O. JUNGGREN.

ELASTIC FLUID TURBINE.

APPLICATION FILED MAR. 3, 1920.

1,352,278. Patented Sept. 7, 1920.

Fig. 1.

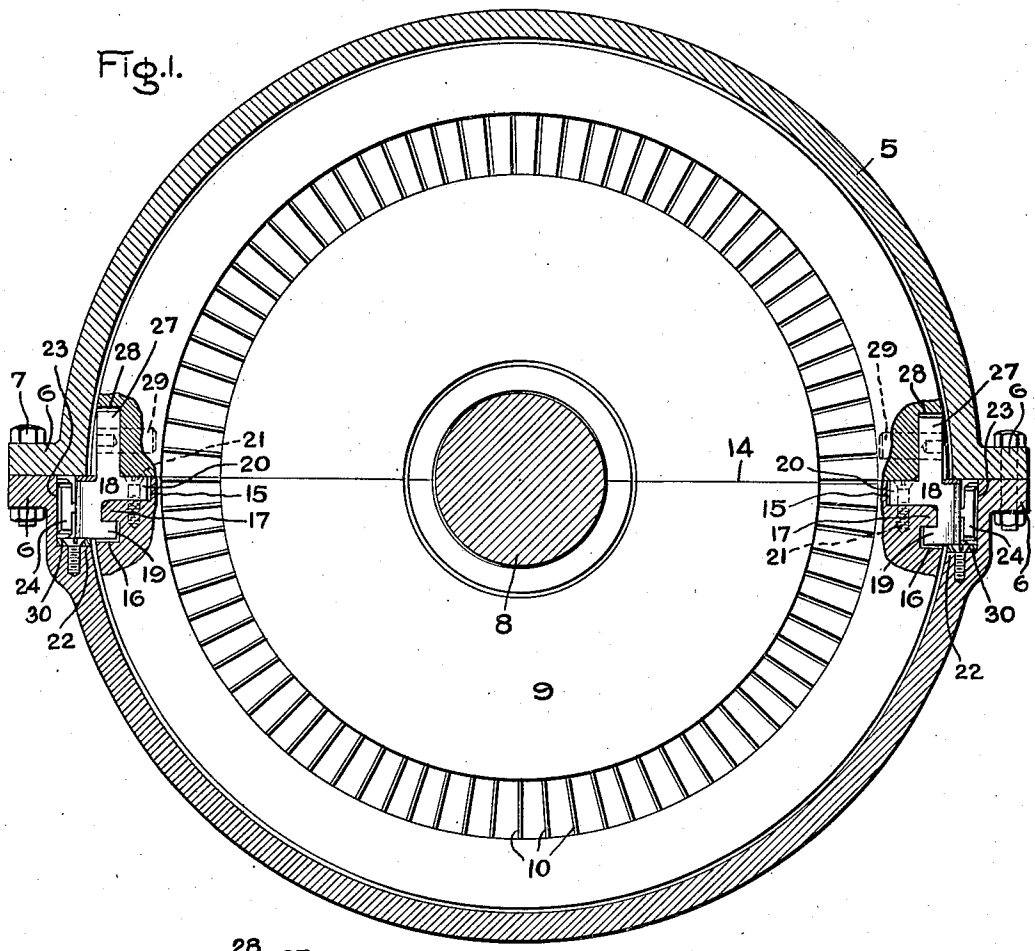


Fig. 2.

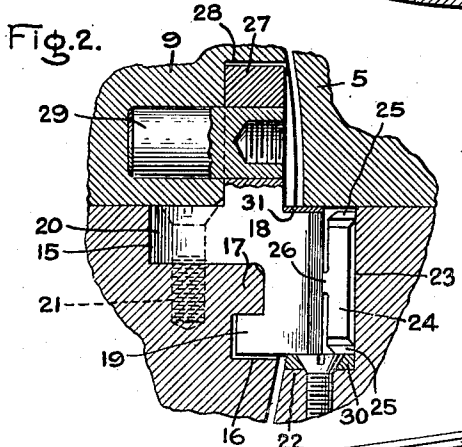


Fig. 3.

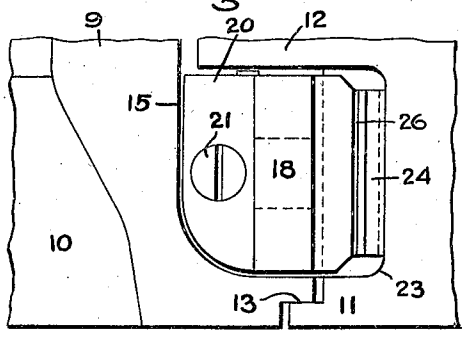
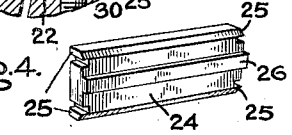


Fig. 4.



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UNITED STATES PATENT OFFICE.

