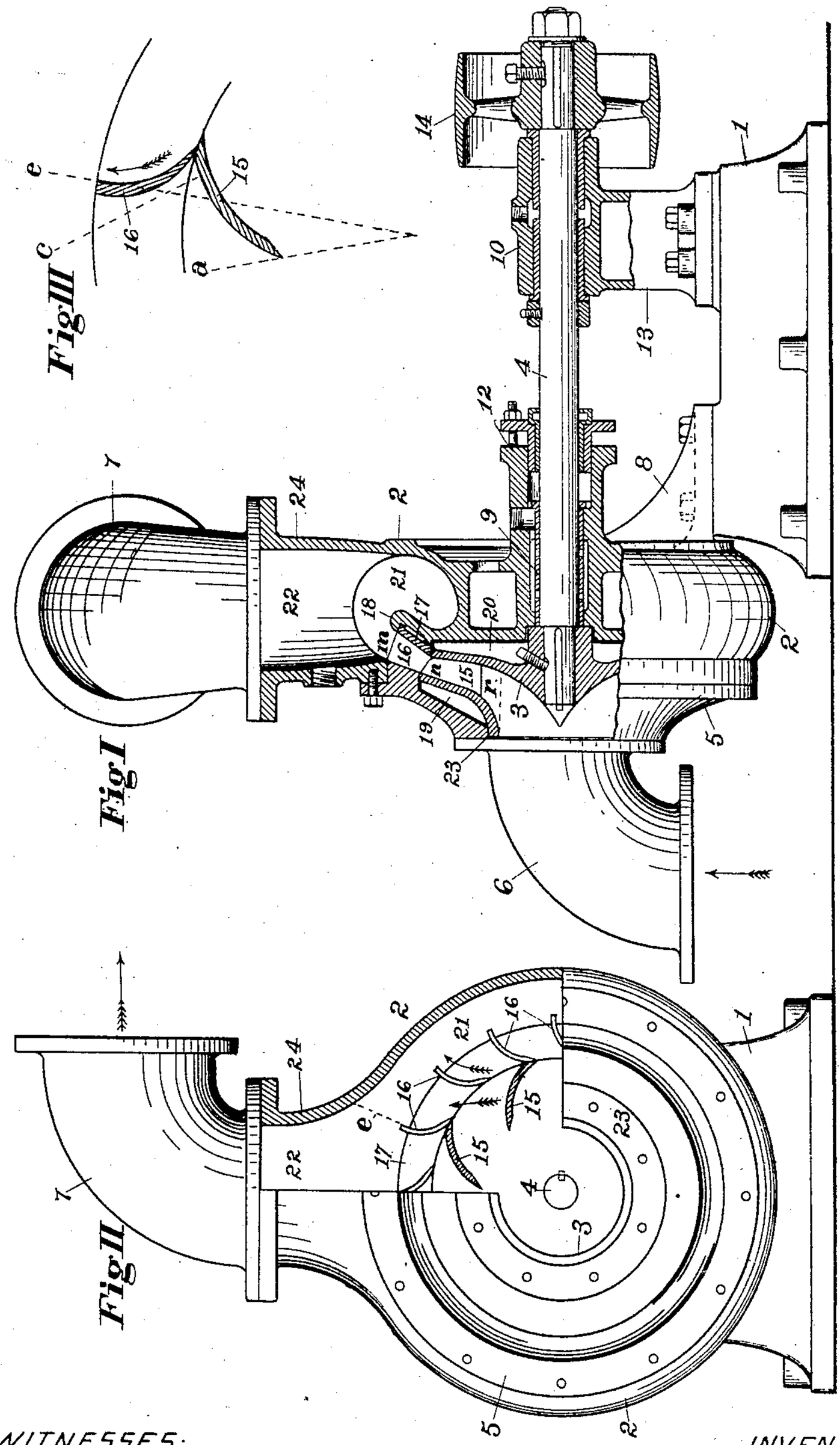
No. 786,384. PATENTED APR. 4, 1905.

J. RICHARDS.

TURBINE PUMP.

