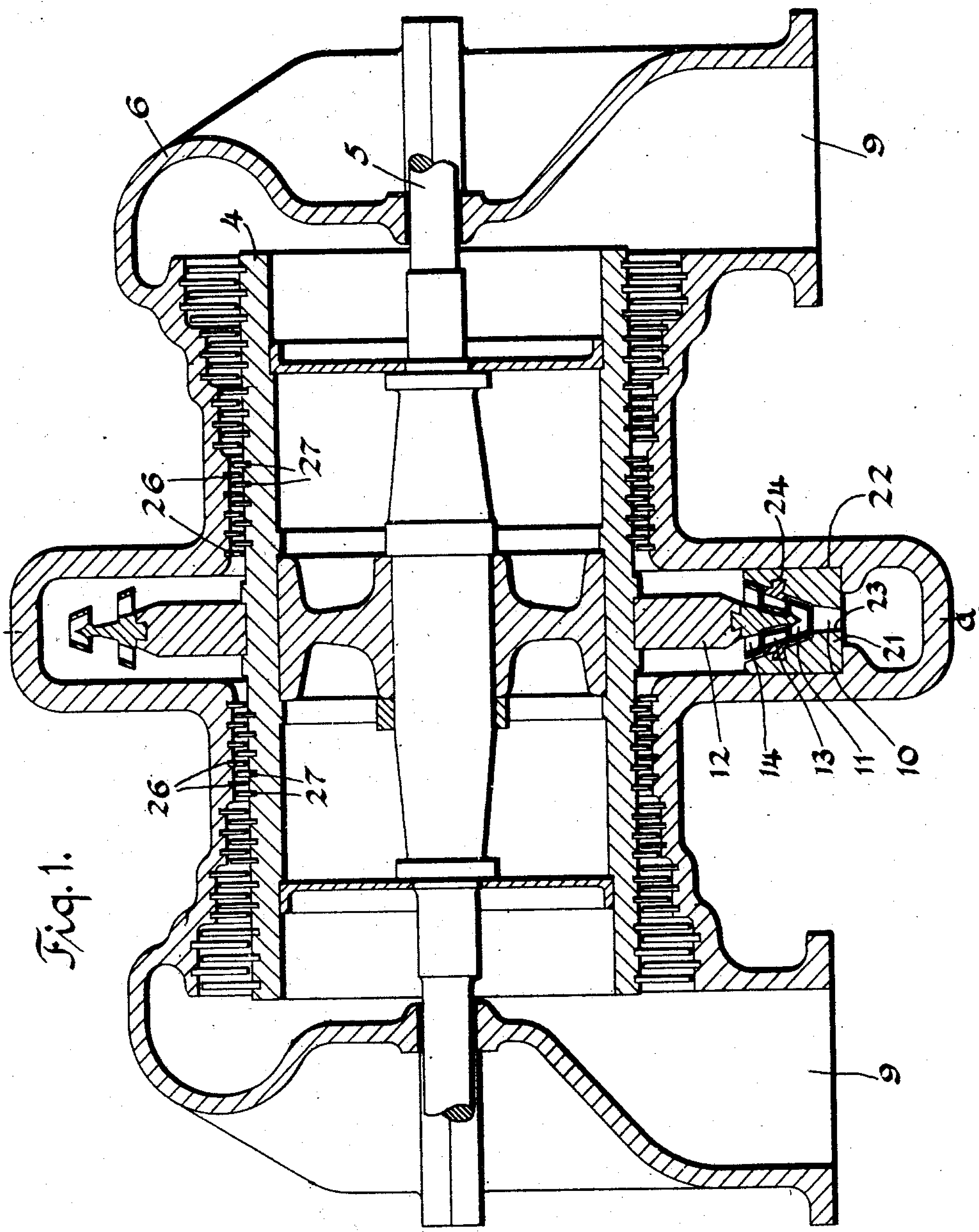
W. J. A. LONDON.
ELASTIC FLUID TURBINE.
APPLICATION FILED APR. 13, 1906.

