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R. H. FREDERICK

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CENTRIFUGAL PUMP

Filed June 2, 1926

Fig. 1.

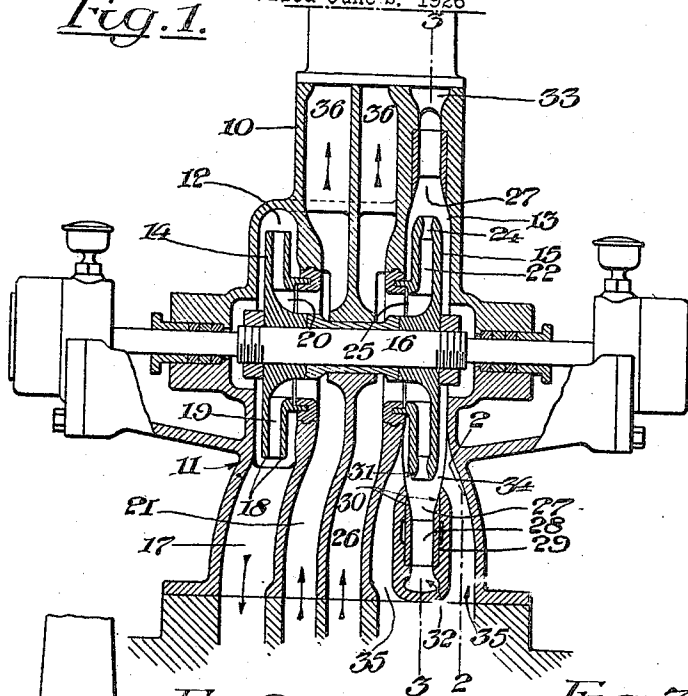


Fig. 2.

Fig. 3.

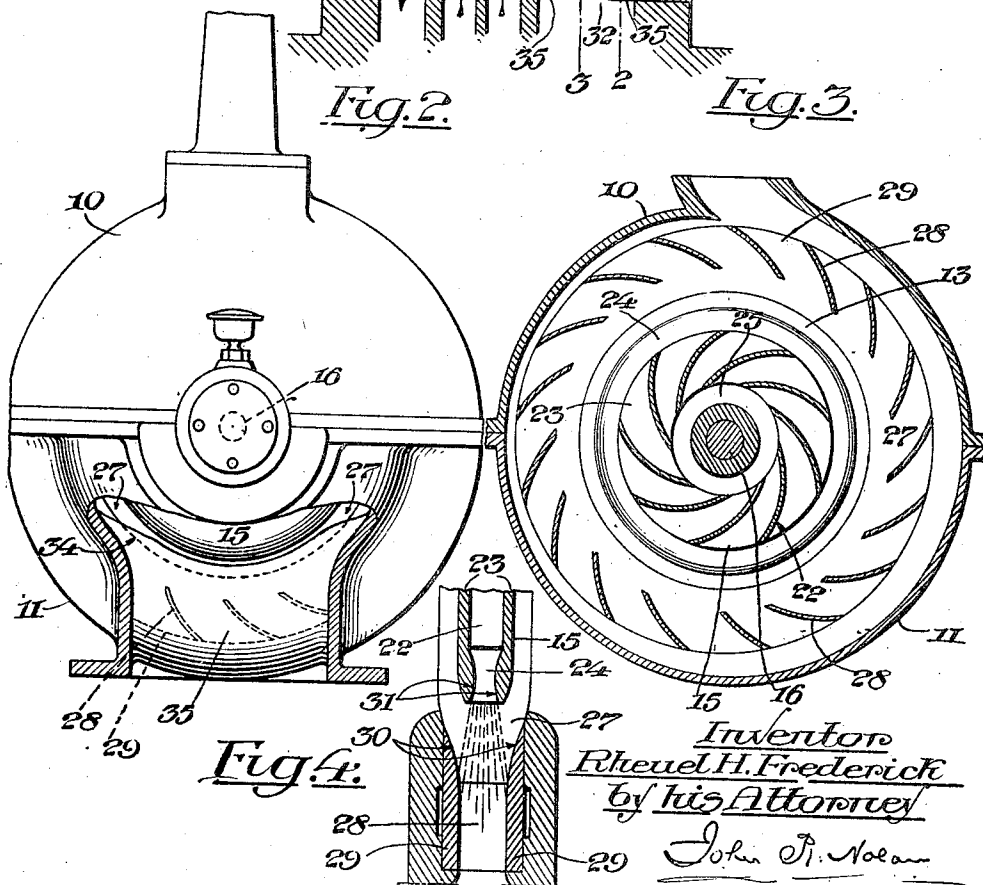


Fig. 4.

Inventor
Rheuel H. Frederick
by his Attorney
John P. Nolan

UNITED STATES PATENT OFFICE.

RHEUEL H. FREDERICK, OF IRVINGTON, NEW JERSEY, ASSIGNOR OF TWO-FIFTHS TO CHARLES F. AMES, OF BROOKLYN, NEW YORK, AND ONE-FIFTH TO ALPHONSE H. E. BERCHEM, OF NEW YORK, N. Y.