APPLICATION FILED MAY 31, 1902.

2 SHEETS—SHEET 1.



WITNESSES:

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INVENTOR.

John Richards

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2 SHEETS—SHEET 2.

Fig: IV

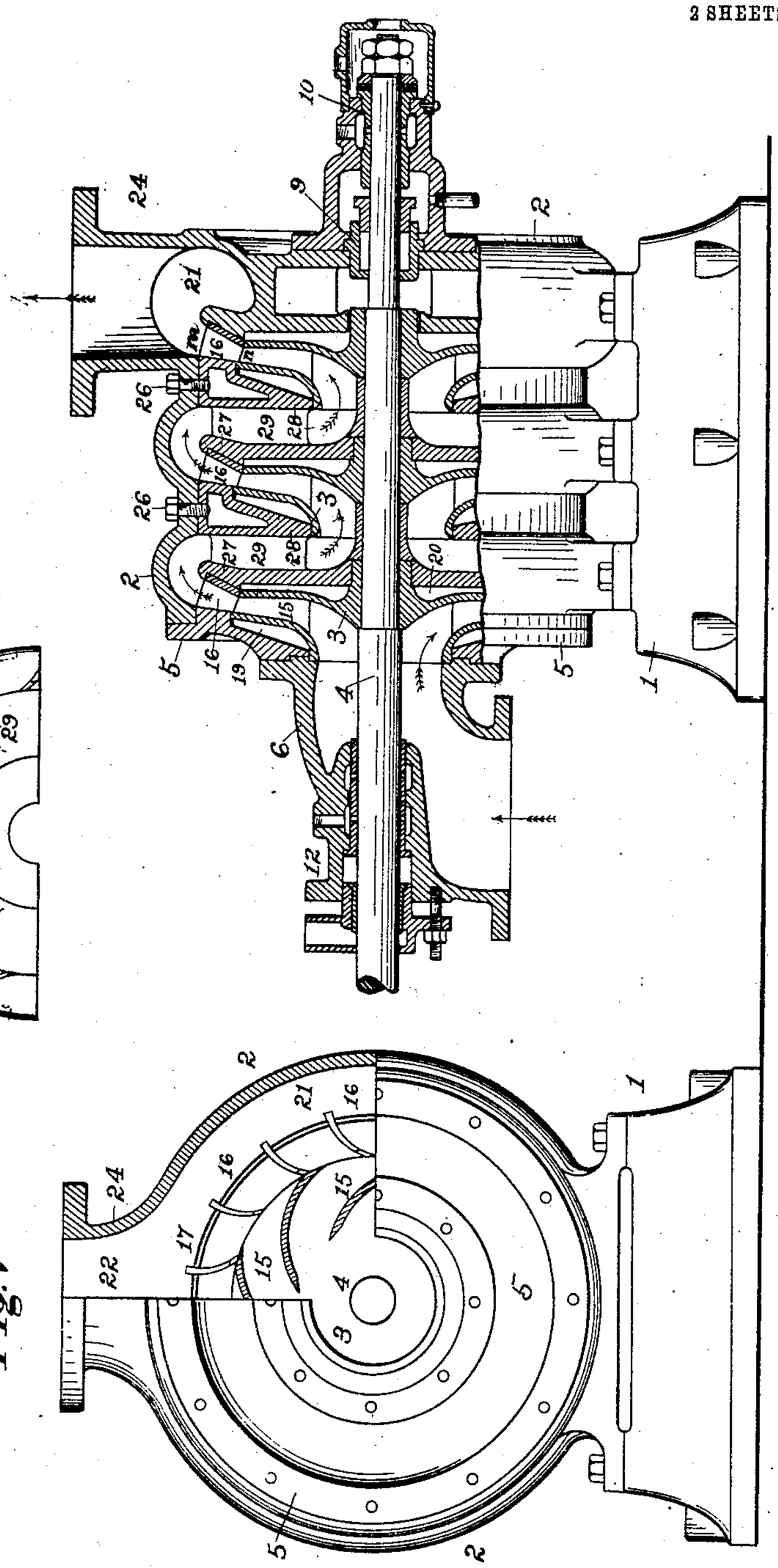

Fig: VI

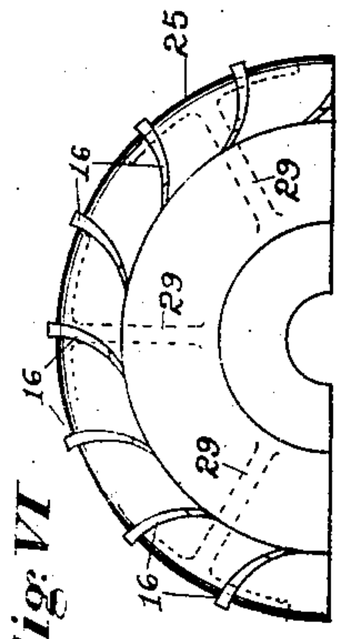

Fig: V

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UNITED STATES PATENT OFFICE.

JOHN RICHARDS, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO TURBINE PUMP COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

TURBINE-PUMP.

SPECIFICATION forming part of Letters Patent No 786,384, dated April 4, 1905.

Application filed May 31, 1902. Serial No. 109,755.

To all whom it may concern:

Be it known that I, JOHN RICHARDS, a citizen of the United States, residing at San Francisco, county of San Francisco, and State of California, have invented certain new and useful Improvements in Turbine-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 rotative pumps of the turbine type; and it consists in a construction whereby the water is impelled outward radially as nearly as possible without revolution and in the manner of an inverted-turbine water-wheel and having impelling and diffusing vanes of a proper curvature or angle to produce radial movement of the water.

The object of my invention is to avoid the frictional and other losses caused by rapid rotation of the water in such pumps, accomplished by means hereinafter described, and illustrated in drawings forming a part of this specification.

Figure I is a longitudinal section through the operating parts of a single-stage pump constructed according to my invention; Fig. II, an end view, partially in section, of the same pump, the suction-pipe being removed; Fig. III, a diagram to show a form of the vanes. Fig. IV is a longitudinal view of a three-stage or multiple pump embodying the same improvements; Fig. V, an end view, partially in section, of Fig. IV; and Fig. VI, a partial view of the division-plates between the impellers.

