

No. 678,198.

Patented July 9, 1901.

J. RICHARDS.  
CENTRIFUGAL PUMP.

(Application filed Sept. 4, 1900.)

(No Model.)

Fig. II

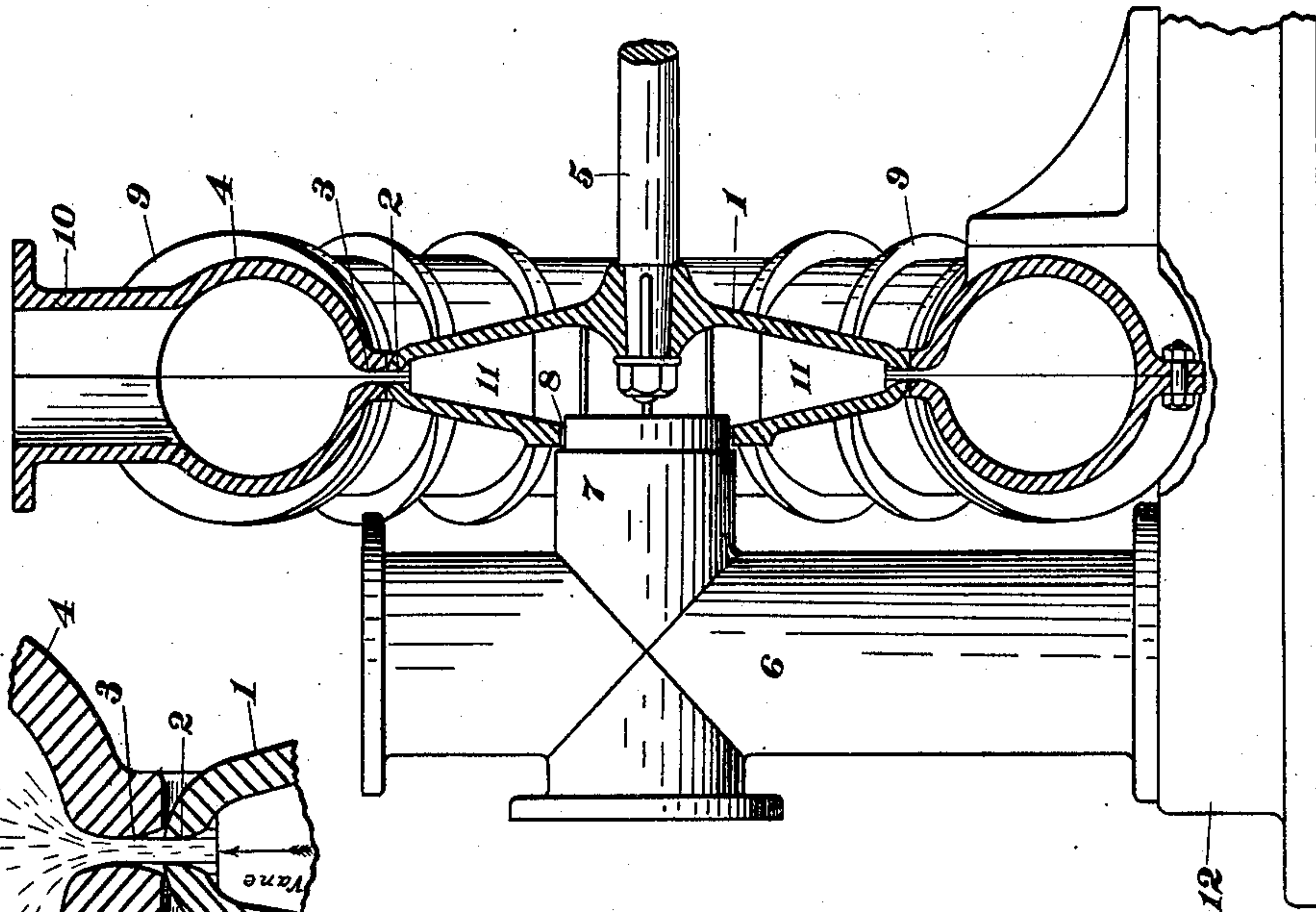


