To all whom it may concern:

Be it known that I, ALFRED BARBEZAT, engineer, a subject of the Republic of Switzerland, and resident of Lesquin, near Lille, Nord, Republic of France, have invented a new and useful Automatic Device to Balance Axial Thrust in Steam-Turbines, of which the following is a specification.

My invention relates to a device to automatically balance axial thrust in steam turbines in which said thrust is eliminated by the combined action of steam, admitted behind the rear bottom of the turbine drum, with one or more packing rings which participate in the axial displacement of the drum and increase or diminish the section through which said steam is admitted behind the bottom of the drum; therefore increasing or diminishing the pressure on said bottom proportionally to the increase or decrease of axial thrust.

The invention is illustrated by way of example in the accompanying drawings in which—

Figure 1 is a sectional view of a construction of a known device. Fig. 2 is a sectional view of the device according to the invention. Fig. 3 is a diagram of a development of the cross section of Fig. 2.

In Fig. 1 of the drawing, which is a particular construction of a known form of device, A B designates that part of the turbine drum which is provided with moving blades. As known, steam, when passing through different stages of blades, relaxes progressively from the boiler's pressure to that of the condenser, thus causing an axial thrust in the direction of the arrow C—D.

To balance this axial thrust a set of packing rings is provided in E and a certain pressure caused to act on the rear G of the drum. This pressure is regulated by throttling more or less the annular space m through which steam is admitted to act on the rear side G of the drum. To this purpose there are provided one or more packing rings R, conveniently disposed and which, for example, as in the drawing, are fixed on to the shaft of the drum in order to participate in its movement due to the axial thrust. The steam which is to act against the rear of the drum is admitted into the space N behind the packing rings R (of which one only is shown in the drawing) and whence it passes through the annular space m whose section varies according to the relative position of R and of the part n of the casing. The steam under pressure is led into the space N by means of any external pipe L.

The above described device works as follows: If, owing to the axial thrust of the drum, said drum is shifted in the direction C—D shown by the arrow in the drawing, the packing-rings R fixed on to the turbine shaft are shifted in the same direction, thus causing an immediate increase of the section of the annular passage m and therefore also an increase of the pressure on the rear G of the turbine drum; this pressure is opposite in direction to that shown by the arrow C—D and increases until it equals the latter. Should the drum, for any reason, be shifted in the opposite direction to that indicated by the arrow C—D, the section of the annular space m will decrease according to the displacement of the drum and therefore practically no more steam will be admitted behind the rear bottom of the drum, thus allowing the low-pressure steam in B to pass through the packing rings E and enter the space behind G; the counter-pressure thus diminishes and the axial thrust whose normal direction is that of the arrow C—D shifts the drum back toward the right.

Such a construction would in practice show a great disadvantage, in fact, the slightest axial displacement of the rotating part of the turbine causing great variation of the balancing pressure of the rear of the drum G, the rotor would oscillate axially and therefore the moving part R would press against the fixed part S of the casing and owing to this friction these parts should soon wear out and an accurate balancing of the axial thrust become impossible.

The construction according to the invention which is shown in Fig. 2 obviates entirely the above stated disadvantage. A collar-ring R with a screw like or inclined face is keyed on the motor shaft and turns in front of a fixed circular part S, whose position can be regulated at will by the provision on the said fixed part S of a screw 105 thread. When, owing to the axial thrust of the drum, the ring R is shifted in the one or the other direction, the steam is throttled.
as necessary by the collar-ring R closing up more or less the inclined opening \( m \) without both parts R and S touching each other in any case. The working of this device, together with a constant throttling device shown at \( a \), eliminates totally the axial oscillations of the rotor.

The diagram Fig. 3 is the development of the cross section; in said diagram X is the section of passage of the steam and \( s \) the total displacement of the collar-ring R in relation to the fixed part S. The line T U instead of being oblique, could be broken or curved in any manner.

The steam to balance the axial thrust is led through I to G and its throttling in \( a \), between I and G, slackens slightly the balancing effect on G and eliminates totally the axial oscillations of the rotor. Owing to the above described device, thrust bearings can be dispensed with. The axial position of the rotor with respect to the turbine casing can be regulated by means of the part S secured by means of the nut M.

Having thus described and ascertained the nature of my invention and in what manner it has to be performed, what I claim is:

In a steam turbine, an automatic device to balance the axial thrust comprising, in combination, an automatically working throttling device located behind the rear of the turbine-drum and consisting of a rotating collar-ring with a screw-like or inclined face keyed on the turbine shaft and of a fixed circular part of smaller external diameter than the inner diameter of the collar-ring, means for regulating the axial distance between said fixed part and the rotating collar-ring, means for admitting steam under pressure in the annular space between the fixed part and the rotating collar-ring of said automatic throttling device and a constant steam throttling device located between the rear of the turbine-drum, and the automatic throttling device all for the purpose specified and substantially as set forth.

ALFRED BARBEZAT.

Witnesses:

EDOUARD LUGNEL
CHRISTOPHER J. KING.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."