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ELASTIC FLUID TURBINE.

APPLICATION FILED SEPT. 12, 1907.

953,241. Patented Mar. 29, 1910.

Fig. 2.

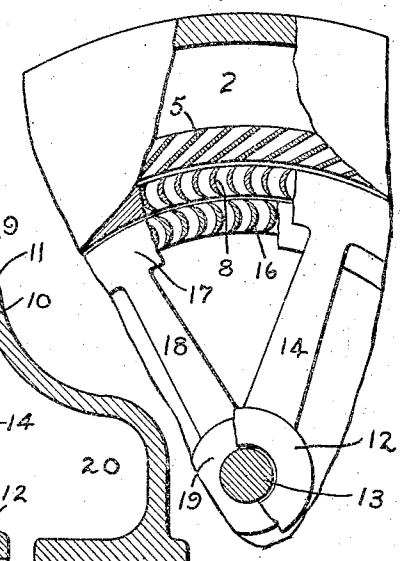

Fig. 1.

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ELASTIC-FLUID TURBINE.

953,241. Specification of Letters Patent. Patented Mar. 29, 1910.

Application filed September 12, 1907. Serial No. 392,445.

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, residing at Swampscott, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

The present invention relates to elastic-fluid turbines and more especially to those wherein low pressure motive fluid acts upon oppositely rotating bucket wheels. In a turbine of this character working, for example, between atmospheric pressure and a vacuum equal to 29″ of mercury, it is a serious problem to handle the large volume of fluid without choking or retarding it on the one hand or abstracting less than the maximum amount of energy on the other.

In carrying out my invention the turbine is so constructed that the direction of steam flow is radial and inward toward the shaft, suitable nozzles being provided for directing and guiding the fluid. The nozzles may be diverging or non-diverging in character, usually the latter, and are supported by the casing of the machine, the latter containing a circumferential steam chamber opening into the nozzles and receiving fluid from a suitable inlet. The bucket wheels are nested one within the other with the proper clearance between, each wheel having its own shaft. It is evident in such a turbine that the buckets must be of considerable length to accommodate the large volume of motive fluid at the low pressure. Since the buckets extend parallel to the axis it follows that if they are supported at one end only they will bend outwardly under centrifugal force, at the other, and in rotating will be injured or destroyed either by contacting with a stationary part of the machine or with another row of buckets. To prevent this, the ends of the row of buckets having the greater diameter are securely anchored to the wheel or other carrier, and at their outer or overhanging ends are secured to a means braced against the effects of centrifugal force which allows the parts to freely rotate but which prevents the pitch diameter of the buckets from changing. This means is pierced by the shaft carrying the inner wheel, but is separated therefrom by a clearance so that the rotation of one wheel creates no mechanical friction on the other wheel or its attached parts. It is important to separate the parts in this manner because each has a fairly high surface speed and since the movements are equal and in opposite directions any friction would be the equivalent of one part traveling at twice the speed. To lighten the outer member as much as possible and to permit the exit of steam, the said means is made up of a ring locked to the bucket carrier, a hub surrounding the shaft with a clearance between surfaces and a plurality of radial spokes. The inner wheel is also provided with a holding means comprising a peripheral ring, radial spokes to increase the strength and permit the steam to escape, and a hub which is fastened to its shaft. The buckets may be secured to the rotating parts in any suitable manner, the principal consideration being to fasten them in such manner that they will resist centrifugal strains and also unite each wheel or carrier with the means for holding the ends of the buckets.

In the accompanying drawing which illustrates one of the embodiments of my invention, Figure 1 is a partial axial section of a turbine; and Fig. 2 is a partial cross section of the same.

1 indicates the casing which is divided into suitable parts in any desired plane or planes. It is provided with an annular steam chamber 2, an inlet conduit 3 and an exhaust conduit 4. Cast into the casing are sheet metal partitions 5 forming walls of the nozzle passages, the other walls being formed by the casing itself. These nozzles or nozzle passages receive steam from the chamber 2 and discharge it at the desired velocity and in the proper direction against the adjacent row of wheel buckets. Located within the casing is a bucket wheel 6 mounted on a shaft 7 carried by a bearing in the casing of the machine. Near the periphery of the wheel is an annular row of buckets 8 which extend parallel to the axis. These buckets are united on the end opposite the wheel web by a ring 9. In the present instance the buckets are cast into the wheel web and ring, but they may be secured in any other manner if desired. Such a ring will not of itself withstand the strains to which it would be subjected. In order to prevent the ring 9 from breaking under centrifugal strains and permitting the buckets to strike the nozzles, a retaining

means 10 is provided, and between the two is a shoulder to take the strain off of the retaining bolts 11, shown in dotted lines. The retainer is provided with a hub 12 that is separated from the shaft 13 of the second wheel by a clearance sufficient to keep the parts out of contact at all times. Connecting the hub with the outer portion of the retainer is a plurality of radial spokes 14. These spokes may be cast integral with the hub and outer chamber, or they may be made separate and secured thereto, depending upon the service for which the turbine is intended. It will thus be seen that the ring 9 and retainer 10 have braces extending diametrically of the structure and in the plane of the parts. This effectively prevents the ring from breaking.

