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F. RAY.

CENTRIFUGAL TURBINE OR LIKE PUMP.

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Fig. 1.

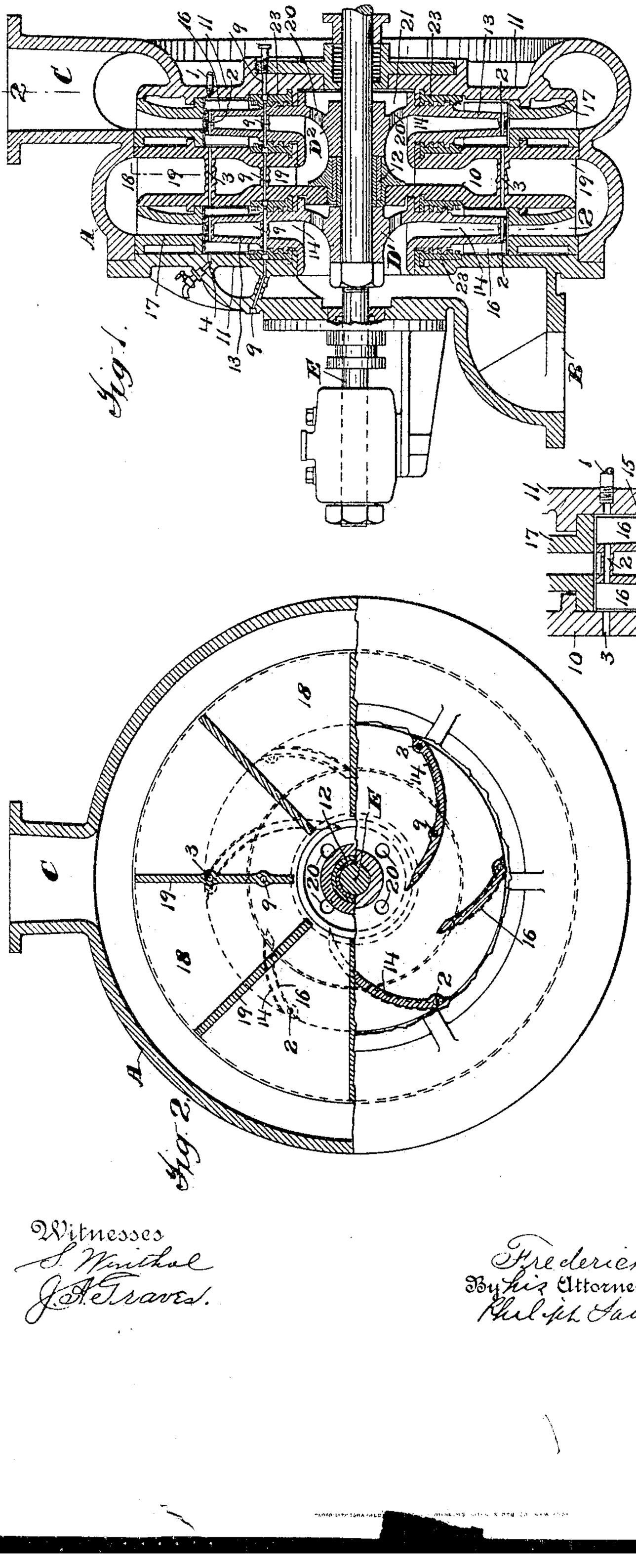

Fig. 3.

