March 25, 1924. 1,488,388

P. HARIVEAU

CENTRIFUGAL PUMP

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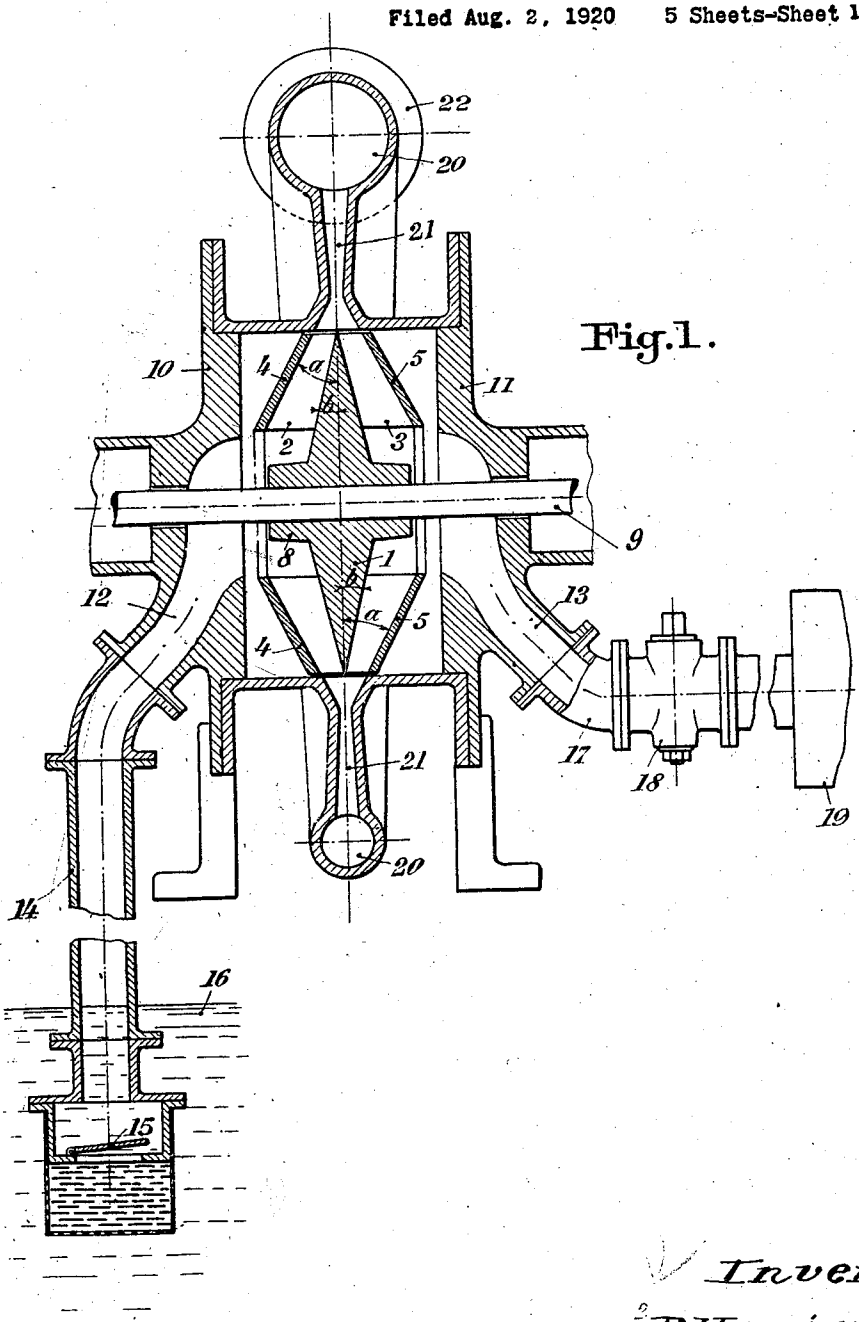


Fig. 1.

