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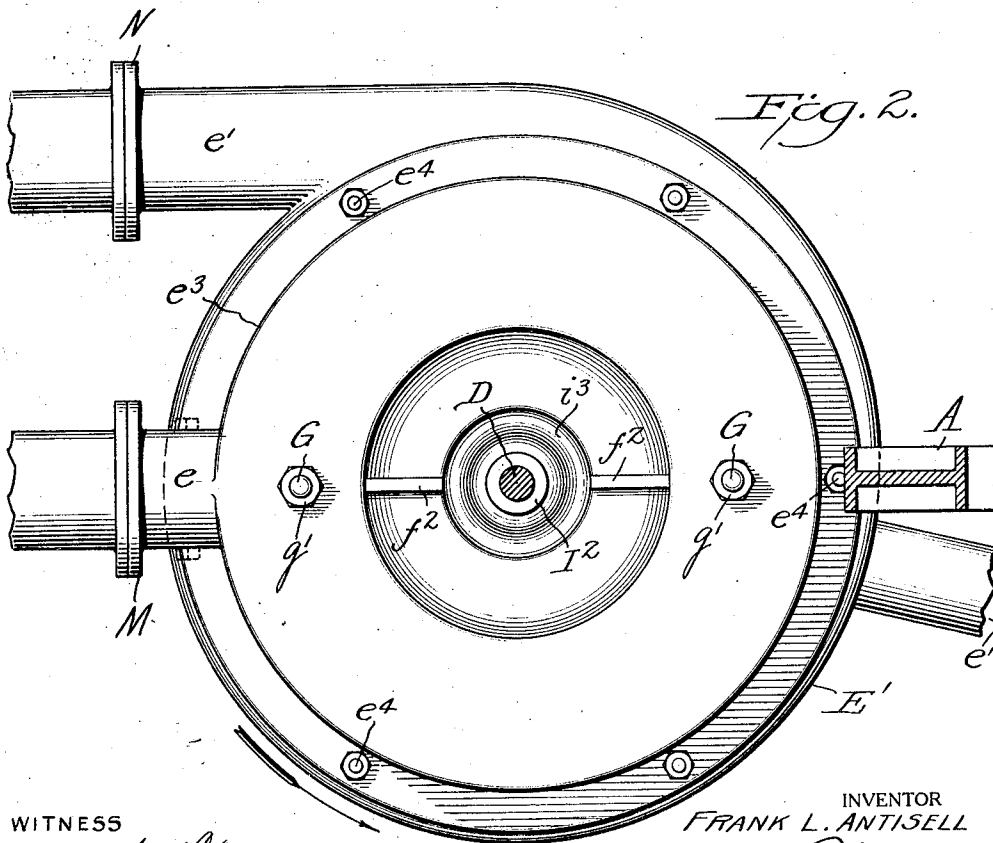
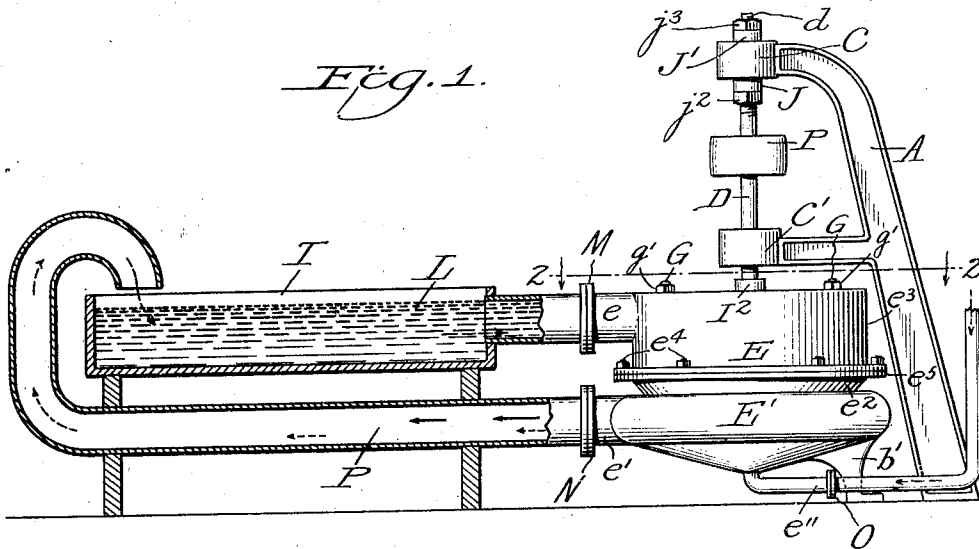
F. L. ANTISELL

