C. R. WALLER.

ELASTIC FLUID TURBINE.

APPLICATION FILED SEPT. 14, 1910.

1,016,660.

Patented Feb. 6, 1912.

2 SHEETS—SHEET 1.

Fig. 2.

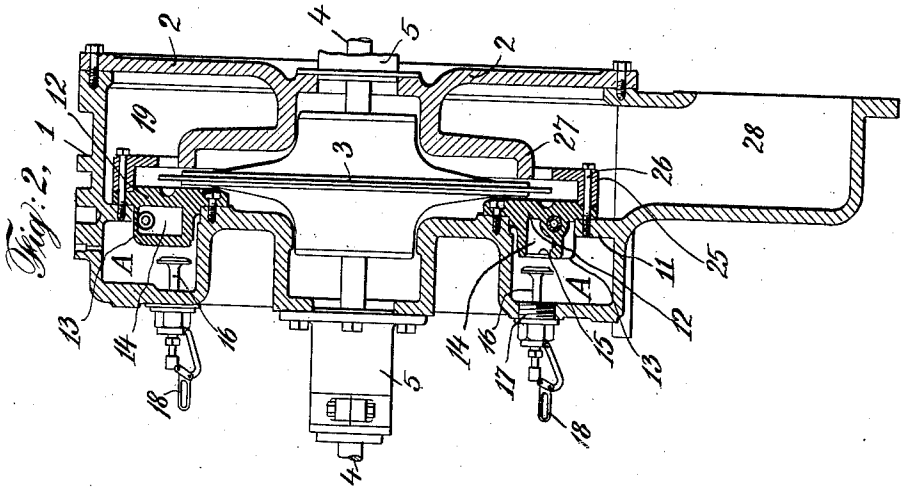
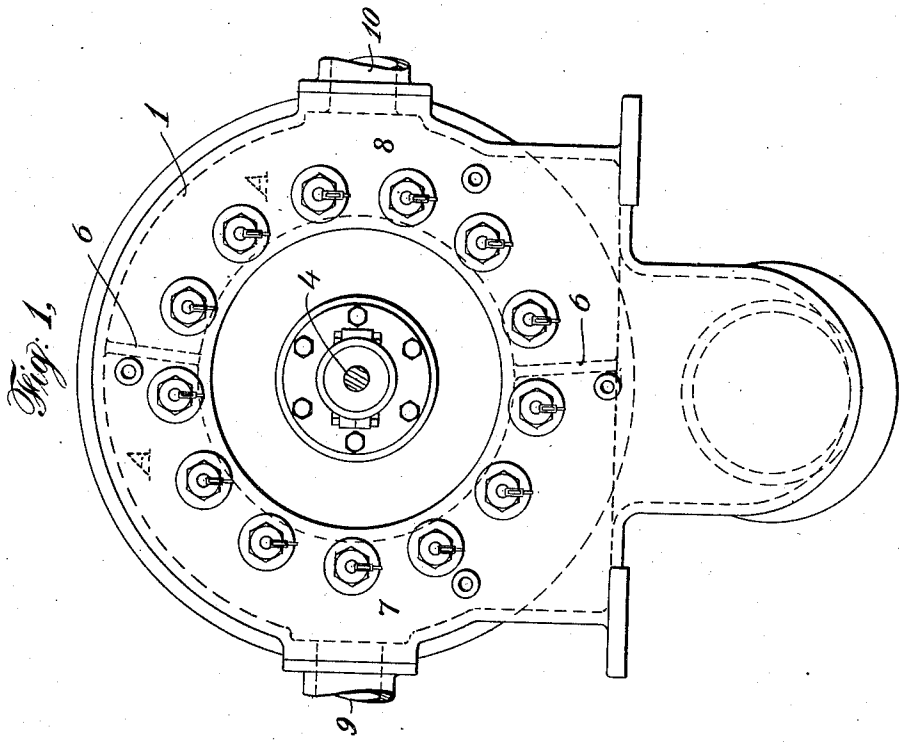


Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 4

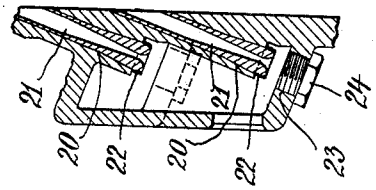


Fig. 3.