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Fig. 2

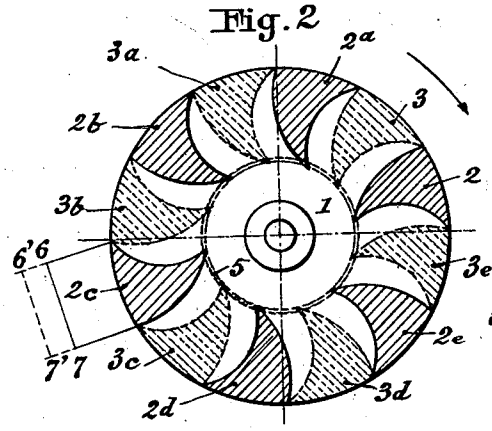


Fig. 2a

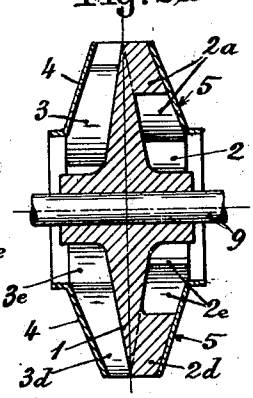


Fig. 4.

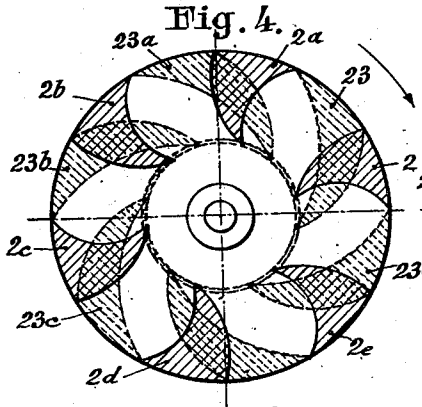


Fig. 4a

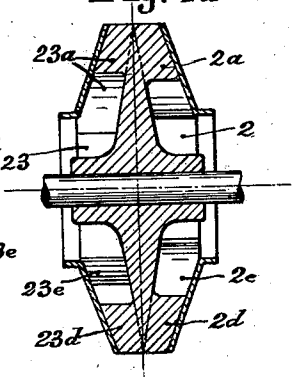


Fig. 6

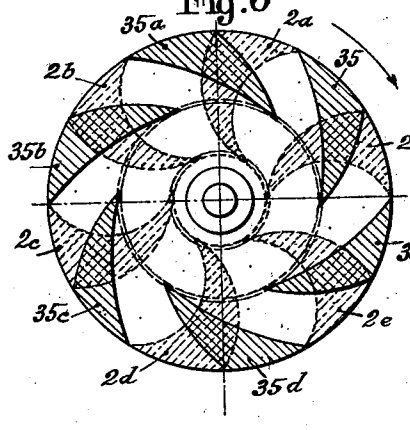
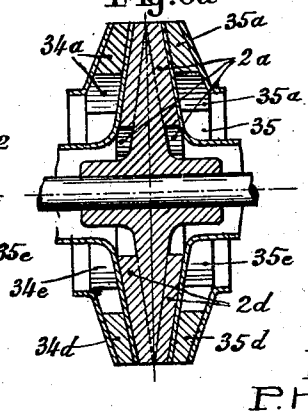


