B. LJUNGSTRÖM.

STEAM TURBINE.

APPLICATION FILED MAR. 26, 1913.

1,067,356.

Patented July 15, 1913.

2 SHEETS—SHEET 1

Fig. 1.

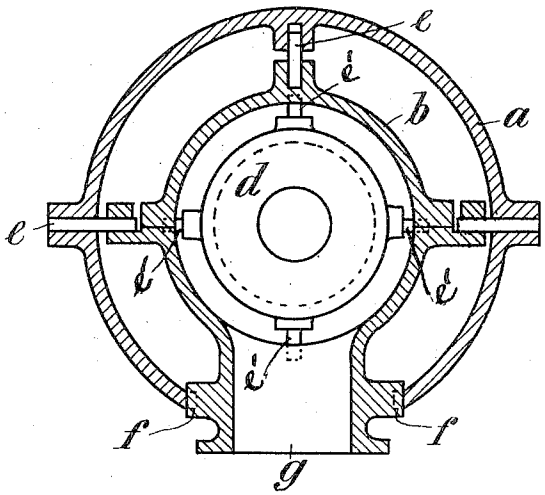
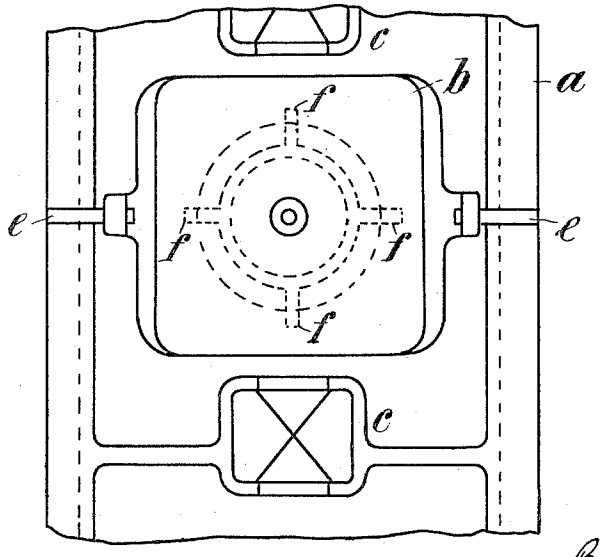


Fig. 2.



WITNESSES:

H. F. Ruelh

G. M. Copenhaver

INVENTOR

Birger Ljungström

BY

Wm. H. Babcock & Son

ATTORNEYS

B. LJUNGSTRÖM.

STEAM TURBINE.

APPLICATION FILED MAR. 26, 1913.

1,067,356.

Patented July 15, 1913.

2 SHEETS—SHEET 2.

Fig. 3.

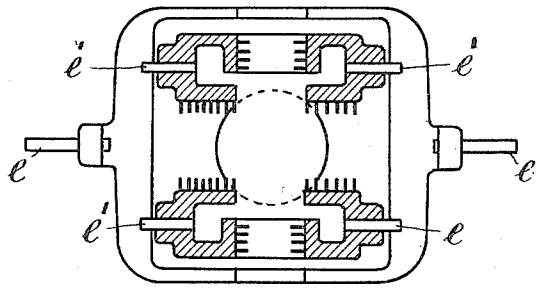


Fig. 4.

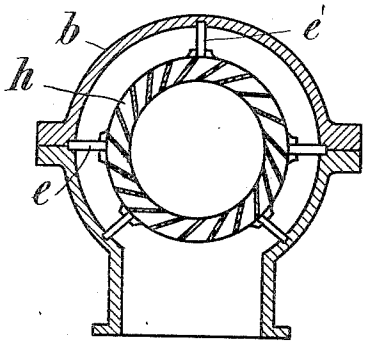
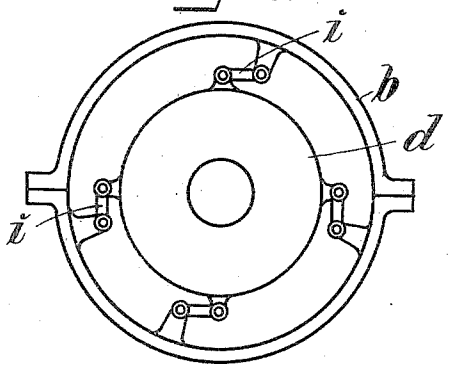


Fig. 5.



WITNESSES:

H. F. Arnold

Geo. M. Coplansaver.

INVENTOR

Birger Ljungström

BY

Wm. H. Babcock & Son

ATTORNEYS

UNITED STATES PATENT OFFICE.

BIRGER LJUNGSTRÖM, OF STOCKHOLM, SWEDEN, ASSIGNOR TO AKTIEBOLAGET LJUNGSTRÖMS ANGTURBIN, OF LILJEHOLMEN, SWEDEN.

STEAM-TURBINE.

1,067,356. Specification of Letters Patent. Patented July 15, 1913.

Application filed March 26, 1913. Serial No. 756,879.

To all whom it may concern:

Be it known that I, BIRGER LJUNGSTRÖM, a subject of the King of Sweden, and a citizen of Sweden, residing at 18 Grefmagnigatan, Stockholm, in the Kingdom of Sweden, have invented certain new and useful Improvements in Steam-Turbines, of which the following is a specification.