Fig. III

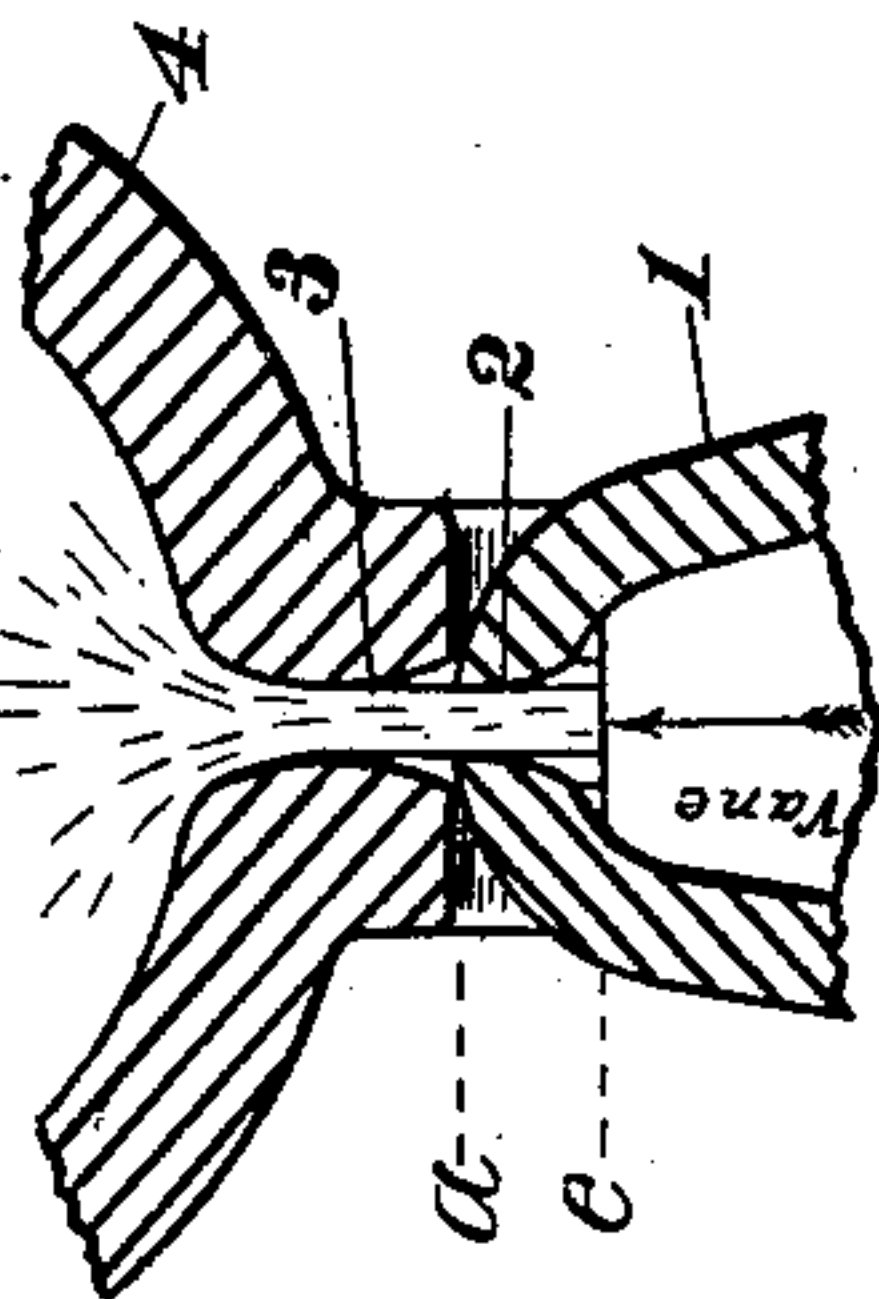
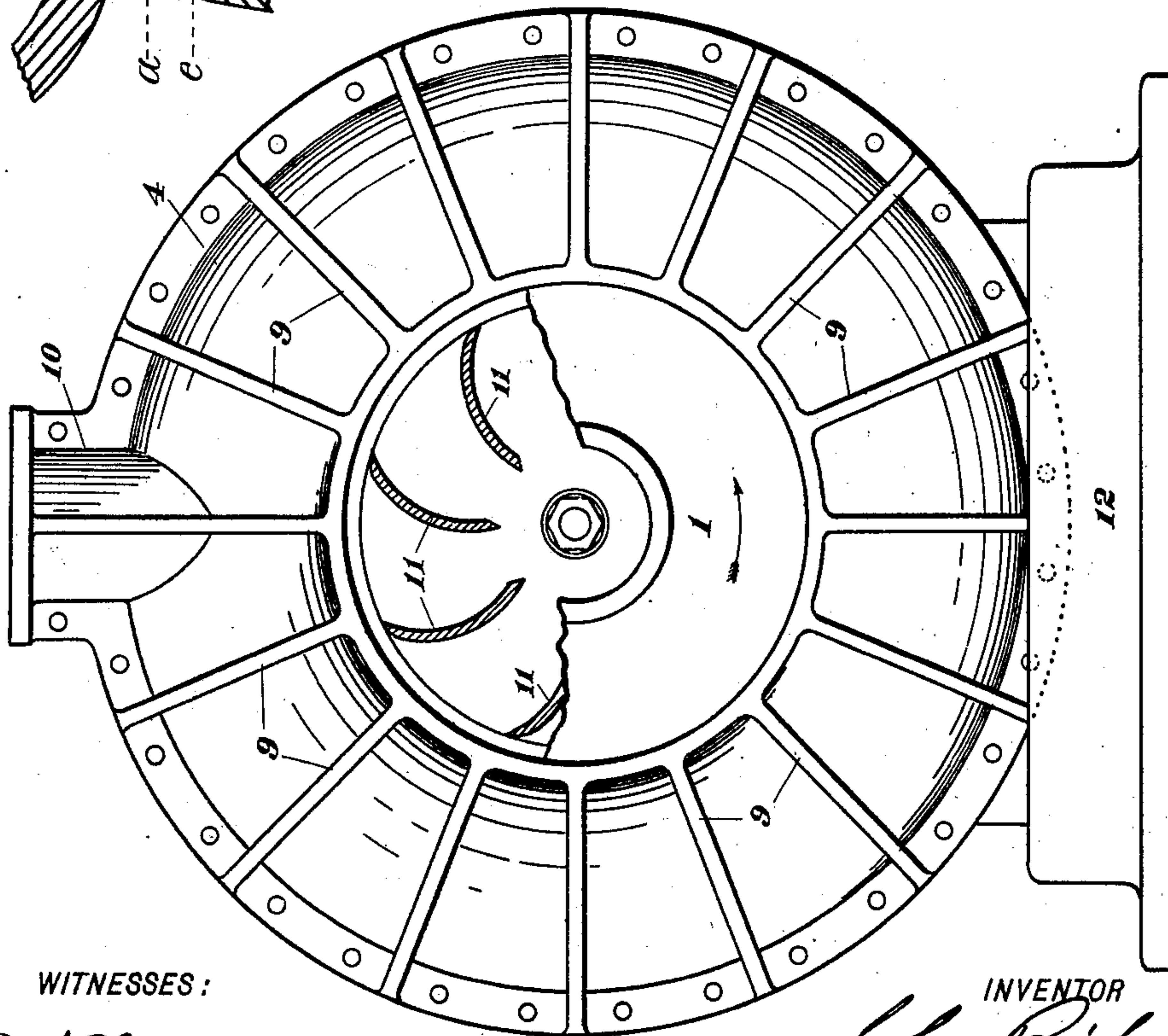


