E. H. FARQUHAR.

DISCHARGING DEVICE FOR TURBINES.

APPLICATION FILED FEB. 2, 1907.

903,279. Patented Nov. 10, 1908.

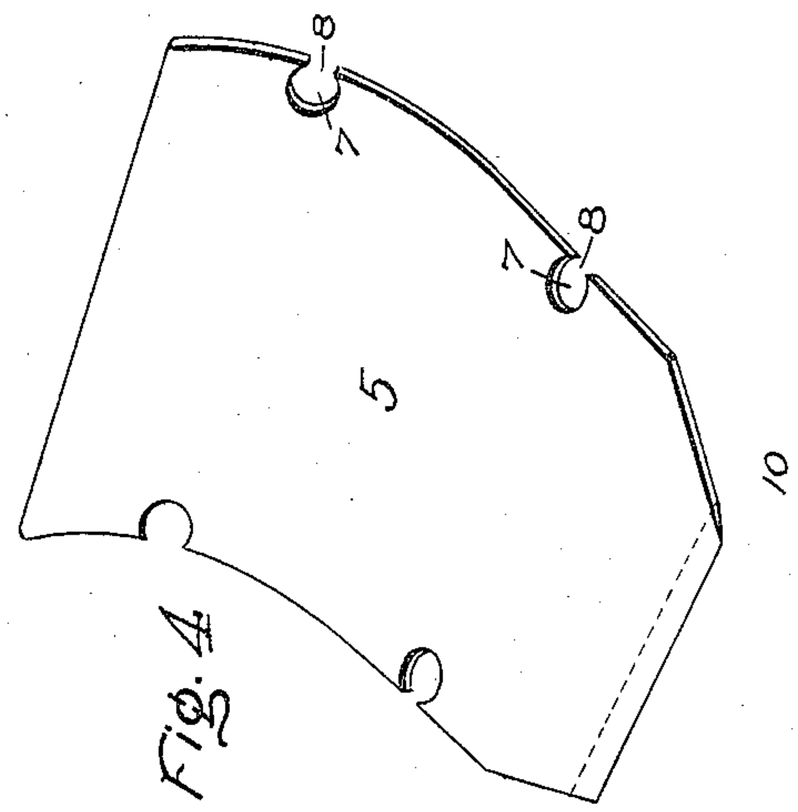

Fig. 4.

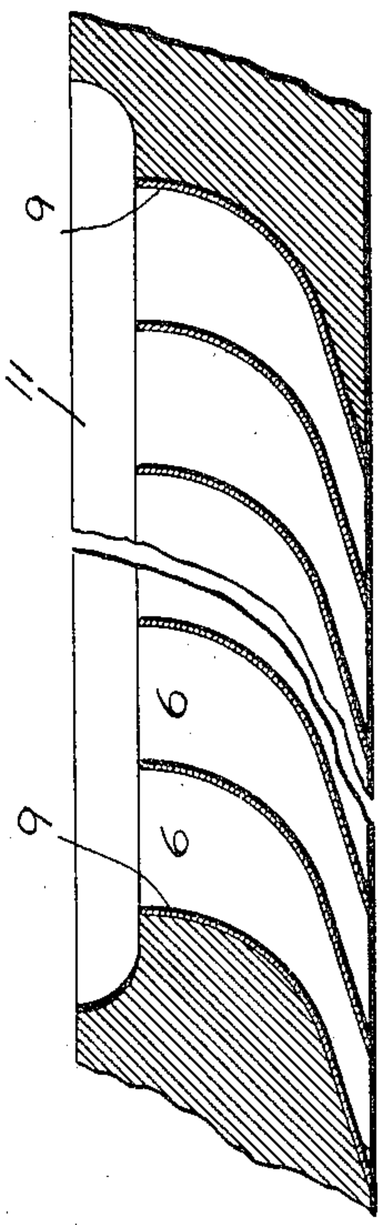

Fig. 3.

