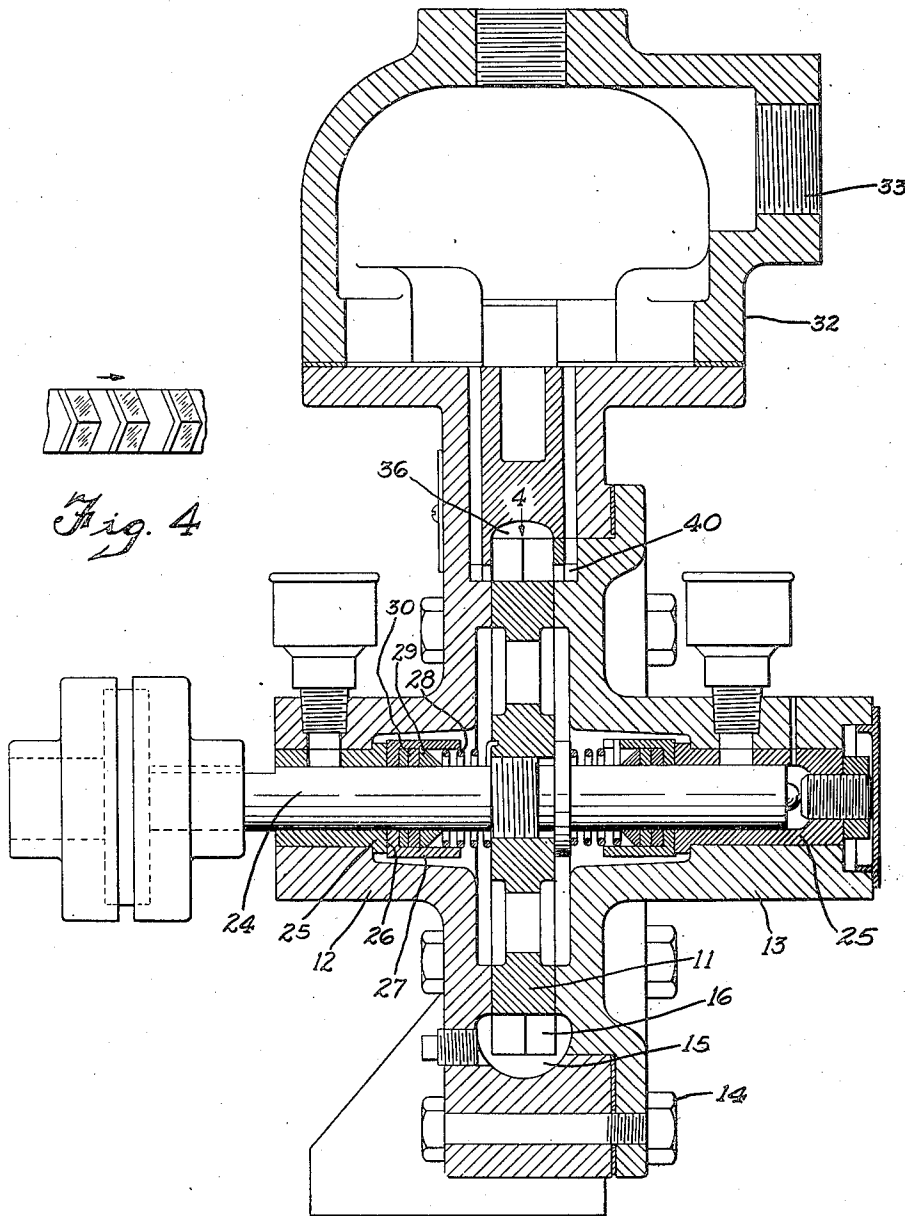


Fig. 4

Fig. 3

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3 Sheets-Sheet 3

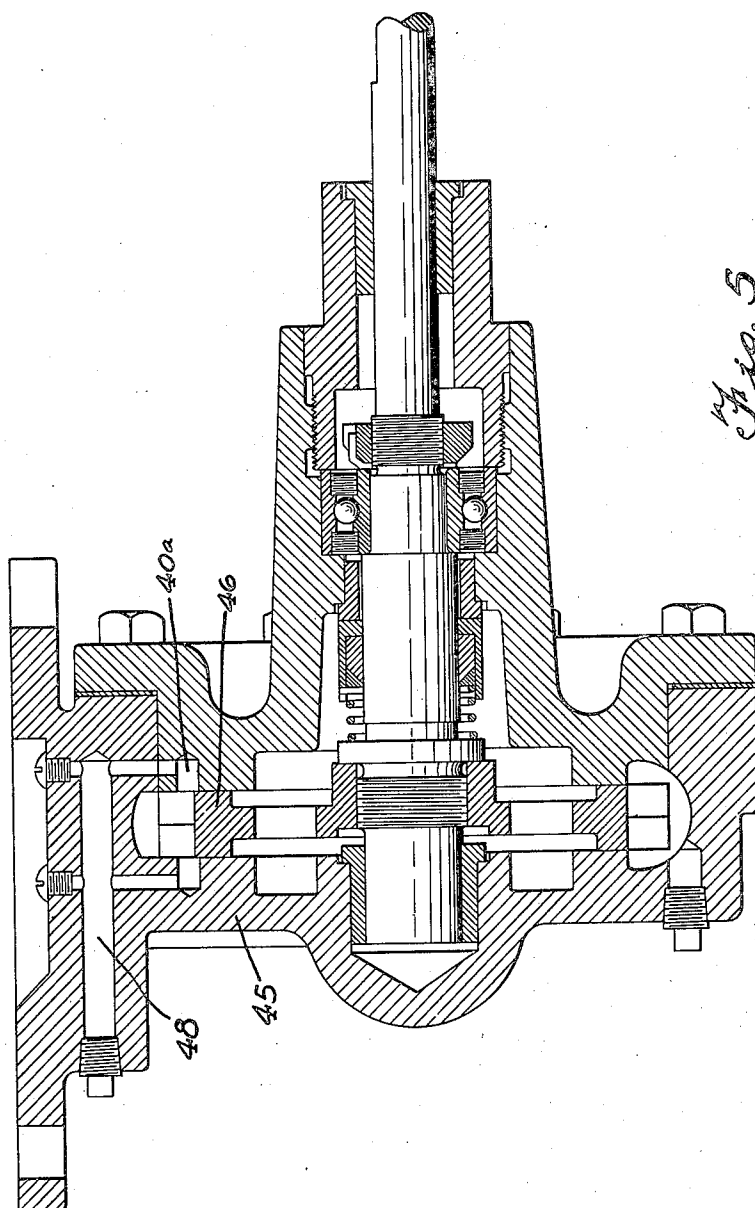


Fig. 5

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2,217,211

ROTARY PUMP

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Application September 11, 1937, Serial No. 163,469

6 Claims. (Cl. 103—113)

This invention relates to pumps and more particularly to self-priming liquid pumps.

One object of the invention is the provision of a self-priming pump which is efficient and capable of operating against comparatively high pressure heads and of creating a high degree of suction and of gas scavenging action, embodying a rotatable member having an annular series of blades which operate in a raceway of an enclosing casing in which is a pocket, just past the outlet port, in which sufficient pressure is created to drive gas or vapor from the base portions of the impeller buckets or chambers, the gas being withdrawn through a conducting passage which communicates with the inner portions of the impeller chambers.

Other objects and advantages of the invention will be apparent from the following description, the appended claims and the accompanying drawings, in which—

Fig. 1 is a front elevation of a pump embodying the present invention, a portion of the pump being broken away and shown in section;

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

Fig. 3 is a section on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary view of a portion of the impeller looking in the direction of the arrow 3 of Fig. 3; and

Fig. 5 is a central vertical section through a somewhat modified form of construction.

Referring more particularly to the drawings by reference numerals, 10 generally designates the casing and 11 the rotatable impeller of a self-priming pump adapted to handle gasoline and other liquids and capable of creating a considerable suction and of delivering the liquid handled under considerable pressure and in an efficient manner.