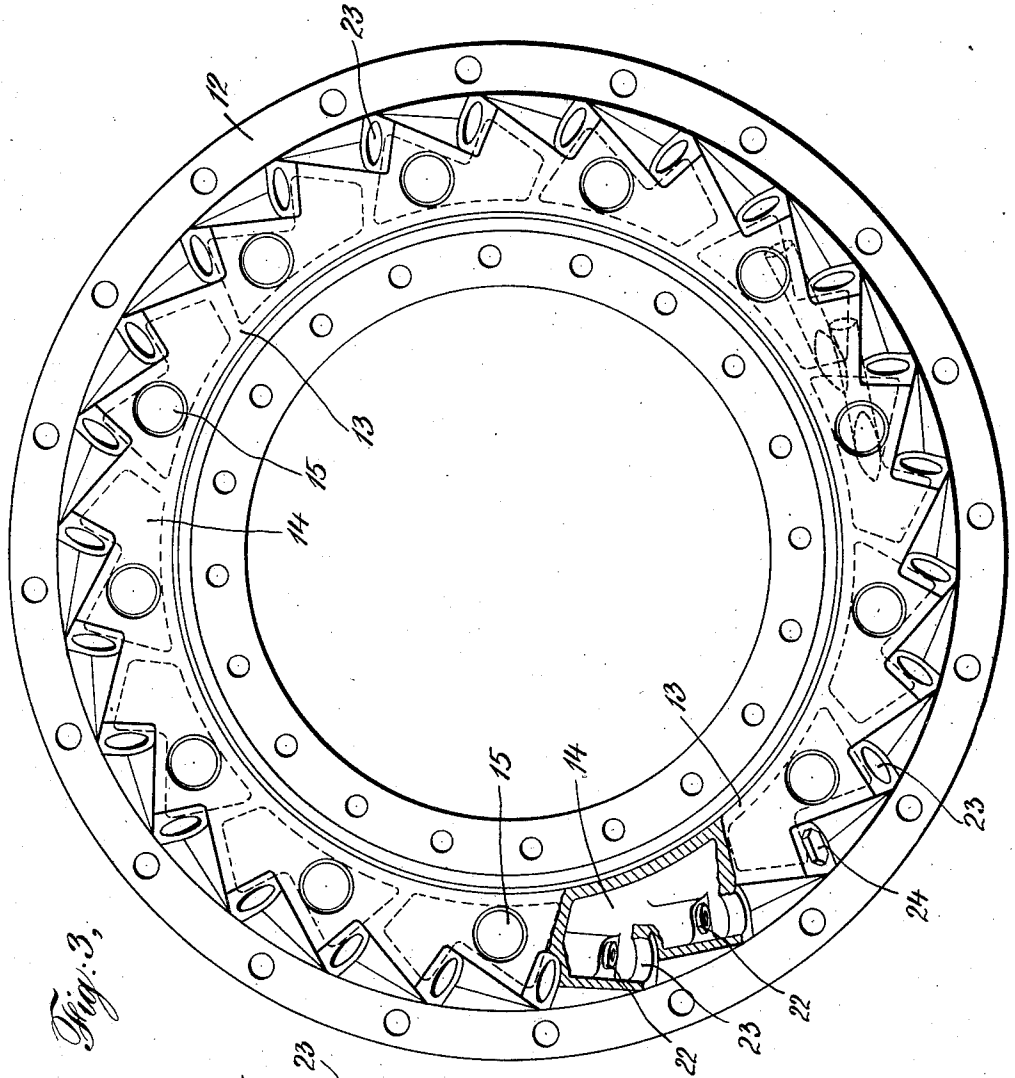
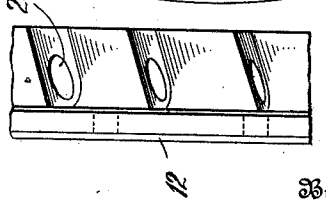


Fig. 5.



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ELASTIC-FLUID TURBINE.

1,016,660. Specification of Letters Patent. Patented Feb. 6, 1912.

Application filed September 14, 1910. Serial No. 581,962.

To all whom it may concern:

Be it known that I, CARL RICHARD WALLER, a citizen of the United States of America, and resident of Trenton, county of Mercer, and State of New Jersey, have invented certain new and useful Improvements in Elastic-Fluid Turbines, of which the following is a specification.