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ELASTIC-FLUID TURBINE.

1,352,278. Specification of Letters Patent. **Patented Sept. 7, 1920.**

Application filed March 3, 1920. Serial No. 362,913.

To all whom it may concern:

Be it known that I, OSCAR JUNGGREN, a citizen of the United States, residing at Schenectady, 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 of the type in which the casing is divided into a number of stages by nozzle-containing diaphragms which surround the shaft and are supported in the casing wall, there being a suitable packing between the bearings of the diaphragms and the shaft to prevent leakage. In the stages formed by the diaphragms are bucket wheels which are carried by the shaft and to the buckets of which elastic fluid is directed by the nozzles.

In starting up and during operation a turbine is subjected to considerable variations in temperature, the variations occurring during operation being due to changes in load and variations in vacuum as is well understood. Also rubbing may sometimes occur between the moving and stationary parts which may be the cause of considerable heat being generated. As a result of the foregoing, the turbine parts are subjected to unequal heating which causes unequal expansion and in the case of the diaphragms and casing the difference in expansion of a diaphragm and a casing may be considerable so that with the diaphragms connected rigidly to the casing, stresses of substantial magnitude may be set up in a diaphragm or on the casing, which may result, in the one case, in buckling of the diaphragm, and, in the other, of cracking of the casing.

The object of my present invention is to provide an improved structure and arrangement for supporting a diaphragm within a turbine casing, which leaves the diaphragm free to expand and contract in all directions relatively to the casing, thereby avoiding undue stresses being set up, 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, Figure 1 is a transverse, sectional view through a turbine showing a diaphragm supported in accordance with my invention; Fig. 2 is a detail sectional view on a larger scale than Fig. 1, of the diaphragm supporting means; Fig. 3 is a top plan view looking down on the lower half of the diaphragm, and Fig. 4 is a perspective view of a spring member.

Referring to the drawing, 5 indicates the turbine casing which is shown as being split in a horizontal plane through its axis to form the upper and lower halves, the halves being provided with flanges 6 to receive bolts 7 for fastening them together. 8 indicates a turbine shaft upon which are mounted bucket wheels (not shown). The bucket wheels may carry one or more rings of buckets as found desirable. The turbine casing 5 is divided into stages by diaphragms 9 which carry partition plates 10 forming nozzles for directing elastic fluid against the buckets of the wheels. The casing is formed on its inner surface with annular, radially extending walls 11 and 12 (Fig. 3) which define an annular groove for the reception of the rim of the diaphragm, and on its discharge side there is a sealing joint between the diaphragm rim and wall 11, as indicated at 13, to prevent leakage of elastic fluid around the periphery of the diaphragm from one stage to the next lower stage. The diaphragm is formed in the upper and lower halves corresponding to the casing halves, being split as indicated at 14. The foregoing may be taken as typical of a turbine structure in connection with which my improved diaphragm supporting means may be used.

Now according to my invention I make the diaphragm of lesser diameter than the turbine casing so the diaphragm is spaced from it around its entire periphery, and I then support the diaphragm on the casing by means of two specially constructed and arranged supporting members which are detachably connected to the diaphragm on substantially diametrically opposite sides of it, and rest on supporting shoulders on the turbine shell. To this end I provide the lower half of the diaphragm at what may be termed its two corners with recesses 15 and 16 to form projections 17 and engaging with projections 17 are hook-shaped members or bars 18, each comprising a part 19 located in recess 16 beneath a projection 17 and a part 20 which lies in recess 15 and is fastened to the diaphragm by a screw 21. Part

20 is of a thickness so it lies flush with the flat top surface of the lower half of the diaphragm and it serves to hold the hook straight and to take up the force caused by the weight of the diaphragm tending to turn the member 18 in a vertical plane. Members 18 project beyond the periphery of the diaphragm and present flat bottom surfaces which rest on shoulders 22 in the lower half of the turbine shell, which shoulders are formed by providing recesses 23 therein. Between the outer walls of recesses 23 and members 18 are spring spacers 24 which serve to center the diaphragm and which may also yield when the diaphragm expands. Spring spacers 24 are shown in the present instance as being in the form of flat bars provided at their two ends with lugs 25 which engage the adjacent walls of recesses 23 and at their central portion with lugs 26 which engage the adjacent surfaces of members 18.

The flat edge of the upper half of the diaphragm rests directly on the upper flat edge of the lower half of the diaphragm and is centered by projections 27 which extend vertically from and form a part of members 18, such projections being located in recesses 28 formed at the two corners of the upper half of the diaphragm. Projections 27 may or may not be fastened to the upper half of the diaphragm as found desirable in any particular instance.

