No. 837,850. PATENTED DEC. 4, 1906.

O. KOLB.

LABYRINTHIAN TIGHTENING DEVICE.

APPLICATION FILED AUG. 3, 1905.

Fig. 1

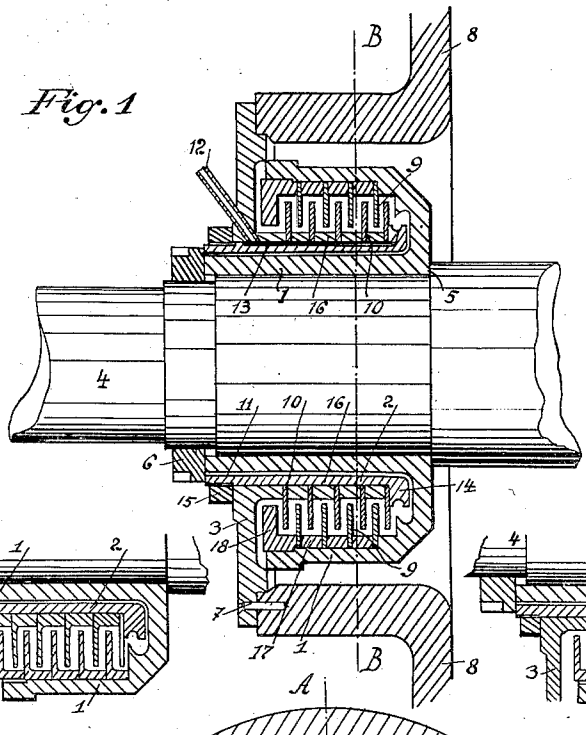


Fig. 3

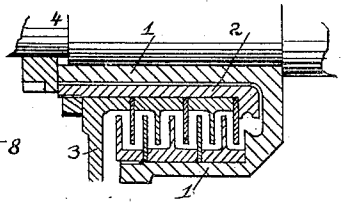


Fig. 4.

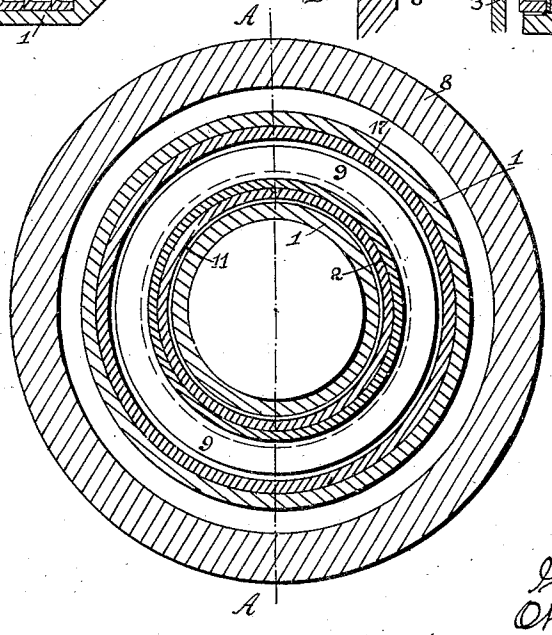


Fig. 2.

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OTTO KOLB, OF KARLSRUHE, GERMANY.

LABYRINTHIAN TIGHTENING DEVICE.

No. 837,850. Specification of Letters Patent. Patented Dec. 4, 1906.

Original application filed May 8, 1905, Serial No. 259,430. Divided and this application filed August 3, 1905. Serial No. 272,556.

To all whom it may concern:

Be it known that I, OTTO KOLB, engineer, a subject of the German Emperor, and a resident of Karlsruhe, Germany, have invented certain new and useful Improvements in Labyrinthian Tightening Devices, of which the following is a specification.

In elastic-fluid turbines the objectionable stuffing-boxes and packings have already been replaced by labyrinthian tightening devices for reducing the friction between the turbine-shafts and the respective parts of the casings, a suitable liquid being introduced into the annular chambers of the labyrinthian tightening devices and pressed by the centrifugal force against the external walls of the chambers, so as to hermetically divide the interiors of the casings from the ambient air. Such known labyrinthian tightening devices present, however, the drawback that during the work of the elastic-fluid turbines the liquid is very apt to escape from the annular chambers, and thus to render the tightening illusory and inactive.

