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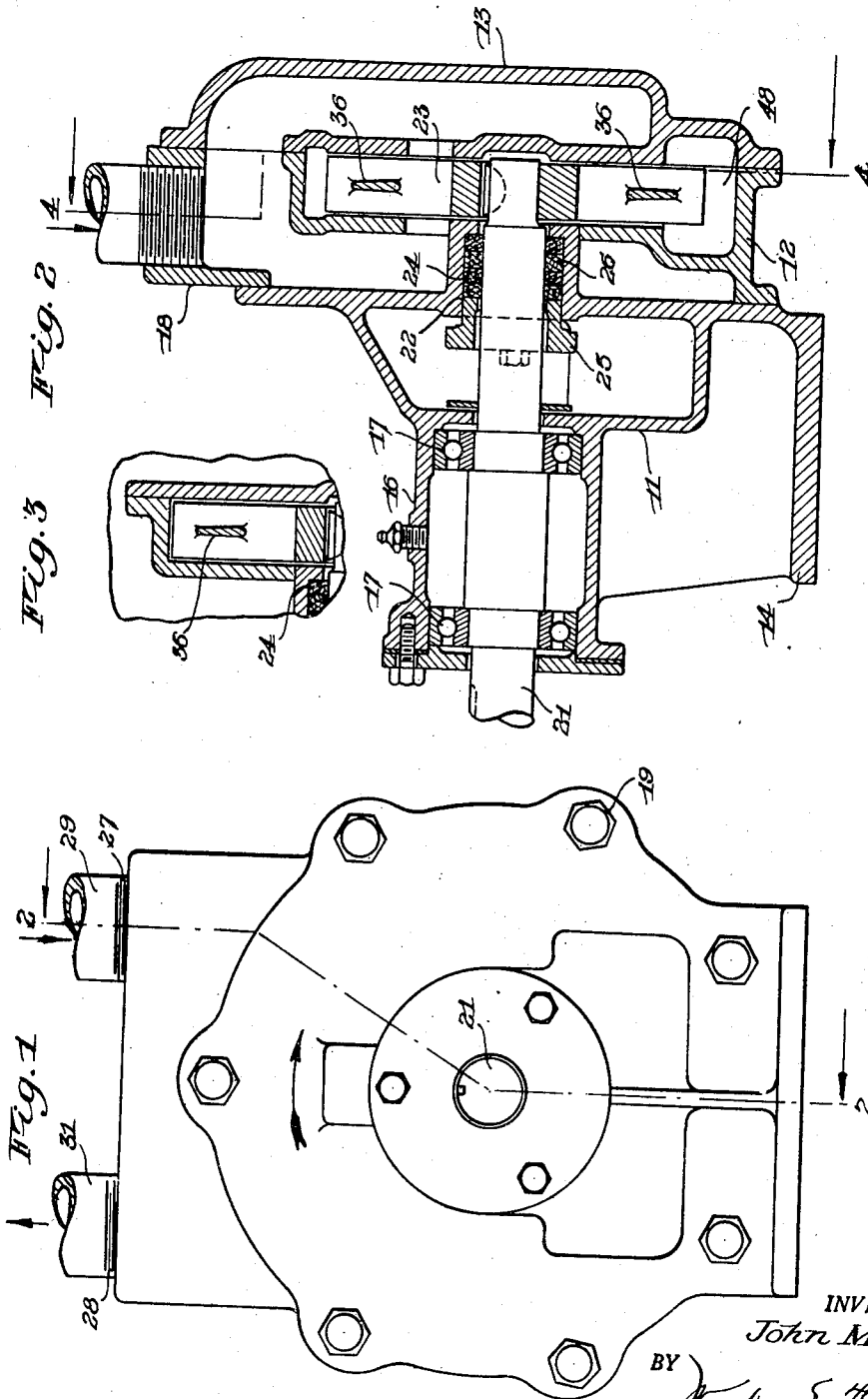
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PUMP

