No. 647,856. Patented Apr. 17, 1900.

F. MARBURG, JR.

ROTARY PUMP OR THE LIKE.

(No Model.) (Application filed Apr. 26, 1899.)

3 Sheets—Sheet 1.

Fig. 1.

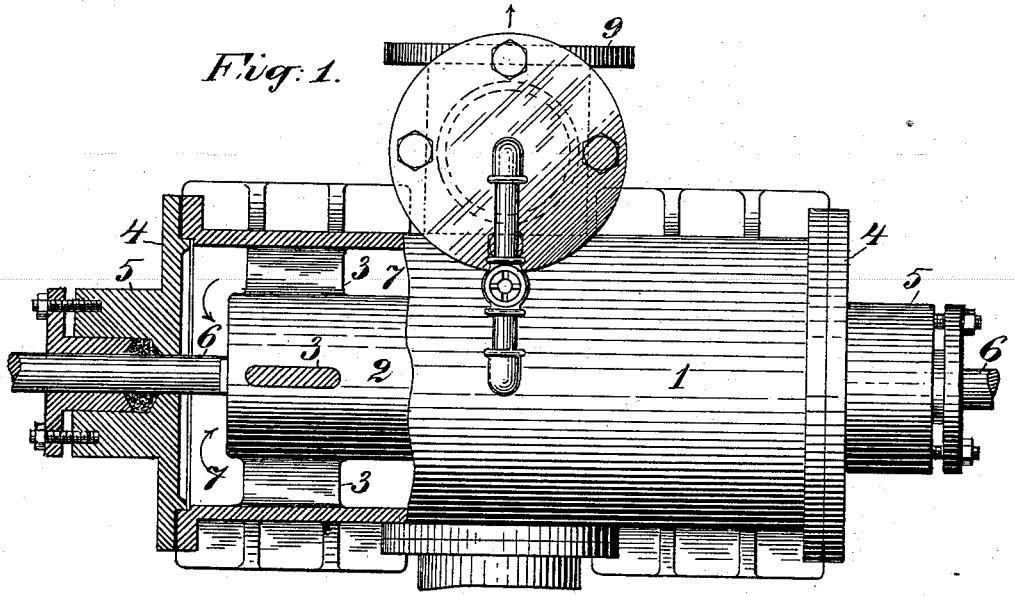

Fig. 2.

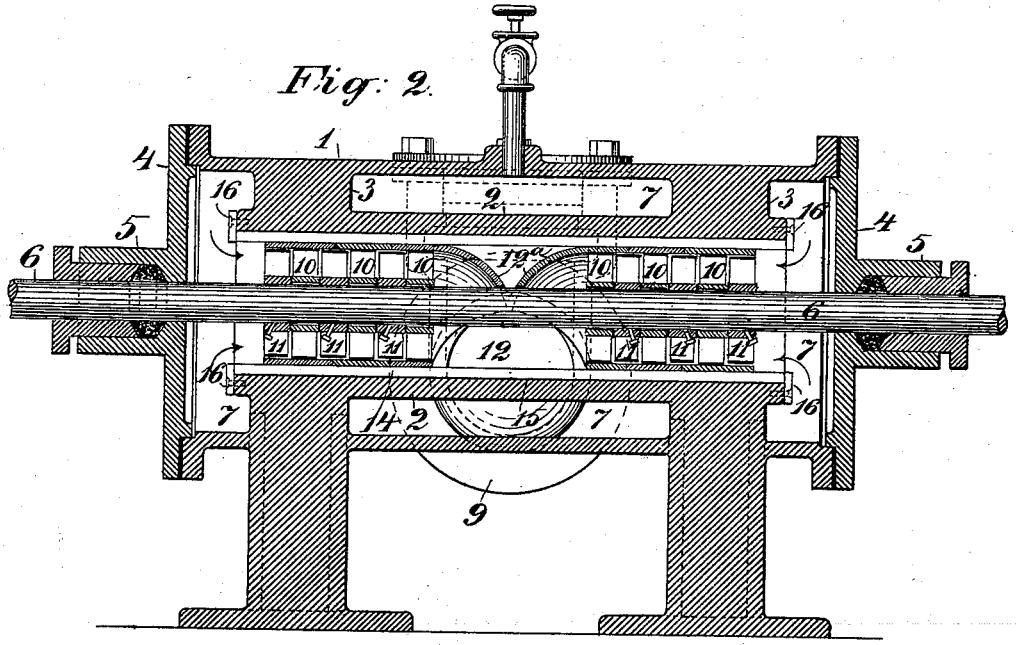

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Fig. 4.