The casing is preferably constructed in two main sections 12 and 13 connected together by bolts 14 to provide an annular raceway 15 in which the impeller blades operate. The blades 16 of the impeller 11, as shown, are constructed generally in accordance with my prior Patent No. 2,042,499, granted June 2, 1936, and, as indicated in Fig. 1, these blades are inclined forwardly in the direction of rotation at an angle of the order of about 25° to a radial line through the axis of rotation. With such a forward inclination of the blades there is a high degree of effectiveness of the outer parts of the blades on the liquid as the blades operate in the annular raceway 15, giving an effective pumping action from the inlet passage 18 to the outlet port 20 which is arranged for the peripheral discharge of the liq-

uid through the outlet passage 21. The inlet port 18 is herein shown as a peripheral inlet delivering the liquid at a comparatively high point near the top of the impeller and into the annular raceway. The blades may be V-shaped as viewed from the ends of the blades, and as shown in Fig. 4, so that opposite sides of the blades are inclined forwardly and outwardly at an angle of the order of 130° to one another. With this substantially V-shaped arrangement of blades a high degree of pumping efficiency is obtained.

As will be noted from Fig. 1, the radial extent of the blades is less than 10% of the diameter of the impeller, and the spacing between adjacent blades is not in excess of 10% of the diameter of the impeller. The blades are thus comparatively small as compared to the diameter of the blade supporting portion of the impeller so that there are a large number of rather small buckets or chambers provided between the blades of the impeller. These chambers are exposed at their peripheral outer portions and also at their lateral portions to the liquid in the raceway 15 as shown in Fig. 3.

As will be apparent from Fig. 3, the body portion of the impeller 11 is secured, as by means of screw threads, to the rotatable shaft 24 which operates in bearings 25 in the casing. The shaft is driven in any suitable manner so as to operate counter-clockwise as viewed in Fig. 1. For sealing against leakage of the material pumped along the shaft and past the bearings 25, the bearing member 25 at the left of the pump in Fig. 3 has a bearing surface 26 engaged by the end of the metallic sealing member 27, these two portions having engaging smooth sealing surfaces. The sealing member 27 rotates with the shaft 24, having a driving connection therewith through the spring 28 which engages at one end with a notch in the member 27 and at the other end with a notch in the impeller body. The spring 28 also bears yieldingly against a pressure disk 29 which maintains suitable packing material 30 under sufficient compression to prevent passage of liquid along the shaft inside of the member 27. A similar construction is provided at the other side of the impeller.

At the top of the casing is a reservoir member 32 receiving the liquid pumped from the outlet passage 21, and having a discharge passage 33 through which this liquid can be taken off to any desired point. When the pump is stopped some liquid is retained in the reservoir 32, which, therefore maintains the pump full of liquid so that the pump can be readily started. This res-

ervoir 32 is also adapted to receive the gas or vapor which is withdrawn from the base portions of the impeller chambers during priming, as will be explained.

5 Just past the discharge port 20, in the direction of rotation, the casing is so formed to provide a curved wall 35 some little distance radially outwardly of the ends of the impeller blades, as shown in Fig. 1. This provides a pocket 36 hav-
 10 ing an annular length sufficient to coact with several of the blades of the rotor, in which a pressure is created by the ends of the blades as these blades pass from the outlet port to a point opposite
 15 the end 37 of the pocket 36. The blades thus build up a considerable pressure in this pocket in excess of the pressure existing in the liquid at the outlet port 20 so that by the time the blades reach a position where the buckets or chambers
 20 between adjacent blades is about to pass through the close fitting passage 39 which seals the inlet from the outlet, there is sufficient pressure created on the liquid to overcome the centrifugal force effect, and vapor or gas in the base portions of
 25 the impeller chambers is forced out through a suitable passage or passages which are provided in communication with the base portions of the buckets of the impeller. These passages com-
 30 municate with the outside air, or with the reservoir 32 where it is desired that gas or vapor will not be lost. It has been found that sufficient
 35 pressure can be created in the pocket 36 to overcome the centrifugal force effect because the radial extent of the blades is comparatively small, and also because the blade arrangement is so
 40 efficient that the speed of operation of the pump is moderate, although the pump is quite efficient and capable of operating against very large
 45 pressure differentials. The air withdrawal passages, while being large enough for the rapid passage of vapor, may be so restricted in size as
 50 to offer considerable resistance to the flow of liquid so that after priming is completed the efficiency of the pumping action is not appreciably
 55 impaired. The air withdrawal passages may extend inwardly into the impeller or may be provided in the casing. As shown in Fig. 1 there are two
 60 passages 40 which are arranged in the casing in communication with the sides of the impeller chambers at opposite sides of the impeller and
 65 adjacent the high pressure end of the pocket 36, these passages extending to the separating chamber or reservoir 32 and beyond the pump discharge. As will now be apparent, even if there
 70 is only sufficient liquid in the pump to fill the raceway itself at a time when the pump is started, an effective suction will be created in the suction line extending to the inlet passage 18, by
 75 reason of the driving action created by the blades on the liquid in the raceway, and while this driving action moving or tending to move the liquid to the discharge port may not be sufficient to force the liquid up through the passage at first, there is a sufficient pressure created in the pocket 36 so that air or vapor which is trapped at the base portions of the impeller pockets or chambers will be driven off, a small portion at a time, as each pocket or chamber comes into communication with the vapor removing passages 40. Evidently, therefore, as this gas is taken off, the spaces between adjacent blades of the impeller will be filled with liquid and the liquid will be drawn up to the pump and discharged from the pump in a continuous stream. The priming action takes place in an exceedingly short time, so rapidly in