Filed March 9, 1944

2 Sheets-Sheet 1



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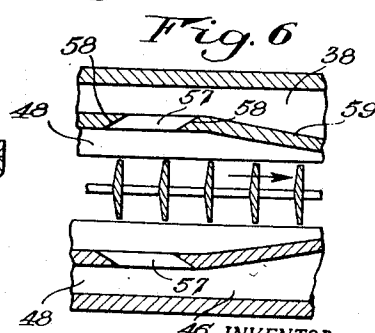
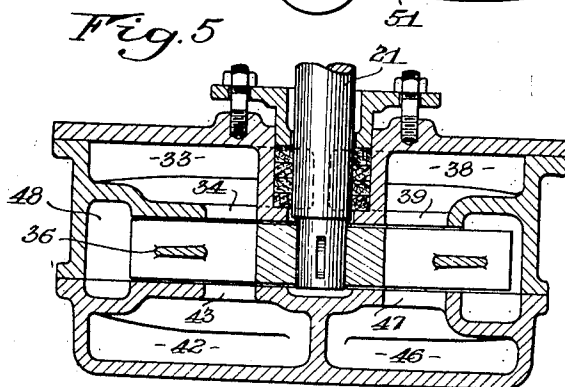
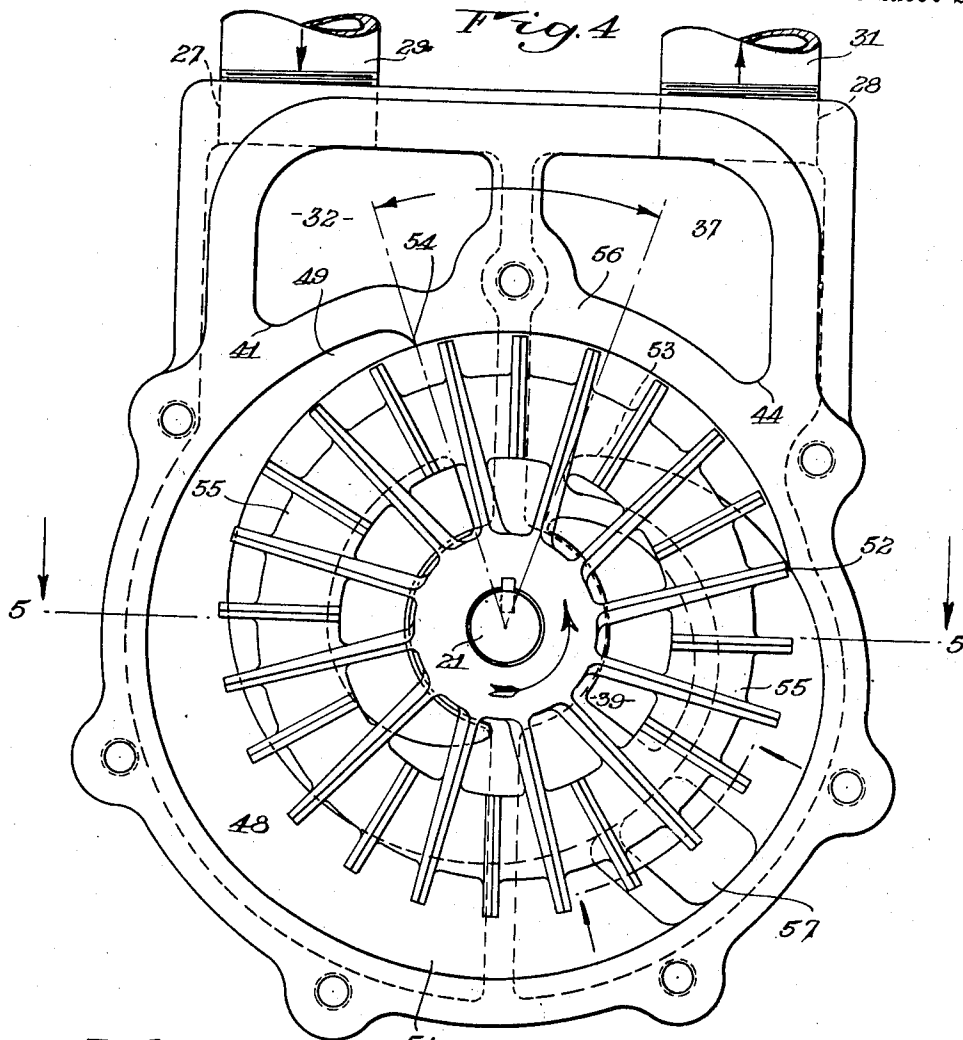
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2,430,299

PUMP

Filed March 9, 1944

2 Sheets-Sheet 2



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2,430,299

PUMP

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Application March 9, 1944, Serial No. 525,751

4 Claims. (Cl. 103—113)

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My invention relates to pumps, and more particularly to a pump of the type in which the pump contains a reserve supply of liquid which, when the rotor is operating, acts as a piston to enable the pump to handle gases, liquids, or a mixture of gases and liquids.

