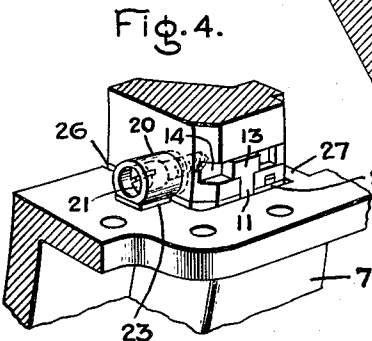
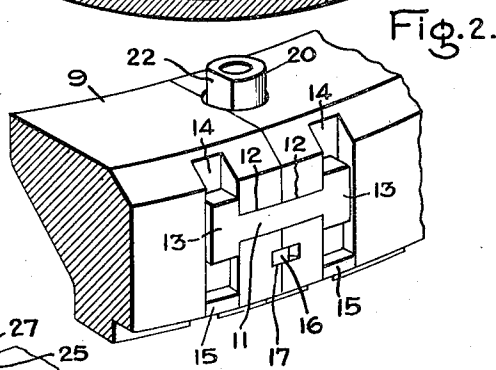
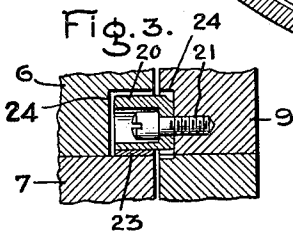
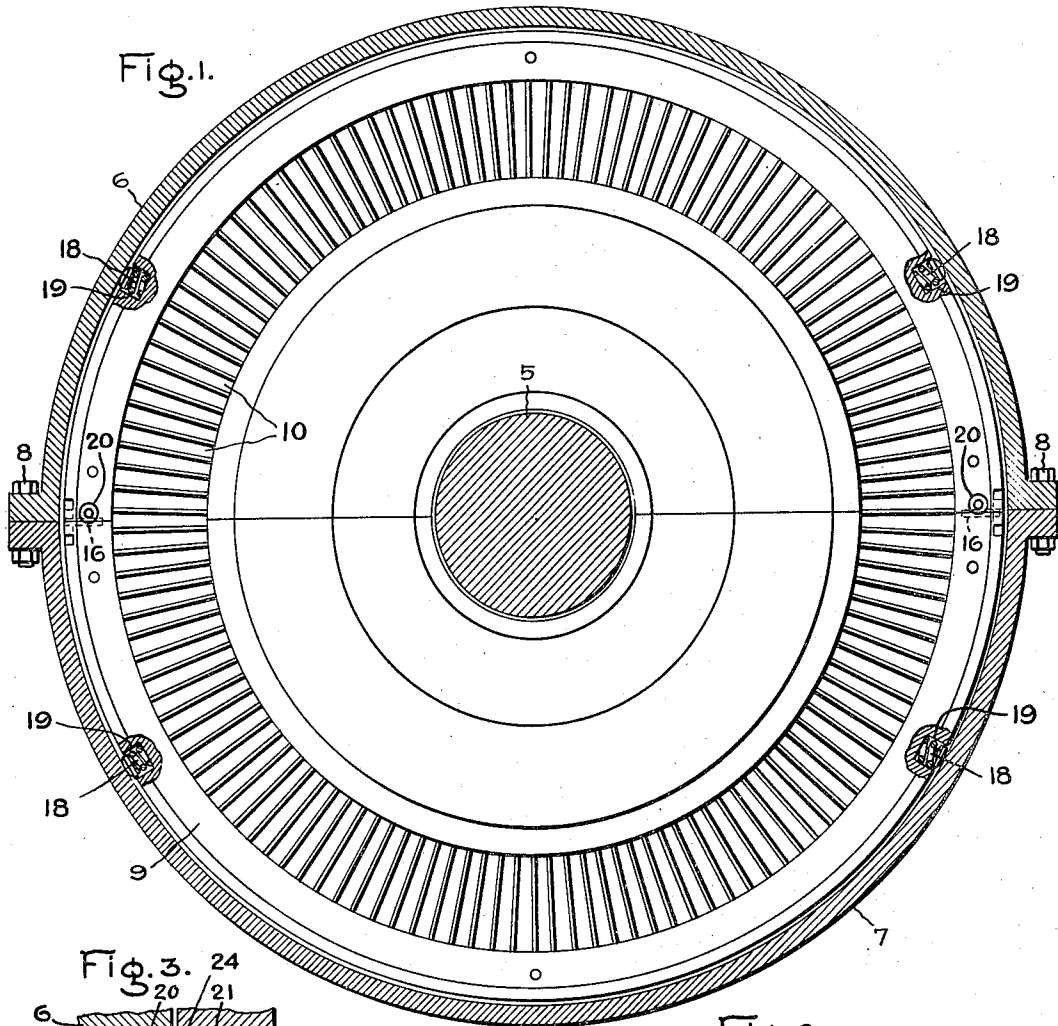


O. JUNGGRÉN.
ELASTIC FLUID TURBINE.
APPLICATION FILED DEC. 6, 1918.

1,352,276.

