No. 687,853. Patented Dec. 3, 1901.

J. RICHARDS.

COMPOUND ROTARY PUMP.

(Application filed Jan. 21, 1901.)

(No Model.)

Fig. II

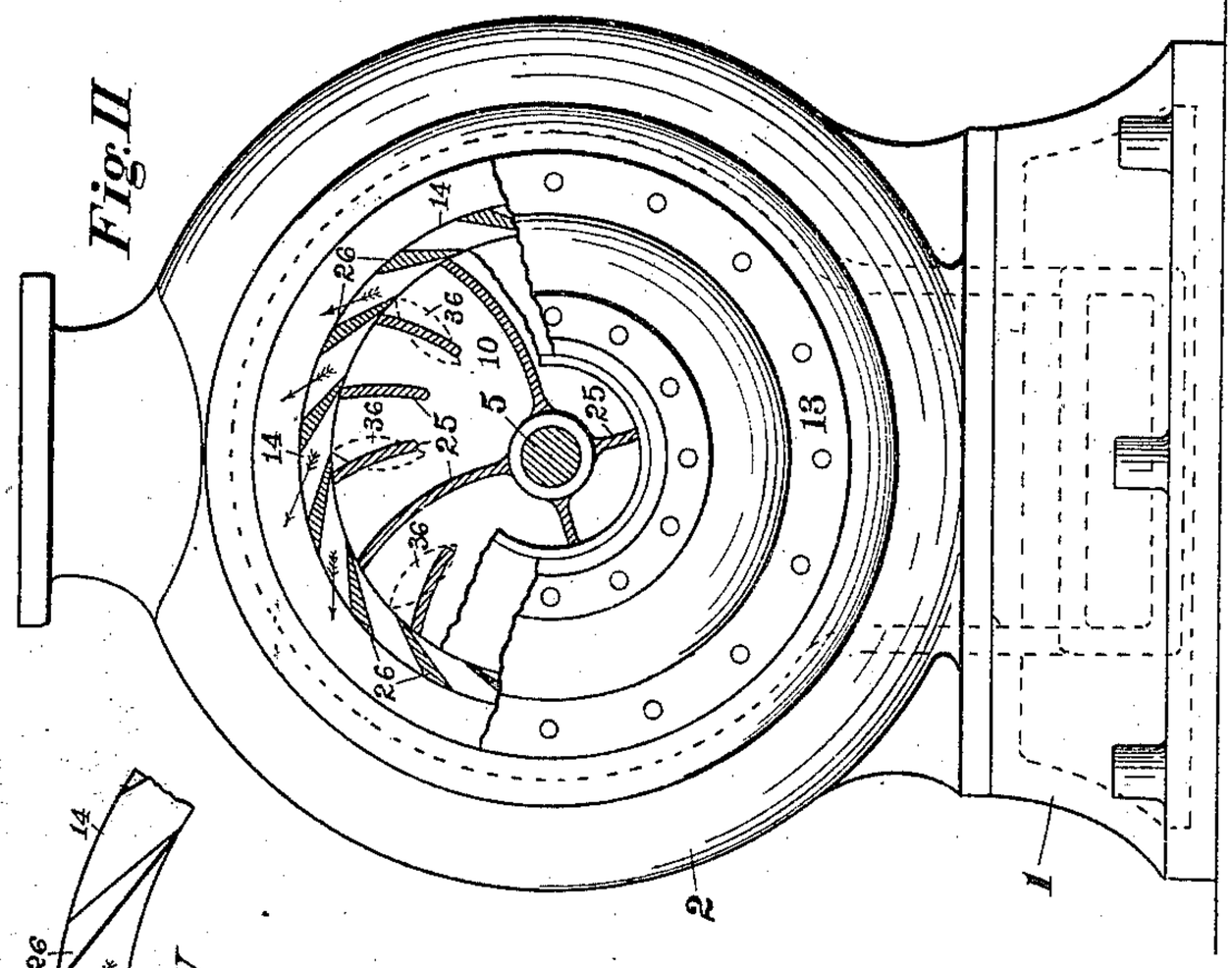

Fig. III

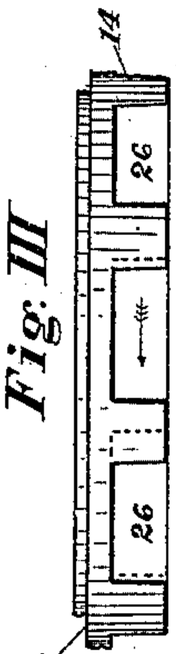

Fig. IV

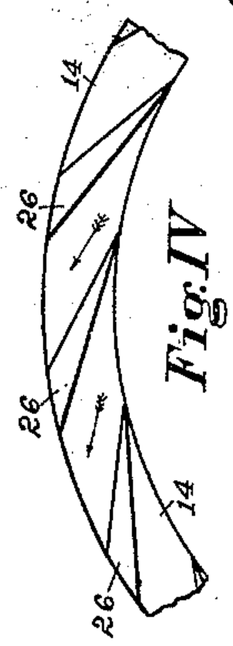

Fig. I

WITNESSES:
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UNITED STATES PATENT OFFICE.

JOHN RICHARDS, OF SAN FRANCISCO, CALIFORNIA.

COMPOUND ROTARY PUMP.

SPECIFICATION forming part of Letters Patent No. 687,853, dated December 3, 1901.

Application filed January 21, 1901. Serial No. 44,001. (No model.)

To all whom it may concern:

Be it known that I, JOHN RICHARDS, a citizen of the United States of America, residing at San Francisco, county of San Francisco, and State of California, have invented certain new and useful Improvements in Compound Rotary Pumps; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to certain improvements in rotary pumps for liquids, and especially to compound or two-stage pumps wherein the liquid raised or impelled is acted upon twice successively.

Referring to the drawings herewith and forming a part of this specification, Figure I is a vertical longitudinal section through a compound pump constructed according to my invention. Fig. II is an end view of the same pump with the supply-pipe and a part of the side plate removed and a portion of the impeller and throat-vanes in section. Fig. III is an enlarged broken edge view of a portion of the diffusing throat-ring. Fig. IV is a side view of Fig. III, showing more clearly the form of the vanes of the throat-ring.