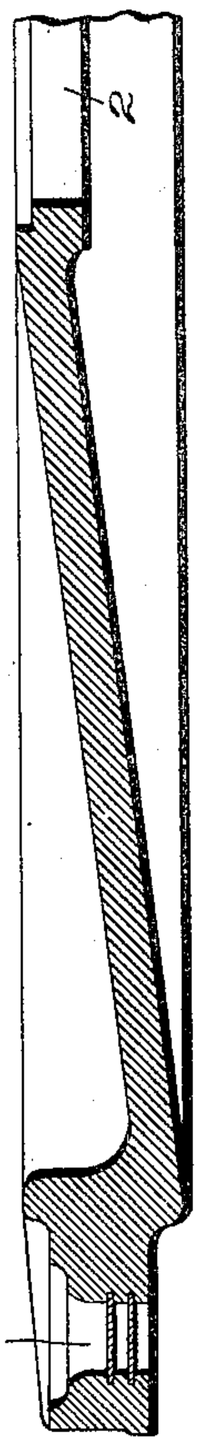

Fig. 1.

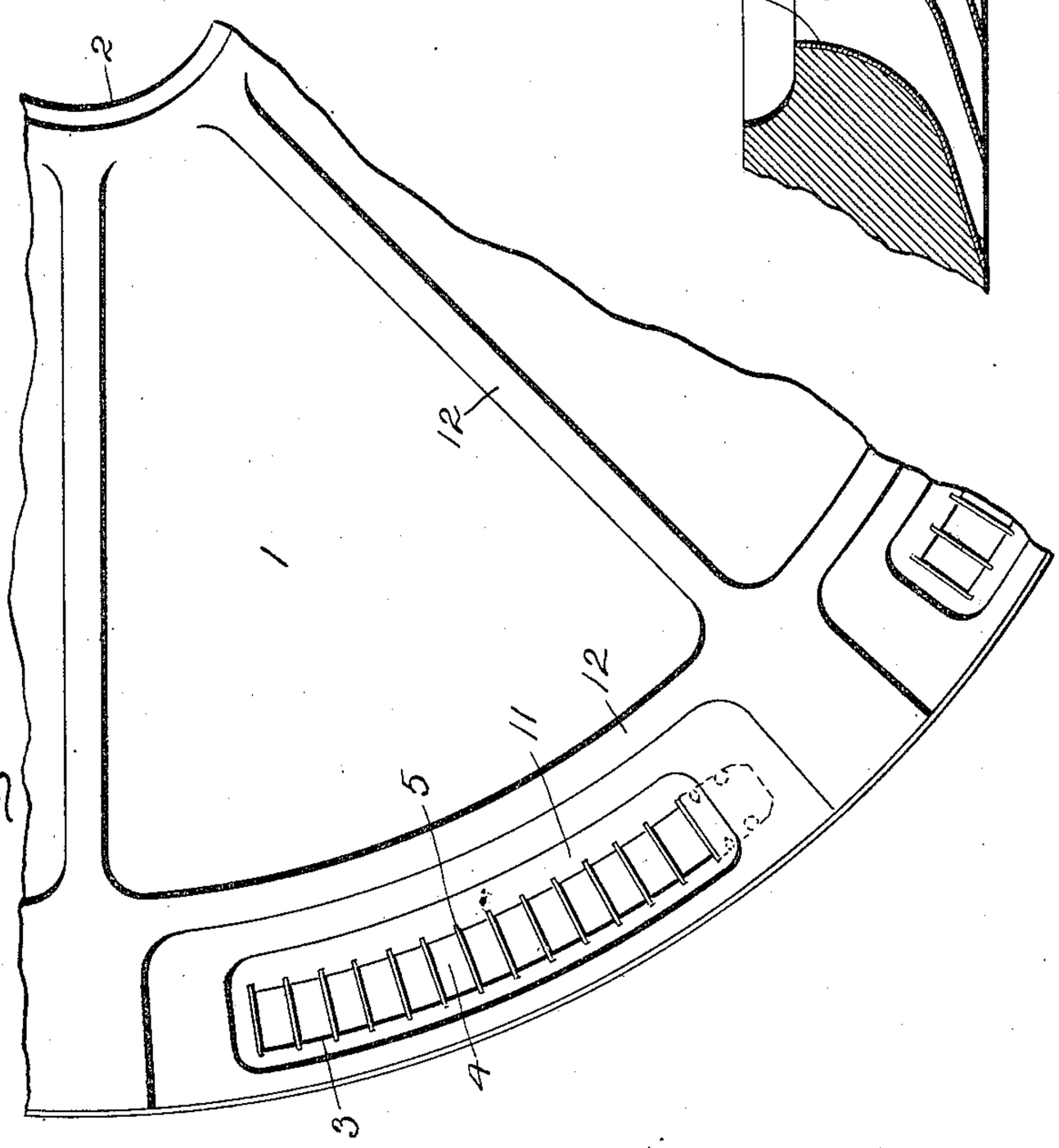

Fig. 2.

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UNITED STATES PATENT OFFICE.

EDMUND H. FARQUHAR, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

DISCHARGING DEVICE FOR TURBINES.

No. 903,279. Specification of Letters Patent. Patented Nov. 10, 1908.

Application filed February 2, 1907. Serial No. 355,441.

To all whom it may concern:

Be it known that I, EDMUND H. FARQUHAR, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Fluid-Discharging Devices for Elastic-Fluid Turbines, of which the following is a specification.

The present invention relates to the nozzles or other devices employed to discharge elastic fluid against the wheel buckets, that are provided with sheet metal partitions between one section or passage and the next, which partitions are cast into the main body of the nozzle or other device.

The present invention has for its object to improve the construction of such devices by providing perforations of suitable size and shape near the sides of the partitions through which the molten metal flows so that when the metal cools the partitions will be firmly anchored in place.

In the accompanying drawing, which represents embodiments of my invention, Figure 1 is a partial axial section of a diaphragm containing nozzles near its periphery; Fig. 2 is a partial plan view of the diaphragm; Fig. 3 is an enlarged section of the nozzle taken in a plane perpendicular to the plane of the diaphragm; and Fig. 4 is a perspective view of one of the sheet metal partitions before it is cast or fused into place.

1 represents the body of a stationary diaphragm for dividing a wheel casing into compartments and having a suitable opening 2 to receive the shaft and its packing and a peripheral portion or rim adapted to engage and be supported by the bucket wheel casing. The peripheral portion has one, two or more segmental passages, openings or orifices 3 through