B. LJUNGSTRÖM.

RADIAL TURBINE.

APPLICATION FILED MAR. 8, 1911.

1,014,659. Patented Jan. 16, 1912.

3 SHEETS—SHEET 1.

Fig. 1

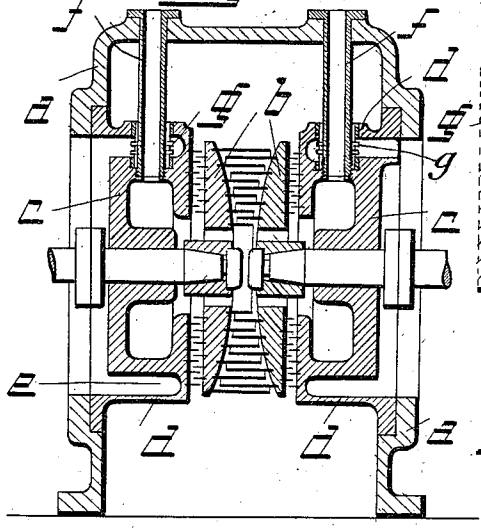


Fig. 2

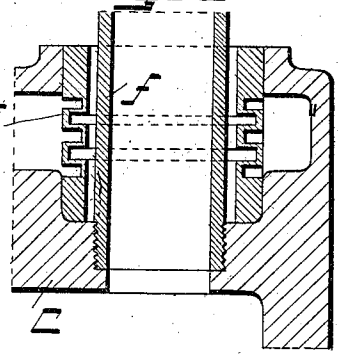


Fig. 3

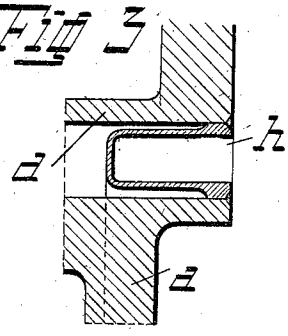


Fig. 5

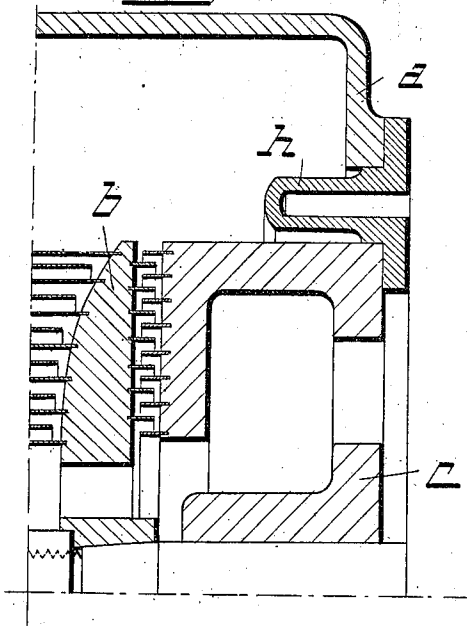


Fig. 4

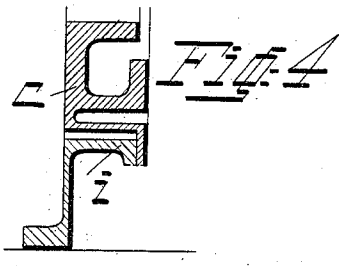
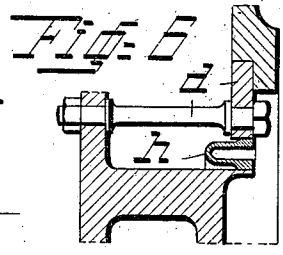


Fig. 6



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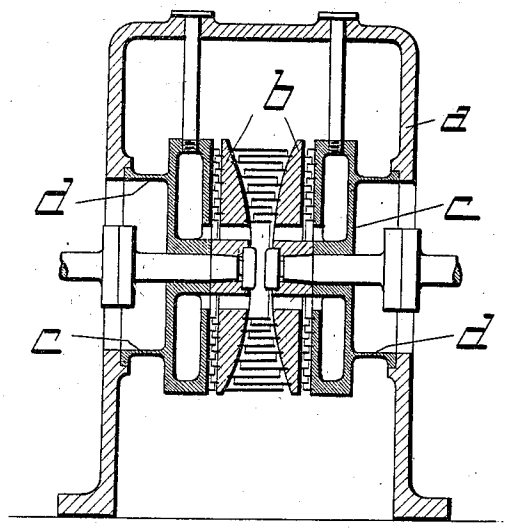
2 SHEETS—SHEET 2.

Fig. 7



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RADIAL TURBINE.