Fig. 6a



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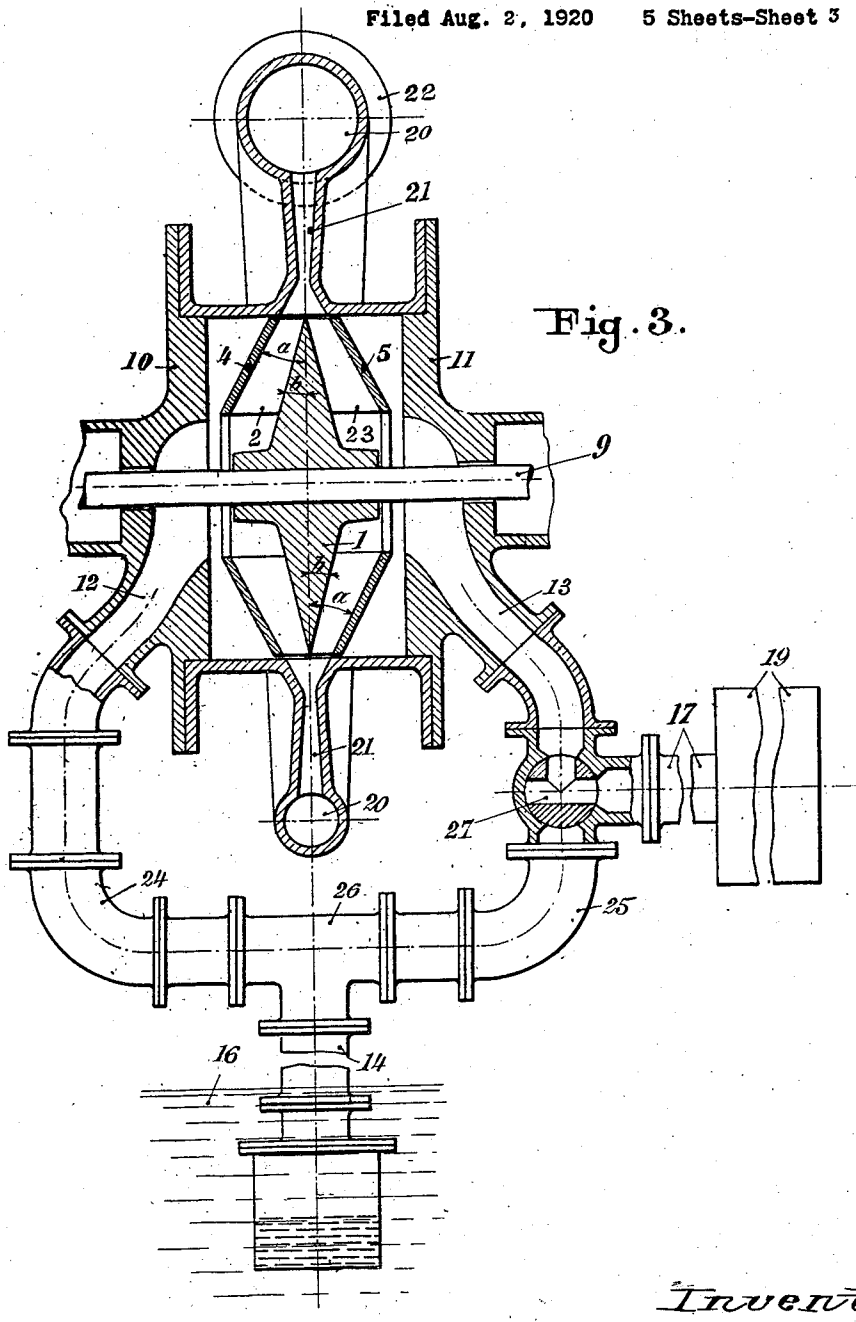


Fig. 3.

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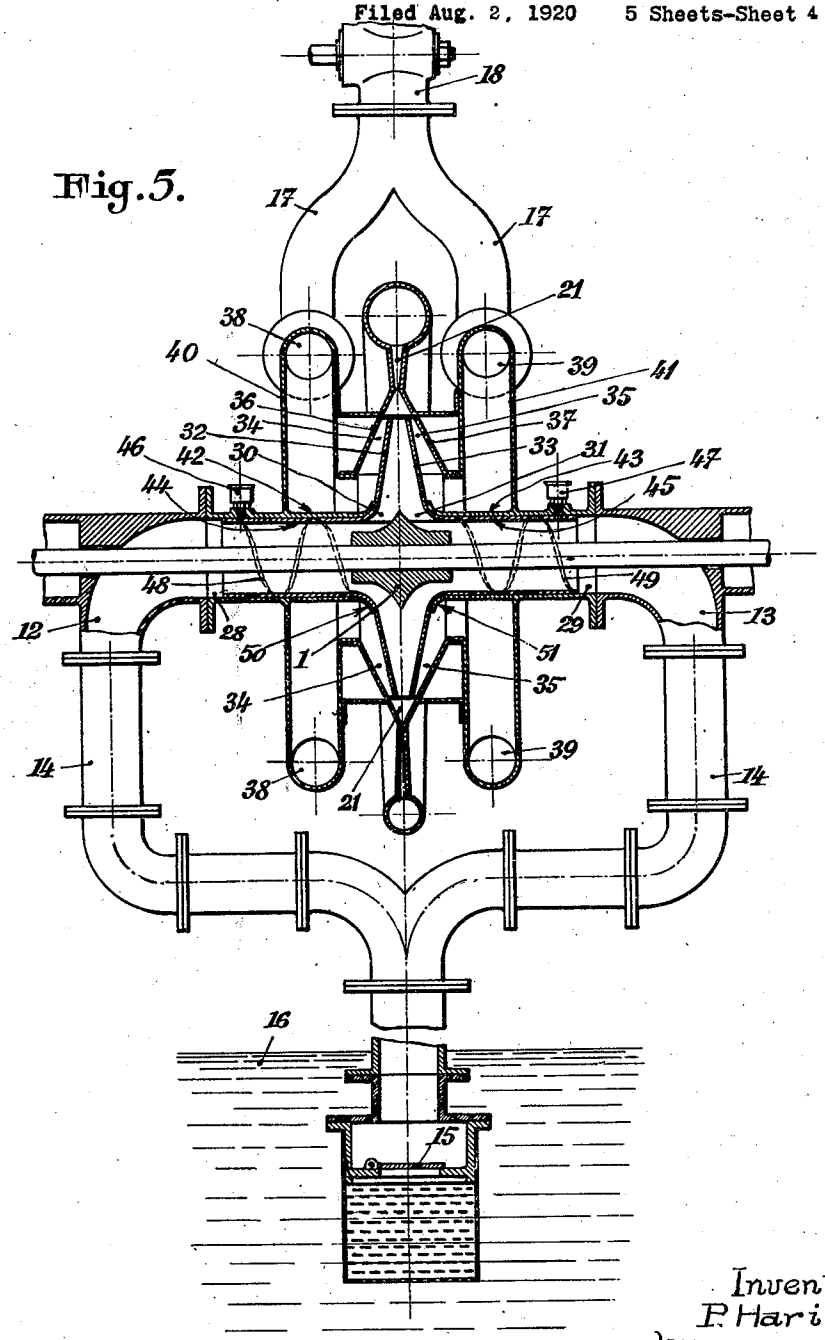
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Fig. 5.