CENTRIFUGAL PUMP.

Application filed June 2, 1926. Serial No. 113,309.

This invention relates to that class of rotary impeller pumps wherein the kinetic energy of a current of water is utilized to exhaust a space or chamber containing fluids, either liquid or gaseous, or both, or to deliver gases into a compression chamber or other container.

The invention more especially concerns the type of vacuum pumps wherein the fluid to be ejected is entrained with the motive liquid and discharged therewith, as, for example, in vacuum producing apparatus for steam heating plants.

The principal object of my invention is to provide a pump of simple and efficient construction whereby the maximum energy generated by the centrifugal force of the liquid in its passage through the rotary impeller is utilized to effect and maintain a high degree of vacuum in a space or chamber to be exhausted.

With this and other objects in view, the invention comprises novel features of construction and combinations of parts which will be hereinafter described and claimed.

In the drawings—

Figure 1 is a side elevation, partly in section, of a pump embodying the preferred form of my invention.

Fig. 2 is an elevation of the pump, partly in section, as on the line 2—2 of Fig. 1.

Fig. 3 is a transverse vertical section, as on the line 3—3 of Fig. 1.

Fig. 4 is a sectional detail, enlarged, of the Venturi nozzle of the vacuum impeller and the adjacent diffuser chamber.

Referring to the drawings, 10, 11 designate complementary lower and upper sections constituting a pump housing or casing within which are formed in spaced-relation to each other two chambers 12, 13 in which impellers 14, 15, respectively, are mounted to rotate. In the present instance the impeller 14 constitutes a pressure impeller and the other a vacuum impeller, said impellers being fast on a power driven shaft 16 which is journaled in suitably disposed bearings on the casing.

The chamber 12 is of volute form with a suitably located outlet 17, and the impeller 14 which is mounted in this chamber comprises two spaced apart walls 18 with interposed vanes 19 of proper number and curva-

ture to meet the particular requirements of service. One of the walls is provided with a central eye 20 in communication with an inlet port 21 formed in the casing. The liquid flows from this port to the interior of the rapidly rotating impeller by way of the eye 20 and is discharged through the outlet 17 of the chamber 12. The function of the impeller 14, when the pump is used in connection with a steam heating system, is to deliver the surplus water of condensation from a suitable receiving chamber to a boiler or other point of discharge, as illustrated in my co-pending application Serial No. 113,308, filed simultaneously herewith.

The chamber 13 is of circular form, and the vacuum impeller 15 which is mounted to rotate therein, is formed similarly to the pressure impeller from the center to the outer extremities of the vanes 22, but, in the vacuum impeller the side walls 23 are extended outwardly beyond the vanes and the peripheral extensions are provided with oppositely curved internal surfaces to present a circumferential Venturi nozzle 24. The eye 25 of the impeller 15 communicates with an inlet port 26 formed in the casing. The liquid passes from this port to the rotating impeller through the eye 25 and is ejected through the Venturi nozzle in the form of a diverging annulus, as will hereinafter appear.

Spaced from and surrounding the circumferential Venturi nozzle is an annular chamber 27 having fixed therein a series of suitably curved vanes 28 which are arranged at intervals apart so as to intercept and diffuse the liquid discharged from the impeller nozzle, as well as fluids—liquid or gaseous—which may be entrained in the discharged liquid. These vanes are preferably supported in and between two annular plates 29 which are seated in recesses in the walls of the chamber 27, and which plates are formed to extend beyond the vanes at the receiving portion of the chamber. These plates 29, which constitute in effect side walls for the chamber 27, are flared or outwardly inclined, as at 30, in opposite relation to the adjacent outer flaring portion 31 of the Venturi nozzle. The chamber 27, which constitutes a whirlpool or diffuser chamber, is surrounded by a volute or spiral

chamber 32 having a discharge outlet 33 at the upper portion of the casing.

Formed in the lower portion of the casing and within the path of rotation of the impeller venturi 24, is a vacuum chamber 34 including ports 35 which are adapted to be connected with the apparatus or system to be exhausted, as, for example, the return line of a steam heating system.

From the foregoing it will be seen that during the rotation of the vacuum impeller 15 the liquid flowing thereto from the port 26, is ejected at high velocity through the venturi in the form of a diverging annulus, which, impinging against the opposing tapering walls of the chamber 27, at or adjacent the inner edges of the vanes 28 establishes a water seal effective to prevent any air or liquid from flowing back into the vacuum chamber 34. This liquid annulus, by its tapering sides, forms a V-shape gap which has the action of an ejector, in that the energy of the fluid in its passage to the chamber 27 is effective to create and maintain in the chamber 34 a partial vacuum sufficient to exhaust the system or apparatus to which the ports 35 are connected. The gases or other fluids thus expelled from the system pass into the diffuser chamber 27 and are therein commingled or mixed with the liquid contents of the latter and the whole finally discharged through the outlet of the volute chamber.