Patented Sept. 7, 1920.



Inventor:
Oscar Junggren,
by *Alfred Davis*
His Attorney.

UNITED STATES PATENT OFFICE.

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

ELASTIC-FLUID TURBINE.

1,352,276.

Specification of Letters Patent.

Patented Sept. 7, 1920.

Application filed December 6, 1918. Serial No. 265,639.

To all whom it may concern:

Be it known that I, OSCAR JUNGREN, 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 diaphragms which surround the shaft and are supported in the casing wall, there being a suitable packing between the bore of the diaphragm and the shaft to prevent leakage.

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 the 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 the 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 in cracking of the casing.

The object of the present invention is to provide an improved turbine structure wherein the diaphragms are so connected to the casing that they may expand and contract without setting up undue stresses 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 sectional view of an elastic-fluid turbine showing a diaphragm in position in the casing; Fig. 2 is a perspective view illustrating an arrangement for fastening the two halves of a diaphragm together; Fig. 3 is a detail sectional view of certain of the parts, and Fig. 4 is a perspective view thereof.

Referring to the drawing, 5 indicates a turbine shaft upon which are mounted the

rotor elements or wheels (not shown) in the usual manner, and 6 and 7 the upper and lower halves of a turbine casing which are fixed together by bolts 8. 9 indicates a diaphragm provided with guide vanes 10. The diaphragm is split horizontally to form upper and lower halves in the usual manner to facilitate assembling. Only a single diaphragm is illustrated in the drawing and my invention is specifically described in connection therewith. It will be understood, however, that the invention may be applied to all the diaphragms of a machine or to as many as desired.

Now according to my invention I provide a suitable detachable means for fastening the two halves of the diaphragm together so as to form in substance a unitary structure and I yieldingly support this unitary structure in the casing in such manner that it is free to expand radially in all directions relatively to the casing.

In the present instance the diaphragm halves are shown fastened together by means of links 11 (Fig. 2) which fit into short circumferentially extending grooves 12 at adjacent edges of the diaphragm halves, and are provided with heads 13 which are located in cross slots 14 with which grooves 12 communicate. At 15 are blocks which fit into slots 14 to prevent leakage of the elastic fluid, and at 16 are keys which are driven into key-ways 17 formed half in each of the adjacent diaphragm surfaces to assist in firmly uniting the diaphragm halves. The diaphragm is of slightly less diameter than the turbine casing and it is yieldingly supported by a suitable number of spaced springs 18 located in sockets 19 in the diaphragm and bearing against the inner surface of the turbine casing. Four such springs 18 are shown, but it will be understood that a greater or fewer number may be used if found desirable. It will be understood also that if the diaphragm is originally formed as a unitary structure, the means for fastening the two halves together will of course not be required.

In connection with the yielding supporting means, I preferably provide a supporting means between the diaphragm and casing, which supporting means is located at or adjacent to the horizontal diameter of the diaphragm, i. e., at or adjacent to the

plane in which the diaphragm is split, and serves to assist in supporting the weight of the diaphragm. This last referred to supporting means is so arranged that it may be adjusted to bring the diaphragm to the correct position relatively to the shaft and maintain it there so the packing between the bore of the diaphragm and the shaft will be correctly positioned to avoid rubbing, and there will be no danger of the diaphragm sagging. Such supporting means may take the form of projections on the diaphragms which engage the casing, or projections on the casing upon which the diaphragms rest. In the present instance the diaphragm is provided on opposite sides and at points just above the horizontal diameter with projections 20 which are suitably fixed in place by screw bolts 21. Projections 20 are provided with flat bottom surfaces 22 and such surfaces are slightly above the horizontal diameter of the diaphragm, *i. e.*, not quite flush with the lower edge of the upper half of the diaphragm. When the diaphragm is assembled in the casing the projections 20 rest on the upper edge of the lower half of the casing as best indicated in Figs. 3 and 4 and to adjust the diaphragm to the correct position shims 23 of the thickness found necessary are inserted between the projections 20 and the casing surface. The object of having surfaces 22 slightly above the horizontal diameter of the casing is so that some shimming will always be necessary as this affords an easy way of obtaining correct adjustment for shims of correct thickness can always be readily obtained. The upper half of the casing is provided on opposite sides with slots or grooves 24 (see Fig. 3) in which the projections 20 are located and as will be seen from Fig. 3, slots or grooves 24 are sufficiently large that the projections 20 are loose therein so as not to interfere with the expansion of the diaphragm. The projections 20 also serve to prevent movement of the diaphragm circumferentially around the shaft.

