

J. F. METTEN.
 NOZZLE CONSTRUCTION FOR ELASTIC FLUID TURBINES.
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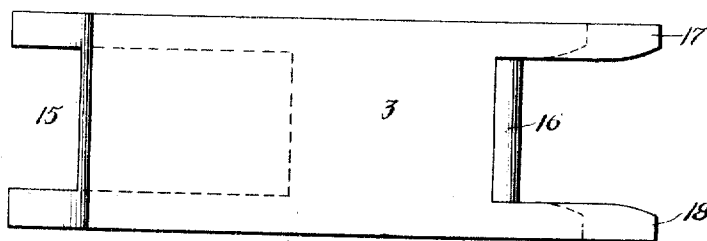
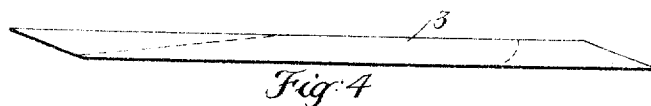
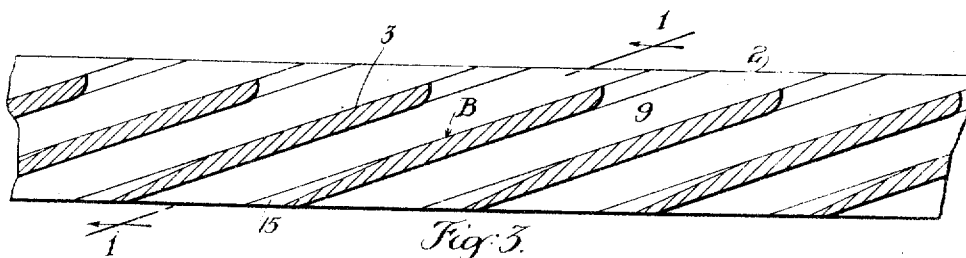
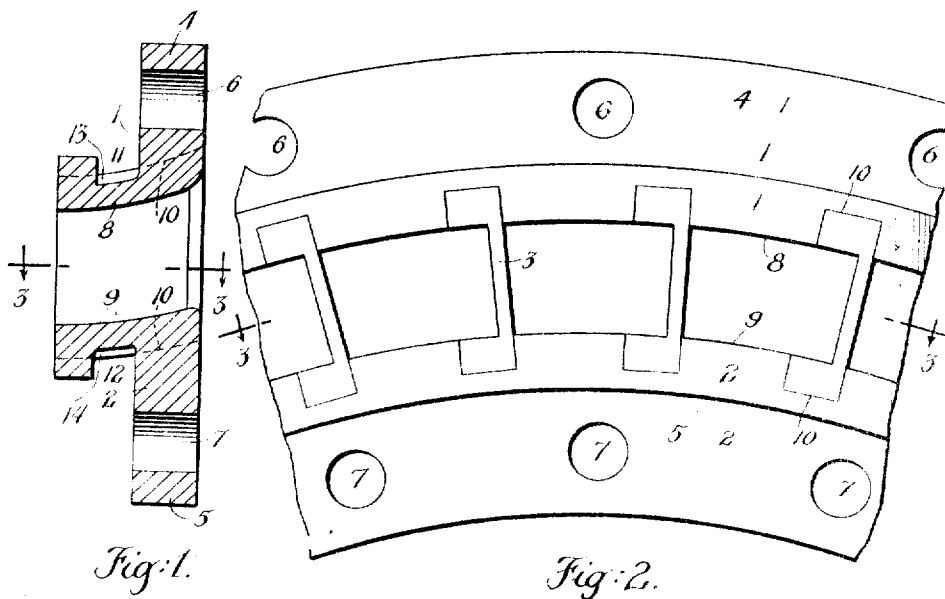


Fig. 5. *John F. Metten* Inventor
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UNITED STATES PATENT OFFICE.

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NOZZLE CONSTRUCTION FOR ELASTIC-FLUID TURBINES.

1,266,973.

Specification of Letters Patent.

Patented May 21, 1918.

Application filed March 23, 1917. Serial No. 156,835.

To all whom it may concern:

Be it known that I, JOHN F. METTEN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Nozzle Constructions for Elastic-Fluid Turbines, of which the following is a specification.

10 The principal object of my invention is to provide a new and improved construction for the nozzles of steam or other elastic fluid turbines. Another object of my invention is to provide a nozzle that can be manufactured by machine processes alone, insuring great accuracy and eliminating all possibility of breakage in service.

The construction is specially adaptable to nozzles of the initial ahead stage or reverse stages of marine turbines where the pressure drop and expansion ratio is fairly large. The usual construction for such nozzles is to cut the passages from solid or partially cored castings or to cast plates of proper shape into the material forming part of the nozzle. With a pure cast nozzle the partitions dividing adjacent channels are subject to breakage due to initial casting strains. With the cast-in plate type the surfaces of passages are difficult to finish properly and accurately, and there is also the possibility of breakage due to defective casting-in of the plates.

15 In the present invention the nozzle is assembled from wholly machined parts, being free of all inherent casting troubles, and can be fastened as a unit to turbine casing or diaphragm in any approved manner.