1,014,659. Specification of Letters Patent. Patented Jan. 16, 1912.

Application filed March 8, 1911. Serial No. 613,054.

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 Stockholm, in the Kingdom of Sweden, have invented certain new and useful Improvements in Radial Steam or Gas 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.

The present invention relates to a device in radial steam or gas turbines, in which a vane carrying disk is arranged opposite to a disk inserted into the turbine casing and rigidly connected with same. In such turbines the turbine casing is subjected to the temperature of the exhaust-steam, said temperature being low, on account of the gradual expansion of the driving medium, while the central parts of the fixed disk are subjected to the high temperature of the admission steam. On account of this difference in temperature there will arise considerable strains in the turbine casing inadmissible for a good turbine, which might cause a movement of the disk out of its central position.

The present invention has for its object to remove these strains, although there is allowed a free expansion of the heated disk, without the disk being moved out of its concentric central position on account of this expansion. I attain this object as hereinafter explained by means of an annular radially yielding connecting device which secures the disk in the turbine casing in such manner that said casing guides said disk. The said device may also prevent the heat of the exhaust steam from passing from the disk to said casing.

The invention is illustrated in the annexed drawings.

Figure 1 shows in longitudinal section a radial turbine according to the invention. Figs. 2 and 3 show details on a greater scale and Figs. 4–7 show different embodiments of the axial connection.

a designates the turbine casing and *b* the turbine disks rotating in opposite directions. Opposite to the said turbine disks fixed disks *c* are provided in the turbine casing, said disks *c* being arranged so as to be able to expand freely in radial direction, without thereby transferring any strains to the turbine casing or leaving their central position. For this purpose the inner edges of the disks *c* are connected, according to the form of my invention shown, to the turbine casing by means of concentric annular connections *d*, which are suitably formed by making annular grooves *e* in the outer edge of the disks *c*.

The disk and the turbine casing may, of course, be made in one piece, the grooves *e* being thereby placed in the turbine casing.

If the channels for the admission steam pass radially through the connections *d*, the intervals between the inlet channels and the corresponding openings in the connections are to be packed against the outer air in such a way that the free expansion of the disk can take place. This may be effected by a corrugated tube *g*, Fig. 2, surrounding the inlet pipe *f*, or a resilient packing piece *h* of U-form in cross section inserted in the recess of connection *d*. This connection may be secured to the disk by means of screws or rivets or by means of bending or folding, or it may be welded as shown in Fig. 3.

Fig. 4 shows a modification, in which the connection *d* is arranged between the outer edge of the disk *c* and the inwardly extending flange *i* of the turbine casing.

According to Fig. 5 the axial connection consists of a ring being U-shaped in cross section, the edges of said ring being connected to the turbine casing and the disk.

According to Fig. 6 the axial connection consists of bolts arranged between the turbine casing and the disk. The U-shaped ring *h* serves as a tightening between the inner space of the turbine and the outer air.

It is obvious that the axial connections also may be of a conical shape. In the embodiments shown the connections are secured to the edge of the disk. They may, however, also be connected to the disk in any other way, for instance to its lateral wall. Fig. 7 shows such an embodiment especially adapted for double rotating turbines. The connections are integral with the disks and are removably connected to the turbine casing.

What I claim is:

1. In a turbine of the radial type a non-rotating disk inserted in the turbine casing and connected with the turbine casing by means of axial connections yielding in the radial direction.

2. In a turbine of the radial type a non-

rotating disk inserted in the turbine casing and connected with the turbine casing by means of axial connections yielding in the radial direction and having a cylindrical shape.

3. In a turbine of the radial type a non-rotating disk inserted in the turbine casing and connected with the turbine casing by means of axial connections yielding in the radial direction and having in section the shape of a U.

4. In a turbine of the radial type a non-rotating disk inserted in the turbine casing and connected with the turbine casing by means of axial connections yielding in the radial direction and having in section the shape of a recumbent U, the one end thereof being united with the turbine casing, the other one with the disk.

5. In a turbine of the radial type a non-rotating disk inserted in the turbine casing and connected with the turbine casing by means of axial connections yielding in the radial direction, the one end of the connection being united with the lateral wall of the turbine casing, the other one with the inner edge of the disk.

6. In a turbine of the radial type, in combination a non-rotating disk inserted in the turbine casing, an axially disposed connection between the said disk and the said casing, said connection being yielding in the axial direction, an inlet channel for the steam passing through the connection and a yielding packing between the connection and the disk.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

BIRGER LJUNGSTRÖM.

Witnesses:
HARRY ALBIHN,
HEDING MELINDER.