An object of my invention is to provide a more compact, efficient pump which is completely self-priming, and is adapted to handle gases, liquids or a mixture of gases and liquids.

Another object of my invention is to provide a so-called liquid piston or water-ring pump which is economical to build, efficient in operation, and access to the interior of which may be attained quickly and with a minimum of effort.

A further object of my invention is to provide a pump of the liquid piston type which is preferably provided with a double suction and double discharge, and which is provided with means whereby the efficiency thereof is increased.

My invention further contemplates a pump of the liquid piston type in which the suction and discharge ports are provided adjacent the root portions of the blades with the unit also being provided with a peripheral discharge port for the free discharge of the major portion of the liquid. The discharge from the root discharge port and the peripheral discharge port are merged so that the complete discharge of the pump flows to the point of use.

Other objects and advantages of my invention will be apparent from the following description, when taken in connection with the accompanying drawings, in which:

Fig. 1 is a rear elevation of the pump of my invention looking from the bracket side;

Fig. 2 is a sectional view taken substantially on the line 2—2 of Fig. 1 in the direction indicated by the arrow;

Fig. 3 is a sectional view through the impeller housing and impeller taken across the bridge or portion of the casing which separates the suction from the discharge;

Fig. 4 is a view taken substantially on the line 4—4 of Fig. 2 in the direction indicated by the arrow;

Fig. 5 is a view taken substantially on the line 5—5 of Fig. 4; and

Fig. 6 is a view showing the peripheral discharge ports.

The pump of my invention comprises a support bracket, generally indicated by the numeral 11 (Fig. 2), a main casing part 12, and a cover part or plate 13. The support bracket 11 has

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a depending part or base 14 by which the pump may be suitably mounted and contains a housing 16 in which suitable bearing assemblies 17 may be supported and housed. The support bracket also comprises a plate or pump bracket 18 to which the main casing part may be bolted, as indicated at 19 (Fig. 1).

A pump or motor shaft 21 is connected to an electric motor or other prime mover, not shown. The motor shaft 21 extends through the bearing housing 16 through an opening 22 provided in the pump bracket plate 18, and has suitably secured thereto substantially at the end thereof a rotor or impeller, generally indicated by the numeral 23. The impeller is keyed to the shaft as shown, but is free to float longitudinally of the shaft. Since, as will be presently described, the pump has a double suction and double discharge, the forces on the impeller are balanced and the impeller centers itself with respect to the walls by which it is enclosed.

Formed in a cylindrical projecting portion in the pump bracket 18 is a bore or cavity 24 for the reception of suitable packing 26 which is held in position by a suitable packing gland assembly 25. The main casing part 12 is also provided with two threaded openings 27 and 28. The threaded opening 27 constitutes the suction connection for the pump and has suitably threaded therein a suction pipe 29. The threaded opening 28 constitutes a discharge connection and has suitably threaded therein a discharge pipe 31.

A passage 32 (Fig. 4) is provided in the main casing part and is connected to the suction opening 27. The passage 32 has access through a passage 33 to a port 34 to the impeller blades 36 adjacent the roots thereof. Similarly the discharge connection is connected through a passage 37, passage 38 and port 39 to the blades of the impeller adjacent the roots thereof.

The suction passage 32 has an opening 41 (Fig. 4) which communicates with a passage 42 formed in the cover plate 13, opening into the blades of the impeller through a port 43. Similarly the passage 37 has an opening 44 which communicates with a passage 46 formed in the cover plate 13 which opens into the blades of the impeller through a port 47.