Pumps of the class to which the present invention belongs operate by centrifugal force, by impact or in the manner of a reversed turbine, and by tangential energy imparted to the fluid by its rotation within the impeller. The relation and relative amount of pressure produced by these different forces is not known, because varied by the accuracy of workmanship and the form of the water-passages and to some extent by the pressure and speed rotation. In the present invention these different forces are believed to be approximately equal.

The main parts of the pump consist of a strong support or base 1 and a central or main member 2, commonly called a "casing," a supply-pipe 3, and discharge-nozzle 4.

5 is the shaft or spindle, supported in the bearings 7, 8, and 9.

10 and 12 are the impellers, alike in construction, but reversed in position, so that any lateral thrust thereon will be compensated or balanced.

At the inlet side of the pump is a removable side plate 13, to which the supply-pipe 3 is attached, and by the removal of which the impeller 10 and the diffusing-throat 14 can be taken out or inserted, the latter being clamped and held against the face 15 by the plate 13. At the other side of the pump is a removable plate or cover 17, provided with an inward-projecting part 18, that holds and clamps the second throat-ring 14. At the bottom this part 17 and above the bed-plate it forms three sides of the water-passage 19 and is bolted to the base 1 and the casing 2.

The impellers 10 and 12 are inclosed in the chambers 20, and the inlet-nozzles 23 of the impellers 10 and 12, projecting out of the chambers 20, are surrounded by removable rings 24, that can be replaced if worn.

