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O. JUNGGREN

ELASTIC FLUID TURBINE

Filed Dec. 5, 1922

Fig. 1.

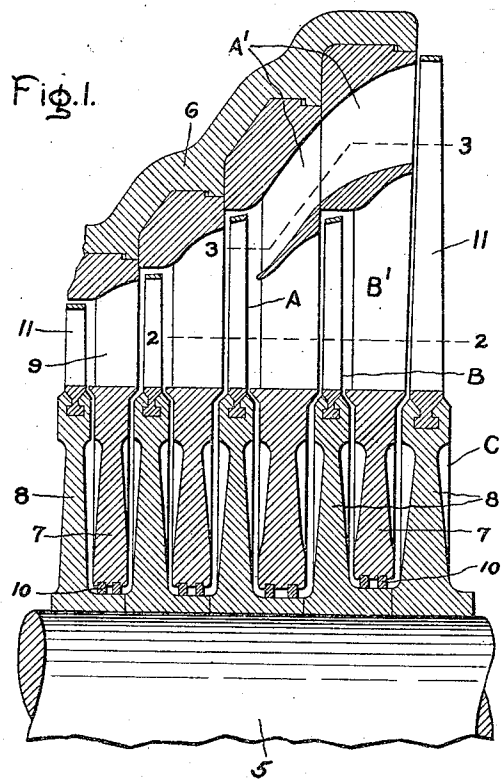


Fig. 2.

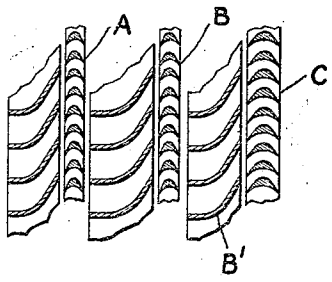
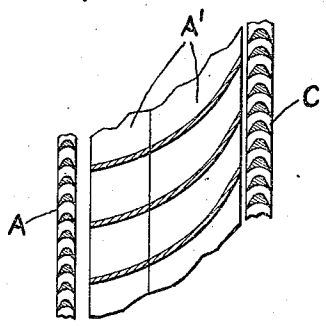


Fig. 3.



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UNITED STATES PATENT OFFICE.

OSCAR JUNGGREN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELASTIC-FLUID TURBINE.

Application filed December 5, 1922. Serial No. 605,115.

To all whom it may concern:

Be it known that I, OSCAR JUNGGREN, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, 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 especially to elastic fluid turbines of the axial flow impulse type.

In elastic fluid turbines of large sizes running at low vacua the quantity of elastic fluid to be handled in the low pressure end becomes very large so that a very large bucket area is required to handle it. In fact, the maximum capacity of a turbine for any given speed is always limited by the low pressure end of the machine, i. e. by the ability of the low pressure end of the machine to handle efficiently the elastic fluid. It is the common practice to obtain additional bucket area in the low pressure end of a turbine by increasing both the wheel diameter and the bucket length. However, the limit of wheel diameter is soon reached because of the peripheral speed becoming excessive and the limit in bucket length is reached because of the inefficiency of very long buckets, due to the fact that the tips travel at a much higher speed than the roots.

The object of my invention is to provide an improved turbine structure wherein I am enabled to use long buckets in an efficient manner, and for a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, Fig. 1 is a sectional view of a turbine structure embodying my invention, and Figs. 2 and 3 are detail sectional views taken on lines 2—2 and 3—3, respectively, Fig. 1.

