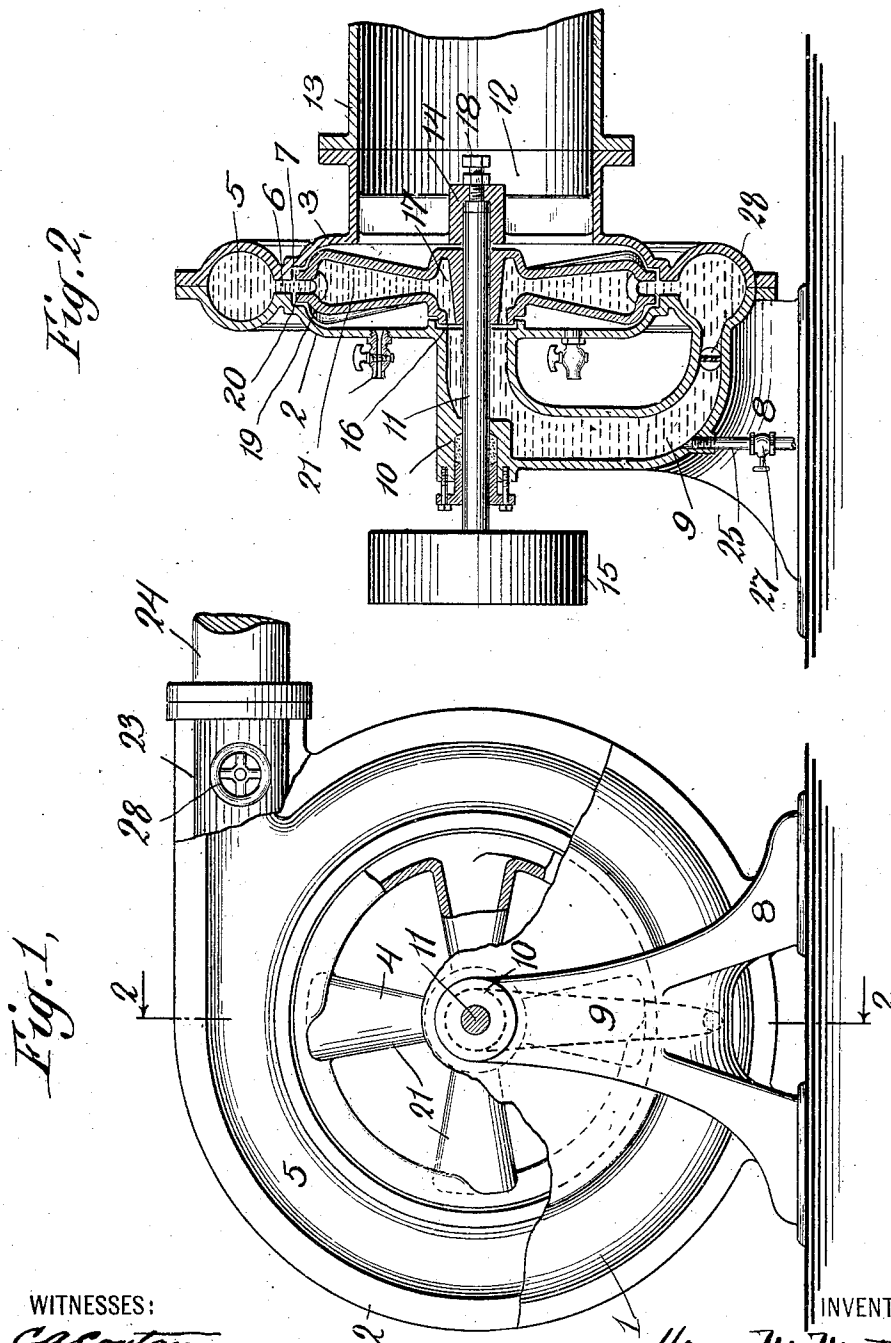


H. M. MONTGOMERY.
 ROTARY AIR PUMP.
 APPLICATION FILED FEB. 26, 1907.

898,493.

Patented Sept. 15, 1908.