This invention relates to elastic fluid turbines, such as steam turbines, and particularly to turbines of the impact type comprising a rotating member carrying buckets, blades or vanes, against which steam or other working fluid is projected by a plurality of nozzles. It is frequently desirable to arrange to operate such turbines with working fluid from a plurality of different sources, either simultaneously or at different times, or to operate the turbine in connection with a condenser at one time and to exhaust from the turbine into the air or under back pressure, at another time, or perhaps to work at times with a relatively low vacuum. For efficient operation, this requires a plurality of nozzles of different shapes; for high efficiency requires the use of different nozzles when the turbine is working condensing from what are used when it is working non-condensing, and different nozzles for use when it is operating with low pressure steam from what are used when it is operating with high pressure steam. The form of such a turbine lends itself admirably to the provision of a large number of nozzles, some of which may differ in shape from others, and part or all of which may be in use at any one time.

The invention herein described comprises means whereby a large number of nozzles are so arranged in connection with the rotating member, that they may be connected in groups, the nozzles of different groups receiving working fluid from different sources if desired, means being provided whereby the number of nozzles in service of any group or groups may be varied as desired; and the invention further comprises an improved nozzle ring or carrier, and various other features hereinafter described and particularly pointed out in the claims.

Steam turbines are particularly adapted for operation by the exhaust steam of high pressure engines which, customarily, exhaust into the air, the turbine in such case in effect taking the place of the low pressure cylinder of a compound, triple expansion, etc., engine, but operating with greater efficiency and being much smaller and more compact. The exhaust steam from an engine which ordinarily operates intermittently or under an extremely variable load (hoisting engines, rolling mill engines and the like) may be utilized effectively for operating a low pressure motor, by interposing between the high pressure motor and the low pressure motor a steam accumulator. Various constructions of accumulators adapted for such use are known and it is not necessary for me to illustrate here any particular accumulator construction. The turbine herein described is well adapted for operation simultaneously by steam derived direct from the boiler at high pressure and by exhaust steam from a high pressure engine, such steam either delivered direct from such engine, or through an accumulator.

The accompanying drawings illustrate one construction of turbine embodying my invention.

In the said drawings: Figure 1 shows an end view of the said turbine; Fig. 2 shows a central vertical section of the turbine; Fig. 3 shows a front elevation and partial section, on a larger scale, of the nozzle ring; Fig. 4 shows a fragmentary diagrammatic transverse section of the nozzle ring; and Fig. 5 shows a fragmentary side view of the nozzle ring.

Referring first to Figs. 1 and 2, the turbine casing, as there shown, comprises two sections, 1 and 2, bolted together, section 2 being in effect an end plate provided, however, with an inwardly projecting portion hereinafter described. The rotary blade-carrying member or wheel 3, is mounted on a shaft 4 passing through stuffing boxes 5—5. The section 1 of the casing is the main section thereof and has cored out in it a chamber A, constituting a steam chest, which, for the purposes of this invention, is divided into a plurality of chambers by means of partitions 6 (indicated in dotted lines in Fig. 1). There may be as many of these partitions as desired, the steam chest being divided into a corresponding number of compartments. In the construction shown, I have indicated two such partitions 6, dividing the steam chest into separate compartments 7 and 8, having independent supply connections 9 and 10 respectively.

Said casing member 1 is provided with an internal flange 11 against which is secured a nozzle ring 12 having formed on it an annular boss 13 projecting past flange 11, the interior of said boss being divided into a plurality of separate secondary steam chests 14. In the front face of this annualr boss 13 are a plurality of valve-seated openings 15, one for each secondary steam chest 14, and for each said opening there is a corresponding valve 16 carried by a valve bonnet 17 screwing into a corresponding opening in the front face of casing 1, each such valve arranged to be operated by a corresponding handle 18. By means of these handles the valves may be opened and closed individually as desired.

The nozzle ring 12 completely closes the steam chest A, except as one or more of the valves 16 may be open, permitting steam to flow in the corresponding secondary steam chest, and thence to nozzles carried by the nozzle ring in the wheel chamber 19. From each of the secondary steam chests 14 one or more nozzle holes (two holes, in the construction shown), extend to the said wheel chamber, and into these nozzle holes are fitted expansion nozzles 21 (Figs. 3 and 4). In practice nozzle holes 20 have a very slight taper (in Fig. 4 this taper is exaggerated for purpose of illustration) and the nozzles have a corresponding taper so that when inserted and forced home they will remain in place without leakage of steam. Each nozzle is customarily provided with a screw threaded end portion 22 for engagement of the nozzle by a removing tool when it is desired to withdraw a nozzle. To permit the insertion and removal of the nozzles from the pressure side of the nozzle ring, screw threaded openings 23 (Figs. 3 and 4) are provided in the faces, and steps are formed on the periphery of the annular boss 13, as shown particularly in Figs. 3 and 4, such openings 23 being each in line with a corresponding nozzle hole, and being closed when the turbine is in use by a screw plug 24.