The impellers 10 and 12 are provided with forwardly-curved vanes 25, that have such position and shape as to drive the fluid by impact tangentially outward between the diffusing-vanes 26, which are made acute at their inner ends to avoid disturbance of the fluid, which after passing into the chamber 27 is discharged through the nozzle 4.

The chambers 20 are connected at the bottom by a passage 28, which communicates with a pipe 29, that projects out through the side of the main casing 2 in any convenient direction. The chambers 20 on the receiving sides of the impellers communicate with the pipes 30 and 32. These pipes 29, 30, and 32 may open into the atmosphere or to an inclosed vessel, their purpose being to relieve pressure in or to drain the chambers 20 and relieve the impellers 10 and 12 from pressure and friction on their sides. The operation of these drain-pipes 29, 30, and 32 being more fully set forth in an application for Letters Patent on high-pressure rotary pumps filed by me at the same time herewith, further description of them is not required here.

The throat-rings 14 (shown in Figs. III and IV) are annular members that occupy only a narrow zone between the peripheries of the impellers and the annular discharge-chambers 19 27. Said members consist each of a simple flat ring having wedge-shaped vanes or partitions 26, integrally formed there-

with or attached thereto, projecting from the plane face thereof, with the acute points directed inward. Said rings thus have no permanent connection with any other member and are clamped and held in place by the separable side plates 13 17, so as to be released by the removal thereof. Being the parts most subject to wear, their removal and replacement are thus rendered convenient and inexpensive. Since they are made to pass freely over the impellers, either one of said members can be readily removed and replaced for repairs or renewal without interference with the other. The vanes 26, which may be of any suitable shape, but preferably with flat faces, are made as many in number as the circumferential space will admit. The open spaces left between the vanes enable the faces to be reached for the purpose of finishing or smoothing the surfaces over which the water passes. Said annular diffusing-rings or throat-rings form an important part of my invention, especially for pumps of multiple type, and as the diametrical dimensions of the casing are increased by so much as the zone occupied by these throat-rings their radial depth is made as narrow as possible, commonly so that the section occupied will be square, or approximately so, as shown in the drawings.

The plates 34 and 35 are integrally connected by the struts 36 (indicated by dotted lines in Fig. II,) made in such shape as to baffle rotation of, but not obstruct the flow of, the liquid through the passage 19, which leads through a curved passage in the base 1 and up to the inlet-nozzle of the second impeller 12, as shown in Fig. I and indicated by arrows.

The operation is as follows: The pump being charged with liquid, the spindle 5 being set in revolution by any suitable driving power, the liquid is discharged from the first impeller 10, follows around the curved face at 37 and through the passage 19 to the second impeller 12, and is next discharged outward into the chamber 27 and through the nozzle 4. The action of the first impeller 10 is to create a pressure equal to the centrifugal force, impact of the vanes 26, and the tangential energy of the liquid, which under this pressure is driven through the passage 19 to the second impeller 12, where the pressure is again increased by a like action of this impeller, and the liquid is discharged into the chamber 27, as before explained. In this manner it will be seen that the impellers 10 and 12 can be placed near together, the dimensions of the structure reduced to small space, the liquid in its course following easy curves, and all parts of the machinery are accessible and symmetrically disposed.

It will be understood that the throat-rings 14 have the same purpose and construction for centrifugal impellers of any kind and of any number and whether they be incased or open. The said throat-rings are shown in my copending application, Serial No. 44,002, and enter as an element thereof, but are not therein specifically claimed.

Having thus explained the nature and objects of my invention and manner of constructing the same, I claim and desire to secure by Letters Patent—

1. In a rotary pump, a casing containing an interior chamber bounded peripherally by a curved wall and having a removable side separable at the throatway of the annular discharge, a rotary impeller mounted in said chamber, and a removable annular diffusing-ring surrounding said impeller, formed of a narrow annular continuous imperforate plate having numerous inclined imperforate vanes or partitions projecting from one side thereof with inclined passages between, occupying the space between the impeller and the annular discharge-way, said ring forming a running joint with said impeller at the periphery thereof, and held in place between the fixed and separable members of the casing, substantially as specified.