3 SHEETS—SHEET 1.



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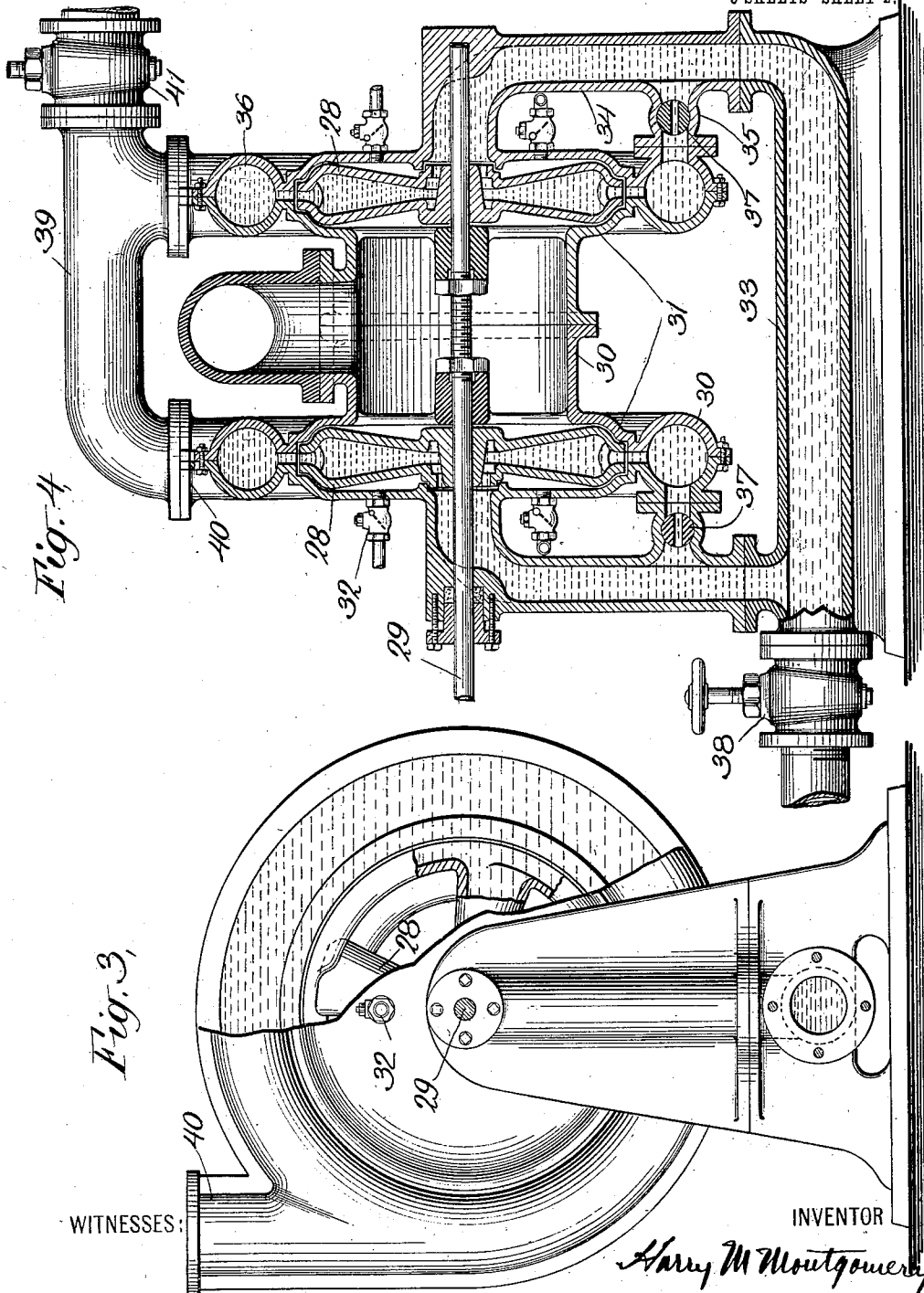


Fig. 4.

Fig. 3.

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3 SHEETS—SHEET 3.