In steam turbines, especially radial turbines, where the steam is admitted through chambers, arranged in the turbine casing, laterally to the rotating disks, or in radial steam turbines, where the turbine casing is arranged within a mantle, there arises a disadvantage, consisting in the chambers, the turbine casing and the mantle having respectively different temperatures during operation, causing dangerous strains in the said parts at the starting and during the operation of the turbine. Such strains may even cause a displacement of the chambers and the turbine casing, or between the turbine casing and the surrounding mantle with respect to their relative positions, whereby the action of the tightening parts is impaired.

The present invention relates to a device, which has for its object to avoid the said disadvantage. According to the invention this is attained by the chambers being provided within the turbine casing and the turbine casing being provided within the mantle with radial guides in such a way, that a free radial expansion of the chambers with respect to the turbine casing is allowed. This solution of the problem can be effected in different ways. It is preferred, however, to combine the two parts to be connected by means of devices, which are radially movable in the one or other of the connected parts or in both, or which are pivotally or by means of links connected with these parts.

On the accompanying drawings some embodiments of the invention are shown.

Figure 1 represents a longitudinal vertical section of an embodiment of my invention, approximately in a central plane parallel to the sides of the steam chambers; Fig. 2, a plan view of the same on a larger scale, the upper part of the mantle being omitted and the lower part broken away; Fig. 3, a plan view of the turbine-casing without its upper section and without the mantle, the two steam chambers being sectioned on approximately the horizontal plane of their centers; Fig. 4, a vertical section through a diffuser having this invention applied thereto, the casing and intervening guides being shown as in Figs. 1 and 3; and Fig. 5 represents in side elevation a modification using a different form of guide between the turbine-casing and a steam chamber or diffuser contained therein.

The mantle *a* and turbine-casing *b* within the same are each in two separable sections, upper and lower. The bearings *c* are integral.

It will be observed that the sectional view shown in Fig. 1 necessarily cuts off one of the two steam chambers; consequently only the other steam chamber appears therein, with its guide *e'*, with the mantle *a*. In the turbine casing *b* the two parallel steam chambers *d* are inserted. The turbine shafts, which rotate in opposite directions, and the movable parts of the turbine are not shown. It is clear, that during the operation of the turbine the chambers *d* become heated approximately to the temperature of the high pressure steam, while the turbine casing will get about the same temperature as the exhaust steam. The mantle *a*, which is not surrounded by the steam, is heated to the lowest temperature. As the bearings *c* are secured in the mantle *a*, it is of course of great importance, that the turbine casing *b* and the chambers *d* maintain their central position with respect to these bearings *c* and to the mantle *a*. To insure this maintenance of proper position the mantle *a* and casing *b* are provided at corresponding points of their opposed faces with recesses which receive the ends of short guide-rods or guide-bars *e*, which connect the said mantle and casing together and hold them in proper positions, said guides being radially movable in said recesses with respect to the said mantle or casing or both and permitting the free radial expansion of the said casing without loss of its concentric position. In like manner, similar radial guides *e'* are interposed between each of the two steam-chambers and the said casing, fitting into recesses at each end as above explained and permitting the radial expansion of said chambers without loss of position or dislodging any part. In order that the exhaust tube *g* also may be permitted to expand freely such adial

guides *f* are arranged between *g* and *a*. According to Fig. 4 a diffuser *h* is secured in the turbine casing in the same way and provided with the guides *e'* set into recesses of said diffuser and casing and permitting radial expansion of the former without displacement.

The modification illustrated in Fig. 5 substitutes pivoted links *i* for guides *e'* above described, each of these links being pivoted at its ends to lugs on the periphery of a steam chamber or diffuser and the inner face of the turbine-casing respectively. These links obviously permit the expansion without displacement of the steam chamber or other parts to which their inner ends are attached. The guides *e*, *e'*, *f* or *i* are arranged at intervals of ninety degrees around the common center of the mantle casing and steam chambers, two of the guides *e* being located in the meeting line or joint of the two separable sections of the mantle and the corresponding two guides *e'* of each steam chamber *d* being similarly located in the meeting line or joint of the two sections of said casing. This construction and arrangement of parts permits the upper section or cover of the mantle and that of the casing to be removed without injury to the guides or other parts or any inconvenience. However, especially when the guides are made detachable or removable, three, five or more guiding organs can also be employed.

Having now described my invention what I claim and desire to protect by Letters Patent is:—

1. Two concentric fixed parts of a turbine structure having opposed recesses, in combination with guides fitting in said recesses and movable with respect to one of said parts in order that the inner part may expand without its displacement.

2. A turbine-casing and mantle inclosing the same, having opposed recesses, which receive radial guides, permitting the expansion of said casing without its displacement.

3. A turbine-casing and steam chamber inclosed therein having opposing recesses which receive radial guides permitting the expansion of the steam chamber without its displacement.

4. In combination with a mantle consisting of two separable sections and an inclosed turbine-casing, guides arranged between said parts at intervals of ninety degrees and yieldingly connecting them, two of said guides being arranged in the joint of the said two sections in order that one of said sections may be readily removed.

5. In combination with a turbine-casing in two separable sections and a concentric part within the same, radial intervening guides arranged at intervals of ninety degrees and making connection between said part and said casing, two of these guides being arranged in the joint of said casing sections to permit the removal of one of said sections substantially as described.

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

BIRGER LJUNGSTRÖM.

Witnesses:
GEO. C. PIERCE,
IRMA GRAAF.