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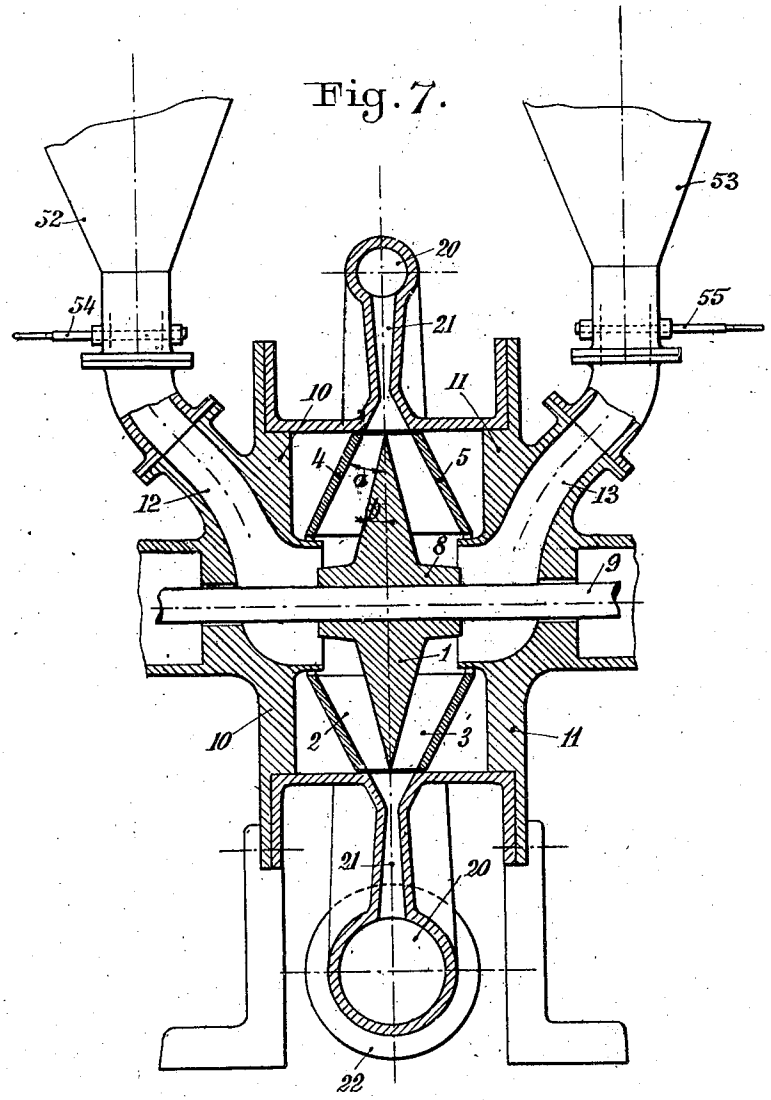
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Fig. 7.