969,891.

Patented Sept. 13, 1910.

2 SHEETS—SHEET 1.



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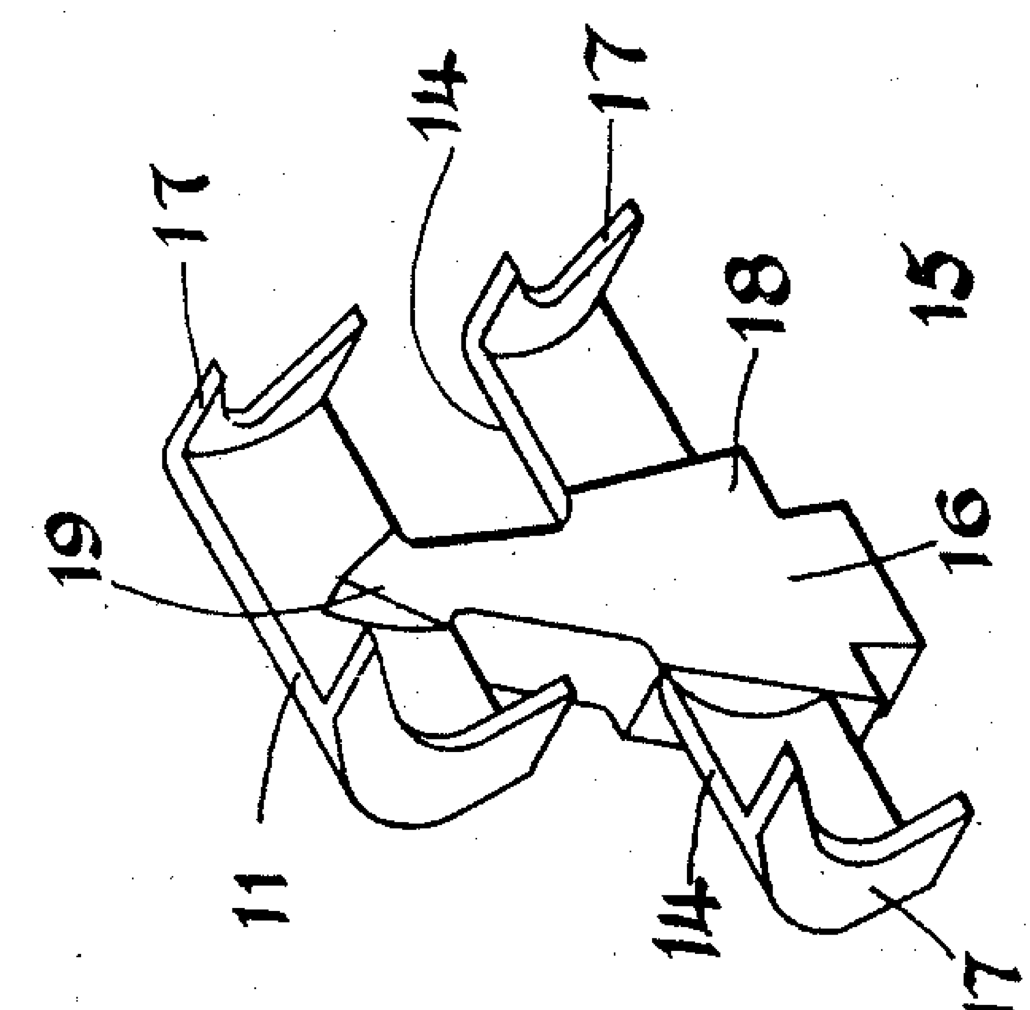

Fig. 3.