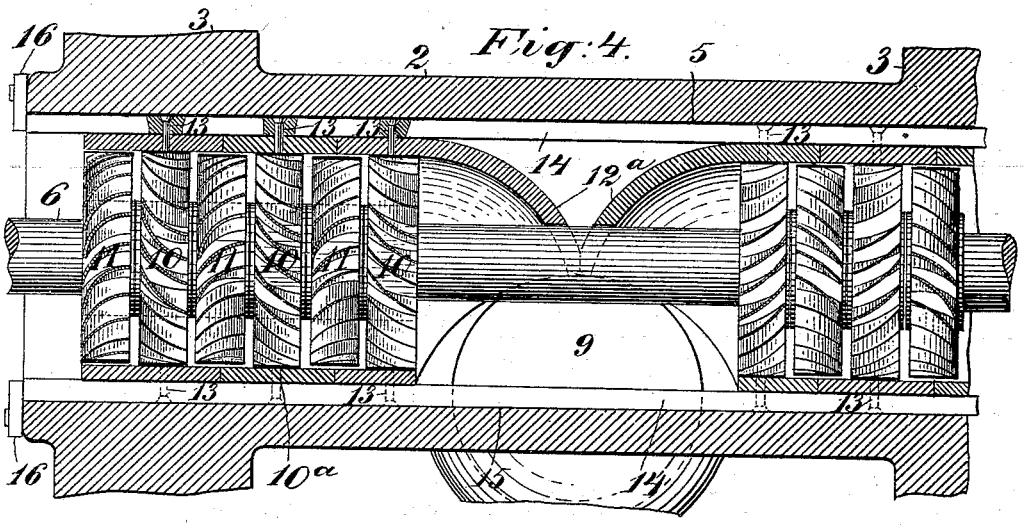

Fig. 3.