Thus liquid entering the pump through the suction pipe 29 branches or divides in the casing, part entering the impeller through the port 34 and part entering the impeller through the port 43. A portion of the liquid or air and liquid, as will be presently pointed out, is discharged

through the ports 39 and 47 and flows therefrom to the discharge pipe 31.

Formed preferably partly in the main casing part and partly in the cover part is a channel 48 which is adjacent the periphery of the blades of the impeller 23 and is adapted to receive the liquid discharged therefrom. This passage, as shown most clearly in Fig. 4, is of small cross sectional area adjacent the suction ports 34 and 43, as indicated at 49. The channel gradually increases in cross sectional area until it attains its maximum cross sectional area about at the point 51. From approximately this point the channel preferably gradually decreases in cross sectional area. The channel continues to decrease in cross sectional area beyond the discharge ports 39 and 47 and at the point 52 the peripheries of the blades make a close running fit with the casing while the channel is continued past the point 52 at the sides of the blades to the point 53. At this point the channel vanishes entirely and the blades make a close running fit with the casing from this point to the point 54 where the channel starts again. While I have shown the channel as being formed partly at the sides and partly at the peripheries of the blades this is optional. If desired, the channel may be formed wholly at the sides or wholly at the peripheries of the blades.

Between the ends 53 and 54 of the channel a bridge, indicated at 56 in the drawings, is formed which constitutes a part of the casing in which no channel is formed. The width of the bridge is such that flow of liquid from the discharge to the suction can not take place. That is, the blades are interconnected by webs and are alternately long and short, as shown in the drawings. The distance across the bridge is slightly greater than the distance between two adjacent long blades. Across the bridge the blades make a close running fit on all sides with the casing and leakage of liquid from discharge to suction can not take place.

Opening preferably sidewardly outward from the channel on each side thereof there is a pair of substantially peripheral discharge openings or discharge ports 57, shown most clearly in Fig. 6. The margins of these openings preferably extend at an acute angle to the direction of rotation of the impeller, as shown at 58. This provides for a smooth discharge of liquid from the channel 48 into the passages 33 and 46.

It will be noted from Fig. 6 that just beyond the discharge ports or openings 57 the side walls of the channel 48 approach the impeller, as shown at 59 in Fig. 6. This gradual approach of the side walls of the channel toward the impeller terminates at the point 53. As previously mentioned, at the point 52 the periphery of the impeller makes a close running fit with the casing or channel walls. The discharge ports or openings 57 may be placed at any point toward the discharge end of the channel depending upon the conditions of operation to be encountered. Moreover, the channel may be decreased in cross sectional area beyond the discharge ports or openings 57 at any progressively increasing rate.

I have found that it is desirable that the peripheral discharge ports or openings 57 be positioned preferably so that the ends thereof in the direction of rotation of the impeller lie, approximately along the radial line marking the beginning of the root discharge ports 39 and 47, as indicated at 61.

Moreover, the channel should rapidly decrease in cross sectional area beyond the ports 57. This

arrangement provides a maximum squeezing effect, as will presently appear, and insures that the major portion of the liquid will discharge through the peripheral ports 57 and only a minor portion of the liquid discharged through the root discharge ports 39 and 47.

The initial priming of the pump is accomplished through a priming opening, not shown, or through the suction or discharge openings if more convenient. After the pump has been primed, rotation of the impeller or rotor throws the water out between the blades toward the periphery by centrifugal force. This liquid is thrown out into the channel 48 and at the same time velocity is imparted to the liquid in this channel as each blade successively acts upon the liquid. The air being lighter than the liquid is not displaced by centrifugal force toward the periphery to as great an extent as the liquid and the major portion of the air remains adjacent the roots of the blades or adjacent center of the casing.

As the liquid approaches the peripheral discharge ports or openings 57 the major portion of the liquid flows outward through these ports. This occurs because the liquid takes the path of least resistance to flow and because just beyond the ports 57 the channel rapidly decreases in cross sectional area causing a slight back pressure which results in the major portion of the liquid being discharged through the ports 57. The liquid and air, should air be contained in the suction pipe or in the liquid being pumped, which passes the discharge ports 57, is squeezed towards the center of the impeller or towards the roots of the blades. The air being inward with respect to the liquid is forced out of the root discharge ports 39 and 47 together with some liquid.