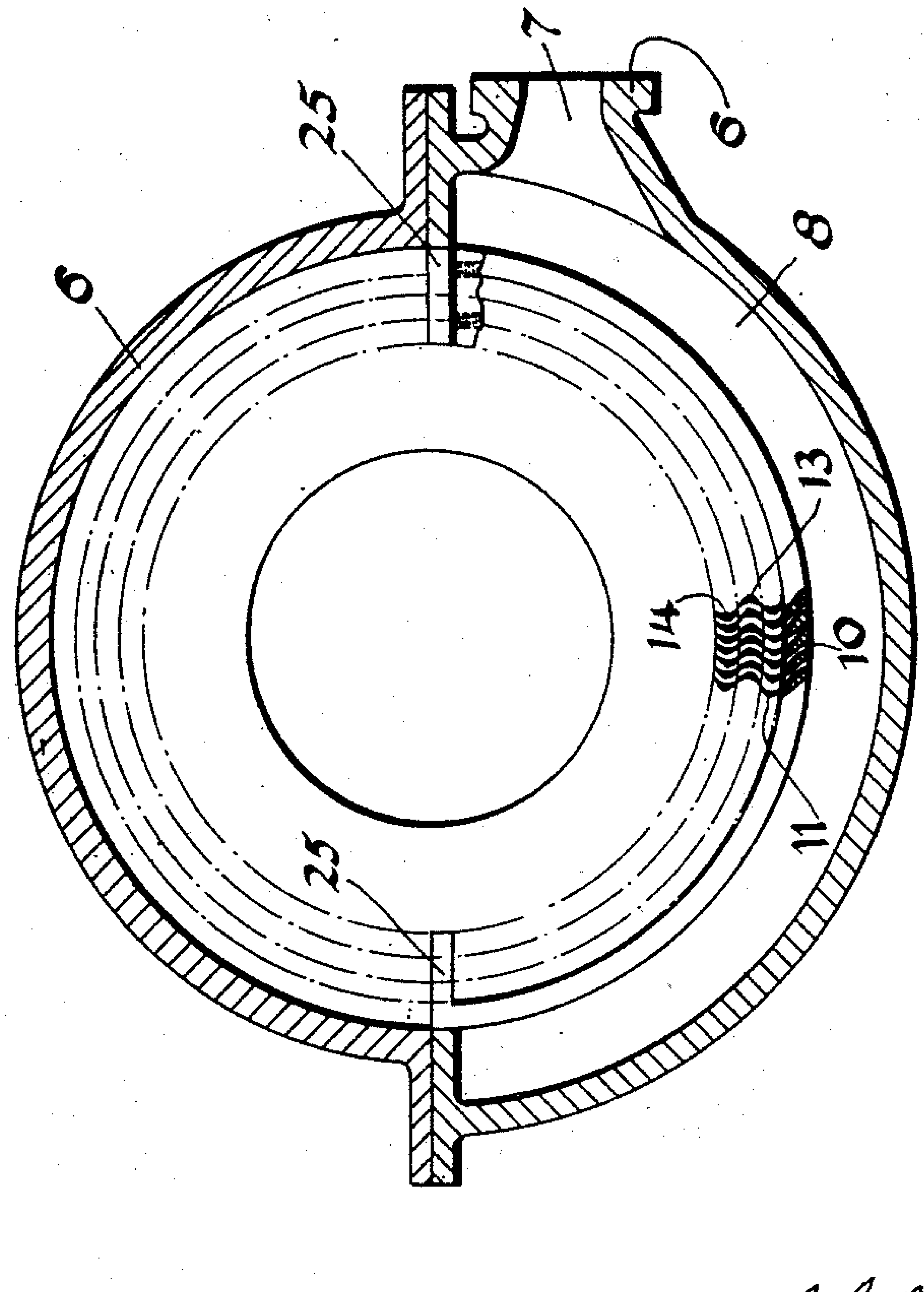

Fig. 2.

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UNITED STATES PATENT OFFICE.

WILLIAM JAMES ALBERT LONDON, OF MANCHESTER, ENGLAND, ASSIGNOR TO THE WESTINGHOUSE MACHINE COMPANY, A CORPORATION OF PENNSYLVANIA.

ELASTIC-FLUID TURBINE.