Referring to the drawings, 5 indicates the shaft of an elastic fluid turbine, 6 the shell, 7 the diaphragms, and 8 the bucket wheels carried by shaft 5. The diaphragms are supported by shell 6 and are provided with nozzles 9 and diaphragm packings 10. On the bucket wheels 8 are rows of buckets 11. Fig. 1 shows only a portion of the low pressure end of a turbine and the parts so far referred to are to be taken as typical of any suitable structure to which my invention may be applied. Now according to my invention I supply to a stage having long buckets, elastic fluid from the preceding stage and also elastic fluid from a stage or stages in advance of the preceding stage, the arrangement being such that this latter fluid supply by-passes the preceding stage. The elastic fluid from the preceding stage and that taken from a stage or stages in advance of the preceding stage and which by-passes the preceding stage, are applied to different radial portions of the bucket ring, each being supplied to a portion of the bucket ring which is traveling at a velocity suited to the velocity of the elastic fluid. I thus obtain elastic fluid discharging from nozzles at a velocity suited to the velocity of the portion of the buckets upon which it acts. Either one or more stages may be by-passed and there may be one or more by-passes in connection with a single row of buckets, the particular arrangement depending upon the difference in speed between the roots and tips of the buckets which make up the bucket ring. Viewed from another aspect, I provide a turbine stage having long buckets and supply elastic fluid to them partly from the preceding stage and partly from one or more stages in advance of the preceding stage.

Referring specifically to the drawing, C indicates a turbine stage containing a wheel having long buckets. The radially inner portions of the buckets receive elastic fluid from the bucket wheel of the preceding stage B through nozzles B′ while the radially outer portions of the buckets receive elastic fluid from the stage A in advance of stage B, special nozzle A′ being provided for directing the elastic fluid from stage A to the bucket ring of stage C. By the arrangement a portion of the elastic fluid from stage A is by-passed around stage B and applied directly to the bucket ring of stage C. The arrangement is such that nozzeles B′ discharge elastic fluid at a velocity suited to the speed of the radially inner portion of the bucket ring in stage C and nozzles A′ discharge elastic fluid at a velocity suited to the speed of the radially outer portion of such bucket ring. This gives a more uniform action on the buckets of stage C and a higher degree of efficiency. Any percentage of the total quantity of elastic fluid may be so by-passed as may be found desirable and while in the present in-

stance only a single by-pass is illustrated, it will be readily appreciated as already pointed out that more than one stage may be by-passed in accordance with the principle of my invention.

Viewed from still another aspect, it may be considered that stages A and C are normal or main stages, that is stages having buckets through which all the elastic fluid flows and that stage B is an auxiliary or supplementary stage introduced between stage A and C and through which only the radially inner portion of the annular elastic fluid stream flows.

By utilizing my invention I am enabled to construct a turbine in which all or any desired number of the wheels are of the same diameter and the inside portions of all or a similar number of the diaphragms are of the same diameter. This is of advantage in that it means that a large number of the parts are alike and hence can be manufactured at a lower cost. Also since the wheels are of small diameter the stresses in them will be low so they may take the form of flat disks. With advantage, a wheel diameter suitable for the first stage wheel may be selected and all the remaining wheels then made of this same diameter, the required bucket area being obtained by increasing the lengths of the buckets. Such a by-passing arrangement embodying my invention may be then utilized as meets the requirements of the particular case.

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 may 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, a stage having long buckets, and means for supplying elastic fluid thereto independently from the preceding stage and from a stage in advance of the preceding stage.

2. In an elastic fluid turbine, a stage having long buckets, fluid-directing means for supplying elastic fluid from the preceding stage to the radially inner portion of said buckets, and fluid-directing means for supplying elastic fluid from a stage in advance of said preceding stage to the radially outer portion of said buckets.

3. In an elastic fluid turbine, a plurality of stage having wheels of the same diameter and buckets which increase in length, and means for supplying elastic fluid to the buckets of one stage independently from two or more preceding stages.

4. An elastic fluid turbine having a plurality of successive stages through which all the elastic fluid passes, characterized by the fact that between certain of the stages there is interposed a supplemental stage the buckets of which are acted upon only by the radially inner portion of the annular elastic fluid stream flow.

5. In an elastic fluid turbine, the combination with two adjacent stages one in advance of the other as regards the flow of elastic fluid, of a stage interposed between said two adjacent stages, and fluid-directing means for conveying elastic fluid from the radially inner portion of the earlier stage through said interposed stage to the later stage and from the radially outer portion of said earlier stage around said interposed stage to the later stage.

In witness whereof, I have hereunto set my hand this 4th day of December, 1922.

OSCAR JUNGGREN.