M. LEBLANC.

CONDENSER.

APPLICATION FILED MAR. 22, 1905. RENEWED JULY 23, 1907.

984,278. Patented Feb. 14, 1911.

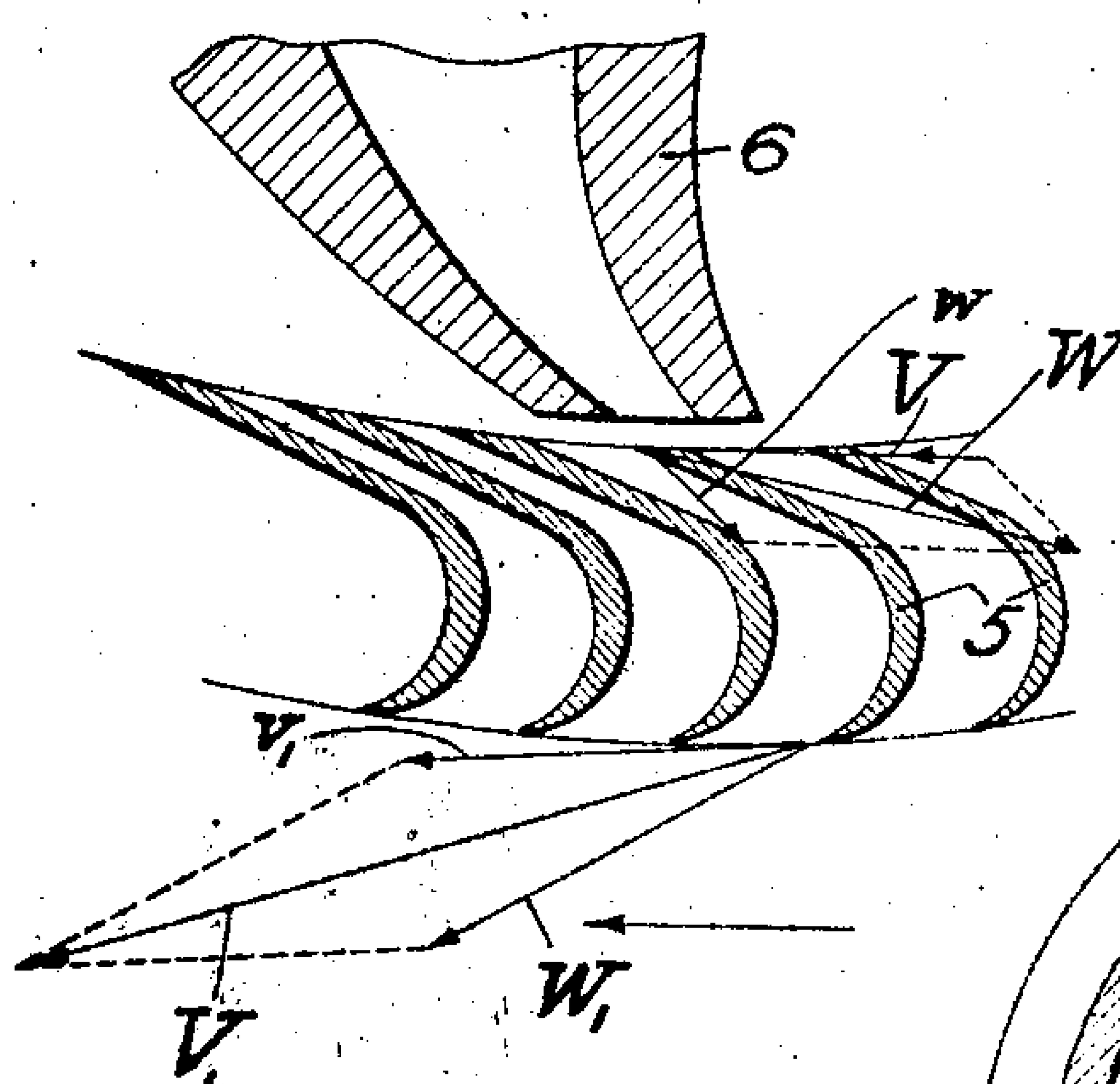


FIG. 1.