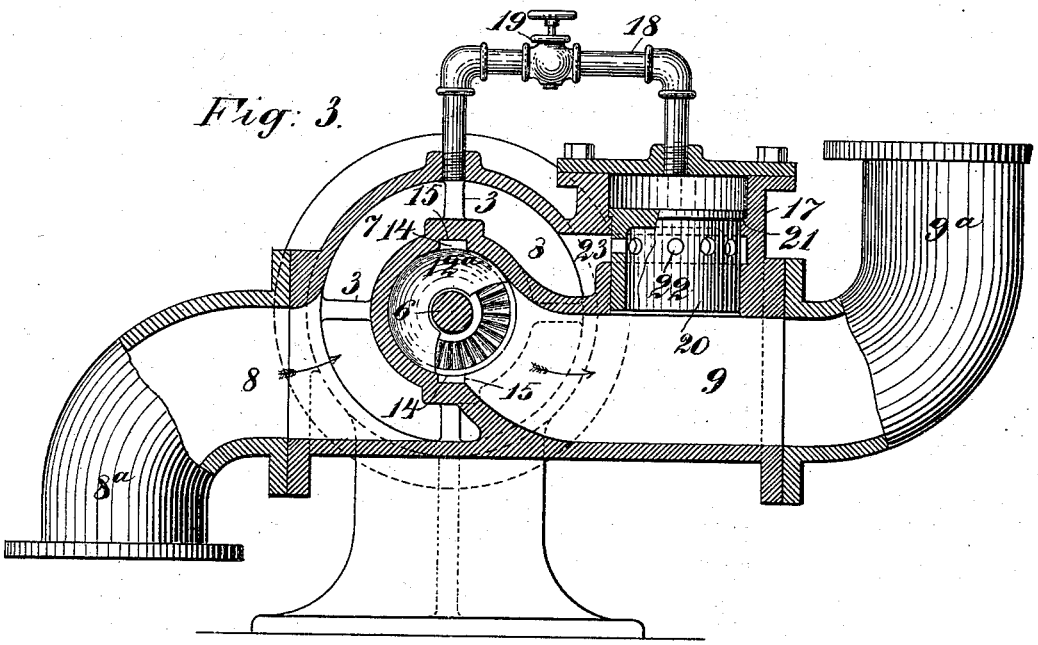

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Fig. 5.

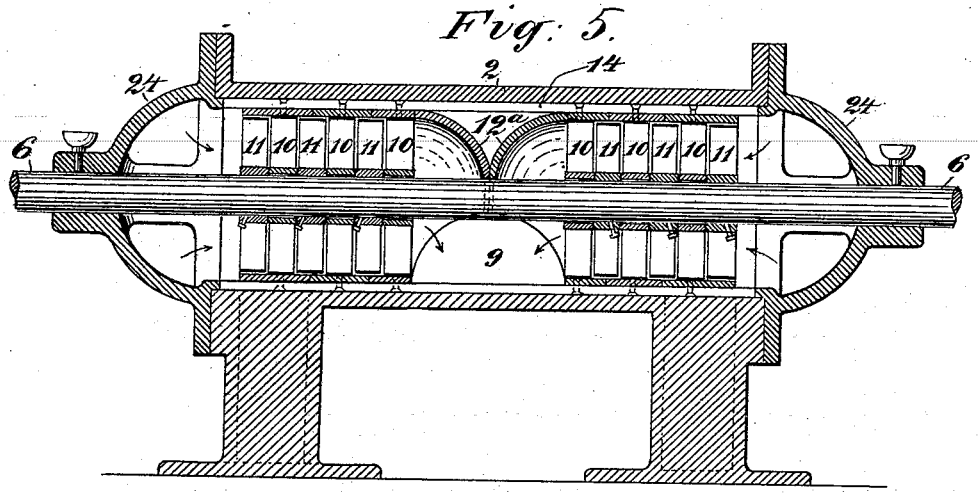
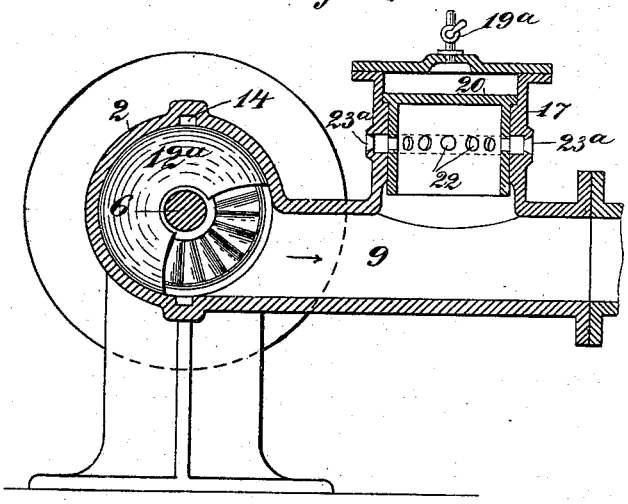


Fig. 6.



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UNITED STATES PATENT OFFICE.

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ROTARY PUMP OR THE LIKE.

SPECIFICATION forming part of Letters Patent No. 647,856, dated April 17, 1900.

Application filed April 26, 1899. Serial No. 714,474. (No model.)

To all whom it may concern:

Be it known that I, FRANZ MARBURG, Jr., a citizen of the United States, residing in the borough of Manhattan, in the city, county, and State of New York, have invented certain new and useful Improvements in Rotary Pumps or the Like, of which the following is a specification.

This invention relates to the general class of mechanisms known as "turbines," wherein the lateral strain and longitudinal thrust from the fluid are balanced; and the object of the invention is in the main to improve the details of construction of the device and to adapt it for use as a pump or blower.

In the accompanying drawings an embodiment of the invention is illustrated.