969,891. Specification of Letters Patent. Patented Sept. 13, 1910.

Application filed April 13, 1906. Serial No. 311,481.

To all whom it may concern:

Be it known that I, WILLIAM JAMES ALBERT LONDON, a subject of the King of England, residing at Westinghouse Works, Trafford Park, Manchester, England, have made a new and useful Invention in Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to elastic fluid turbines in which the motive fluid is initially expanded and the available velocity energy due to said expansion is extracted by moving rows of impulse blades and the remaining pressure energy extracted by impact and reaction in alternate rows of moving blades and stationary vanes.

The turbine embodying my invention belongs to a type known as "double flow" and the motive fluid is delivered to the working passages through nozzles arranged in the casing midway between the ends of the turbine, the working passages being symmetrically arranged on either side thereof so that the pressure of the working fluid in one end of the turbine is counterbalanced by an equal and opposite longitudinal thrust of the working fluid in the other end.

The object of this invention is the production of a turbine of the class above described, which shall be of simple construction, efficient in operation and which will be cheap to manufacture. This and other objects I attain in a turbine embodying the features herein described and illustrated.

In the drawings accompanying this application and forming a part thereof, Figure 1 is a longitudinal section of a turbine embodying my invention. Fig. 2 is a transverse section, at a reduced scale, along the line A—A of Fig. 1. Fig. 3 is a perspective view of a detail embodied in my invention.

A rotor, which comprises a cylindrical portion 4, suitably mounted on a shaft 5, is inclosed within a stationary casing 6 which is divided longitudinally on a horizontal plane passing through the axis of the rotor. The casing is provided with a motive fluid admission port 7, which communicates with a passage 8, formed within the casing, and exhaust ports 9, located at either end of the turbine which communicate with the exhaust ends of the working passages. Inwardly discharging nozzles 10 communicate with the fluid supply passages 8 and deliver motive fluid to an annular row of moving blades 11, mounted on a disk 12, which is rigidly mounted on the cylindrical portion 4. The motive fluid delivered to the blades 11 is divided into two streams which are discharged into symmetrically arranged rows of stationary directing vanes 13, located at either side of the rotor element. The motive fluid is redirected by the vanes 13 and is delivered to blades 14 mounted on either side of the disk 12.

The blades 11 and 14 are formed on rotor elements 15 which are located side by side around the periphery of the disk 12. Each element 15, as shown in Fig. 3, comprises a blade 11 formed integrally with and located at the end of a mounting shank 16 and two blades 14 located at either side thereof. The free end of each blade is provided with a projecting portion 17 which fits against the corresponding blade next in series and thereby forms a continuous annular shroud. The shank 16 is provided with a dovetailed tongue 18 which fits into an undercut groove located in the periphery of the disk 12. The shank portion 16 of the individual elements coöperate when mounted in place on the disk 12 to form a partition which separates the blades 14 on one side of the shank from those on the other side. Each shank is provided with an apex 19, formed on the blade 11, which is effective in dividing the flow of steam discharged from the blades 11 and directing it toward either end of the turbine. The rotor elements 15 may be drop forged or made in any other suitable manner.

The nozzles 10 are formed in a nozzle block which is made in two parts, 21 and 22, the line of division being in a plane passing through a face 23. The portion 22 is provided with extending partitions which coöperate with the face 23 of the portion 21 to form the nozzles 10. The two parts of the nozzle section are bolted or otherwise secured together and serve to carry the guide blades 13, which may be conveniently inserted into circumferential undercut grooves 24. The separate parts of the nozzle section are located at either side of the annular row of elements 15 in the lower half of the casing 6, which is provided with a plate 25 adapted to hold them in place.