which the steam or other elastic fluid enters the turbine or flows from one stage to another. The arrangement of all the nozzles being the same, a description of one of them will be sufficient. The segmental orifice is divided into two or more passages 4 by the sheet-steel partitions or guide plates 5. These passages may be expanding or non-expanding in character depending upon the desired velocity to be imparted to the motive fluid. The partitions are of the shape represented by Fig. 4 and slightly wider than the orifice, and are first sheared or punched out of sheet stock and are afterwards bent to the form shown. The upper end of each partition forms a portion of the bowls 6 of two adjacent sections or passages, while the lower end forms walls for the discharge portion. The remaining side walls of the sections or passages are formed by the cast metal, usually steel, of which the diaphragm is composed. In the sides of the partitions are perforations 7 through which the molten metal flows in casting, and when cooled forms anchoring devices to hold the partitions firmly in place and resist any strains to which they may be subjected. These perforations reduce the eddies in the molten stream of metal as it flows through the mold, and in so doing reduces the tendency to chill and also to form poor castings.

In order to further prevent the metal from being chilled while casting and also to make a better union, I cut away a portion of the metal adjacent the perforations to form an opening, as at 8, Fig. 4, so that the molten metal can freely flow through it, and in so doing reduce the tendency to eddying. Reducing the eddies improves the union between the partitions and the main body of the casing because the metal will fill every portion of the mold. It is to be noted that the openings 8 are smaller than the perforations so that the body of metal contained therein will act as an anchor against radial strains on the partitions and also against strains perpendicular thereto.