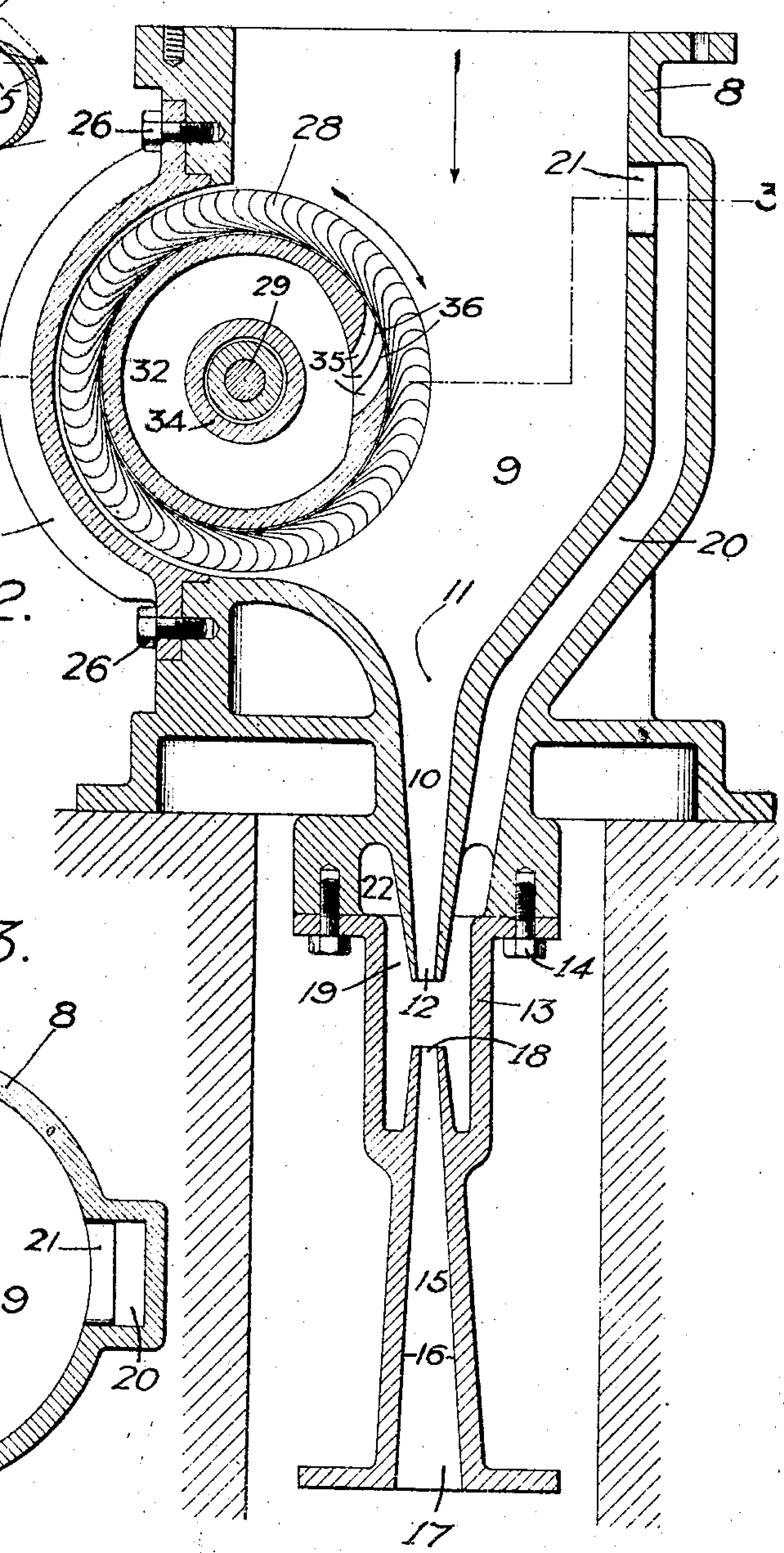