1,726,136

VACUUM PUMP

Filed Jan. 13, 1926

3 Sheets-Sheet 1



WITNESS

Oliver W. Holmes.

INVENTOR
FRANK L. ANTISELL

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his ATTORNEY

Aug. 27, 1929.

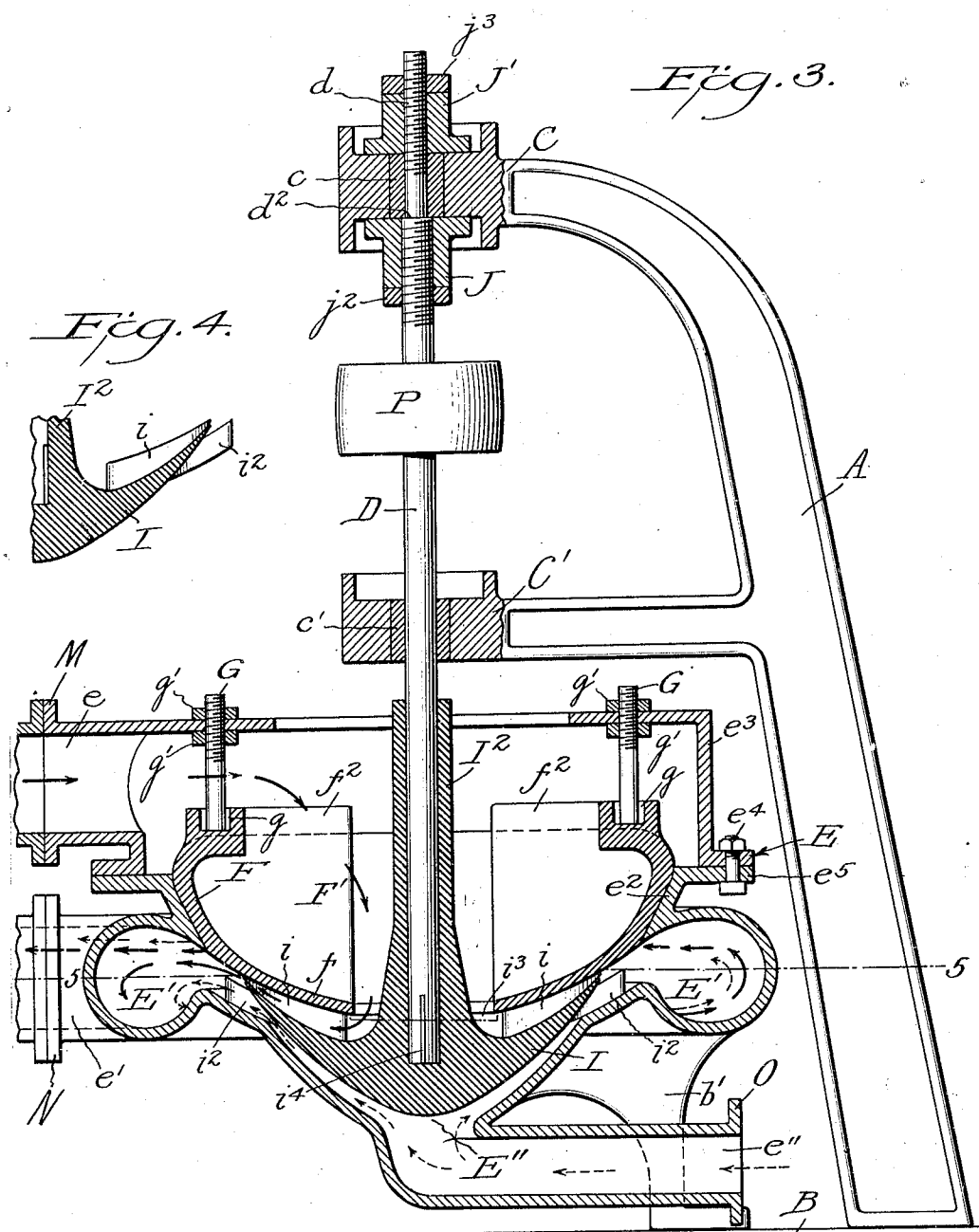
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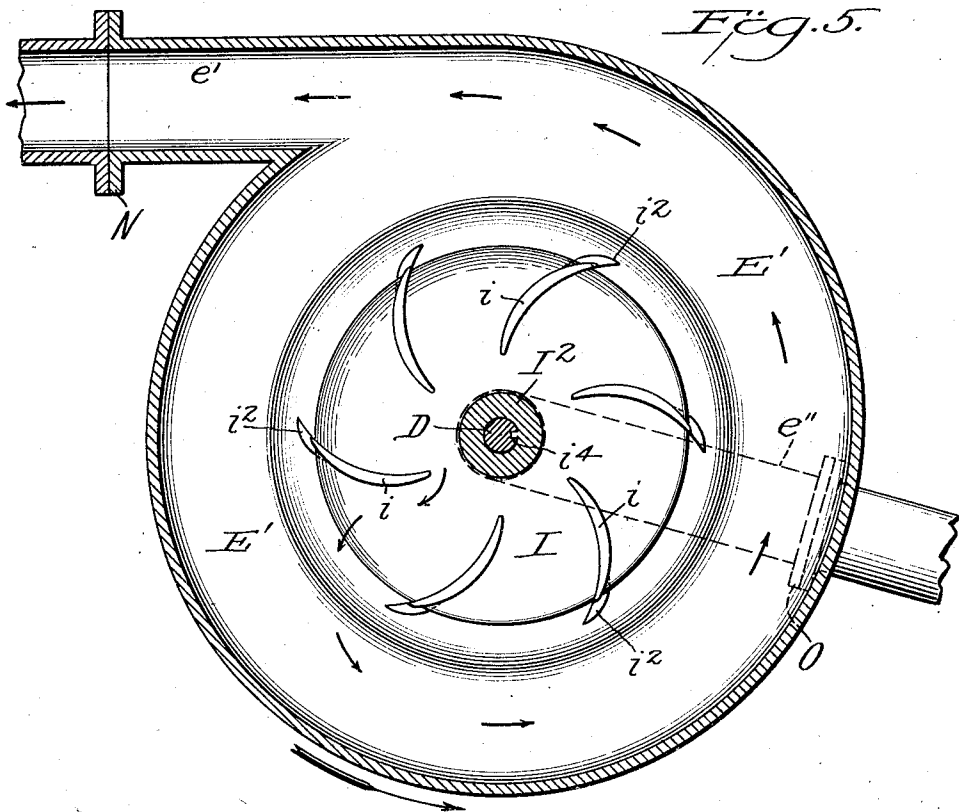
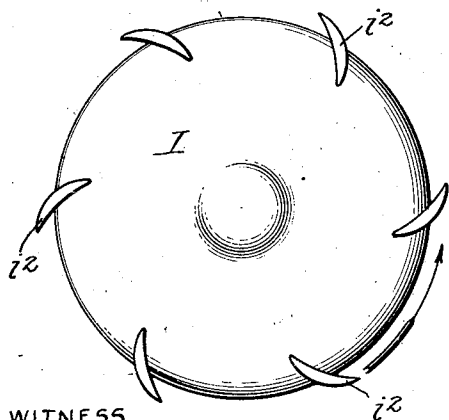