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Patented Mar. 25, 1924. 1,488,388

UNITED STATES PATENT OFFICE.

PAUL HARIVEAU, OF PARIS, FRANCE.

CENTRIFUGAL PUMP.

Application filed August 2, 1920. Serial No. 400,783.

To all whom it may concern:

Be it known that I, PAUL HARIVEAU, a citizen of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in Centrifugal Pumps, of which the following is a specification.

The invention relates to a centrifugal pump and more particularly to a type of pump applicable to steam condensers, characterized by being composed of two end plates each provided with an intake branch sloping at an angle at 45 degrees, a delivery volute adapted to have its position in relation to the intake branches altered at will along its median plane, and of a rotor provided with two bladings arranged on each side in such a way that, at the periphery of the rotor, the thickness of a blade on one of the sets is equal to the space which faces it and is bounded by two blades of the other set.

In the accompanying drawing, which illustrates, by way of example, several methods of carrying out the invention, Figure 1 is a vertical section of a primary form;

Figure 2 is a sectional view of the rotor of the pump illustrating the shape and disposition of the blades;

Fig. 2^a is a sectional view of the rotor taken at right angles to Fig. 2;

Fig. 3 is a vertical sectional view of a modified type of pump;

Figs. 4 and 4^a are sectional views taken at right angles to each other of the rotor used in connection with the type of pump shown in Fig. 3;

Fig. 5 is a vertical sectional view of a further modification of the pump;

Figs. 6 and 6^a are sectional views taken at right angles to one another of the rotor used in connection with the type of pump illustrated in Fig. 5;

Fig. 7 is a sectional view of a further modified form of the invention adapted for use as a centrifugal mixer.

The rotor 1 is provided with two bladings 2 and 3, which are covered by the cheeks 4 and 5. The two bladings 2 and 3 are arranged in such a way that the thickness 6—7 (Fig. 2) of a blade of the set 2 is equal to the space 6^1—7^1 bounded by two blades of the set 3. The hub 8 is keyed to the shaft 9 traversing the cover plates 10 and 11 which carry, respectively, the intake branches 12 and 13 sloped at an angle of 45 degrees in relation to the cover plates. The branch 12 is connected, by a pipe 14, to a foot valve 15 in the pit 16, and the branch 13 is connected, by a pipe 17, through cock 18, to a vessel 19 containing air, steam and other gaseous fluids. The volute 20 with the diffuser 21 and delivery branch 22, is secured to the cover plates 10 and 11 in any suitable way. The delivery branch is provided with a stop valve, not shown.

The pump according to the invention operates in the following manner. The shaft 9 being driven by any motor whatsoever, and the pump having been started or primed, the blades 2, 2^a, 2^b suck up the water from the pit 16 and discharge it in jets, through the diffuser 21, into the volute 20 and the delivery branch 22. In consequence of the kinetic energy transmitted to the water by the blades 2, a negative pressure is set up in the vicinity of the jets of water, and more particularly in the space existing between two successive jets. This interval between two jets corresponding to the space between two blades 3, 3^a, 3^b the air, steam and other gaseous fluids in the vessel 19—the cock 18 being assumed to be open—are aspirated not only indirectly, in consequence of the negative pressure due to the moving water, but also directly, by the action of the blades 3. The air, steam and other gaseous fluids are therefore expelled by the rotor in the form of jets between two jets of water, and consequently produce a vacuum in the vessel 19.

In the form shown in Figs. 1, 2 and 2^a, the blades 2 and 3 act on the water and on the air, steam and other gaseous fluids, by a concave surface, that is to say, by a surface bent forwards in relation to the direction of rotation of the rotor. In the modification illustrated in Figs. 3, 4, 4^a, the blades 2 which expel the water in the form of jets are also concave, but the blades 3 are replaced by blades 23, 23^a, 23^b which act by means of their convex part. At the point where they spring from the rotor, the blades 23 alternate with the blades 2 in the same way as the blades 2 and 3 of Figs. 1, 2 and 2^a. Moreover, the intake branches 12 and 13 are extended by branches 24 and 25, between the ends of which is fixed a T junction 26, from which branches the pipe 14. A three-way cock 27 enables communication to be set up between the branch 13 and either the T junction 26 or the vessel 19.