Figure 1 is a plan of the device as a pump with the outer casing partly broken away at the left. Fig. 2 is a longitudinal vertical axial section of the same, and Fig. 3 is a transverse vertical mid-section thereof. Fig. 4 is an enlarged fragmentary sectional view showing the sets of turbines and guides in side elevation. Fig. 5 is a sectional view similar to Fig. 2, showing the device in the form preferred for use as a blower, and Fig. 6 is a transverse mid-section thereof.

As illustrated in Figs. 1 to 4 of the drawings, my invention is embodied in a pump adapted for lifting a liquid. 1 is an outer casing, conveniently of cylindrical form, and 2 is an inner cylinder, which may be cast integrally with the casing 1 and be connected thereto by ties 3. The outer cylinder or casing has heads 4, provided with stuffing-box bearings 5 for the shaft 6, which extends through the axis of the cylinder 2. This cylinder 2 is open at its ends whereat it communicates with a jacket-space 7 between the casing 1 and cylinder 2, the liquid entering said space 7 at an induction-inlet 8. The eduction-outlet 9 for the fluid is from the middle of the cylinder 2.

Within the cylinder 2 are the two sets of operating mechanisms, each set comprising, preferably, a plurality of guides 10, which are fixed in the cylinder 2, and a plurality of turbines 11, which are fixed to the shaft 6 and rotative in the cylinder and which alternate in position with the guides 10. It will be understood that the two sets of operative mechanisms in the cylinder 2 are alike, except that the angular settings of their blades or buckets are reversed, so that when the shaft 6 is rotated they will take in the fluid at the opposite ends of the cylinder 2, respectively, and discharge it into the central chamber 12, connected with the outlet 9. Thus endwise or longitudinal thrust on the shaft 6 is avoided. In Fig. 4 only a part of the set of turbines and guides at the right are shown for lack of room.

The manner of mounting the turbines and guides in the cylinder will now be explained. The turbine 11 has a boss and is secured to the shaft 6. The guide 10 has also a boss, which loosely embraces the shaft, and a peripheral rim 10^a of cylindrical form, which fits snugly into the cylinder 2 and is secured by pins 13 to two bars or strips 14 14, which extend lengthwise of the cylinder and occupy, respectively, grooves or channels 15 15, formed in the cylinder at opposite sides of its axis. These bars serve to accurately distance or space the guides 10 and to prevent them from rotating in the cylinder. In assembling the parts the guides and turbines are slipped onto the shaft 6 one by one in alternate order, the turbines being secured to the shaft by keys, set-screws, or the like and the guides secured to the strips or bars 14 by the pins 13. The whole operative mechanism is then passed into the cylinder 2, the bars 14 being made to engage the grooves 15 therein. The bars may be prevented from endwise movement when in place by clips or detents 16 on the ends of the cylinder 2.

It will be noted that the turbine adjacent to a guide rotates within the cylindrical rim 10^a of the guide, and the rims of the several guides of a set of mechanism may abut and form a continuous cylinder, as seen at the left in Fig. 4.

By imparting rotation to the shaft 6 in the proper direction liquid will be taken in at both ends of the cylinder 2 and be discharged into the central chamber 12, and thence out at the outlet 9. The fluid forced by the first or outer turbine through the first or outermost guide is delivered by the latter to the next turbine, which forces it to the next in

succession, and so on through the series, the turbines thus establishing a flow through the pump.

Preferably there will be in the chamber 12 a suitable deflector 12^a to direct the incoming liquid to the outlet 9.

In Fig. 3 the pump is shown as adapted to lift the liquid through a suction-pipe 8^a, and the delivery-pipe 9^a is turned upward. The pump must be flushed at starting and kept full of liquid in order to get the best results. Hence if the pump must lift on the induction side an ordinary check-valve will be required in the suction-pipe, as will be understood, to keep the liquid from draining away from the pump. There may be one or more turbines 11 in each set; but a plurality of turbines in each set is preferred, as this enables the rotary speed to be reduced inversely to the number of turbines employed. The angle of the blades in the turbines and guides will be varied in a known way to suit the maximum speed at which the turbines are to be driven.