Fig. I



WITNESSES:

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# UNITED STATES PATENT OFFICE.

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## CENTRIFUGAL PUMP.

SPECIFICATION forming part of Letters Patent No. 678,198, dated July 9, 1901.

Application filed September 4, 1900. Serial No. 28,907. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN RICHARDS, a citizen of the United States of America, residing in the city and county of San Francisco, in the State of California, have invented certain new and useful Improvements in Centrifugal Apparatus for Impelling Fluids; 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 centrifugal apparatus for raising and impelling water or other liquids and to certain improvements therein.

The improvements consist in a rapidly-revolving hollow disk or chamber having vanes therein and a continuous and converging discharge-throat that coincides with a fixed receiving throat or nozzle extending around the disk or impeller, the two producing inductive action in the manner of an ejector or injector.

The objects of the invention are to avoid the inclosure of the impeller in a sealed chamber and its immersion in the fluid being raised or forced and the consequent friction on the outer surface of the impeller, to dispense with an inclosing case at the sides of the impeller, and to attain a higher speed and pressure than is attainable in a common centrifugal pump. To this end I provide devices as shown in the drawings herewith and forming a part of this specification.

Figure I is a side view of a water raising or forcing machine constructed according to my invention, the supply or inlet pipe being removed. Fig. II is a vertical section through the same machine parallel to the axis of rotation and at an angle of ninety degrees from Fig. I, and Fig. III an enlarged diagram of the throat or discharge and inlet ways around the impeller.

In raising and impelling fluids with centrifugal apparatus a principal impediment to economical working is the resistance of water friction either on the exterior of submerged impellers or because of water set in rotation within the interior of a chamber when the water revolves with the impelling devices; also, because of the tips of the vanes extending to the water in the discharge-casing. Such resistance varies as some function of the pressure and velocity. To prevent back-

flow from the discharge-chamber, to avoid such water friction, and for other reasons, I construct apparatus as shown in the drawings, the essential parts being a rotary impeller 1, having a continuous contracted peripheral vent 2, corresponding to the nozzle of an ejector or injector, a corresponding contracted throat 3, opening into an annular discharge-chamber 4, set concentric with and in exact alinement with the discharge-way of the rotary impeller 1.

The impeller 1 is mounted on a spindle 5, adapted to be driven at high speed, and externally is open to the air and out of contact with the fluid being raised or impelled. Water or other fluid is admitted to the impeller 1 from a pipe through the nipple 7, preferably by gravity from a higher head, but can also be drawn into the impeller by suction if a packed or water-tight joint is provided at 8, in the usual manner of such devices.

For high heads, to which the apparatus is especially adapted, the discharge-casing 4 is reinforced by ribs 9 to prevent the throat 3 from expanding by pressure and is provided with a discharge-nipple 10, that can be placed at any point around the periphery of the casing as may be most convenient.

The discharge-chamber 4 and the supply-pipe 6 are attached to a base-frame 12 in the usual manner, and thus maintain a concentric position of the impeller 1 around the inlet-nipple 7.

In the drawings the machine is shown arranged as a common centrifugal pump; but it will be understood that except for connection to an electric motor a more natural position is to set the spindle 5 in a vertical position.

The impeller 1 is divided into radial compartments by the partitions or vanes 11, that may be straight or curved, as in Fig. I, but must terminate within the nozzle-way 2, so as to permit a continuous discharge all around the impeller, and thus prevent backflow from the discharge-casing 4.

By referring to Fig. III it will be seen that the interior chamber of the impeller 1 out to the line *e* is of capacity or section much in excess of that of the inlet-nipple 7 and that the water at this point flows slowly around the tips of the vanes 11, uniting in the zone



from *e* to *a*, so as to cause a solid and continuous discharge into the throat 3.

The essential feature of the invention resides in the induction-nozzles 2 and 3, a continuous discharge-way around the impeller, and the resultant modifications that grow out of those features, and I therefore claim as my invention and desire to secure by Letters Patent—

10 1. In a centrifugal pump, an annular discharge-chamber, an uninclosed rotary disk impeller mounted concentrically therein, divergent vanes within said impeller forming between them passages expanding toward the  
15 periphery in the plane of rotation, said vanes terminating a short distance within the periphery of the impeller to form an annular continuous discharge-way at the margin thereof, and a continuous annular throatway  
20 on the surrounding discharge-chamber cooperating with said discharge-way, substantially as specified.

25 2. In a centrifugal pump, an annular discharge-chamber having a compressed throatway 3, in combination with an uninclosed rotary disk impeller mounted concentrically within said annulus, compressed at its mar-

gin to form a discharge-way 2, adjacent to and cooperating with said throatway, and provided with interior divergent vanes forming expanding passages between them, said vanes terminating a short distance within the periphery of the impeller to give continuity to the annular discharge-way and provide for a smooth delivery, substantially as specified. 35

3. In a centrifugal pump, an annular discharge-chamber having a compressed throatway, an uninclosed disk impeller mounted concentrically therein, compressed at its margin to form a discharge-way adjacent to and cooperating with said throatway, interior divergent vanes in said impeller forming expanding passages between them, and terminating short of the compressed margin to form a continuous discharge-way, substantially as specified. 45

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.