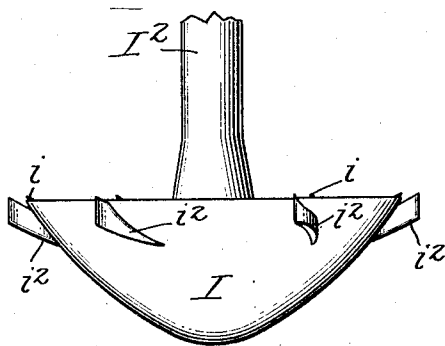
Fig. 6.



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Fig. 7.



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UNITED STATES PATENT OFFICE.

FRANK L. ANTISELL, OF PERTH AMBOY, NEW JERSEY.

VACUUM PUMP.

Application filed January 13, 1926. Serial No. 80,898.

This invention relates to a vacuum pump of the centrifugal type, the construction and operation thereof being in general similar to the pump disclosed in Patent No. 1,281,478, granted to me on October 15th, 1918.

The present structure, as with the patented structure, is characterized by an initially high mechanical efficiency and the ease with which said efficiency may be maintained; also with simplicity of construction and a correlation of the parts being such that the pump may be readily assembled and disassembled.

An important purpose of the present apparatus is to provide both a combined wet and dry vacuum apparatus of large capacity and of high efficiency.

In the drawings, forming a part of this specification, wherein like characters of reference denote corresponding parts in the several views:

Fig. 1 is a view in side elevation, partly in section, of an apparatus embodying my invention.

Fig. 2 is a plan view of the pumping apparatus taken on the sectional line 2—2 of Fig. 1.

Fig. 3 is a view partly in elevation and partly in vertical section of a centrifugal pump embodying my invention.

Fig. 4 is a detail of a portion of the impeller showing the vanes secured thereto.

Fig. 5 is a section on line 5—5 of Fig. 3.

Fig. 6 is a plan view of the lower face of the impeller.

Fig. 7 is a side view of the impeller.

In the interest of clearness, the same reference characters are used to designate like parts, so far as may be applicable, as were used in the specification of the aforesaid prior patent.

A designates a suitable supporting member mounted upon an appropriate base B and having spaced arms or brackets C and C' with alined openings therein. These openings are provided with suitable bearings c and c' respectively through which the impeller shaft D extends and is journaled. This shaft is suspended from the upper arm or bracket C and is adjustable longitudinally.

E designates a vertical centrifugal pump casing which is disposed below the arm or bracket C' and is preferably mounted on the base B by means of suitable supports b'. Supported upon the upper surface of the casing

E is a top or cap e^3 which is bolted as at e^4 to the radially extending flange e^5 of the casing E. F designates a stationary member which constitutes a cover and has a body portion f which rests upon the ledge e^2 of the casing E. The cover is provided with a plurality of vanes f^2 which project inwardly and upwardly therefrom. The cover F is held in position by a suitable number of threaded rods G which fit in sockets g in the upper edge of the cover F, which rods extend through the top or cap e^3 and are provided with locking nuts g' , g' above and below said top so that upon proper manipulation of these nuts the rods G bear upon and press against the upper edge of the cover F, as above described.

From the above construction it will be noted that a chamber F' is formed above the cover F, and that said cover F separates the spiral chamber E' from the chamber F.

Suitably splined at i^4 to the lower end of the shaft D is a rotary member or impeller I², said member being provided with an outwardly extending mushroom shaped head I, having secured thereto, at its edge, oppositely disposed impeller vanes, one set, indicated by i , being on the upper surface, and the other set, indicated by i^2 , being on the under surface, the vanes i extending from the periphery towards the hub, and the vanes i^2 being of less length than the opposing vanes but extending outwardly a short distance beyond the periphery of the impeller head.