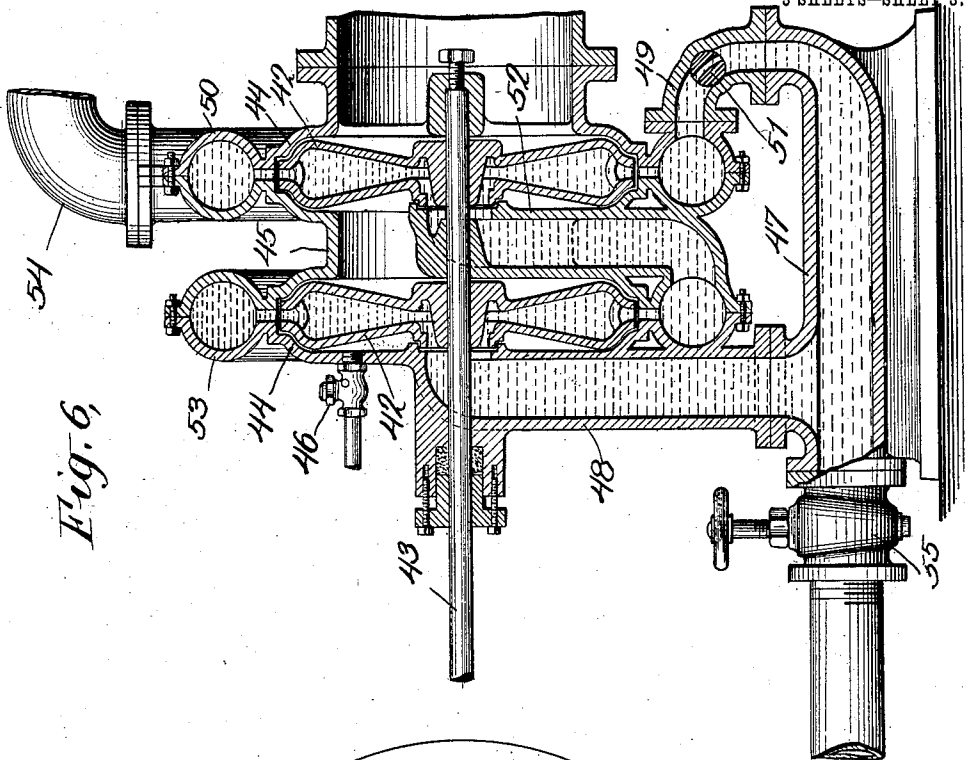


Fig. 6,

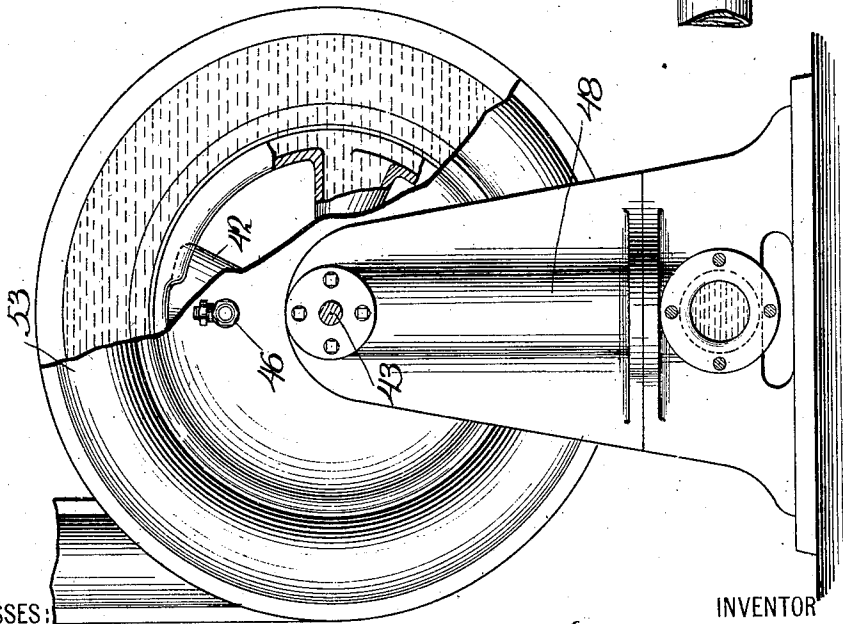


Fig. 5,

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UNITED STATES PATENT OFFICE.

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ROTARY AIR-PUMP.

No. 898,493.

Specification of Letters Patent.

Patented Sept. 15, 1908.

Application filed February 26, 1907. Serial No. 359,502.

To all whom it may concern:

Be it known that I, HARRY M. MONTGOMERY, a citizen of the United States of America, and resident of the city of Chicago, county of Cook, State of Illinois, have invented certain new and useful Improvements in Rotary Air-Pumps, of which the following is a specification.

