O. A. WIBERG.

ELASTIC FLUID TURBINE.

APPLICATION FILED MAY 16, 1917.

1,257,167. Patented Feb. 19, 1918.

Fig. 1.

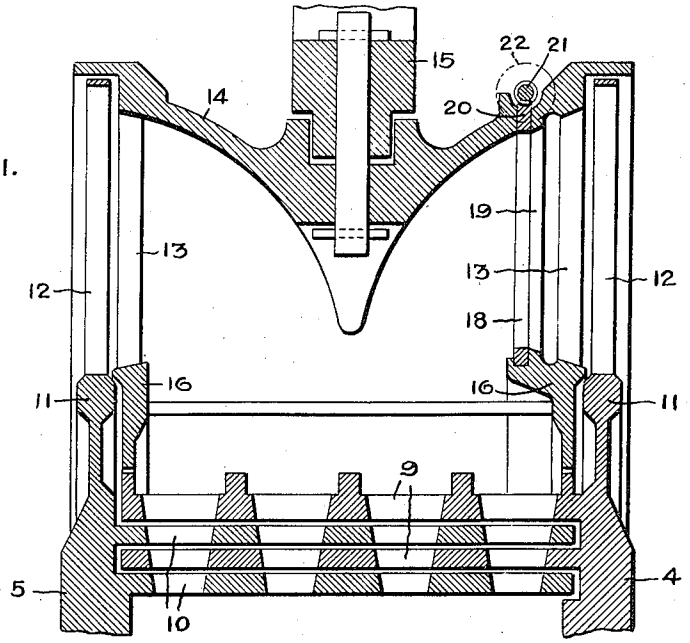


Fig. 2.

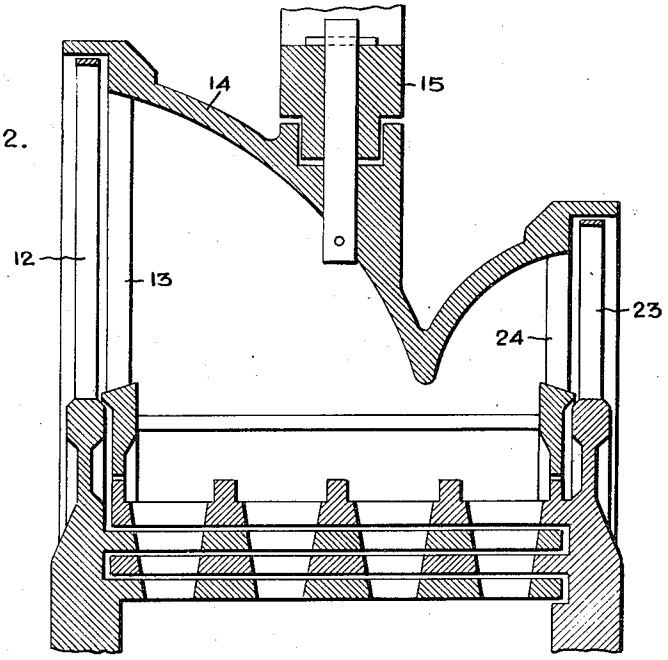
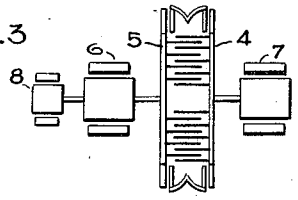


Fig. 3



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UNITED STATES PATENT OFFICE.

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ELASTIC-FLUID TURBINE.

1,257,167. Specification of Letters Patent. Patented Feb. 19, 1918.

Application filed May 16, 1917. Serial No. 169,105.

To all whom it may concern:

Be it known that I, OSCAR ANTON WIBERG, a subject of the King of Sweden, residing at Finspong, Sweden, 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 having oppositely rotating blade carrying rotors, and specifically to such turbines in which the blades are divided into systems or sets, the motive fluid flowing radially through one system and axially through another system.

Turbines of this character are very effective for the purpose intended, but have the limitation that the output cannot be distributed arbitrarily between the rotor shafts because the effect of the motive fluid on the blades is to impart equal, or substantially equal, turning moments to the rotors and their shafts.

When such turbines drive electric generators, it is desirable to have one of the rotor shafts drive an exciter, lubricating pump, or other load, in addition to its main generator, thereby requiring a greater output from one shaft than from the other. In the case of turbo-alternators, this is now accomplished by connecting the two generators in parallel so that the rotors are compelled to move in synchronism. Under these conditions the turbine rotor which drives the additional load tends to lag behind the other, and hence current flows to its generator from the other in sufficient amount to prevent it from dropping out of step. The objection to this is that one generator always carries a greater load than the other which may at times be a very substantial amount.

My invention has for its object to avoid this unequal loading of the generators and to provide means whereby, in a turbine of the character described, the blade carrying rotors can be made to develop unequal amounts of work and hence to drive unequal loads.

In the accompanying drawing, which is illustrative of my invention, Figure 1 is a partial axial section of one embodiment of my invention; Fig. 2 is a similar section of a modification, and Fig. 3 is a diagrammatic view of a turbo-generator set.