2. In a rotary pump, a casing having one or more interior chambers bounded peripherally by annular curved walls, said chambers separable at the throatways of the discharge-passages, rotary impellers mounted in said chambers, and removable diffusing-rings formed of a narrow annular continuous imperforate plate having numerous inclined imperforate vanes or partitions projecting from one side thereof with inclined passages between, occupying the space between the impeller and the annular discharge-way, said ring forming a running joint with said impeller at the periphery thereof, and held in place by the separable members of the said casing, substantially as specified.

3. In a rotary pump, a casing containing an interior chamber bounded peripherally by a curved wall forming an annular discharge-way, said chamber separable at the throatway of the annular discharge, a rotary impeller in said chamber, and a removable diffusing-ring formed of a narrow annular continuous imperforate plate having numerous inclined imperforate vanes or partitions projecting from one side thereof with inclined passages between, occupying the space between the impeller and the annular discharge-way, said ring forming a running joint with said impeller but located entirely outside thereof, whereby either may be removed and replaced without disturbing the other.

4. In a rotary pump, a casing having an interior chamber bounded peripherally by a curved wall forming an annular discharge-way, said chamber separable at the throatway of the annular discharge, a rotary impeller in said chamber, and a removable diffusing-ring formed of a narrow annular continuous imperforate plate having numerous inclined imperforate vanes or partitions projecting from one side thereof with inclined passages between, occupying the space be-

tween the impeller and the annular discharge-way, said ring forming a running joint with said impeller at the periphery thereof, substantially as specified.

5. In a rotary pump, a casing having an interior chamber bounded peripherally by a curved wall forming an annular discharge-way, said chamber separable at the throat-way of said annular discharge, a rotary impeller in said chamber, an annular recess in the wall of said chamber concentric with said impeller, of an inner diameter not less than that of the impeller, said recess approximately square in cross-section, and in said recess a removable annular diffusing-ring formed of a narrow annular continuous imperforate plate having numerous inclined imperforate vanes or partitions projecting from one side thereof with inclined passages between, occupying the space between the impeller and the annular discharge-way, said ring forming a running joint with said impeller at the periphery thereof, and held in place between the separable members of the casing, substantially as specified.

6. In a compound rotary pump, the combination with a casing containing two interior chambers bounded peripherally by curved walls, of a driving-shaft passing through both chambers in substantially the line of the axes of their peripheral walls, an imperforate disk partition in the first chamber dividing it into two waterways in communication by means of an annular peripheral passage formed between the disk edges and the curved wall of the chamber, an impeller on said driving-shaft in the first waterway of said chamber, a removable annular throat-ring provided with inclined wedge-shaped partitions forming between them smooth straight passages approximating a tangential direction in the line of motion of the impeller, interposed between said impeller at its periphery and the entrance to said annular peripheral passage, said impeller forming a running joint with the entrances in said throat-rings, baffle-plates in the second waterway supporting said disk partition, a curved discharge-way from said second waterway to the second chamber, an impeller on said shaft in said second chamber facing oppositely from the first impeller, a removable annular throat-ring with inclined wedge-shaped partitions surrounding said second impeller, forming a running joint with the periphery thereof, said throat-ring having inclined passages discharging into the annular peripheral passage of the second chamber, and an outlet from said second chamber, substantially as specified.

7. In a rotary pump, a main casing having two impeller-chambers therein, removable plates at each side of the casing by means of which the impellers and throat-rings can be inserted, one side plate provided with a passage to the base-plate and forming in part the passage from the first to the second impeller, substantially as specified.

8. In a rotary pump, a main casing and impellers therein, a base to which the pump-casing is attached and a passage therein forming communication from the discharge-way of one impeller to the inlet-nozzle of the next, substantially as specified and described.

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

JOHN RICHARDS.

Witnesses:

ALFRED A. ENQUIST,

ELMER WICKES.