fact as to be almost instantaneous under favorable conditions.

To satisfy those conditions where it is undesirable to pass the vapor or gas withdrawn through the passage 40 back to the stream of liquid that has passed through the pump, the passage 40 may be so arranged as to take this gas off separately. Thus as shown in the modification illustrated in Fig. 5, the casing 45 and the impeller 46 are generally similar in construction to the casing and impeller of the construction illustrated in Figs. 1 to 4 inclusive. The casing 45 is provided with passages 40a communicating with the base portions of the pockets between adjacent blades, just as illustrated in Fig. 1 of the drawings, but these passages 40a extend up to a lead-off passage 48 instead of passing up into the reservoir and discharge chamber above the pump. The passage 48 may be open so that the gas is discharged to the atmosphere, or this passage may be connected through a suitable conduit into any suitable receptacle where gas or vapors are separated from any liquid that may pass through and liquid returned to the pump suction while the vapor goes to atmosphere. Only a small quantity of liquid can be forced out through the passages 40a after the priming of the pump is completed because these passages are quite restricted in size.

While the forms of apparatus herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to these precise forms of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A self-priming rotary pump of the character described comprising a rotatable impeller having a series of outwardly extending peripheral blades which are inclined forwardly in the direction of rotation and of a radial length less than 10% of the diameter of the impeller, said blades providing impeller chambers open at a side thereof and of an annular length less than 10% of the diameter of the impeller, an impeller casing providing an inlet passage, a peripheral outlet port and an annular raceway from the inlet to the outlet, said casing having a portion formed to provide a pocket around the impeller periphery just past the outlet port in the direction of rotation in which a pressure considerably greater than the pressure of the liquid at the outlet port is created by the movement of the blades, said pocket being open to the outlet port and having an annular length several times the annular length of an impeller chamber, the casing being formed to closely surround the periphery and sides of the impeller chambers for a distance at least as great as the annular length of such chambers from the high pressure end of said pocket to the inlet passage of the casing, and a gas conducting passage communicating with the inner portions of the impeller chambers when they reach the high pressure end of the pocket for withdrawing gas successively from the inner portions of the impeller chambers.

2. A self-priming rotary pump of the character described comprising a rotatable impeller having a series of outwardly extending peripheral blades which are inclined forwardly in the direction of rotation and of a radial length less than 10% of the diameter of the impeller, said blades providing impeller chambers open at a side thereof and of an annular length less than 10%

of the diameter of the impeller, an impeller casing providing an inlet passage, a peripheral outlet port and an annular raceway from the inlet to the outlet, said casing having a portion formed to provide a pocket around the impeller periphery just past the outlet port in the direction of rotation in which a pressure considerably greater than the pressure of the liquid at the outlet port is created by the movement of the blades, said pocket being open to the outlet end of said raceway and having an annular length several times the annular length of an impeller chamber, and a gas conducting passage provided in said casing and extending from a point communicating with a side of the inner portions of the impeller chambers when they reach the high pressure end of the pocket for withdrawing gas successively from the inner portions of the impeller chambers.