In operating the pump at starting under back pressure or resistance to axial displacement and flow the turbines are liable to carry the liquid around with them and not displace it in an axial direction, and to overcome this difficulty by relieving the back pressure, and thus enabling the turbines to set up and afterward maintain the proper axial displacement and flow, I employ a relief device, which will now be described with especial reference to Fig. 3.

At the outlet 9 of the pump is an upright cylindrical valve-box 17, which is connected at its top by a pipe 18 with the jacket-space 7 of the pump, and in this pipe is a regulating valve or cock 19. In the valve-box is a cylindrical bell-valve 20, which has a flange at its top to rest on a seat 21 in the valve-box. When seated, as in Fig. 3, a series of ports 22 in the side wall of the valve register with a by-pass 23, communicating with the jacket-space 7 at the induction side of the pump. Now when the pump starts the liquid displaced and flowing through the pump to the outlet will not have sufficient force to overcome the head or back pressure thereat, and in order to establish and maintain the flow this liquid is permitted to rise in the hollow of the valve 20 and flow through the ports 22 therein and the passage 23 to the induction side of the pump, thus insuring circulation; but as the pressure of the liquid from the pump increases at the outlet the valve will be lifted, and this will cut off the circulation by closing the ports 22. The too-ready rise of the valve is resisted by liquid in the valve-box above the valve, which must be forced out by the piston-like valve 20 through the pipe 18, and the cock 19 permits of this flow being retarded in any required degree, and thereby enabling the valve 20 to be held open for circulation until the proper degree of pressure is reached at the pump-outlet. Otherwise the valve would lift and arrest the circulation before the pressure from the pump sufficed to overcome the head or back pressure.

Figs. 5 and 6 show a construction adapted for use as a blower. In this case the outer casing 1 is omitted as unnecessary, such casing only serving to provide conveniently an air-tight induction-passage to connect with the suction-pipe, and this passage is not needed in the blower, as the air may enter the ends of the cylinder 2 directly. In this construction the shaft 6 has bearings in open end pieces 24 on the cylinder 2, the other mechanisms being the same as those before described, except as to the relief device seen in Fig. 6. This feature differs from that seen in Fig. 3 only in that the space above the valve 20 opens to the atmosphere by way of a controlling-cock 19^a and the ports 22 in the valve open to the outer air through apertures 23^a in the wall of the valve-box. Obviously as the atmosphere is the reservoir from which the blower takes the air the arrangement described is equivalent to connecting with the induction side of the pump, as in Fig. 3, for effecting circulation.

The construction of the pump, as shown in Figs. 5 and 6, will serve as a pump for liquids if submerged in a liquid to be raised. In this case the water of submergence takes the place of the ambient air.

It will be understood that the pump herein described is not of the centrifugal class nor of the class having positive displacement, and hence the operation of the valve 20 must not only be automatic, but be dependent on the pressure of the fluid coming from the turbines. It is not controllable by the speed of the pump, as the pump does not have positive displacement. The object is not to overcome the head at the discharge in order to set the pump in motion, but to set up a flow through the pump where there is a head to overcome, and this has been found a great objection to the use of pumps of this class.

Having thus described my invention, I claim—

1. In a turbine mechanism, the combination with a cylinder having induction and eduction openings, a shaft extending through said cylinder, and turbines on said shaft within the cylinder, of an automatic relief device at the said eduction-outlet, comprising a normally-open valve controlling a fluid-outlet, and a regulable resistance to the closing of said valve, substantially as set forth.

2. In a turbine mechanism having fixed guides, the combination with a cylinder having induction and eduction openings, a shaft extending through said cylinder, and turbines on said shaft within the cylinder, of an automatic relief device at the said eduction-outlet, comprising a normally-open valve controlling a fluid-outlet, and a regulable resistance back of said valve, said valve being at all times under a pressure which tends to close

it, from the liquid flowing to the main outlet, substantially as set forth.