In Fig. 4 for purpose of illustration I have shown the nozzles as being in the plane of section. As a matter of fact, however, and as clearly shown in Figs. 3 and 5, the nozzles are inclined to the plane of section of Fig. 4, being directed toward the wheel chamber.

Against the inner face of the nozzle ring 12 there is a ring 25, commonly termed the diffuser ring, the studs 26 by which this ring 25 is held in place passing through the nozzle ring so that the said studs also serve as holding studs for the nozzle ring. Adjacent to this ring 25 is a flange 27 carried by the plate 2, the annular space between this flange 27 and the ring 24 forming a passage through which the working fluid, after acting on the vanes of wheel 3, escapes to the exhaust space 19 and thence to the exhaust outlet 28.

The turbine structure as above described resembles somewhat a turbine structure described and claimed in my application for Letters Patent filed June 10, 1909, Sr. No. 501,299, differing therefrom in that in the turbine of this present application communication between the primary steam chest and the wheel chamber is blocked by the nozzle ring itself, except as one or more of the valve openings of this nozzle ring may be opened, and except that in this present turbine the secondary steam chests are formed entirely in the nozzle ring itself, such nozzle ring having the hollow annular boss 13 of the stepped contour illustrated in Fig. 3, and provided with openings whereby the expansion nozzles may be inserted in their holes and removed therefrom at will, working from the pressure side of the nozzle ring. The construction herein illustrated and described is superior to that described in my above mentioned application, in that in the present construction it is much easier to make a good steam tight joint between the nozzle ring and casing member 1, and to provide suitable seats for valve 16; also the construction herein described makes it easier to insert and remove the nozzles.

In other applications for Letters Patent filed June 10, 1909 Sr. Nos. 501,297 and 501,298 I have illustrated, as one feature of a turbine there shown, a nozzle ring similar to the nozzle ring herein illustrated and described, but without claiming the same.

What I claim is:—

1. An elastic fluid turbine comprising in combination a casing having within it a steam chest and a rotor chamber and provided, between said chest and chamber, with a projecting flange, and a nozzle ring secured to said flange and separating said chest and chamber, and having a hollow boss projecting into said steam chest, the interior of said boss divided into a plurality of secondary steam chests, nozzles extending from said secondary steam chests to said rotor chamber, and means connecting said secondary steam chests and main steam chest.

2. An elastic fluid turbine comprising in combination a casing having within it a steam chest and a rotor chamber, and a nozzle ring within said casing separating said steam chest and rotor chamber, and having an interior space constituting one or more secondary steam chests, said ring provided with a plurality of nozzle holes opening from said steam chest or chests and adapted to receive nozzles, the opposite peripheral wall of said ring being provided with openings substantially in line with said nozzle holes.

3. An elastic fluid turbine comprising in

combination a casing having within it a steam chest and a rotor chamber, and a nozzle ring within said casing separating said steam chest and rotor chamber, and projecting into the steam chest and having within it an interior space constituting one or more secondary steam chests, said ring provided with nozzle holes opening from its interior space and adapted to receive nozzles, and the peripheral wall of said ring being provided with openings substantially in line with said nozzle holes.

4. A nozzle ring for elastic fluid turbines, comprising a hollow ring, provided with nozzle holes opening from its interior space and adapted to receive nozzles, the outer wall of said ring, opposite said nozzle holes, being stepped, and being provided, in said steps, with openings substantially in line with said nozzle holes.

5. A nozzle ring for elastic fluid turbines, comprising a hollow ring adapted for interposition between a steam chest and rotor chamber, and having stepped surfaces on opposite lateral walls of its hollow interior, the stepped surfaces of one said wall provided with nozzle holes adapted to receive nozzles, the stepped surfaces of the opposite wall having holes each substantially in line with one of the nozzle holes of the opposite wall.

6. A nozzle ring for elastic fluid turbines, comprising a hollow ring provided with nozzle holes opening from its interior space and adapted to receive nozzles, said holes tapering toward their outer mouths, said ring provided, opposite the said nozzle holes, with openings for the insertion and removal of nozzles.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CARL RICHARD WALLER.

Witnesses:
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T. R. PELLEY.