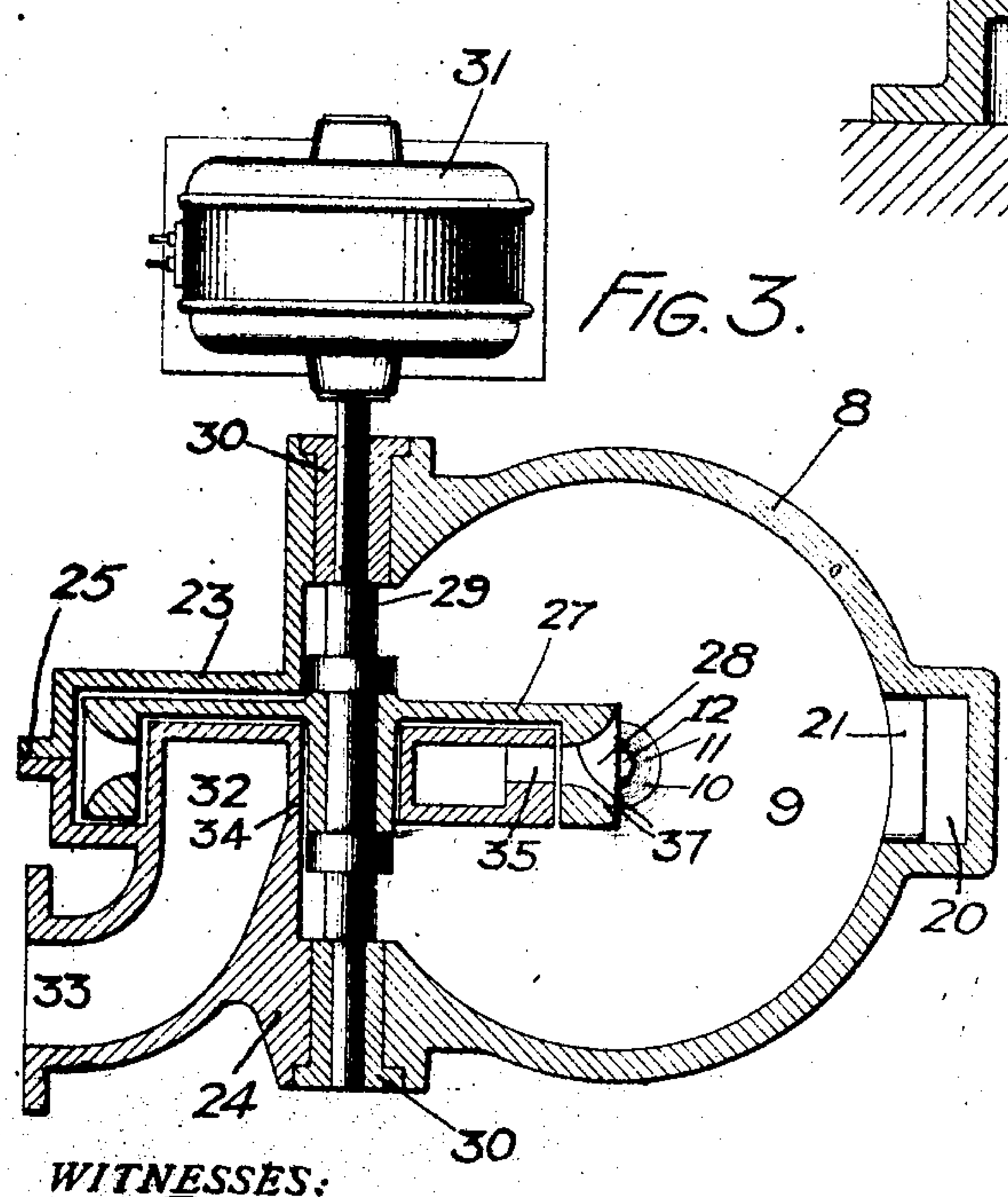