My invention relates to improvements in such labyrinthian tightening devices whereby the said drawback is avoided, and also their manufacture and composition is facilitated and rendered easy when so desired.

The objects of my improvement are, first, to arrange the annular inwardly-open chambers on the rotary member instead of on the stationary member, as hitherto, and to arrange the annular outwardly-open chambers on the stationary member, and, second, to preferably construct the labyrinthian tightening device with annular disks and distance-pieces or their equivalents, so as to avoid the division of the one member in a longitudinal plane of the turbine-shaft. I attain these objects by the construction illustrated in the accompanyings drawings, in which—

Figure 1 is a vertical longitudinal section through a labyrinthian tightening device on the line A A in Fig. 2. Fig. 2 is a cross-section through the same on the line B B in Fig. 1, and Figs. 3 and 4 are details which will be referred to later on.

Similar characters of reference refer to similar parts throughout the several views.

The labyrinthian tightening device comprises an annular box 1 open on one side and a disk 2 3. The box 1 is secured on the shaft 4 between a shoulder 5 (or its equivalent) and a nut 6. The disk 2 3 is fastened with screws 7 on the respective part 8 of the casing. The box 1 is in its cavity provided with a plurality of annular partition-walls 9 9, whereby a plurality of inwardly-open chambers is formed. In a similar manner the disk 2 3 is provided with a plurality of annular partition-walls 10 10, which alternate with the other ones, 9 9, and form between them chambers which are outwardly open. It will be seen that the partition-walls 9 9 in the box 1 partake in the revolution of the turbine-shaft 4, while the other partition-walls 10 10 are stationary. For reducing the friction between the shaft 4 and the disk 2 3 an annular clearance 11 is left between the internal wall of the box 1 and the part 2 of the disk 2 3, while the nut 6 should just touch the part 3 without producing any pressure. Through a tube 12 in the disk 2 3 and a channel 13 a suitable liquid—such as water, oil, glycerin, analin, or the like—is introduced, (be it by means of a pump or any known dropping a lubricator,) so that during the rotation of the shaft 4 with the turbine wheel or wheels (not shown) this liquid partakes in the revolution and partly fills the chambers of the box 1 between the several partition-walls 9 10 9 10, as is clearly shown in Figs. 1 and 2. By means of this annular layer of liquid (which shape is due to its centrifugal force) the interior of the casing is hermetically divided from the ambient air. According to there being an overpressure or a vacuum within the casing, the annular layers of the liquid in the several chambers will adjust themselves, their depth in the radial direction varying from one side to the other side in proportion to the difference of the pressures within and without the turbine and to the number of the chambers. For a small difference of pressures a single chamber might suffice. In any case, even for a high difference of pressures, every stuffing-box and packing is rendered superfluous by this labyrinthian tightening device.

As will be seen, my improved labyrinthian tightening device differs from similar known labyrinthian tightening devices in that with the latter the member with the outwardly-open chambers (such as 2 10 10 in Fig. 1) is made to rotate, whereas with my device it is the other member with the inwardly-open chambers—that is, the box 1 with the par-

tition-walls 9 9—which is made to rotate. Thereby the important advantage is obtained that the tightening liquid is securely held in the chambers of the box 1 and prevented from flowing off, as this is the case with the known devices by reason of the friction of the rotating partition-walls. The box 1 may be made in one piece with its partition-walls 9 9, the same as the disk 2 3 with its partition-walls 10 10, in which case, however, the box 1 requires to be made in halves to render possible the composition of the device.