In the operation of that type of rotative pumps called "free-running" it is obvious that the frictional and other resistance incident to setting the water in revolution is a loss except as such resistance may be recovered by the tangential energy resulting from such revolution. It is also evident, as in the case of turbine water-wheels or pumps, that to attain the most useful result the water should pass through the machines with as little deviation as possible from its intended course. These ends are attained as nearly as possible by avoiding disturbance of the entering water until it has been deflected outward or radially in the pump and by diffusing-vanes that gradually arrest rotation of the water and convert its flowing energy into pressure.

Referring to the drawings, especially to Figs. I, II, and III, 1 is a base-frame on which the parts are mounted; 2, the main casing; 3, the impeller; 4, the shaft; 5, the removable front plate; 6, the suction or supply pipe, and 7 the discharge-pipe.

The supporting-bracket 8, pump-shaft 4, bearings 9 and 10, packing-gland 12, stand 13, and pulley 14 being all of ordinary construction will be understood without particular description.

The impelling-vanes 15 are curved and set obliquely to the radius, but not always in one position. Their angle, preferably and as shown in the drawings, being a function of the speed of rotation, is arranged accordingly. The diffusing-vanes 16 are shown as made constant in shape in so far as terminating on the radial line *e*, but may have circular or ellipsoidal or other curved faces and be of any length to produce the required expansion of the area of the water-passages from *n* to *m* in Fig. I. These diffusing-vanes 16 are preferably made integral with a removable ring 17 and bear against the front plate 5, are held by a ledge 18, and are removable with the impeller 3 and front plate 5, but may be formed on the cover-plate 5 and removable therewith.