By virtue of the characteristic form of the Venturi nozzle the entire pressure energy of the fluid generated by the centrifugal force imparted thereto by the rapidly rotating impeller 15 is changed into velocity or kinetic energy in the portion of the nozzle from the outer extremities of the vanes 22 to the contracted area of the nozzle, and as the liquid escapes from this contracted area a portion of the velocity energy is changed back to the form of pressure energy. Hence both pressure energy and velocity energy of the liquid are present at the circumference of the impeller 15, the velocity energy compensating for any losses that may occur when the liquid is flowing from the circumference of the impeller, thus insuring pump efficiency.

Formed in the upper part of the pump casing are two ports 36 in communication at their lower ends with the supply ports for the central inlets of the respective impellers, which ports 36 lead to a suitable point of discharge, and afford vents for the diversion and escape of entrained gases which would otherwise pass with the liquids into the impellers.

The vacuum impeller 15 is illustrated herein in conjunction with the pressure impeller 14 since the associated impellers may be advantageously employed in a vacuum producing apparatus for steam heating sys-

tems as described in my co-pending application aforesaid. The described vacuum impeller may be used for the purpose of ejecting fluids, either liquid or gaseous, under various conditions, and also to perform the function of a gas compressor.

My invention is not limited to the particular construction and arrangement of parts herein disclosed to exemplify the invention, as the structure may be modified in many respects within the principle of the invention and the scope of the appended claims.

I claim—

1. A pump comprising a casing, an impeller chamber therein, a centrifugal impeller mounted to rotate in said chamber and having a central fluid inlet and a circumferential Venturi nozzle, a chamber spaced from and encircling said nozzle and adapted to receive a diverging annulus of fluid ejected from the nozzle, a vacuum chamber in operative communication with the venturi and the encircling chamber, and a discharge chamber encircling the latter chamber.

2. A pump comprising a casing, an impeller chamber therein, a centrifugal impeller mounted to rotate in said chamber and having a central fluid inlet and a circumferential Venturi nozzle, a chamber spaced from and encircling said nozzle and having flaring side walls arranged in opposite relation to the outwardly flaring walls of the venturi and adapted to receive a diverging annulus of fluid ejected from the nozzle, a vacuum chamber in operative communication with the venturi and the encircling chamber, and a discharge chamber encircling the latter chamber.

3. A pump comprising a casing, an impeller chamber therein, a centrifugal impeller mounted to rotate in said chamber and having a central fluid inlet and a circumferential Venturi nozzle, a diffuser chamber spaced from and encircling said nozzle and having spaced apart vanes, the walls of said latter chamber extending beyond the vanes toward the nozzle, and being flared in opposite relation to the flaring walls of the nozzle and adapted to receive a diverging annulus of fluid ejected from the nozzle, a vacuum chamber in operative communication with the venturi and the diffuser chamber, and a discharge chamber encircling the diffuser chamber.

4. A pump comprising a casing, an impeller chamber therein, a centrifugal impeller mounted to rotate in said chamber and having a central fluid inlet and a circumferential Venturi nozzle, a diffuser chamber spaced from and encircling said nozzle and comprising two annular wall plates and spaced apart vanes therebetween, said plates extending beyond the vanes toward the nozzle and being adapted to re-

ceive a diverging annulus of fluid from the nozzle, a vacuum chamber in operative communication with the venturi and the diffuser chamber, and a discharge chamber encircling

5 the diffuser chamber.

5. A pump comprising a casing, an impeller chamber therein, a centrifugal impeller mounted to rotate in said chamber and having a central fluid inlet and a circumferential outlet, a supply port leading to said inlet, a vent port communicating with said supply port adjacent the inlet, and a discharge chamber in communication with the impeller chamber.

15 6. A pump comprising a casing, an impeller chamber therein, a centrifugal impeller mounted to rotate in said chamber and having a central fluid inlet and a circumferential Venturi nozzle, a supply port leading to said inlet, a vent port communicating with said supply port adjacent the inlet, a chamber spaced from and encircling said nozzle and adapted to receive a diverging annulus of fluid ejected from the nozzle, a vacuum chamber in operative communication with the venturi and the encircling

chamber, and a discharge chamber encircling the latter chamber.

7. A centrifugal vacuum impeller, comprising two side walls, vanes therebetween, 30 a central inlet in one of said walls, and a circumferential Venturi nozzle between the walls and outwardly of the vanes.

8. A pump comprising a casing having a chamber therein, a rotary impeller having 35 a central fluid inlet leading thereto within said chamber, said impeller having a circumferential Venturi nozzle at its periphery, vanes within the impeller between the nozzle and the fluid inlet, there being an outlet for 40 vapor and water from said chamber, there being an annular suction space on each side of the nozzle from which air and vapor are drawn by the jet of fluid issuing from the nozzle, an inlet leading to said suction spaces, 45 a fluid chamber in communication with the central fluid inlet to the impeller, and means to rotate the impeller.

Signed at New York in the county and State of New York this 28th day of May 50 A. D. 1926.

RHEUEL H. FREDERICK.