The invention can best be described in connection with the accompanying drawings, of which—

Figure 1 is a section of the nozzle taken on line 1—1 in Fig. 3 but looking in the direction of the arrows, showing the containing rings in section;

Fig. 2 is an elevation of the nozzle looking from the exhaust side;

Fig. 3 is a developed circumferential section of nozzle taken on pitch line 3—3 in Figs. 1 and 2;

Fig. 4 is a view of one of the blades seen edgewise;

Fig. 5 is a side view of one of the blades.

Fig. 1 is drawn on the assumption that all points depicted therein have been carried

along respective circumferences having a common axis so as to bring such points into the plane of the drawing.

The nozzle is made up from an outer circumferential ring 1, either solid or segmental, and an inner circumferential ring 2, either solid or segmental, and a number of machined plates 3. The rings have flanges 4 and 5, and holes 6 and 7 for receiving bolts for fastening the nozzle to the turbine casing or diaphragm. The inside surfaces 8 and 9 are so generated that their intersection with the front sides B of plates, set to a prescribed angle, form straight lines. Slots 10 are milled obliquely to a uniform depth into the generated surfaces 8 and 9 for receiving the plates 3. To generate the concentric surfaces 8 and 9 as described above, a tool of a width equal to the radial distance between the two surfaces is fed on the same angle as prescribed for the blade carrying slots. Outside circumferential grooves 11 and 12 partially intersect the inner slots 10, permitting the edges of plates 3 to project through at these places. These extended portions 13 and 14 are riveted over when in place thus fastening all the parts together as one unit.

Each plate 3 is identical and has the form as shown in Figs. 2 and 4. The front side of each is partially milled out toward its exhaust end forming a wedge shaped channel 15 for giving the desired expansion ratio to the steam passage. This necessitates a plate of some thickness dependent on the desired expansion ratio.

The middle portion of the inlet end 16 is rounded on the back side to form easy entrance of steam. The extensions 17 and 18 at sides are for completely filling the slots in the inner surfaces and preventing restriction to flow of the steam at nozzle entrance.

This construction nozzle permits of the most suitable metals being used for the rings and plates as the fabrication does not depend on the relative melting temperatures as in a cast-in plate nozzle. Present practice indicates that mild steel is most suitable for the rings and brass composition for the plates as best to resist the action of the steam.

The assembly of the nozzle is easy. The rings are clamped in their relative positions and the plate inserted endwise and riveted as previously described.

The term "ring" in my specification and claims is intended to cover a complete ring or a segment thereof.

Having thus described my invention, I declare that what I claim as new and desire to secure by Letters Patent, is:—

1. A steam turbine nozzle comprising two concentric rings with opposed oblique straight edged channels formed therein and straight edged blades in said channels.

2. A steam turbine nozzle comprising two rings spaced apart annularly with opposed oblique straight channels formed therein and straight edged blades in said channels, said blades having portions bounded by straight lines cut away so as to give proper design to the nozzles formed thereby.

3. A steam turbine nozzle comprising two rings spaced apart annularly with opposed oblique straight channels formed therein and straight edged blades in said channels, the inside opposed nozzle-bounding surfaces of the rings being formed so that said oblique straight channels will have a uniform depth.

4. A steam turbine nozzle comprising two rings spaced apart annularly with opposed oblique straight channels formed therein, said channels being of uniform depth, and straight edged blades in said channels.

5. A steam turbine nozzle comprising two rings spaced apart annularly, each ring having a flange directed away from the other ring in a plane transverse to their common axis by which flange the ring may be attached to a suitable supporting member, said rings having opposed oblique channels formed therein, and straight edged blades in said channels.

6. A steam turbine nozzle comprising two rings spaced apart annularly with opposed oblique straight channels formed therein and straight edged blades in said channels, said blades completely filling said channels and having their intermediate portions at one end rounded over to form suitable nozzle inlets.

7. A steam turbine nozzle comprising two rings spaced apart annularly with opposed oblique straight channels formed therein and straight edged blades in said channels, said blades completely filling said channels and having their intermediate portions at one end planed off obliquely so as to give

the nozzle formed thereby an expanding cross-section.

8. A steam turbine nozzle comprising two rings spaced apart annularly with opposed oblique straight channels formed therein and outer circumferential channels with their bottom portions intersecting the bottom portions of said oblique channels, and straight edged blades having their edges lying in said oblique channels and having the portions thereof projecting into the circumferential channels riveted over to secure the parts together.

9. A steam turbine nozzle comprising two concentric rings with circumferential channels therein and with oblique channels, the bottom portions of which intersect the bottom portions of said circumferential channels, and blades in said oblique channels having the portions thereof project into the circumferential channels headed over to secure the parts together.

10. A steam turbine nozzle comprising two rings spaced apart annularly, each ring having a flange directed away from the other ring in a plane transverse to their common axis by which flange the ring may be attached to a suitable supporting member, the opposed surfaces of the rings having oblique straight channels of uniform depth formed therein, said surfaces being curved to facilitate the forming of such channels, in combination with straight edged blades between said rings, the opposite edges of said blades completely filling said channels but having their intermediate portions cut away obliquely so as to give each nozzle an expanding cross-section, said rings having outer circumferential channels intersecting the bottom of said oblique channels and said blades and rings being secured together by riveting over the portions of the blades projecting from the oblique channels into said circumferential channels.

11. A steam turbine nozzle comprising two rings spaced apart annularly with opposed oblique channels formed therein, and blades having their edge portions completely filling said channels and their intermediate portions cut away so as to give proper design to the nozzles formed thereby.

JOHN F. METTEN.