3. In an axial-flow turbine mechanism, the combination with a cylinder having induction and eduction openings, a shaft extending through said cylinder, and turbines on said shaft within the cylinder, of an automatic relief device at the said eduction-outlet, comprising a normally-open valve controlling a passage connecting the eduction with the induction side of the pump, and a regulable resistance to the closing of said valve, substantially as set forth.

4. A turbine mechanism having turbines and non-rotating guides alternating therewith, in combination with a relief device at the eduction-outlet of said mechanism, said device comprising a normally-open valve controlling a fluid-outlet which is not under pressure or head, and means for regulating the resistance to the closing of such valve, substantially as set forth.

5. In an axial-flow turbine mechanism, the combination with a cylinder having induction and eduction openings, a shaft extending through said cylinder, and turbines on said shaft within the cylinder, of an automatic relief device situated at the eduction-opening, said device comprising a normally-open valve controlling a passage connecting the induction and eduction sides of the mechanism, and means for regulating the resistance to closing of said valve, substantially as set forth.

6. In a turbine mechanism, the combination with a cylinder having induction and eduction openings, a shaft extending through said cylinder, and turbines on said shaft within the cylinder, of a branch outlet for the fluid, a valve adapted for closing said branch outlet and open to constant pressure from the fluid passing to the main outlet and tending to close the valve, and means for opposing a regulable resistance to the closing of said valve, substantially as set forth.

7. In an axial-flow turbine mechanism, the combination with a cylinder having induction and eduction openings, a shaft extending through said cylinder, turbines on said shaft within the cylinder, and non-rotative guides in the cylinder and alternating with said turbines, of an automatic relief device at the said eduction-outlet, said device comprising a normally-open valve controlling a passage connecting the eduction with the induction side of the pump, and means for regulating the resistance to the closing of said valve, substantially as set forth.

8. A pump of the character described, having a by-pass connecting its induction and eduction sides, a normally-open and automatically-operated valve in said passage and adapted to close the latter when the pressure on the valve reaches a predetermined point, a passage connecting the valve-chamber back of said valve with the induction side of the pump, and a manually-operative valve controlling said passage, substantially as set forth.

9. A pump of the character described, having a by-pass 23 between its induction and eduction sides, a piston-valve controlling said by-pass and normally open, a pipe 18, connecting the valve-chamber back of the valve with the induction side of the pump, and a manually-operable valve controlling the flow through the pipe 18, substantially as set forth.

10. In an axial-flow turbine mechanism, the combination with a cylinder adapted to receive a fluid at its ends and to discharge a fluid laterally at its middle part, and a shaft extending through said cylinder axially, of two sets of turbine mechanisms in and at or near the respective ends of said cylinder, each of said sets comprising a turbine secured to and rotating with said shaft, and a non-rotating guide embracing said shaft and having a cylindrical rim, bars 14, which engage oppositely-arranged channels in the cylinder, and means for securing the guide to said bars, substantially as set forth.

11. In an axial-flow turbine mechanism, the combination with the cylinder 2, having induction and eduction apertures for a fluid and longitudinal channels 15, the bars 14, to occupy the respective channels 15, the securing-pins 13, and the shaft 6, extending through the axis of the cylinder, of the like operative mechanisms in the cylinder and near the respective ends thereof, each of said mechanisms comprising a plurality of turbines 10 and non-rotative guides 11, arranged in alternate order, the turbines being fixed to the shaft and the guides being fixed to the respective bars 14 by the pins 13, substantially as set forth.

12. In a turbine mechanism for forcing liquids, and having fixed guides, the combination with a cylinder or casing having induction and eduction openings, a shaft extending through the same, and turbines on said shaft between said openings, of a relief device at the eduction side, comprising a valve-chamber at the outlet connected with the induction side of the device, and a valve in said chamber adapted to close a waste-outlet when the pressure at the main outlet rises to a predetermined extent, substantially as set forth.

In witness whereof I have hereunto signed my name, this 21st day of April, 1899, in the presence of two subscribing witnesses.

FRANZ MARBURG, JR.

Witnesses:
HENRY CONNETT,
PETER A. ROSS.