B. LJUNGSTRÖM.

ELASTIC FLUID TURBINE.

APPLICATION FILED MAR. 15, 1909.

931,323. Patented Aug. 17, 1909.

Fig. 1

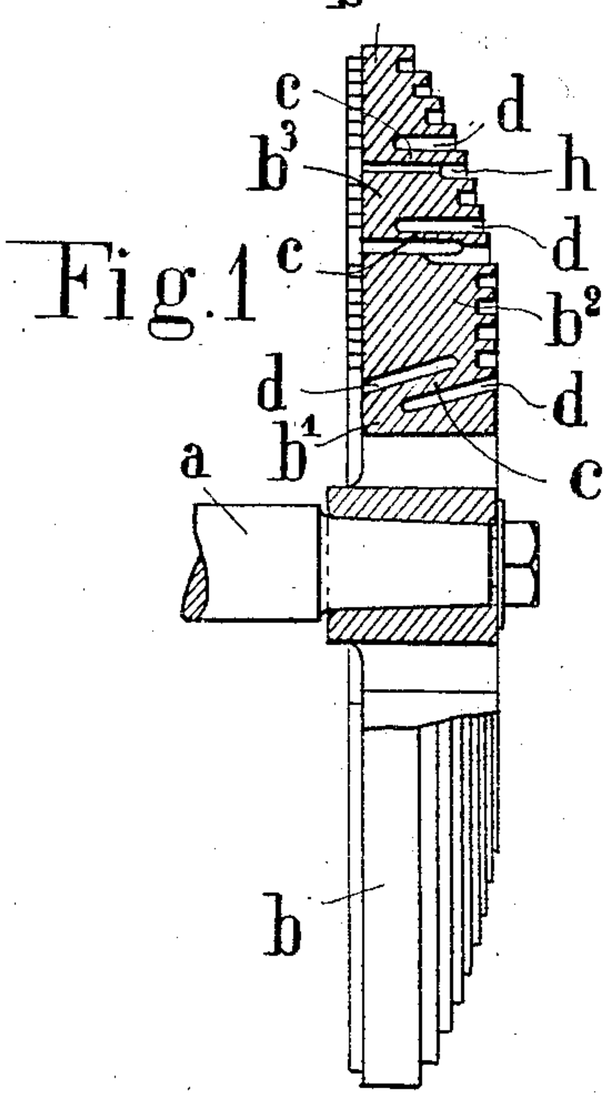


Fig. 2

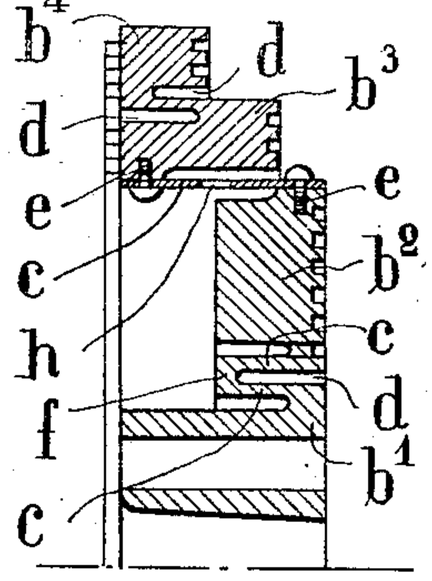
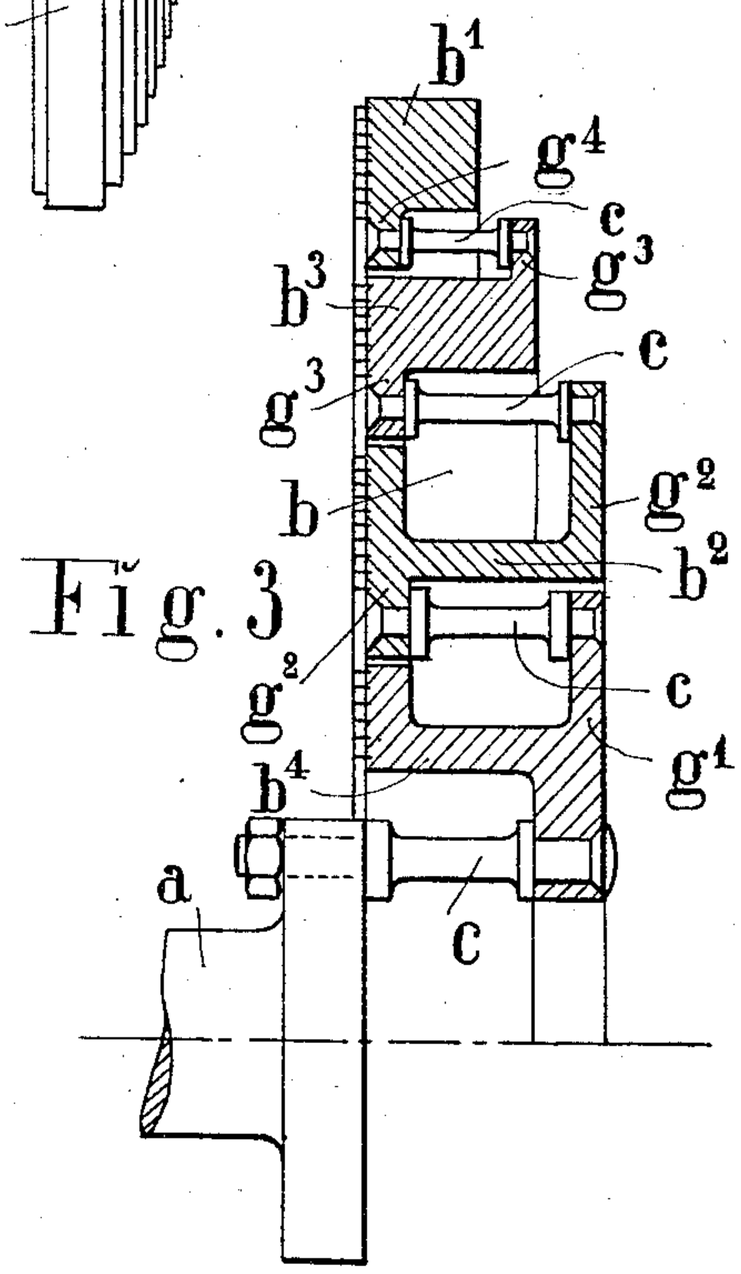


Fig. 3



Witnesses
Richard E. Babcock.
Rose E. Babcock.

Inventor.
Birger Ljungström
by Wm. H. Babcock
Attorney

UNITED STATES PATENT OFFICE.

BIRGER LJUNGSTRÖM, OF STOCKHOLM, SWEDEN, ASSIGNOR TO AKTIEBOLAGET LJUNGSTRÖM ÅNGTURBIN, OF STOCKHOLM, SWEDEN, A COMPANY.

ELASTIC-FLUID TURBINE.

No. 931,323. Specification of Letters Patent. Patented Aug. 17, 1909.

Application filed March 15, 1909. Serial No. 483,508.

To all whom it may concern:

Be it known that I, BIRGER LJUNGSTRÖM, a subject of the King of Sweden, and residing at Grefmagnigatan 18, Stockholm, Sweden, have invented certain new and useful Improvements in Elastic-Fluid Turbines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to turbines of radial or similar type in the driving medium, which expanding in the vane series, passes along the vane disks, heating them to a high temperature at the center and a relatively low temperature at the periphery.

These radial differences cause considerable strains in said disks, and it is the object of this invention to lessen these strains in the best way. Such strains often change the shape of the vane disks, making them buckle: hence my invention is of real importance. In order that the vanes may not come in contact with each other after buckling, such vanes have sometimes been arranged with relatively great interspaces involving considerable leakage. This I do not have.

To avoid such objections and accomplish the reduction of strain above mentioned, my invention consists in the construction and combination of parts, hereinafter more particularly set forth and claimed.

In the accompanying drawings, Figure 1 represents a side elevation, partly in vertical section, of a device embodying my invention. Figs. 2 and 3 represent detail sectional views of the upper halves of similar devices, embodying other forms of said invention.