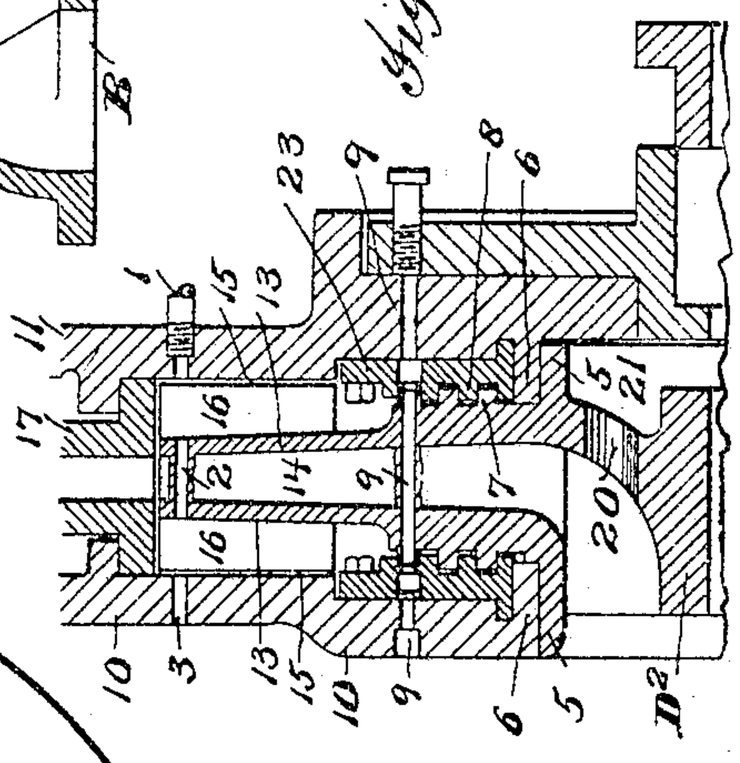

Fig. 2.

Witnesses
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UNITED STATES PATENT OFFICE.

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CENTRIFUGAL, TURBINE, OR LIKE PUMP.

SPECIFICATION forming part of Letters Patent No. 782,271, dated February 14, 1905.

Application filed April 30, 1904. Serial No. 205,679.

To all whom it may concern:

Be it known that I, FREDERICK RAY, a citizen of the United States, residing at East Orange, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Centrifugal, Turbine, or Like Pumps, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to that class of centrifugal, turbine, or similar pumps in which inclosed impellers are used, the especial objects of the invention being to provide a simple and efficient construction in which friction is lessened by air-chambers on opposite sides of the impeller, and to provide improved means for balancing the impeller and preventing leakage at the hub.

The invention is applicable to pumps having either a single impeller or series of impellers—that is, either single stage or multistage pumps; but certain features of the invention have been devised in connection with the application of the broad invention to multistage pumps, which features form specific parts of the invention.

For a full understanding of the invention a detailed description of a construction embodying the same in its preferred form as applied to a multistage pump having two impellers will now be given in connection with the accompanying drawings, forming a part of this specification, and the features forming the invention will then be specifically pointed out in the claims.

In the drawings, Figure 1 is a central section of the pump, taken longitudinally of the axis. Fig. 2 is a cross-section on the broken line 2 of Fig. 1. Fig. 3 is an enlarged detail section of a portion of one of the impellers.

Referring to said drawings, A is the pump-casing, having the suction B and delivery C, and D' D^2 are the two impellers carried by the shaft E and separated by the usual diaphragms 10, forming, with the end casings 11, the impeller-chambers and the delivery-passage from the first to the second impeller. The hubs of the two impellers D' D^2 abut against and are separated by the packing-ring 12 on shaft E. The impellers are shown as of a common inclosed type, having the side walls 13 and vanes 14 extending between the side walls, and on opposite sides of the impellers are chambers 15, in which run vanes 16, carried on the outside of the impeller-walls 13. These chambers 15 extend from the outer edge of the impeller inward to a packing-ring construction, presently to be described, and the chambers are closed to the water-space of the impeller by the side walls 13 and form air-chambers on the opposite sides of the impeller. The delivery of the first impeller D' passes outward from the impeller through the usual diffusion-ring 17 and then sidewise and downward through the passage 18 to the suction of the second impeller D^2, and in this passage 18 are preferably arranged fixed vanes 19, extending downward to the suction of the second impeller. The air is preferably supplied to all the air-chambers 15 on opposite sides of the two impellers by passing the air through from one side of the pump to the other, the air being admitted to the outside air-chamber 15 at the delivery end of the pump from an air-compressor or other suitable means through pipe 1, the air passing from the chamber 15 from one side of each impeller to the other through holes 2 in the impeller-vanes 14 and through the diaphragms and one of the fixed vanes 19 by hole 3, an outlet-opening 4 from the outside chamber 15 on the impeller D' being provided, preferably controlled by an adjustable air-cock, as shown. Thus the air admitted through pipe 1 will pass through the successive chambers 15 from one side of the pump to the other and out through the escape-pipe 4. It will be understood, however, that a separate supply-pipe may be used for each of the impellers or each chamber, if desired; but the construction shown is simple and efficient and is preferably used.

Referring now to the balancing and leakage-preventing construction, each of the impellers is preferably provided at the hub with an

opening 20, through which the suction fluid passes to a balancing-chamber 21 on the rear of the impeller, so as to balance the suction-pressure. The impellers are provided also with flanges 5 outside the openings 20 and outside the suction-opening, which flanges form running-joints with shoulders or flanges 6 on the casings and diaphragms outside the suction-openings and balancing-chambers.