As is clearly illustrated in Fig. 4, in the present instance the turbine casing is of such contour that it presents a surface 25 to the periphery of the diaphragm and a surface 26 to one side thereof, the diaphragm being held against axial movement by surface 26 and an annular projection 27. The supporting projections 20 are accordingly in the present instance located at the side of the diaphragm but it will be understood that this is only one specific embodiment of the invention and that the arrangement may be modified to fit any particular case.

With the foregoing arrangement it will be seen that the diaphragm is rigidly supported on the casing as to its weight by the

projections 20 so that it is prevented from sagging but that it is yieldingly supported on the casing in all radial directions so that it is free to expand radially relatively to the casing, such yielding supporting means serving to normally center the diaphragm in a transverse direction and maintain it centered.

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, a supporting wall, a diaphragm, and means which yieldingly supports the diaphragm in the wall so that it is free to expand and contract radially relatively to the wall.

2. In an elastic-fluid turbine, an annular supporting wall, a diaphragm of less diameter than the inner diameter of said wall, and yielding means which supports the diaphragm in the wall whereby said diaphragm may expand and contract radially relatively to said wall.

3. In an elastic-fluid turbine, an annular supporting wall, a diaphragm of less diameter than the inner diameter of said wall, and spring means located between the periphery of the diaphragm and said wall to yieldingly support the diaphragm therein.

4. In an elastic-fluid turbine, an annular supporting wall, a diaphragm of less diameter than the inner diameter of said wall, and spaced coiled springs located between the periphery of the diaphragm and the supporting wall.

5. In an elastic-fluid turbine, the combination of a supporting wall, a diaphragm comprising a plurality of sections, means fastening said sections together, and means which yieldingly supports the diaphragm in said supporting wall.

6. In an elastic-fluid turbine, the combination of a casing, a diaphragm comprising upper and lower halves, means fastening said two halves together, and spring means located between the periphery of the diaphragm and said casing to yieldingly support the diaphragm therein.

7. In an elastic-fluid turbine, an annular supporting wall, a diaphragm, means adjacent the horizontal diameter of the diaphragm which supports the diaphragm on said wall, and yielding means between the diaphragm and the wall which also support the diaphragm.

8. In an elastic-fluid turbine, an annular supporting wall, a diaphragm, means pro-

jecting from the diaphragm at opposite ends of its horizontal diameter and resting on said supporting wall, and yielding supporting means between the diaphragm and said wall.

9. In an elastic-fluid turbine, the combination of a casing, a diaphragm formed of a plurality of sections, means fastening said sections together, rigid supporting means between the casing and diaphragm located at opposite ends of the horizontal diameter of the diaphragm, and yielding supporting means between the diaphragm and casing.

10. In an elastic-fluid turbine, a casing formed of upper and lower halves, a diaphragm provided with projections which rest on the upper edge of the lower half of the casing, and yielding positioning means between the periphery of the diaphragm and the casing.

11. In an elastic fluid turbine, a casing, a diaphragm therein of less diameter than said casing, and means supporting said diaphragm on the casing at opposite ends of the horizontal diameter of the diaphragm, said means serving to carry the weight of the diaphragm and position it in spaced relation to said casing.

12. In an elastic fluid turbine, a casing, a diaphragm therein of less diameter than said casing, means supporting said diaphragm on the casing at opposite ends of the horizontal diameter of the diaphragm, and yielding means for centering said diaphragm.

13. In an elastic fluid turbine, an annular supporting wall, a diaphragm, means adjacent the horizontal diameter of the diaphragm which supports the diaphragm on said wall, and yielding means for centering said diaphragm.

14. In an elastic fluid turbine, an annular supporting wall, a diaphragm, and means projecting from the diaphragm at opposite ends of its horizontal diameter and resting on said supporting wall for supporting said diaphragm in spaced relation to said annular wall.

15. In an elastic fluid turbine, an annular supporting wall, a diaphragm, means projecting from the diaphragm at opposite ends of its horizontal diameter and resting on said supporting wall, said means serving to support the diaphragm in spaced relation to said annular wall, and yielding means for centering said diaphragm in a transverse direction.

16. In an elastic fluid turbine, a casing formed of upper and lower halves and a diaphragm provided with projections which engage the lower half of said casing at approximately the horizontal diameter of the diaphragm for supporting said diaphragm in spaced relation to the casing.

17. In an elastic fluid turbine, a casing formed of upper and lower halves, a diaphragm provided with projections which engage the lower half of said casing and serve to support the weight of the diaphragm, and yielding means for positioning the diaphragm in the casing.

18. In an elastic fluid turbine, the combination of a casing, a diaphragm comprising upper and lower halves, means fastening said two halves together, means for supporting said diaphragm on the casing at opposite ends of the horizontal diameter of the diaphragm, and yielding means for centering said diaphragm.

In witness whereof, I have hereunto set my hand this 5th day of December, 1918.
OSCAR JUNGREN.