My invention relates to fans and pumps and especially to exhaust fans and pumps such as circulating pumps.

In the operation of exhaust fans of the common type comprising an impeller or screw operating in a pipe or housing, there is an appreciable loss in efficiency due to the leakage or backward flow at the periphery of the fan. This flow is induced, of course, by the excess of pressure existing on the delivery side of the fan.

The object of my invention is to provide an apparatus of this class which shall be simple in its construction and operation, which shall effectually prevent the leakage or backward flow, as above described, at the periphery of the fan and which shall be capable of performing the functions of a fan for air and a centrifugal pump for liquids, either separately or in combination. This arrangement is especially useful in connection with steam condensers, as the same apparatus or machine serves both to maintain the vacuum in the condenser and to circulate the water through the condenser, or for removing the water of condensation from the condenser.

My invention consists in the construction and combination of parts to be more fully described hereinafter and particularly set forth in the claims.

In the drawings accompanying and forming a part of this specification, Figure 1 is a side elevation and Fig. 2 is a section on line *a-a* of Fig. 1 of the preferred form of my invention. Fig. 3 is an end elevation, partly broken away and shown in section, illustrating a modified form, Fig. 4 is a vertical longitudinal section through the device as constructed in Fig. 3, Fig. 5 is a view similar to Fig. 3 showing the form illustrated in Fig. 6, and Fig. 6 is a longitudinal section showing a second modified arrangement.

Referring more particularly to the parts and especially to Figs. 1 and 2, 1 represents the fan housing. The body of this housing is in the form of a circular plate or head 2, to which a cover 3 is attached as shown, these parts being shaped as indicated so as to form

a fan space to receive the impeller 4; around its edge the housing is formed into a water-ring 5, the said water-ring being located as shown at the meeting faces of the head 2 and the cover 3, and extending continuously around the housing; the interior of this water-ring is in communication with the fan space or interior of the housing by means of a continuous slot 6, and at the opening into this slot the wall of the housing is formed with an annular channel or groove 7 which also extends continuously around the fan.

The housing 1 is formed below into a suitable base 8 in which there is formed a water-passage or duct 9, the upper end of the said passage connects with the head 2 and is formed into a bearing 10 for the shaft 11 which carries the impeller 4 referred to above; on the opposite side of the fan the cover 3 is formed into a suction neck 12 having a flange as shown to facilitate the connection to a suction-pipe 13 which leads from a condenser or vacuum chamber. This neck is provided with a cross-bar which is formed at its middle into a bearing 14 for this end of the shaft; the other end of the shaft is provided with a suitable belt pulley 15 for driving the fan.

The water-passage 9 communicates with an opening 16 in the hub 17 of the impeller or fan. In order to adjust the impeller the bearing 14 is provided with an adjusting screw 18.

The impeller 4 comprises a rim 19 which is formed on its outer face into a channel 20 opening outwardly and the said rim is connected with the hub by radial inclined blades 21. In external appearance these blades resemble the blades of an ordinary fan.

The hub 17 is hollow so that it presents a chamber 22 communicating through the inner face of the hub with the water-passage as before described; this chamber 22 is extended into the blades 21, and at their outer ends the blades open into the channel 20. As shown clearly in Fig. 2 the rim 19 extends into the annular groove 7 and the walls of the housing at this point conform closely to the outline of the impeller blades. In this way the channel 20 is brought opposite to the slot 6 so that a current of water may flow from the fan blades into the water-ring 5. At a suitable point the housing is formed with a delivery neck 23 which communicates with the water-ring and to which the service pipe 24 is attached.

Water is delivered to the water-passage by a suitable pipe 25 as shown. A valve 26 is placed in the delivery neck 23 and a valve 27 is placed in the inlet pipe 25. A valve 28 is also placed so as to control communication between the water-passage 9 and the annular water-ring 5.

In the operation of this form of the invention the rotation of the fan withdraws the air through the suction pipe 13 and expels the same on the other side of the impeller. The impeller 4 being rotated at a high speed the centrifugal force developed throws the water outwardly in the blades and through the channel 20 and slot 6 into the water-ring 5. In this way a current of water is formed around the periphery of the impeller which seals this part; for it will be seen that this current is interposed before and obstructs the path of the air leakage current tending to flow back to the vacuum. Hence the loss of efficiency which might occur otherwise, is prevented; furthermore the velocity given to the water may be sufficient to cause a circulation in a pipe system or through a condenser.