The shaft of the turbine disk is designated by a and the disk itself by b; the latter being composed of ring-shaped parts b', b^2, b^3 and b^4, having connecting yielding members c. In Fig. 1 these members c, are formed with thin walls left by annular grooves d, such grooves being cut out in pairs from the opposite sides of disk and nearly penetrating through the same. The members c thus have an annular shape and one end of each member c is integral with the next outer ring the other end with the next inner ring, so that both of said rings and the said thin connecting part are in one piece. The said rings b', b^2, b^3 and b^4 successively increase in diameter and are fitted into each other.

In Fig. 2 two forms of connecting members are shown. Between the rings b^2 and b^3 the connecting member c consists of a short cylinder, whose ends, by means of screws or equivalents, are fastened to the rings. Between the rings b' and b^2, the connecting member consists of two integral projecting parts connected at f with the rings.

In Fig. 3 the members c consists of bolts connecting one edge of one ring with the other edge of the adjacent ring. For the purpose of facilitating the connection of rings by means of these bolts, they are provided with flanges g', g^2, g^3 and g^4.

In the above forms, passages h are arranged from one side to the other of the disk, either in connecting members c (Fig. 2) or disk b at the end of said connecting members c (Fig. 1). The ring shaped parts b', b^2, b^3 and b^4 are in all instances connected by bolts, bars, thin cylinders or the like, constituting yielding members which will allow the rings to expand or contract independently of each other and will prevent the heat from passing from one ring to the other.

It will be understood that the vane disks, instead of having a temperature decreasing continuously from the inner to the outer periphery and thereby causing them to buckle on account of the different expansion in the different parts of the disks, will, when constructed as above, have a series of temperatures in the several parts, as the temperature in every ring of the disks will be a certain one, the temperature, however, of the several rings being different. In each ring the temperature will be nearly the same in all parts thereof, for different temperatures will be easily equalized on account of the small radial dimensions of the rings. With respect to the temperature, each ring may be regarded as a separate part, on account of the yielding members being relatively long and small in cross section. In the different rings the strains will be very small on account of the slightness of the differences of temperature and every ring expands independently of the other ones. The strains between the rings thus expanding differently, will be equalized by the thin

and yielding nature of the connecting members. Furthermore a disk constructed as above will, in every part, be of the same temperature, being nearly the same as that of the driving medium passing along said part. The rings, as mentioned above, may be said to be insulated from each other; and their temperature determined by the temperature of the medium, will not be influenced by the temperature of the other rings. Thus the temperature of the driving medium will in no way be changed by the said medium being heated or cooled by the rings, as would be the case with the ordinary construction of disk. Then the outer parts thereof will, of course, have a higher temperature than that of the driving medium at the same point, as the heat will be conducted from the central parts of the disk.

What I claim is:

1. A disk for turbines composed of a series of annular rings, successively increasing in diameter, fitted into each other and provided with interposed yielding parts and means of attachment.

2. A turbine vane disk composed of a series of annular rings, successively increasing in diameter, fitted into each other, having interposed spaces and connected to each other by yielding members and means of attachment therefor, substantially as set forth.

3. In turbines in combination a vane disk composed of rings, leaving interspaces between them, a thin cylinder in the said interspaces, joined with its one end with the one ring and with its other end with the adjacent ring.

4. In turbines in combination a vane disk composed of rings leaving interspaces between them a thin cylinder in the said interspaces integral with its one end with the one ring and with its other end with the adjacent ring.

5. In turbines in combination a vane disk composed of rings and annular grooves in the vane disk arranged two and two from opposite sides and leaving only a thin cylinder between them, the ends which are integral with the rings.

6. In turbines in combination a vane disk composed of rings leaving interspaces between them a thin cylinder in the said interspaces, joined with its one end with the one ring and with its other end with the adjacent ring, said cylinder being provided with passages.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

BIRGER LJUNGSTRÖM.

Witnesses:
HARRY ALBILUS,
NANNY BOLIN.