The impeller 3 is smooth on its exterior and revolves in water contained in the chambers 19 and 20 at the sides, which chambers sustain a pressure equal to that in the discharge-chamber 21, and to prevent lateral thrust on the impeller its outer sides or faces are made of equal area and its periphery angular, as shown in Fig. I. It will be understood that this construction does not prevent water from escaping into the main bearing 8 or around the inlet-nozzle at 23, but is suit-

able for pure water and does not require the interior of the pump to be finished.

In operating there are several distinctions from centrifugal pumps. The zone occupied by the impelling-vanes 15 lies at some distance without the line of the entering water, as indicated at *r* in Fig. I, and the water is deflected outward by the shape of the impeller 3 and is flowing in a radial direction before being engaged by the vanes 15. These vanes impart but little rotation to the water, moving it approximately on the line *c* in Fig. III, and on entering between the diffusing-vanes 16 it is deflected forwardly and outwardly and preferably to a radial direction, (indicated by the line *e* in Fig. III,) and so enters the discharge-chamber 21 and being free to flow either way to the discharge-nozzle 24, so the cross-section or area of this chamber can be one-half as much as when the water is in rotation and flowing in one direction only.

By expansion of the water-passage from *n* to *m* and by the increase in diameter between these points the velocity of the water is gradually reduced to a point where little energy remains. This is essential in pumps made for a high efficiency. In the present drawings the proportions are such that water entering the pump at five feet per second is increased to eight feet per second as it leaves the vanes 15 and is reduced to two feet per second as it enters the chamber 21. It will be understood that these features require modification according to the class of pumps to be made and the efficiency of their performance, the manner of operating remaining the same.

Referring now to Figs. IV, V, and VI, these figures represent the same construction applied in three stages, but substantially the same in each case, the impellers 3 being separated by the members 25, held by the screws 26. These members 25 consist of the plates 27 and 28, connected by the longitudinal division-plates 29, (indicated by dotted lines in Fig. VI, where the diffusing-vanes 16 are shown set in place.) In other respects the construction is practically the same as in Figs. I and II, and like numerals of reference are applied.

Having thus described the nature and objects of my invention and the manner of its application in practice, what I claim as new, and desire to secure by Letters Patent, is—

1. In a turbine-pump, an incased impeller provided with interior impelling-vanes backwardly inclined with reference to the direction of motion, in combination with fixed diffusing-vanes curved from a forwardly-oblique to an approximately radial direction outward from the impeller zone, whereby any circular motion of the outflowing water is gradually diverted toward a radial direction as it enters the discharge-chamber, substantially as specified.

2. In a turbine-pump, an incased impeller having inclined impelling-vanes located in a zone outside of the inlet-way, in combination with an annular series of fixed diffusing-vanes in a zone outside of the impeller-vanes, said diffusing-vanes curved from a forwardly-inclined to an approximately radial direction, whereby the water is delivered into the discharge-chamber with a minimum of rotatory motion, substantially as specified.

3. In a turbine-pump, in combination, an annular discharge-chamber, an incased impeller provided with inclined impeller-vanes, a series of fixed diffusing-vanes disposed in a zone exterior to said impeller-vanes, forwardly inclined relatively thereto, and curved from the inclined to an approximately radial direction at the terminals, said diffusing-vanes forming passages between them disposed tangentially with reference to the circular inner wall of the annular chamber into which they discharge, substantially as specified.

4. In a turbine-pump, in combination, an annular discharge-chamber, an annular throatway having its outer wall disposed tangentially to the circular wall of the discharge-chamber, its inner wall divergent relatively to said outer wall of the throatway in the direction of discharge, an impeller with inclined vanes, running in alinement with the entrance to said throatway, and forwardly-inclined diffusing-vanes in said throatway, curved from the inclined toward the radial position, to gradually arrest the circular tendency of the current of discharge, substantially as specified.

5. In a turbine-pump, an incased impeller provided with interior impelling-vanes backwardly inclined with reference to the direction of motion, in combination with fixed diffusing-vanes curved forwardly and outwardly from the impeller zone whereby any circular motion of the outflowing water is gradually changed as it enters the discharge-chamber.

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

JOHN RICHARDS.

Witnesses:

ALFRED A. ENQUIST,

J. C. PIERSON.