The pump according to Figure 3 works as follows:

The three-way cock 27 is first set to connect the branch 13 with the branch 25, and, therefore, with the pit, the vessel 19 being shut off. The pump being then filled with water and the motor having been set running, the pump is primed, in consequence of the convex blades 23, irrespective of the delivery head. At this moment the pump works as an ordinary centrifugal water pump with double intake. In order to make it act as a centrifugal pump for air, steam or other gaseous fluids, all that is necessary is to turn the three-way cock to the position shewn in Figure 3, so as to establish communication between the branch 13 and vessel 19, and to shut the branch 13 from the pipe 25.

Figures 1 and 3 show that the angles *a* and *b* enclosed between the median plane of the rotor and the cheeks 4 and 5, and the surface of the rotor 1, respectively, are much greater than in ordinary double intake centrifugal pumps. This arrangement was adopted in order to ensure more complete intermingling of the water and the gaseous fluid, by entangling one in the other, with the result of increasing the pull on the gaseous fluid and thus obtaining a higher vacuum in the vessel 19.

The pump illustrated in Fig. 5 has two water intakes 28 and 29 connected by a central header 14. The rotor 1 with two intakes 30 and 31 is provided with blades 2, 2^a, 2^b. The cheeks 32 and 33 carry convex blades 34, 34^a, 34^b and 35, 35^a and 35^b respectively, Figs. 6 and 6^a, alternating in relation to the concave blades 2, 2^a and 2^b of the rotor, their thickness at the periphery of the rotor being equal to the space in front thereof which is bounded by the two corresponding blades of the rotor. The blades 34, 34^a, 34^b and 35, 35^a and 35^b are themselves covered by cheeks 36 and 37.

Spiral inlets 38 and 39 are preferably connected by a central header, communicating with the vessel 19 containing air, steam and other gaseous fluids. The cover plates 40 and 41 are provided with tubular extensions 42 and 43 loosely surrounding the water intake passages 44 and 45. Lubricators 46 and 47, mounted on the extensions 42 and 43, fill with thick grease the helicoidal grooves 48 and 49 provided in the passages 44 and 45, so as to deliver the grease towards the rotor.

The pump of Figure 5 is started in the same way as the pump of Figure 3. With that object, the header 14 connecting the water intakes 28 and 29, and the header 17 connecting the spiral inlets 38 and 39, are connected by a branch, not shown, provided with a three way cock 18 mounted at the junction of said branch with the header connecting the spiral inlets 38, 39. When the pump has started, the three-way cock is turned in the manner explained with reference to Figure 3, the gaseous fluid coming from the vessel 19 issuing through the spiral inlets 38 and 39, and being drawn, in a succession of jets, between the jets of water expelled by the rotor.

The object of the lubricators 46 and 47 is to prevent the back flow of air—which would occur immediately on communication being established between the spiral inlets 38 and 39 and the vessel 19 by means of the three-way cock—by depositing a layer of grease in the very narrow annular space between the extensions 42 and 43 and the passages 44 and 45.

These lubricators 46 and 47 also serve to prevent the back flow of air at the moment when the vacuum in the vessel 19 begins to become greater than the negative pressure produced by the suction of the water. And to provide further against the contingency of air passing through, the extensions 42 and 43 are bent outward at the end 50 and 51, so as to deliver the air to the blades 34 and 35 which would expel it along with the gaseous fluid.

This modification presents the advantage that the water drawn in on both sides of the rotor acts symmetrically on the gaseous fluid, whereas in the devices according to Figure 1 and 3, the action of the water is asymmetrical. Another advantage results from this, namely, that the rotor is not subjected to any axial thrust. This modification also enables different fluids to be aspirated simultaneously, it being sufficient, for this purpose, to connect each of the spiral inlets 38 and 39 to different vessels.

In the accompanying drawing, Figures 2, 2^a, 4 and 4^a illustrate rotors provided with only six blades on each side, but any desired number may be employed, according to the conditions under which the pump is worked.