FIG. 2.

FIG. 3.



WITNESSES:

INVENTOR.

BY Maurice Leblanc

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MAURICE LEBLANC, OF PARIS, FRANCE, ASSIGNOR TO SOCIETE ANONYME POUR L'EXPLOITATION DES PROCEDES WESTINGHOUSE-LEBLANC, OF PARIS, FRANCE.

CONDENSER.

984,278. Specification of Letters Patent. Patented Feb. 14, 1911.

Application filed March 22, 1905, Serial No. 251,392. Renewed July 23, 1907. Serial No. 385,142.

To all whom it may concern:

Be it known that I, MAURICE LEBLANC, a citizen of the Republic of France, residing at Villa Montmorency, Auteuil, Paris, France, have invented a new and useful Improvement in Condensers, of which the following is a specification.

This invention relates to fluid translating devices; that is, devices for translating or moving fluid from one point to another point.

An object of this invention is to produce or provide a simple and efficient fluid translating device or apparatus for mechanically forming a stream or jet of liquid of high velocity.

A further object is to produce or provide a device or apparatus for mechanically forming a stream or jet of liquid of high velocity so subdivided that it has the power to entrain and carry with it from one point to a point of greater pressure more elastic fluid for a given amount of liquid at a given velocity than can be carried by any of the liquid jet devices in use before my invention so far as I know.

A still further object is to produce or provide an efficient vapor condenser utilizing my novel liquid jet-forming device for carrying away the condensed and non-condensable vapors as well as for performing the act of condensing the condensable vapors.

Figure 1 is a diagrammatic illustration in which a portion of the ring of blades of the bladed impeller are shown in section, in connection with a sectional view of a distributer or liquid delivery nozzle and force diagrams, which represent the velocities of the liquid entering and leaving the impeller. Fig. 2 is a vertical section taken through a condenser embodying my invention and Fig. 3 is a view in cross section taken along the broken line 3—3 of the Fig. 2.

The fluid translating device consists of: 1st. A bladed, rotatable impeller; 2nd. A distributer for delivering liquid, such as water, to a number of the blades of the impeller less than the total number; 3rd. A device, such as a reciprocating engine, a steam or water turbine or an electric motor, for driving or rotating the impeller; 4th. A collecting chamber or combining tube for collecting the liquid projected by the impeller and compacting or reducing the cross section thereof without increasing its pressure; and 5th. A diffuser for transforming the velocity imparted to the liquid by the impeller into pressure.

In order to clearly explain the formation of the liquid stream or jet of my device or apparatus, I have included Fig. 1 of the drawings to which reference may be had. In connection with this view, which is diagrammatic, I assume: 1st. That the blades 5 are a number of those embraced in an annular row projecting laterally from the rim of the impeller; 2nd. That the impeller is rotated by some suitable means at a speed which will give to the blades the desired speed of travel; 3rd. That the nozzle or spout 6 is a distributer located within the ring described by the moving blades and delivers water or other liquid to a number of the blades less than the total number embraced in the annular row; 4th. That the speed of travel of the blades or the velocity at which they are moved or rotated past the distributer equals V; and, 5th. That the distributer delivers liquid at a velocity w.

Under the above conditions the liquid enters the spaces between the blades at a velocity W relative to the blades and is discharged by the blades with a velocity W_1 relative to the blades. The velocity W_1, depends upon the form of the blades and will exceed w as a certain amount of velocity is added due to the centrifugal pumping action of the blades. The velocity of the blades at their outlet edges is v^1 and the liquid leaves the blades at an absolute velocity V_1. This velocity V_1 is approximately double the velocity v_1. It is, therefore, seen that by means of my device I can communicate a velocity to the liquid approximately double the velocity obtainable by means of a centrifugal pump of the same peripheral speed, it being understood that in centrifugal pumps the pressure of the liquid must be first increased and then this pressure transformed into velocity in a nozzle. The liquid leaving the impeller of a centrifugal pump has a certain velocity which results in a loss of efficiency, but in my device all of the *vis viva* of the liquid leaving the impeller is effectively utilized. This is of the utmost importance when streams or jets of liquid of high velocity are necessary.

In the drawings, without any idea of limiting the invention, but only with the idea of showing one adaptation, I have illustrated

the invention in connection with a vapor condenser in which the steam or other vapor to be condensed is brought into direct contact with the condensing liquid, such as water. Hereinafter such vapor will be called "steam" and the liquid "water," with no idea, however, of limiting the invention thereby to such particular fluids.

The condenser consists of a body portion 8 inclosing a condensing chamber 9 adapted to be connected to the pipe or conduit for conducting to it the steam to be condensed.

The walls of the body portion near the bottom converge to form a collecting chamber or combining tube 10 which decreases in cross sectional area from its inlet 11 to its outlet 12. A casting 13, by means of bolts 14, is secured to the body portion and has a diffuser 15 formed therein. The walls 16 of the diffuser diverge so that its outlet 17 is larger than its inlet 18, which inlet is arranged axially in line with the collecting chamber 10. Casting 13 is of such shape that a chamber 19 is provided which surrounds and connects with the outlet of the collecting chamber and the inlet of the diffuser.