Between the air-chambers 15 and the running-joints 5 6 are arranged intermeshing packing-rings, which are formed by projecting rings 7 on the side walls 13 of the impellers alternating with rings 8 on a packing-ring 23, secured within depressions in the casings and diaphragms outside the running-joints 5 6. For the purpose of supplying these packing-rings with oil or water, distilled water preferably being used so as to avoid the wear which would result from grit, suitable openings are provided for admitting liquid, and, as in the case of the air-passages above described, these liquid-openings preferably form a passage extending through the pump, so that a single liquid-inlet supplies all the packing-rings. As shown, there is a single liquid-passage 9 passing through the outside casing to the outside packing-rings of impeller D′, then through the impeller to the packing-rings on the opposite side of this impeller, then through the diaphragms and a fixed vane 19 to the inner packing-rings on impeller D^2, then through the impeller to the outer packing-rings on this impeller, and then to the outlet from the casing. It will be understood, however, that as in the case of the air this lubricating and sealing liquid may be supplied to the packing-rings by separate pipes or by a single pipe for each impeller, if preferred.

The complete invention, as above described, provides a very simple and efficient construction of pump with the impellers running in air and with the impellers efficiently balanced and leakage of air prevented. The outside vanes 16 in the air-chambers 15, as will be readily understood, result in a centrifugal action within these chambers, which secures a small body of liquid within the chambers at the outer ends of the vanes, which efficiently seals the chambers against the escape of air at the outer edges of the impellers, this liquid being outside the air-pipe, so as to permit air to enter through these pipes. These outside vanes also reduce the pressure toward the center to such an extent as to materially reduce the tendency of the air to escape toward the center past the joints 5 6, and such escape is fully prevented by the sealed packing-rings 7 8 between the air-chambers and the running-joints. The outside vanes 15 have been shown as extending from the impeller edge to the packing-rings; but this length may be varied, and in some constructions it may be found that only narrow vanes at the edge of the impellers are required. The construction shown, however, is preferable. The air-chambers are of especial importance in connection with the vanes on the outside of the impeller, as they avoid the friction of water on the sides of the impeller and casing; but the outside vanes, with the balancing-chambers and packing-rings, may be used with the outside vanes, running in liquid instead of air.

While the invention has been shown as applied to a two-stage pump, it will be understood that the broader features of the invention are applicable also to single-impeller pumps and that the same construction may be used for any number of successive impellers.

While the openings 20 and balancing-chambers 21 are preferably used for balancing the pump, it will be understood that this feature is not essential to the invention, considered broadly, but that other means for balancing the pump may be used. This balancing-chamber feature, however, is preferably used in combination with the running-joints and leakage-preventing construction and in combination with other features, as defined by the claims, forms a part of the invention independently of the air-chamber feature.

What I claim is—

1. In a centrifugal, turbine or similar pump, the combination with an inclosed impeller, of air-chambers on the opposite sides of the impeller, and vanes in said chambers carried by the impeller.

2. In a centrifugal, turbine or similar pump, the combination with an inclosed impeller, of air-chambers on the opposite sides of the impeller, vanes in said chambers carried by the impeller, and a series of packing-rings on the casing and impeller closing the inner side of said chambers.

3. In a centrifugal, turbine or similar pump, the combination with an inclosed impeller, of air-chambers on the opposite sides of the impeller, vanes in said chambers carried by the impeller, a suction-balancing chamber on the back of the impeller communicating with the impeller-suction, a running-joint outside said balancing-chamber, and packing-rings on the casing and impeller closing the inner side of said air-chambers.

4. In a centrifugal, turbine or similar pump, the combination with an inclosed impeller, of air-chambers on the opposite sides of the impeller, vanes in said chambers carried by the impeller, a suction-balancing chamber on the back of the impeller communicating with the impeller-suction, and a running-joint outside said balancing-chamber.

5. In a centrifugal, turbine or similar pump,

the combination with an inclosed impeller, of air-chambers on the opposite sides of the impeller, vanes in said chambers carried by the impeller, and passages through the impeller connecting the air-chambers.

6. In a centrifugal, turbine or similar pump, the combination with an inclosed impeller, of air-chambers on the opposite sides of the impeller, vanes in said chambers carried by the impeller, passages through the impeller connecting the air-chambers, packing-rings on the casing and impeller closing the inner side of said chambers, and liquid-passages through the impeller connecting the packing-rings on opposite sides of the impeller.