Numerous modifications in point of detail may be introduced into this centrifugal pump without departing from the principle of the invention. Thus, Figure 7 shows how the pump according to Figure 1 may easily be transformed into a centrifugal mixer. For this purpose all that is necessary is to invert the pump of Figure 1, and to replace the pipes 14 and 17 by hoppers 52 and 53, preferably provided with regulating dampers 54 and 55. This apparatus may be used when two substances—solids in a subdivided state, liquids or gases—have to be mixed together in definite proportions. A simpler plan in the two latter cases would be, in order to save the transference of the liquids or gases, to connect the branches 12 and 13, to the vessels containing the liquids or gases, by two pipes, as shown, for example, in Figure 1. When it is a question of mixing a solid and a liquid, the branch receiving

the subdivided solid is preferably arranged above the apparatus, whilst that through which the liquid is to be aspired is arranged below.

It has been mentioned that the dimensions of the blades 2, 2^a, 2^b, and 3, 3^a, 3^b are arranged so that, at the periphery of the rotor, the space 6—7 between two blades 2 corresponds exactly to the thickness 6^1—7^1 of a blade 3 Figure 2, or 23 Figure 4. The blades are arranged in this manner in order to obtain a larger output, but it will be quite evident that a vacuum would still be produced in the vessel 19 if the blades 2 and 3, and even the blades 2 and 23 did not correspond exactly. Similarly, instead of providing the rotor with two bladings 2 and 3 Figure 1, and 2 and 23 Figure 3, it would be possible to mount on the shaft 9 two rotors, one provided with the blading 2 and the other with the blading 3 of Figure 1, or 23 of Figure 3.

The chief advantages of the centrifugal pump according to the invention are as follows:

1. The possibility of varying the delivery within wide limits, by simply replacing the rotor 1 and the volute 20 by other sets of rotors and other volutes;

2. The intake and delivery orifices may occupy any desired relative positions, and that, too, independently, of each other.

3. Sloping the intake branches 12 and 13 at an angle of 45 degrees enables them to be connected by one and the same coupling pipe, to a vertical or horizontal pipe.

4. The members liable to wear may be replaced without changing the other members.

What I claim is:

1. A centrifugal pump comprising two cover plates carrying an intake branch sloping at an angle of 45 degrees, a delivery volute adapted to be rotated at will along its median plane, a rotor provided with two bladings arranged on either side in such a way that, the free outlet from the blades on one side is opposite the solid parts of the blades on the other side.

2. A centrifugal pump comprising two cover plates carrying an intake branch sloping at an angle of 45 degrees, a delivery volute adapted to be rotated at will along its median plane, a rotor provided with two bladings arranged on either side in such a way that, the free outlet from the blades on one side is opposite the solid parts of the blades on the other side; means to assemble the cover plates with the volute, the latter being exchangeable for other volutes of different widths corresponding to rotors of different widths;

3. A centrifugal pump comprising two cover plates carrying an intake branch sloping at an angle of 45 degrees, a delivery volute adapted to be rotated at will along its median plane, a rotor provided with two bladings arranged on either side in such a way that, at the periphery of the rotor, the thickness of a blade on the one set is equal to the space facing same and bounded by two blades of the other set; the blades intended for aspirating water being concave and those for aspirating gaseous fluids being convex;

4. A centrifugal pump comprising two cover plates carrying an intake branch sloping at an angle of 45 degrees, a delivery volute adapted to be rotated at will along its median plane, a rotor provided with two bladings arranged on either side in such a way that, the free outlet from the blades on one side is opposite the solid parts of the blades on the other side, the blades intended for aspirating water being concave and those for aspirating gaseous fluids convex; means for priming consisting of a three-way cock and means for supplying either liquid or gaseous fluid to said cock.

5. A centrifugal pump comprising two cover plates a delivery volute adapted to be rotated at will along its median plane, a rotor provided with two bladings, means to assemble the cover plates with the volute, the latter being exchangeable for other volutes of different widths corresponding to rotors of different widths; a water suction inlet at each side of the rotor and two inlets for gaseous fluid between the jets of water, the blades intended for aspirating water being concave and those for aspirating gaseous fluids convex; means for starting consisting of a three-way cock and means for supplying either liquid or gaseous fluid to said cock.

In testimony whereof I affix my signature.

PAUL HARIVEAU.