The motive fluid discharged from the blades 14 is delivered to a series of alternate rows of stationary vanes 26, mounted on the casing 6, and moving blades 27, mounted on the cylindrical portion 4. The nozzles 10 are adapted to expand the motive fluid from the initial pressure to some predetermined pressure and the blades 11 and 14 are adapted to convert the available velocity energy, due to the partial expansion, into rotary motion. The vanes 26 and 27 are adapted to fractionally expand the motive fluid and abstract the available energy derived from the fractional expansion by impact and reaction. After the motive fluid has been fully expanded it is discharged into discharge passages at either end of the turbine, which communicate with the exhaust ports 9.

In assembling the parts of the turbine, the rotor with the blades attached thereto is placed in the bottom portion of the casing 6 and the sections 21 and 22 comprising the nozzle ring and containing the vanes 13 are put over the rotating blades 11 and 14 at the top and fed into the lower half of the casing circumferentially whereupon they are then clamped in position by the plates 25 and the top half of the casing is put on and secured in place.

Having now described my invention, what I claim as new and useful and desire to secure by Letters Patent is:

1. In an elastic fluid turbine, a plurality of inwardly discharging nozzles, a row of blades adjacent thereto and receiving fluid therefrom, means for dividing the fluid discharged from said blades into two streams, two rows of stationary vanes adapted to receive the fluid discharged from said blades, two rows of impulse blades adapted to receive the motive fluid delivered by said vanes and a series of alternate rows of blades and vanes at either side of said nozzles and communicating with said impulse blades.

2. In an elastic fluid turbine, a rotor element comprising a shank portion, a blade integrally formed therewith and mounted at one end of said shank portion and two blades integrally formed and located at either side of said shank portion.

3. In an elastic fluid turbine, a rotor element comprising a shank portion provided with three integrally formed blades.

4. In an elastic fluid turbine, a rotor element provided with a plurality of rows of blades, in combination with a nozzle block formed in separate sections, located at each side of said rotor element and provided with a plurality of rows of directing vanes, and means whereby the separate sections coöperate to form a row of fluid nozzles.

5. In an elastic fluid turbine, a blade carrying element comprising a shank portion, a plurality of blades integrally formed therewith, and an extending portion at the free ends of said blades.

6. In an elastic fluid turbine, a blade carrying element comprising a shank portion provided with a plurality of integrally formed blades, and means for dividing the fluid delivered from one of said blades in two streams.

7. In combination with a rotor of an elastic fluid turbine, a blade carrying element comprising a tip adapted to divide the motive fluid into two streams, a shank portion adapted to be mounted on said rotor, two integrally formed blades located at either side of said shank portion, and a radially extending blade formed at the end of said shank.

8. In combination with the rotor of an elastic fluid turbine, a blade carrying element comprising a shank portion adapted to be mounted on said rotor, blades integrally formed with said shank portion and located at either side thereof, and projections formed at the free ends of said blades and adapted to engage similar projections on adjacent blades.

9. In an elastic fluid turbine, a radial double flow impulse stage and a double flow reaction stage, the separate sections of said reaction stage receiving motive fluid discharged from the separate sections of said double flow impulse stage.

10. In an elastic fluid turbine, a radial double flow impulse stage having one set of nozzles supplying both sections, and a double flow reaction stage, the separate sections of said reaction stage receiving motive fluid discharged from separate sections of said double flow impulse stage.

11. In an elastic fluid turbine, in combination with the rotor and stator elements of the turbine, a plurality of rows of blades mounted on said rotor element, segmental sections secured to said stator element and located on each side of the blades of said rotor element, a plurality of directing vanes provided on each section and means whereby the separate sections coöperate to form fluid nozzles.

12. In an elastic fluid turbine, in combination with the rotor and stator elements of the turbine, a row of blades carried by said rotor element, segmental sections secured to said stator element and located on each side of said blades, a row of directing vanes mounted on each section and means whereby the separate sections coöperate to form fluid nozzles adapted to deliver motive fluid to said blades.

In testimony whereof, I have hereunto subscribed my name this 28th day of March, 1906.

WILLIAM JAMES ALBERT LONDON

Witnesses:

ATHOL WILFRID CLARKE,

WILLIAM HERBERT WALLIS.