The mushroom head of the impeller fits between the cover F and the lower surface of the casing E. The upper edges of the vanes i fitting closely with the lower surface of the cover F and the lower edges of the vanes i^2 fitting closely with the upper surface of the casing E. By means of this construction it will be seen that the mushroom shaped head of the impeller I operates in the chamber E'. The vanes i and i^2 are arcuate in shape as clearly indicated in Figs. 5 to 7, inclusive.

A central opening is provided in the cover which is of greater diameter than the base of the stem portion of the impeller, thus forming a passageway i^3 between the chamber F' and the chamber E'.

The casing E is provided with an inlet e and an outlet e' , the inlet leading into the chamber F' and the outlet leading from the chamber E', and, as above stated, the annu-

larly disposed passageway i^2 , connecting the two chambers.

In order to rotate the impeller a pulley P is provided on the shaft D, and as hereinbefore stated, the shaft is adjustable longitudinally through the arms C and C' and is maintained in position by the nuts J and J'. The upper end of the shaft D is formed into a portion d of less area in cross section than that of the shaft D, and the bearing c is mounted upon the section d and its lower end rests partly upon the shoulder d^2 formed at the junction of the section d with the shaft D, and partly upon the upper end of the nut J which engages with screw threads on the shaft D. The nut J' has a screw threaded engagement with the portion d of the shaft above the bearing c and rests partly upon the upper surface of the arm and bracket C. This correlation of parts enables them to be readily assembled, and also affords ready access to the bearing when the latter is renewed, as well as affording means for the convenient adjustment of the shaft and impeller. To more effectively maintain the parts in adjusted position, I prefer to employ lock nuts j^2 and j^3 below and above the nuts J and J' respectively.

Leading to a chamber E'' just below the central portion of the impeller is a conduit e'' which may be secured to an engine or to any device in which it is desired to form a vacuum. Suitable coupling flanges M, N and O are provided to readily secure the pump portions of the device with the engine or the machine in which the vacuum is to be formed and to a deaerating tank, as shown.

The principle of operation is very simple. The shaft and impeller is rotated by suitable motor connection, not shown, in the direction indicated by the large arrow in Figs. 2, 5 and 6. The impeller is supplied by means of two different inlets, one above for liquid and the other below for gas. The liquid flows from the deaerating tank T through the inlet e then through the annular opening i^2 around the impeller and discharged through the outlet e' , as indicated by the heavy line arrows.

The vacuum is developed through the conduit e'' . The velocity of the passage of the solution over the rim of the impeller ejects (sucks) the vapors from the engine, or other device, to be evacuated through the opening e'' below the impeller. These gases, of course, immediately mix with the primary liquid L entering the liquid as they are drawn from the chamber to be evacuated and pass with the solution through the conduit P into the tank T and the gases are then liberated from the tank as indicated by the small bubbles illustrated in Fig. 1. The solution then passes through the pump and again with the occluded gases through the pipe P to the tank T, and so on, until a complete and perfect vacuum is produced or effected. The gas passes in through the conduit e'' and through

the chambers E'' and E and are expelled with the liquid from the periphery of the impeller, as indicated by the arrows in dotted lines, the passage of the solution being indicated both by the heavy and the dotted line arrows.

As described above and illustrated in Fig. 1, the occluded gases are liberated from the tank T and the solution is returned to the pump through e' for a continuous cycle, the vacuum being produced by a process of operation very similar to that carried out in the ordinary hydraulic ejector where the static pressure is converted into a velocity pressure in a nozzle tube that projects a stream of fluid, water, steam or air, the high velocity of said stream ejecting the air surrounding the nozzle.

With my invention, I am enabled to employ the entire circumference of the impeller, say 40 inches in circumference with an opening of substantially $\frac{1}{2}$ in. high, or 20 sq. in. through which the ejector liquid is caused to flow at a very high velocity and generated at a high efficiency. This high moving body of liquid being projected in a radial and more or less horizontal plane, causes a very efficient production of the vacuum, the gas passing through a nozzle of about the same size as the one for the liquid described above.