Any tendency of the water to leak out about the rim of the fan is overcome by the centrifugal force which operates to throw such water back into the groove 7.

Where it is not desired to use the apparatus as a circulating pump, the valves 26 and 27 are closed and the valve 28 is opened. The water then circulates continuously through the impeller blades into the water-ring and back through the passage 9, thereby maintaining the water-seal at the periphery of the impeller the same as before.

In Figs. 3 and 4 I illustrate an arrangement in which the pump is of a duplex type, there being two impellers 28 mounted rigidly on the same shaft 29. In this case the impellers take the air from a neck 30 connecting their housings 31 and force the air through check-valves 32 in the heads of the housings. The check-valves will prevent any back-flow of air so that the vacuum will be maintained even if the pumps stop. The blades of the impellers are of opposite pitch of course, one being right hand while the other is left hand. A duplex intake pipe connection 33 is provided which leads the water supply up the legs 34 to the impellers. These legs have necks 35 communicating directly with the water-rings 36, which necks may be closed if desired by stop-cocks 37. The intake is provided with a gate-valve 38 through which the supply may be cut off.

A duplex delivery connection 39 is provided to which the hubs 40 of the water-rings connect and beyond this connection a valve 41 is placed.

If it is not desired at any time to use this pump to circulate water, the valves 38 and 41 will be closed and the cocks 37 left open.

The water will then simply circulate in the fans to maintain the seal of the impellers, as will be readily understood. When using the device as a circulating pump as well as a fan, the cocks 37 will be kept closed. In this type of the machine the fans are evidently balanced; that is there is no thrust on the shaft.

In Figs. 5 and 6 a tandem or multiple construction is illustrated, in which two impellers 42 are rigidly mounted on the same shaft 43, the fan housings 44 being connected by an integral neck 45. The fan at the right receives the air and delivers to the neck 45; the fan at the left takes the air from this neck and delivers it through the valve 46 in its housing. An intake connection 47 delivers to the leg 48 of the left pump and is connected by means of an elbow 49 with the water-ring 50 of the right hand pump, said elbow being provided with a stop cock 51. A water-leg 52 connects the water-ring 53 of the left hand pump with hub of the impeller of the right hand pump, and a delivery pipe 54 connects to the water ring 50 diametrically opposite to the elbow 49. With this arrangement the impellers operate in series or successively upon the air and likewise upon the water. Valves such as that indicated at 55 are provided before and beyond the pump as illustrated in Figs. 3 and 4. When these valves are closed the water simply circulates through the pumps to maintain the seal, the cock 51 being left open to permit the return of the water to the left hand impeller through the connection 47. When using this type as a pump as well as a fan the cock 51 will ordinarily be left closed.

Having thus described my invention what I claim is:

1. In a rotary air pump the combination with a housing of a rotatable impeller having blades inclined to its plane of rotation, an air inlet on one side and an air outlet on the other side of said impeller, and means for maintaining a water seal between the periphery of said impeller and said housing.

2. In a rotary air pump the combination with a rotatable impeller having inclined blades joined at their outer ends by an annular rim, of a housing for said impeller having an annular channel in which said rim rotates, and means for supplying water to said channel.

3. A fan having a rotatable impeller consisting of a hub, radial blades inclined at an angle to the plane of rotation, an annular rim connecting said blades and a passage for liquid leading from said hub to said rim, an annular chamber surrounding said rim and a passage for liquid leading from said annular chamber to said hub.

4. In a fan the combination with a rotatable impeller consisting of a hub, flat radial blades whose planes are inclined to the plane

of rotation and an annular rim connecting
said blades and having a passage formed
therein connecting said hub with said rim, of
a housing for said impeller adapted to be con-
5 nected with the chamber from which air is to
be exhausted on one side of said impeller and
having valve outlets for air on the opposite
side and an annular chamber surrounding the
rim of said impeller, a passage in said housing
10 leading from said annular chamber to and

communicating with an opening in the hub of
said impeller.

In testimony whereof, I have signed my
name to this specification in the presence of
two subscribing witnesses.

H. M. MONTGOMERY.

Witnesses:

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O. D. SHERWOOD.