Chamber 19 is connected to the condensing chamber by means of a passage 20 cored in the body portion and which terminates at one end in a port 21 leading into the condensing chamber and at the other end in a recess 22 which forms a portion of chamber 19. The passage 20 operates as an equalizing passage and insures the same pressure in the chamber 19 as that existing in the chamber 9. With this arrangement the stream of liquid ejected from the outlet 12 does not have to overcome an increase of pressure in entering the chamber 19.

A cover cast in two sections 23 and 24 bolted together at 25 is secured to the body portion by means of bolts 26.

An impeller 27 carrying an annular row of blades 28 is mounted on shaft 29 journaled in bearings 30 which are located between the body portion 8 and the cover formed by sections 23 and 24.

The shaft is adapted to be rotated at the desired speed by means of an electric motor 31 which, of course, if desired, may be replaced by any other type of motor, such as a steam or water turbine or a reciprocating engine.

Section 24 of the cover is cored so as to provide a water chamber 32 having an inlet 33 adapted to be connected to a suitable source of supply of condensing water. The chamber 32 has a tubular wall 34 which surrounds the hub of the impeller and also has an outlet 35 provided with partition vanes 36. The chamber 32 and the outlet 35, which latter may be termed a nozzle, lie within the ring described by the blades 28 and together form the distributer for delivering water to the blades. As the nozzle extends only part way around the ring described by the blades and delivers water to a portion only of the circumference of the row of the blades, or, in other words, to a number of the blades less than the total number, I term the impeller a partial injection or partial influx type of impeller as distinguished from one in which all of the blades simultaneously receive water.

The faces 37 of the shrouds or ends of the blades diverge; therefore, the water projected by the blades will be in the nature of films or leaves of fan-like formation and at the velocity imparted to them will be projected toward the collecting chamber. In this way a minute subdivision of the water is attained and it has been found that the capacity of such a stream or jet for condensing steam or vapor and for removing air or other non-condensable gases and uncondensed vapor, is extremely high.

The operation of the device is as follows: The stream comprising the succession of separate leaves or films of liquid discharged from the rotating impeller travels downwardly through the chamber 9 and is received by the collecting chamber 10, where it is compressed and rendered more compact and from which it is discharged, due to its initial velocity, into the diffuser or transformer 15. The velocity of the liquid is converted into pressure as the liquid traverses the diffuser. The films or leaves of water discharged from the impeller blades operate as a series of separate pistons in traversing the chamber 9 and the tube 10 and the air removed from the chamber 9 is confined between adjacent films or leaves and is ejected from the condensing chamber with the water.

I have found by experience that it is desirable to have the separate leaves, or the stream composed of the separate leaves, projected from the impeller into the condensing chamber, at a point between the admission port, through which air enters the chamber, and the discharge port from which the air is ejected. In addition to this, I find it desirable to confine the leaves or films of liquid by means of the walls of the tube or tubular passage through which they move in order to obtain the highest efficiency. By providing such a tube or passage, the analogy between the operation of each leaf, traversing the passage, and a piston will be more marked. My theory is, that the leaf, at the time of its formation and subsequently, must be subjected to substantially equal pressures on both sides, or else it will break into a mass of separate drops and be rendered less effective as a fluid translating agent.

As the separate leaves travel down-

wardly, through the converging walls of the chamber 9 and the collector tube 10, they are gradually contracted or confined by the converging walls, but the pressures on both sides of each film are approximately equal during the time that the leaves or films are traversing the chamber 9 and the tube 10. The impeller may be so arranged that it will project more than one stream composed of a succession of separate leaves or films; but with such an arrangement, a separate chamber 9 and collector 10 must be provided for each stream. The fact that it is desirable to project the separate leaves entering each chamber 9 into the chamber between the air admission and the air discharge port, renders it impracticable to employ a total influx impeller; in other words, the fact that the separate leaves should be discharged into a chamber or passage at a point between the air inlet and the air discharge port of that passage in order to obtain the best results, and the fact that the separate leaves must be confined by the walls of the passage, through which they pass, renders it impracticable to employ a total injection or total influx impeller. In addition to this, if a total influx impeller were employed the width of the distributing port, that is, of the annular port delivering liquid to the blades 28, would of necessity be so small for commercial sizes of condensers that the device would not operate with any kind of efficiency and in fact would be practically inoperative.

Having thus described my invention, what I claim is:

1. The combination of a collecting and combining chamber, a diffuser communicating therewith and a partial injection rotatable impeller adapted to discharge liquid into said chamber.