Referring first to Fig. 3, 4 and 5 indicate turbine rotors which revolve in opposite directions and are provided with a system of blades comprising concentric rings of blades through which the motive fluid flows radially outward, and a system of blades through which the motive fluid exhausting from the radial system flows in an axial direction. 6 and 7 indicate the main generators which are driven by the rotors, and 8 indicates an exciter or other additional load which is driven by one of the rotors, as 5 for example. The main generators may be connected in parallel as usual to insure the same shaft speed for both rotors.

Referring to Fig. 1, 4 and 5 indicate the rotors. Mounted on the rotor 4 are concentric rings of blades 9 coöperating with rings of blades 10 on the rotor 5. These rotors may be provided with as many concentric rings of blades as is desired. Each rotor is provided with an enlarged rim 11 in which are mounted the blades 12, the latter being of any suitable type. Coöperating with these blades are stationary directing devices or blades 13 which are carried by the ring 14 which also forms a means for deflecting the exhaust steam from the radial flow system through the axial flow system. The ring is carried by projections 15 that are secured to the inclosing casing which has been omitted for simplicity, but which is of ordinary construction. The inner ends of the directing device 13 are secured to rings 16 whose inner surfaces stand in close proximity to projections on the rotor 5 to reduce leakage. In a turbine constructed as described, the two rotors have equal, or substantially equal, turning moments. As above explained, it is sometimes desirable to have one rotor do more work than the other. This can be accomplished in a number of ways. For example, by regulating the amount of steam which flows through one set of axial flow blades, by changing the angles of one set of said blades, by changing the lengths of one set of said blades, or by using a different diameter for one set than the other accompanied by a difference in amount of fluid which can flow per unit of time.

In Fig. 1 is shown an arrangement whereby the amount of steam flowing through one part of the axial flow system can be controlled, the parts of the system being alike. To this end the right-hand ring 16 is enlarged to form a seat for the ring or gridiron valve 18, the latter coöperating with a fixed

valve seat 19. The valve and its seat are provided with openings or slots after the fashion of the damper of a stove and by moving the valve with respect to its seat, more or less steam will be permitted to pass to the blades on the discharge side. To permit the valve to be adjusted the ring 14 is slotted at its upper end to receive a projection 20 on the valve. The periphery of the projection is provided with gear teeth which mesh with the teeth of the worm 21. On the end of the worm shaft and outside of the casing is a hand wheel 22, by means of which the valve can be adjusted to regulate the flow of steam.

In some cases it is sufficient to fix the outputs of the two rotors once for all. To this end one set of axial flow blades is made shorter than the other, as shown in Fig. 2, so that a greater amount of steam will flow through one side than the other, and hence one rotor will have a greater turning moment for a given flow of steam than the other. This arrangement is somewhat simpler than the one shown in Fig. 2, and is satisfactory for many purposes.

Referring to the drawing, 12 and 13 indicate the rotating and stationary blades respectively for one-half of the axial flow system, and 23 and 24 the stationary and rotating blades of the other half of the axial flow system. It will be noted that the blades 23 and 24 are substantially shorter than blades 12 and 13, and hence less steam will flow through them than through the blades 12 and 13.

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. The combination in an elastic fluid turbine having rotors with interleaving blade rings through which the elastic fluid flows, and which revolve simultaneously and in opposite directions, and also blades which interleave with fixed blades, of means for delivering unequal amounts of motive fluid to said last-named blades to cause said rotors to deliver unequal amounts of power.

2. In an elastic fluid turbine, the combination of rotors which revolve in opposite directions and have radial and axial flow blade systems, and means for causing the rotors to deliver unequal amounts of power.

3. In an elastic fluid turbine, the combination of rotors which revolve in opposite directions and have radial and axial flow blade systems, with means acting on the axial flow blade system for causing the rotors to deliver unequal amounts of power.

4. In an elastic fluid turbine, the combination of rotors which revolve in opposite directions and have a radial flow blade system comprising concentric rings of blades, and a second system which assists the first and comprises moving blades and stationary directing devices, the blades in the second system for a given flow of motive fluid being arranged to exert unequal torque on said rotors.

5. In an elastic fluid turbine, the combination of rotors which revolve in opposite directions and have a radial flow blade system between them, and an axial flow blade system comprising stationary fluid directing devices and rows of blades which are mounted on the peripheries of the rotors, the said devices and blades of one part of the system being longer than those of the other to cause the rotors to deliver unequal power.

6. In an elastic fluid turbine, the combination of a pair of rotors which revolve in opposite directions and have a radial outflow blade system between them and also an axial flow blade system comprising stationary directing devices and blades which assist in driving the rotors, the exhaust from the radial flow system flowing in parallel through the axial flow system, and means for causing a lesser amount of said exhaust to flow through one portion of the axial flow system than through the other.

7. The combination in an elastic fluid turbine comprising a pair of rotors which revolve in opposite directions and have a radial flow system between them, and separate axial flow systems which receive the exhaust from the radial flow system in parallel, said rotors being connected to unequal loads, of means for dividing the elastic fluid between said axial flow systems in accordance with said unequal loads.

In testimony whereof I affix my signature in presence of two witnesses.

OSCAR ANTON WIBERG.

Witnesses:
TURC ALUNÉCY,
GUNNAR BARNS.