To avoid machining the end walls of the segmental orifices, they are provided with linings 9 made in the same way as the partitions and similarly cast into place.

A simple way to cast these partitions into the diaphragm is to place them in a hard-baked core which is afterwards inserted in the mold in the proper place; then the mold is closed and the molten metal poured in the usual way.

The discharge end of each partition and also of each lining is beveled as at 10, so as not to break the continuity of the machined under surface of the diaphragm, which is objectionable; to prevent the metal from chilling around the partition ends, and also to avoid imperfections in the casting. The end of the partition is also sharpened so that the several streams will issue as a solid column. As the upper or bowl ends of the partitions do not extend to the surface, the beveling is unnecessary at this point. Since

it is preferable to have a large bowl for each nozzle section, I make the partitions wider at the top than the bottom and gradually taper them.

The thickened rim or peripheral portion of the diaphragm is provided with as many segmental chambers 11 as there are groups of partitions and they supply motive fluid to the bowls of the passages or sections and also tend to equalize the pressure of the fluid supply.

The diaphragm is provided with thick, heavy ribs 12, certain of which extend circumferentially and others radially to resist the strains to which it is subjected.

The invention is shown in connection with nozzles formed in a diaphragm, but it is evident that it is equally applicable to nozzles having cast-in partitions which are made separate and are afterwards bolted or otherwise secured to a casing wall, diaphragm or other support.

The invention is shown in connection with a stage nozzle since it has material advantages in this connection, but it can also be used for initial or high-pressure nozzles.

Practice has demonstrated that nozzles made in this way are much cheaper than those cored out and afterwards machined and filed, and are also more uniform.

I do not claim the idea of a stationary element for an elastic-fluid turbine having a nozzle passage therethrough with thin metallic guide-plates of greater width than said nozzle, which are held in position therein by having their ends united by a cast-joint to said element, the ends of said plates being provided with locking perforations which are rooted in said element.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In an elastic fluid turbine, the combination of an element containing a nozzle passage, thin sheet metal partitions of a greater width than the passage which are cast into the element, and locking perforations provided in the partitions which are rooted in the element, said perforations having openings leading therefrom to the edge of the partitions, which openings are of less width than the perforations.

2. In an elastic fluid turbine, the combination of a stationary element having a nozzle passsage leading therethrough, thin metallic guide-plates of greater width than said nozzle passage which are held in position by having their edges united by a cast joint to the element, and a plurality of circular locking perforations adjacent said edges which are rooted in the element, the perforations having openings leading thereto from the edges of the plates which are of less width than the diameter of the perforations.

3. In an elastic fluid turbine, the combination of an element containing passages with sheet-metal partitions cast into the element to form walls for said passages, the said partitions being cut away at one end so as not to interrupt the continuity of the machined surface of the element.

4. In an elastic fluid turbine, the combination of an element containing passages with sheet-metal partitions cast into the element to form walls for said passages, the said partitions being tapered from the inlet to the discharge end to provide for a bowl and also beveled at the discharge end so as not to interrupt the continuity of the machined surface on the discharge side of the said element.

5. In an elastic fluid turbine, the combination of a stationary element containing a nozzle passage with thin sheet-metal partitions of a greater width than the passage for dividing it into sections, the said partitions being beveled at the discharge end and provided with locking perforations which are rooted in said element.

6. In an elastic fluid turbine, the combination of a stationary element containing a nozzle passage with thin sheet-metal partitions of a greater width than the passage for dividing it into sections, the said partitions being beveled at the discharge end and provided with locking perforations which are rooted in said element, and linings for the ends of the passage which are perforated to receive molten metal and form an anchoring means when the metal cools.

In witness whereof, I have hereunto set my hand this 31st day of January, 1907.

EDMUND H. FARQUHAR.

Witnesses:

BENJAMIN B. HULL,

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