2. In a device of the character described, a collecting and combining chamber, a diffuser in line therewith, a bladed rotatable impeller and means for distributing liquid to a number of the blades of said impeller less than the total number.

3. In a device of the character described, a collecting and combining chamber, a diffuser, a rotatable bladed impeller and means located within the periphery of said impeller for distributing liquid to a number of the blades thereof less than the total number.

4. In a condenser, a condensing chamber, a combining tube communicating with said chamber, a diffuser in line with said combining tube, a chamber surrounding the outlet of said combining tube and the inlet of said diffuser, a conduit or passage connecting said latter chamber with said condensing chamber, a bladed rotatable impeller and means located within the ring described by the blades of said impeller for distributing condensing liquid to a number of said blades less than the total number.

5. In a fluid translating device, a combining tube, a diffuser in line therewith, a rotatable impeller provided with an annular row of blades, means for delivering liquid to a portion only of the blades whereby said liquid is discharged into and through said combining tube and diffuser and means for rotating said impeller.

6. In a fluid translating device, a collecting and combining chamber, a diffuser in line therewith, an impeller provided with an annular row of blades the longitudinal axes of which extend parallel to the axis of rotation of said impeller and means for delivering liquid to a number of said blades less than the total number.

7. In a fluid translating device, a collecting and combining chamber, a diffuser in line therewith, a rotatable impeller provided with an annular row of blades adapted to discharge toward said chamber and means for distributing liquid to a number of the blades of said row less than the total number.

8. In a fluid translating device, a liquid distributing nozzle, rotatable means provided with curved blades so formed that the liquid delivered from said nozzle is projected from said blades at a velocity higher than the peripheral velocity of said means, and an agent for rotating said rotatable means in a direction opposite to the direction of rotation which the liquid discharged from said nozzle would tend to impart thereto.

9. In a fluid translating device, a liquid distributing nozzle, an impeller provided with blades for receiving the liquid discharged from said nozzle and formed so as to impart to the liquid a velocity higher than the peripheral velocity of said impeller and means for rotating said impeller in a direction opposite to the direction of rotation which the liquid delivered to said blades would tend to impart to the impeller.

10. In a device of the character described, an impeller provided with an annular row of blades, means for delivering liquid to a number of said blades less than the total number thereof, a chamber provided with an inlet for fluid to be acted upon by the discharged liquid and adapted to serve as a collecting and combining chamber and a diffuser communicating with the outlet of said chamber.

11. In a device of the character described, an impeller provided with an annular row of blades, means for delivering liquid to a number of said blades less than the total number thereof, a chamber provided with an inlet for fluid to be acted upon by the discharged liquid and adapted to serve as a

collecting and combining chamber and a diffuser in line with the outlet of said chamber.

12. In a device of the character described, an impeller provided with an annular row of blades, means for delivering liquid to a number of said blades less than the total number thereof, a chamber provided with an inlet for fluid to be acted upon by the discharged liquid and adapted to serve as a collecting and combining chamber, a diffuser in line with the outlet of said chamber and a chamber surrounding the outlet of said first mentioned chamber and the inlet to said diffuser.

13. In a device of the character described, an impeller provided with an annular row of blades, means for delivering liquid to a number of said blades less than the total number thereof, a chamber provided with an inlet for fluid to be acted upon by the discharged liquid and adapted to serve as a collecting and combining chamber, a diffuser in line with the outlet of said chamber, a chamber surrounding the outlet of said first mentioned chamber and the inlet to said diffuser and means other than the outlet to said first mentioned chamber for placing said two chambers in communication one with the other.

14. In a device of the character described, a bladed impeller, means for rotating said impeller, means for delivering liquid to a number of the blades thereof less than the total number, a chamber provided with an inlet for the fluid to be acted upon by the liquid discharged from said impeller and adapted to collect and combine said liquid and said fluid and a diffuser in communication with the outlet of said chamber.

15. In a device of the character described, a bladed impeller, means for rotating said impeller, means for delivering liquid to a number of the blades thereof less than the total number, a chamber provided with an inlet for the fluid to be acted upon by the liquid discharged from said impeller and adapted to collect and combine said liquid and said fluid and a diffuser in line with said chamber.

16. The combination of a collecting and combining chamber, a diffuser communicating therewith, a bladed impeller adapted to discharge liquid into said chamber and means for delivering liquid to a number of the blades of said impeller less than the total number thereof.