Located wholly within the first mentioned wheel is a wheel 15 carried by the shaft 13 and rotating in the opposite direction to the said outer wheel. It is provided with an annular row of buckets 16 extending parallel to the axis. These buckets are similar in construction to those of the first wheel except that they are oppositely disposed as shown in Fig. 2. Steam from the nozzles strikes the outer row of buckets and produces rotation thereof in one direction, and the steam escaping therefrom is directed against the buckets of the inner wheel and produces rotation thereof in the opposite direction. The right hand ends of the buckets are secured to a retainer 17 and the latter is connected by spokes 18 with the hub 19. In this particular instance the buckets 16 are cast into the wheel 15 and the retainer 17, but they can be made separate therefrom and secured in place by any suitable means.

The steam enters the machine through the conduit 3 and immediately fills the annular chamber 2 whence it passes through the nozzles and acts on the buckets. Steam issuing from the buckets 16 enters the space within the inner wheel and freely passes through the spaces between the spokes of the retainers of both wheels into the exhaust chamber 20, the latter communicating with the conduit 4 which leads to a condenser of suitable construction. By reason of the construction described I am able to make the buckets 8 and 16 of such length and width as are necessary to handle very large volumes of motive fluid and it is evident that they may be made longer or shorter as the requirements of the service demand.

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 a casing, wheels mounted therein one inside of the other, axially extending buckets mounted on the wheels, separate shafts for the wheels, a retaining means for the ends of the buckets, and diametrically extending braces for the retainer which hold it against centrifugal forces.

2. In an elastic fluid turbine, the combination of a casing, a wheel mounted therein, a shaft for the wheel, buckets supported at one end by the wheel and extending parallel with the shaft, and a retaining means for maintaining the unsupported portion of the buckets against centrifugal stresses, said means comprising a ring, a hub, and radially-disposed connectors between the ring and hub.

3. In an elastic-fluid turbine, the combination of a casing, wheels mounted therein, and located one within the other, axially extending buckets, individual shafts for the wheels, a retaining means for the ends of one set of buckets, diametrically extending braces for said means, and a hub to which the braces are connected, the said hub being bored to receive one of the shafts, which bore is larger than the shaft.

4. In an elastic-fluid turbine, the combination of a casing, wheels mounted therein and located one within the other, axially extending buckets mounted on the wheels, oppositely extending shafts for the wheels, a retainer for the ends of one set of buckets rigidly supported by a shaft, a retainer for a second set of buckets, and diametrically extending braces for the retainer.

5. In an elastic fluid turbine, the combination of a casing, wheels mounted therein, axially-extending buckets supported at one end by one of the wheels, a retainer for maintaining the unsupported portion of the buckets against centrifugal stresses, and braces for said retainer which extend diametrically of the wheel and are under tension when the same is rotating.

6. In an elastic-fluid turbine, the combination of a casing, wheels located therein, axial buckets mounted on the wheels, individual shafts for the wheels, a ring uniting the ends of one row of buckets, and a retaining means therefor comprising an interlocking ring, radial spokes that are under tension, and a hub which is connected to the spokes and is bored to permit one of the shafts to pass through it without engagement.

7. In an elastic-fluid turbine, the combination of a casing containing a circumferential chamber, an inlet conduit connected to the chamber, nozzles receiving motive fluid from the chamber, oppositely rotating wheels, axial buckets carried by the wheels

and propelled by the fluid from the nozzles, retainers for the buckets of both wheels through which the exhaust passes, one of the retainers being perforated to permit a shaft to pass freely through it, and an exhaust conduit.

8. In an elastic-fluid turbine, the combination of a casing having an inlet and an outlet, oppositely rotating wheels mounted therein, shafts for the wheels extending in opposite directions, bearings for the shafts located on opposite sides of the casing, axial buckets secured to the shafts, a retaining means for the ends of one set of buckets, which is carried by the same shaft that supports the buckets, a retaining means for the ends of the other set of buckets, and diametrically extending braces for the means which revolve freely with respect to the other wheel and its shaft.

9. In an elastic fluid turbine, the combination of a casing, oppositely rotating wheels mounted in the casing and located one within the other, axially-extending buckets carried by said wheels, diametrically extending braces for the outer ends of the buckets, a supply conduit, nozzles arranged adjacent the periphery of the outer wheel to supply the turbine with motive fluid from said conduit, and an exhaust conduit for the turbine, said wheels being provided with axially arranged passages for delivering the exhaust from the interior of the wheels to flow to the exhaust conduit.

In witness whereof, I have hereunto set my hand this ninth day of September, 1907.

ELIHU THOMSON.

Witnesses:
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