As shown, the series of vanes i^2 extend beyond the periphery of the impeller, and operate to preclude the backward movement of the solution being pumped, into the vacuum inlet e'' when the deaerating tank on the pump head is very high. These supplementary vanes or tips i^2 , being arranged at a proper position and angle, have a greater resultant velocity than the vanes i , and, as above stated, the liquid, therefore, is excluded from passing under the impeller, thus enabling a vacuum to be formed under the impeller. The term "resultant" is used in the same manner and with the same meaning as that used in velocity exit centrifugal pump graphics.

From the above, it will be seen that this apparatus, while being well adapted for the production of a vacuum containing gases of a corrosive nature, is also suitable for maintaining a vacuum in condensing engines or turbines, in which case the vacuum inlet e'' would necessarily be relatively large in proportion to the inlet e , while the respective dimensions in these inlets in a device for handling gases in a chemical plant are so proportioned that the vacuum production inlet e'' is considerably smaller in diameter than that of the inlet e .

When the apparatus is used in connection with steam or heated vapors, it is desirable, and may even be absolutely necessary, to cool the circulating water or provide fresh water to replace the water heated during the cycle of operation.

In the production of a vacuum the gases will liberate themselves from the solution in

the deaerating tank T to the atmosphere, and a vacuum of greater or less tension is thus maintained.

The apparatus, as above described, can be well adapted to the manufacture of products in solution, or to collect gases, which, as they are liberated, may be stored in a gasometer, or to retain gases in liquids.

The pump embodying my invention, however, is primarily adapted to provide the necessary vacuum in the apparatus being operated upon. If a steam engine, the pump is connected to the exhaust; if a heating system, the pump should be connected to the main drip of that system. If it is desired to operate with chemical fumes, the solution is treated accordingly, and the parts of the apparatus are constructed from material not affected by the fumes.

As changes of construction could be made within the scope of my invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. Apparatus of the type described which comprises a centrifugal impeller plate, a casing enclosing said impeller and forming upper and lower annular jet openings therewith and having an annular expanded jet passage beyond the edge of said impeller plate and opening to a receiving chamber beyond the periphery of said impeller, means for supplying liquid to one face of said impeller to be ejected through one of said jet openings, means on said impeller plate to centrifugally force water over the periphery of said impeller through said jet opening into said annular receiving chamber, and means on the opposite face of said impeller plate to create a centrifugal force on the liquid and gas in said jet passage against the back pressure of said liquid and gas.

2. Apparatus of the type described which comprises a centrifugal impeller plate, a casing enclosing said impeller plate having an annular receiving chamber beyond the periphery of said impeller plate, said casing forming a water jet with one side of said impeller plate and an expanding air and water mixing passage on the opposite face of said impeller plate adjacent, and extending beyond, its periphery, means on said impeller plate to impart a centrifugal velocity to said water jet, and means to create a centrifugal pressure on water and gas in said expanding air and water mixing passage.

3. Apparatus of the type described which comprises a centrifugal impeller plate, a casing for said impeller having an annular receiving chamber beyond the edge of said impeller plate, said casing having a water inlet

in its upper wall and an air inlet in its lower wall and forming with said impeller plate a converging jet above said impeller, a passage for air beneath said impeller plate and a widened passage from said jets to said annular chamber, means between said impeller plate, and the upper wall of said chamber to impart a positive centrifugal force to water above said impeller plate, and means to impart additional centrifugal force to air drawn into said widened passage and to water admixed with said air counter to the back pressure from said annular chamber.

4. Apparatus of the type described which comprises a shallow dished chamber having opposite walls converging towards their peripheral edges, and each having a central inlet, said chamber having a peripheral compartment with a tangential outlet, an impeller plate in said chamber concentric therewith, the edge of said plate approaching one wall of said chamber and forming a diverging mixing chamber with the other wall, and impeller vanes in said diverging mixing chamber.