17. The combination of a collecting and combining chamber provided with a fluid inlet, a liquid inlet and an outlet for combined fluid and liquid, a diffuser communicating with said outlet, a bladed impeller adapted to discharge liquid through said liquid inlet and means for delivering liquid to a number of the blades of said impeller less than the total number thereof.

18. The combination of a collecting and combining chamber provided with a fluid inlet, a liquid inlet and an outlet for combined fluid and liquid, a diffuser communicating with said outlet, a bladed impeller adapted to discharge liquid through said liquid inlet and means for delivering liquid to said impeller.

19. The combination of a collecting and combining chamber provided with a fluid inlet, a liquid inlet and an outlet for combining fluid and liquid, a diffuser communicating with said inlet, an impeller provided with an annular row of blades adapted to discharge liquid through said liquid inlet and a nozzle located within the ring described by said blades for delivering liquid thereto.

20. In a device of the character described, a bladed rotatable impeller, means for delivering liquid to a portion of the periphery thereof, a collector for the liquid projected by said impeller, the longitudinal axis of which is tangent to said impeller and means for transforming the velocity of said liquid into pressure.

21. In a device of the character described, a bladed rotatable impeller, means for delivering liquid thereto, a collector for the liquid projected by said impeller, the longitudinal axis of which is tangent to said impeller and means for transforming the velocity of said liquid into pressure.

22. In a device of the character described, a chambered member provided with a fluid inlet, a liquid inlet and a combined liquid and fluid outlet, means adapted to receive the liquid and fluid delivered through said outlet and to transform the velocity thereof into pressure and means employing a bladed rotor element for projecting liquid into said chambered member through said liquid inlet.

23. In a device of the character described, a rotatable impeller provided with an annular row of blades, means for delivering liquid to said impeller in such a manner that it will be projected by said impeller through a portion only of its periphery, a chamber into which said liquid is adapted to be projected provided with an inlet for the fluid to be acted upon by said liquid and an outlet for said liquid and the fluid acted upon and means in connection with said outlet adapted to transform fluid velocity into pressure.

24. In an elastic fluid pump, a chambered member provided with a fluid inlet adapted to be connected to the device from which elastic fluid is to be pumped, an outlet, an inlet for liquid located between said fluid inlet and said outlet, a bladed rotatable impeller adapted to project liquid into the chamber of said member and toward said

outlet, means for delivering liquid to said impeller and means for transforming the velocity of the liquid passing through said outlet into pressure.

25. In an elastic fluid pump, a chambered member provided with a fluid inlet adapted to be connected to the device from which elastic fluid is to be pumped, an outlet, an inlet for liquid located between said fluid inlet and said outlet, a bladed rotatable impeller adapted to project liquid into the chamber of said member and toward said outlet, means for delivering liquid to said impeller and means for raising the pressure of the fluid passing through said outlet above the pressure existing in said chamber.

26. In combination with a chamber provided with an inlet for fluid and converging walls terminating in an outlet, means employing a rotatable liquid impeller for delivering liquid to said chamber at a point between the inlet and the outlet thereof and for projecting it in a subdivided state through said chamber and means for rotating said impeller.

27. In combination with a chamber provided with an inlet for fluid and converging walls terminating in an outlet, means employing a rotatable liquid impeller for delivering liquid in the form of films or leaves into said chamber between the inlet and the outlet thereof and for projecting the liquid through said chamber and means for rotating said impeller.

28. In combination with a chamber provided with an inlet for fluid and converging walls terminating in an outlet, means arranged so as to project liquid at a relatively high velocity in the form of films or leaves into said chamber between the inlet and outlet thereof and means for rotating said impeller.

29. In combination with a chamber provided with an inlet for fluid and converging walls terminating in an outlet, a partial efflux impeller arranged so as to project liquid at a relatively high velocity in the form of films or leaves into said chamber between the inlet and outlet thereof.

30. In combination with a chamber provided with an inlet for fluid and converging walls terminating in an outlet, means employing a partial efflux rotatable liquid impeller arranged so as to project liquid at relatively high velocity in a subdivided state into said chamber between the inlet and outlet thereof and means communicating with said outlet for transforming fluid velocity into pressure.

31. In combination with a chamber provided with an inlet for fluid and converging walls terminating in an outlet, means communicating with said outlet formed for transforming fluid velocity into pressure and means employing a partial efflux liquid impeller arranged so as to project a succession of liquid films of relatively high velocity into said chamber between the inlet and outlet thereof.