In some cases the upper halves of the diaphragms may be assembled in the upper half of the turbine casing and provided with a suitable holding means to form a structure which is handled as a unit in assembling the turbine. That is, the upper half of the turbine casing with the upper halves of the diaphragms therein are put into position or removed at the same time. In such cases, the upper halves of the diaphragms would not be fastened to projections 27. In case, however, the upper diaphragm half is assembled on the lower half prior to the putting into position of the upper half of the casing, then projections 27 may be fastened to the upper diaphragm half by suitable means, such as the pins 29.

In assembling the turbine, the members 18 are placed in position at the corners of the lower diaphragm halves and fastened by screws 21. The diaphragm halves are then placed in the lower half of the turbine casing, members 18 resting on shoulders 22, suitable shims being provided, as indicated at 30, to bring the diaphragms to correct position. Spring spacers 24 are then put in position after which the upper halves of the diaphragm and the upper half of the turbine casing are placed in position. When assembled, the members 18 are held between the two halves of the casing, a suitable shim 31 being provided to give the desired tightness to the fit. This firmly anchors the diaphragm and prevents its turning in the casing.

It will be seen that the members 18 serve to support the diaphragm at two opposed points located at substantially the horizontal axis of the diaphragm and maintain the diaphragm in correct position in a vertical direction, while spring spacers 24 serve to center the diaphragm in a transverse direction and yieldingly hold it. The diaphragm is thus free to expand and contract in all directions.

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 supporting wall provided with shoulders adjacent its horizontal axis, a diaphragm of less diameter than the inner diameter of said wall, means connected to said diaphragm and resting on said shoulders for supporting the weight of said diaphragm, and yielding means which engages said first named means for centering said diaphragm.

2. In an elastic-fluid turbine, a casing, a diaphragm therein of less diameter than said casing, means for supporting said diaphragm rigidly on the casing at opposite ends of the horizontal diameter of the diaphragm, and yielding means which engages said first named means for centering said diaphragm.

3. In an elastic-fluid turbine, a casing formed in upper and lower halves, a diaphragm therein of less diameter than said casing and formed in upper and lower halves, and means carried by the lower half of the diaphragm and engaging the lower half of the casing for supporting the diaphragm in spaced relation to the casing.

4. In an elastic-fluid turbine, a casing formed in upper and lower halves, a diaphragm therein of less diameter than said casing and formed in upper and lower halves, means carried by the lower half of the diaphragm and engaging the lower half of the casing for supporting the diaphragm in spaced relation to the casing, and yielding means for centering the diaphragm.

5. In an elastic-fluid turbine, a casing formed in upper and lower halves, a diaphragm therein of less diameter than said casing and formed in upper and lower halves, means carried by the lower half of the diaphragm and engaging the lower half

of the casing for supporting the diaphragm in spaced relation to the casing, yielding means for centering the diaphragm, and means carried by said supporting means which engages the upper half of the diaphragm for holding it in correct relation to the lower half of the diaphragm.

6. In an elastic-fluid turbine, a casing formed in upper and lower halves, said lower half being formed with recesses providing shoulders, a diaphragm, supporting means for the diaphragm which rests on said shoulders, and yielding means in said recesses which serve to center the diaphragm.

7. In an elastic-fluid turbine, a casing formed in upper and lower halves, said lower half being formed with recesses providing shoulders, a diaphragm formed in upper and lower halves, said diaphragms being of less diameter than the casing, recesses formed at the two corners of the lower half of the diaphragm to form horizontally extending projections, hook members engaging said projections and resting on said shoulders for supporting the weight of the diaphragm, and projections on said hook members for locating the upper diaphragm half relatively to the lower half.

8. In an elastic-fluid turbine, a casing formed in upper and lower halves, said lower half being formed with recesses providing shoulders, a diaphragm formed in upper and lower halves, said diaphragm being of less diameter than the casing, recesses formed at the two corners of the lower half of the diaphragm to form horizontally extending projections, hook members engaging said projections and resting on said shoulders for supporting the weight of the diaphragm, projections on said hook members for locating the upper diaphragm half relatively to the lower half, and yielding means for centering the diaphragm transversely.

9. In an elastic-fluid turbine, a casing formed in upper and lower halves, said lower half being formed with recesses providing shoulders, a diaphragm formed in upper and lower halves, said diaphragms being of less diameter than the casing, recesses formed at the two corners of the lower half of the diaphragm to form horizontally extending projections, hook members engaging said projections and resting on said shoulders for supporting the weight of the diaphragm, yielding means for centering the diaphragm, and means for locating the upper diaphragm half relatively to the lower diaphragm half.

10. In an elastic-fluid turbine, a casing formed in upper and lower halves, said lower half being provided on opposite sides with recesses forming shoulders, a diaphragm formed in upper and lower halves, said lower diaphragm half being provided at its two corners with recesses forming projections, hook members located in said recesses and engaging said projections, said hook members resting on said shoulders to support the diaphragm and space it from the casing wall vertically, and yielding means for locating said diaphragm transversely.

In witness whereof, I have hereunto set my hand this first day of March, 1920.

OSCAR JUNGGREN.