To facilitate the manufacture and the composition of the labyrinthian tightening device, I prefer to make all the several partition-walls separately of sheet metal, as shown. Then the disk 3 is made separately, also the sleeve 2, into which the channel 13 is cut. The several partition-disks 10 10 are secured on the sleeve 2 between the collar 14 and the nave of the disk 3 by means of a nut 15 and with the aid of annular distance-pieces 16 16. In a similar manner the several partition-disks 9 9 in the box 1 are with the aid of annular distance-pieces 17 17 secured between a shoulder and a nut 18, screwed into the box and cast in one piece with a partition-wall. Then the composition of the device can be effected in a manner which is obvious to any one versed in the art to which this invention appertains. Where so preferred, of course each of the several partition-disks 9 9 10 10 may be made in one piece with one adjoining distance-piece 17 or 16, respectively, or they may be made alternately in one piece with two adjoining distance-pieces 17 or 16. In the first case annular disks of an L cross-section will be produced, as is shown at Fig 3, and in the second case annular disks of a ⊥ cross-section, as in Fig. 4, will be produced, which alternate with smooth disks.

The labyrinthian tightening device may be varied without deviating from the spirit of my invention.

The subject-matter of this application is set forth, but not claimed, in my application, Serial No. 259,430, filed May 8, 1905, of which this is a division.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a labyrinthian tightening device for elastic-fluid turbines, the combination with a member adapted to rotate with the turbine-shaft and provided with a plurality of annular inwardly-projecting partition-walls, of another member fastened on a stationary part of the casing and provided with a plurality of annular outwardly-projecting partition-walls which engage between the partition-walls of said first member and therewith form chambers for a tightening liquid.

2. In a labyrinthian tightening device for elastic-fluid turbines, the combination with a turbine-shaft, of an annular box open on one side and adapted to be fastened on said turbine-shaft, it being divisible in a longitudinal plane of this shaft and being provided on the inside of its external wall with a plurality of annular inwardly-projecting partition-walls, and a disk adapted to be fastened on a part of the stationary casing on the open side of said annular box and having a sleeve which surrounds the internal wall of said annular box and is provided with a plurality of annular outwardly-projecting partition-walls, said plurality of annular inwardly-projecting partition-walls alternating with said plurality of annular outwardly-projecting partition-walls and forming therewith chambers for a tightening liquid.

3. In a labyrinthian tightening device for elastic-fluid turbines, the combination with a turbine-shaft, of an annular box open on one side and adapted to be fastened on said turbine-shaft, a disk adapted to be fastened on a part of the stationary casing on the open side of said annular box, a sleeve surrounding the internal wall of said annular box and mounted in said disk to longitudinally move and provided at the inner end with a collar, a plurality of annular distance-pieces with annular outwardly-projecting partition-walls loose on said sleeve between its collar and the nave of said disk, a nut on the external end of said sleeve, a locking-nut screwed into the end of the external wall of said annular box and made in one piece with an inwardly-projecting partition-wall, and a plurality of annular distance-pieces with annular inwardly-projecting partition-walls loose within the external wall of said annular box between a shoulder and said locking-nut, said inwardly-projecting partition-walls alternating with said outwardly-projecting partition-walls and forming therewith chambers for a tightening liquid.

4. In a labyrinthian tightening device for elastic-fluid turbines, the combination with a turbine-shaft, of an annular box open on one side and adapted to be fastened on said turbine-shaft, a disk adapted to be fastened on a part of the stationary casing on the open side of said annular box, a sleeve surrounding the internal wall of said annular box and mounted in said disk to longitudinally move and provided at the inner end with a collar, a plurality of annular distance-pieces loose on said sleeve, a plurality of annular disks on said sleeve between its collar, said plurality of annular distance-pieces and the nave of said disk so as to form outwardly-projecting partition-walls, a nut on the external end of said sleeve, a locking-nut screwed into the end of the external wall of said annular box and made in one piece with an inwardly-projecting partition-wall, a plurality of larger annular distance-pieces loose within the external wall of said annular box, and a plurality of

annular disks between a shoulder of the external wall of said annular box, said plurality of larger annular distance-pieces and said locking-nut, so as to form inwardly-projecting partition-walls, which alternate with the outwardly-projecting partition-walls and form therewith chambers for a tightening liquid.

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

OTTO KOLB.

Witnesses:
JOSEF WOLFF,
ROBERT GUNDEL.