32. In combination with a chamber provided with an inlet for fluid and converging walls terminating in an outlet, means communicating with said outlet for transforming fluid velocity into pressure and means employing a partial ejection rotatable liquid impeller arranged so as to project liquid at relatively high velocity in the form of films into said chamber between the inlet and outlet thereof.

33. In combination with a chamber provided with an inlet for fluid and converging walls terminating in an outlet, means employing a partial efflux rotatable liquid impeller arranged so as to project liquid at a relatively high velocity in a subdivided state into said chamber between the inlet and outlet thereof, means communicating with said outlet for transforming fluid velocity into pressure and a passage arranged so as to maintain a pressure at the inlet to said velocity transforming means substantially the same as the pressure within said chamber.

34. In combination with a chamber provided with an inlet for fluid and converging walls terminating in an outlet, means communicating with said outlet formed for transforming fluid velocity into pressure, means employing a partial efflux liquid impeller arranged so as to project a succession of liquid films of relatively high velocity into said chamber between the inlet and outlet thereof, and a passage arranged so as to maintain a pressure at the inlet to said velocity-transforming means substantially the same as the pressure within said chamber.

35. In combination with a chamber provided with an inlet for fluid and converging walls terminating in an outlet, means communicating with said outlet for transforming fluid velocity into pressure, means employing a partial ejection rotatable liquid impeller arranged so as to project liquid at relatively high velocity in the form of films into said chamber between the inlet and outlet thereof and a passage arranged so as to maintain a pressure at the inlet to said velocity-transforming means substantially the same as the pressure within said chamber.

36. In combination with a chamber provided with an inlet for fluid and an outlet, means arranged so as to project liquid at a relatively high velocity in the form of films or leaves into said chamber between the inlet and outlet thereof and means for rotating said impeller.

37. In combination with a chamber provided with an inlet for fluid and an outlet, a partial efflux impeller arranged so as to project liquid at a relatively high velocity

in the form of films or leaves into said chamber between the inlet and outlet thereof.

38. In combination with a chamber provided with an inlet for fluid and an outlet, means employing a partial efflux rotatable liquid impeller arranged so as to project liquid at relatively high velocity in a subdivided state into said chamber between the inlet and outlet thereof and means communicating with said outlet for transforming fluid velocity into pressure.

39. In combination with a chamber provided with an inlet for fluid and an outlet, means communicating with said outlet formed for transforming fluid velocity into pressure and means employing a partial efflux liquid impeller arranged so as to project a succession of liquid films of relatively high velocity into said chamber between the inlet and outlet thereof.

40. In combination with a chamber provided with an inlet for fluid and an outlet, means communicating with said outlet for transforming fluid velocity into pressure and means employing a partial ejection rotatable liquid impeller arranged so as to project liquid at relatively high velocity in the form of films into said chamber between inlet and outlet thereof.

41. In combination with a chamber provided with an inlet for fluid and an outlet, means employing a partial efflux rotatable liquid impeller arranged so as to project liquid at a relatively high velocity in a subdivided state into said chamber between the inlet and outlet thereof, means communicating with said outlet for transforming fluid velocity into pressure and a passage arranged so as to maintain a pressure at the inlet to said velocity transforming means substantially the same as the pressure within said chamber.

42. In combination with a chamber provided with an inlet for fluid and an outlet, means communicating with said outlet formed for transforming fluid velocity into pressure, means employing a partial efflux liquid impeller arranged so as to project a succession of liquid films of relatively high velocity into said chamber between the inlet and outlet thereof, and a passage arranged so as to maintain a pressure at the inlet to said velocity-transforming means substantially the same as the pressure within said chamber.

43. In combination with a chamber provided with an inlet for fluid and an outlet, means communicating with said outlet for transforming fluid velocity into pressure, means employing a partial ejection rotatable liquid impeller arranged so as to project liquid at relatively high velocity in the form of films into said chamber between the inlet and outlet thereof and a passage arranged so as to maintain a pressure at the inlet to said velocity-transforming means substantially the same as the pressure within said chamber.

In testimony whereof I have hereunto subscribed my name this 3d day of March 1905.

MAURICE LEBLANC.

Witnesses:

ALBERT DELAS,

H. C. COXE.