5. Apparatus of the type described which comprises an impeller plate, a chamber enclosing said plate and having a liquid inlet at one side of said plate, a gas inlet at the opposite side of said plate, an annular receiving and outlet compartment encircling said plate, said plate forming with one wall of said chamber an annular contracted liquid jet opening and forming with the other wall a narrow gas jet opening, an enlarged air and gas mixing passage in free communication with said gas opening and said receiving compartment, impeller means on the liquid receiving side of said plate, and impeller means on said plate in said mixing passage.

6. Apparatus of the type described which comprises an impeller plate, a chamber enclosing said plate and having a liquid inlet at one side of said plate, a gas inlet at the opposite side of said plate, an annular peripheral receiving compartment having an annular connecting passage to said chamber, said impeller plate forming a contracted liquid jet with one wall of said chamber and an expanding gas and liquid mixing chamber with the other wall of said chamber, means for impelling water towards said liquid jet, and means in said expanding gas and liquid mixing chamber to impart additional centrifugal force to the fluids therein.

7. A centrifugal pump which comprises an impeller plate, a chamber housing said impeller and having an axial liquid inlet to one face of said plate and an axial gas inlet to the opposite face, and having an annular receiving chamber encircling the edge of said impeller plate, a tangential outlet for said annular receiving chamber, said housing chamber forming with one face of said im-

5 peller plate adjacent its periphery an expanding gas passage opening directly into said annular receiving chamber and forming with the peripheral edge of said impeller plate a liquid jet into said expanding gas passage.

10 8. A centrifugal pump which comprises an impeller plate, a housing chamber for said impeller plate having an axial liquid inlet at one face of said plate and an axial gas inlet at the opposite face, said housing chamber having an annular receiving chamber encircling the edge of said impeller plate, a tangential outlet for said annular receiving chamber, said housing chamber forming, with one face of said impeller plate adjacent its periphery, an expanding gas passage opening directly into said annular receiving chamber and forming, with the peripheral edge of said impeller plate, a liquid jet into said expanding gas passage, impeller vanes on the liquid receiving face of said plate, and impeller vanes on the opposite face of said plate projecting into said expanding gas passage.

25 9. A centrifugal pump which comprises a dished impeller plate, a chamber having a lower wall, a passage in said lower wall centrally of said impeller plate, the lower wall of said chamber gradually approaching said impeller plate to a distance short of the edge of said impeller plate and then diverging therefrom and forming an annular enlarged chamber encircling the periphery of said impeller plate, said annular chamber having an annular joint surface at its inner periphery, an upper wall for said chamber fitting said joint surface and curving to form a narrow jet with the edge of said impeller plate and an inwardly diverging liquid passage, and having an inlet centrally of said impeller plate, impeller vanes on the upper surface of

said impeller, and impeller vanes on the lower surface of said impeller plate and projecting beyond its periphery into said diverging passage.

10. Apparatus of the type described which comprises a shallow chamber having a pair of spaced walls and central inlets in said walls and having a peripheral compartment, an impeller plate centrally mounted in said chamber, the edge of said plate diverging from one wall of said chamber to form an expanding gas and liquid passage to said peripheral compartment and forming with the opposed wall of said chamber a liquid jet into said diverging passage.

11. Apparatus of the type described which comprises a shallow, dished chamber having spaced walls and central inlets in said walls and having a peripheral compartment, an impeller plate in said chamber, the edge of said plate diverging from one wall of said chamber adjacent said peripheral compartment to form an expanding gas and liquid mixing jet and approaching the opposed wall of said chamber to form a contracted liquid jet opening into said gas and liquid mixing jet, and impeller vanes on said impeller plate and extending to the wall of said chamber towards which said plate converges.

12. Apparatus of the type described which comprises a shallow, dished chamber having central inlets in its opposed walls and having a peripheral compartment into which it opens at its periphery, a dished impeller plate mounted centrally in said chamber to form a diverging gas jet with one wall of said chamber adjacent said peripheral compartment, and a liquid jet with the opposed wall of said chamber, and impeller vanes on said impeller plate and between said plate and said chamber walls.

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