7. In a centrifugal, turbine or similar pump, the combination with an inclosed impeller, of air-chambers on the opposite sides of the impeller, vanes in said chambers carried by the impeller, a suction-balancing chamber on the back of the impeller communicating with the impeller-suction, a running-joint outside said balancing-chamber, packing-rings on the casing and impeller between the air-chambers and joint, and liquid-passages through the impeller connecting the packing-rings on opposite sides of the impeller.

8. In a centrifugal, turbine or similar pump, the combination with a rotary impeller, of a balancing-chamber on the back of the impeller communicating with the impeller-suction, a running-joint outside said balancing-chamber, a series of packing-rings on the casing and impeller outside said running-joint, a chamber on the back of the impeller outside said packing-rings, and vanes carried by the impeller running in said chamber.

9. In a centrifugal, turbine or similar pump, the combination with a rotary impeller, of a balancing-chamber on the back of the impeller communicating with the impeller-suction, a running-joint outside said balancing-chamber, a series of packing-rings on the casing and impeller on each side of the impeller, vane-chambers on opposite sides of the impeller outside said packing-rings, and vanes carried by the impeller running in said vane-chambers.

10. In a multistage centrifugal, turbine or similar pump, the combination with a plurality of inclosed impellers, of air-chambers on the opposite sides of the impellers, and vanes in said chambers carried by the impellers.

11. In a multistage centrifugal, turbine or similar pump, the combination with a plurality of inclosed impellers, of air-chambers on the opposite sides of the impellers, vanes in said chambers carried by the impellers, and passages through the impellers connecting the air-chambers of the different impellers.

12. In a multistage centrifugal, turbine or similar pump, the combination with a plurality of inclosed impellers, of air-chambers on the opposite sides of the impellers, vanes in said chambers carried by the impellers, and packing-rings on the casing and impellers closing the inner side of said chambers.

13. In a multistage centrifugal, turbine or similar pump, the combination with a plurality of inclosed impellers, of air-chambers on the opposite sides of the impellers, vanes in said chambers carried by the impellers, packing-rings on the casing and impellers closing the inner side of said chambers, and liquid-passages connecting the packing-rings of the different impellers.

14. In a multistage centrifugal, turbine or similar pump, the combination with a plurality of inclosed impellers, of air-chambers on the opposite sides of the impellers, vanes in said chambers carried by the impellers, packing-rings on the casing and impellers closing the inner side of said chambers, passages through the impellers connecting the air-chambers of the different impellers, and liquid-passages connecting the packing-rings of the different impellers.

15. The combination with a plurality of inclosed impellers, of air-chambers on the opposite sides of the impellers, vanes in said chambers carried by the impellers, balancing-chambers on the backs of the impellers communicating with the impeller-suctions, and packing-rings on the casing and impeller between the balancing-chambers and air-chambers.

16. The combination with a plurality of impellers, of balancing-chambers on the backs of the impellers communicating with the impeller-suctions, running-joints outside said balancing-chambers, vane-chambers on the backs of the impellers outside said joints, packing-rings on the impellers and casing between said chambers and joints, and vanes in said vane-chambers carried by the impellers.

17. The combination with a plurality of impellers, of balancing-chambers on the backs of the impellers communicating with the impeller-suctions, running-joints outside said balancing-chambers, vane-chambers on opposite sides of the impellers outside said joints, packing-rings on the impellers and casing between said chambers and joints, vanes in said chambers carried by the impellers, and liquid-passages connecting the packing-rings of the different impellers.

18. In a centrifugal, turbine or similar pump, the combination with an inclosed impeller, of air-chambers on the opposite sides of the impeller, and passages through the impeller connecting said chambers.

19. In a multistage centrifugal, turbine or similar pump, the combination with a plurality of inclosed impellers, of air-chambers on the

opposite sides of the impellers, and passages through the impellers connecting the air-chambers of the different impellers.

20. In a multistage centrifugal, turbine or similar pump, the combination with a plurality of inclosed impellers, of air-chambers on the opposite sides of the impellers, packing-rings on the casing and impellers closing the inner side of said chambers, passages through the impellers connecting the air-chambers of the different impellers, and liquid-passages connecting the packing-rings of the different impellers.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FREDERICK RAY.

Witnesses:
C. J. SAWYER,
W. H. KENNEDY.