It is desirable that the location of the peripheral discharge ports 57 and the root discharge ports 39 and 47 and the decreasing cross sectional area of the channel be arranged such that almost the entire volume of liquid discharged from the pump shall discharge through the peripheral discharge ports 57 and only a small portion of the liquid, together with the air, discharge through the root discharge ports. I have found with this arrangement that the over-all efficiency of the pump is increased by at least fifty per cent without any great sacrifice in the air handling ability of the pump. That is, the pump will prime itself rapidly and any decrease in air handling ability is more than offset by the greatly increased pumping efficiency of the unit.

Several facts of particular importance will be noted: first, that both the peripheral discharge ports 57 and the root discharge ports discharge into a common passageway which communicates with the discharge pipe 31. Thus the entire liquid of the pump is discharged to the point of use and no loss in efficiency results from wasting part of the useful effort of the pump. This is particularly important when the pump is handling only liquid since the over-all efficiency of the pump is maintained at a maximum. Should the suction pipe be filled with air, should air be contained in the liquid being pumped, or should the pump be used for pumping a volatile liquid, the air or volatilized liquid all passes out through the discharge passage so that no waste of useful energy occurs.

It will further be noted that the passageways 33 and 38 are located in the main part of the casing in which portion of the casing is also mounted the impeller. The passageways 42 and 46, on the other hand, are located in the cover plate.

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Moreover, the suction and discharge pipes 29 and 31 are located in the main portion of the casing. Thus the cover plate may be removed and access gained to the impeller without disturbing the suction and discharge pipes.

While I have shown and described the preferred form of my invention, it will be appreciated that various changes and modifications may be made, particularly in the form and relation of parts, without departing from the spirit of my invention as set forth in the appended claims.

I claim:

1. A pump comprising, in combination, a casing having an inlet and an outlet, a bladed impeller mounted in said casing, said impeller blades having root portions and peripheral portions, said casing having a passageway leading from the inlet to the roots of the blades, a channel in said casing adjacent the periphery of the blades into which the impeller discharges, said channel having a port for the discharge of liquid adjacent the periphery of the blades, and said casing having a passageway leading from the roots of the blades to the outlet for the discharge of air or a mixture of air and liquid when the pump is pumping air, said port and passageway being arranged so that liquid in its rotation first reaches the port and the major portion of the liquid is discharged therethrough said port and passageway being connected together so that the liquid and air flow to the common casing outlet, said casing channel increasing in cross section from the inlet to the roots of the blades to a point of maximum cross sectional area and thereafter decreasing in cross section to the outlet adjacent the roots of the blades.

2. A pump comprising, in combination, a casing having an inlet connection and an outlet connection, a bladed impeller mounted in said casing, said impeller blades having root portions and peripheral portions, said casing having a suction opening to the roots of the blades on each side of the impeller and passageways therethrough connecting the inlet connection to the suction openings, said casing also having a discharge outlet adjacent the roots of the blades on each side of the impeller for air or a mixture of air and liquid when the pump is pumping air, a channel in said casing adjacent the periphery of the blades into which liquid is discharged by the impeller,

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said channel having a discharge port for the discharge of liquid, and passageways through said casing connecting said discharge outlets and said discharge port with the outlet connection.

3. A pump comprising, in combination, a casing having an inlet connection and an outlet connection, a bladed impeller mounted in said casing, said impeller blades having root portions and peripheral portions, said casing having a suction opening to the roots of the blades on each side of the impeller and passageways therethrough connecting the inlet connection to the suction openings, said casing also having a discharge outlet adjacent the roots of the blades on each side of the impeller for air or a mixture of air and liquid when the pump is pumping air, a channel in said casing adjacent the periphery of the blades into which liquid is discharged by the impeller, said channel having a discharge port for the discharge of liquid in each side of the impeller, and passageways through said casing connecting said discharge outlets and said discharge ports with the outlet connection.

4. A pump as set forth in claim 2 in which the casing is made in at least two parts, one of which constitutes a cover plate for the pump with one of the suction openings and one of the ports together with the passages thereto being located in said cover plate.

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