3. A self-priming rotary pump of the character described comprising a rotatable impeller having an annular series of impeller blades which are inclined forwardly in the direction of rotation and of a radial length less than 10% of the diameter of the impeller, said blades providing impeller chambers open at a side thereof and of an annular length less than 10% of the diameter of the impeller, an impeller casing providing an inlet passage, an outlet port, a discharge passage extending from said outlet port, and an annular raceway from the inlet to the outlet, said casing having a portion formed to provide a pocket around the impeller periphery just past the outlet port in the direction of rotation in which a pressure considerably greater than the pressure of the liquid at the outlet port is created by the movement of the blades, said pocket being open to the outlet end of said raceway and having an annular length several times the annular length of an impeller chamber, the casing being formed to closely surround the periphery and sides of the impeller chambers for a distance at least as great as the annular length of such chambers from the high pressure end of said pocket to the inlet passage of the casing, and a gas conducting passage leading to the discharge passage beyond said outlet port and extending from a point communicating with the inner portions of the impeller chambers when they reach the high pressure end of the pocket for withdrawing gas successively from the inner portions of the impeller chambers.

4. A self-priming rotary pump of the character described comprising a rotatable impeller having a series of outwardly extending peripheral blades which are of a radial length less than 10% of the diameter of the impeller, said blades providing impeller chambers open at a side thereof and of an annular length less than 10% of the diameter of the impeller, an impeller casing providing a tangential inlet passage, a peripheral outlet port and an annular raceway from the inlet to the outlet, said casing having a portion formed to provide a pocket around the impeller periphery just past the outlet port in the direction of rotation in which a pressure considerably greater than the pressure of the liquid at the outlet port is created by the movement of the blades, said pocket being open to

the outlet end of said raceway and having an annular length several times the annular length of an impeller chamber, and a gas conducting passage provided in said casing and extending from a point communicating with a side of the inner portions of the impeller chambers when they reach the high pressure end of the pocket for withdrawing gas successively from the inner portions of the impeller chambers.

5. A self-priming rotary pump of the character described comprising a rotatable impeller having a series of outwardly extending peripheral blades which are inclined forwardly in the direction of rotation at an angle of the order of 25° to a radial line from the axis of rotation and of a radial length less than 10% of the diameter of the impeller, said blades providing impeller chambers open at a side thereof and of an annular length less than 10% of the diameter of the impeller, an impeller casing providing a tangential inlet passage, a peripheral outlet port and an annular raceway from the inlet to the outlet, said casing having a portion formed to provide a pocket around the impeller periphery just past the outlet port in the direction of rotation in which a pressure considerably greater than the pressure of the liquid at the outlet port is created by the movement of the blades, said pocket being open to the outlet end of said raceway and having an annular length several times the annular length of an impeller chamber, and a gas conducting passage provided in said casing and extending from a point communicating with a side of the inner portions of the impeller chambers when they reach the high pressure end of the pocket for withdrawing gas successively from the inner portions of the impeller chambers.

6. A self-priming rotary pump of the character described comprising a rotatable impeller having a series of outwardly extending peripheral blades which are inclined forwardly in the direction of rotation at a substantial angle with the opposite sides of the blades inclining forwardly and outwardly from the blade center, said blades having a radial length less than 10% of the diameter of the impeller and providing impeller chambers open at opposite sides thereof and of an annular length less than 10% of the diameter of the impeller, an impeller casing providing an inlet passage, a peripheral outlet port and an annular raceway from the inlet to the outlet, said casing having a portion formed to provide a pocket around the impeller periphery and of substantial radial depth throughout its length and located just past the outlet port in the direction of rotation in which a pressure considerably greater than the pressure of the liquid at the outlet port is created by the movement of the blades, said pocket being open to the outlet end of said raceway and having an annular length several times the annular length of an impeller chamber, and a gas conducting passage provided in said casing and extending from a point communicating with a side of the inner portions of the impeller chambers when they reach the high pressure end of the pocket for withdrawing gas successively from the inner portions of the impeller chambers.

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