

1,233,347.

T. HALL.
PACKING.
APPLICATION FILED JUNE 17, 1915.

Patented July 17, 1917.
2 SHEETS—SHEET 1.

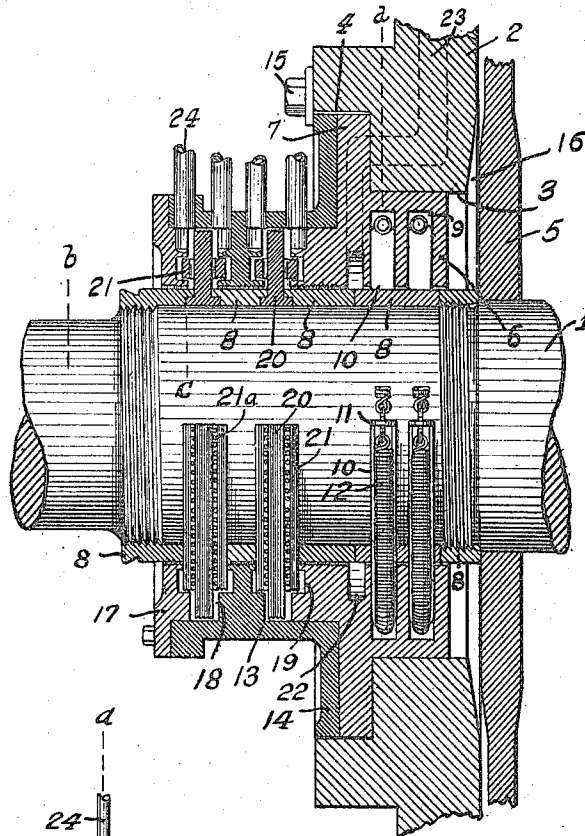


Fig. 1

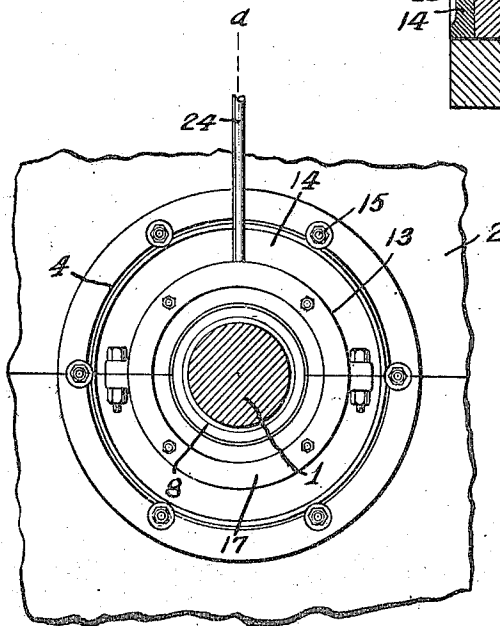


Fig. 2

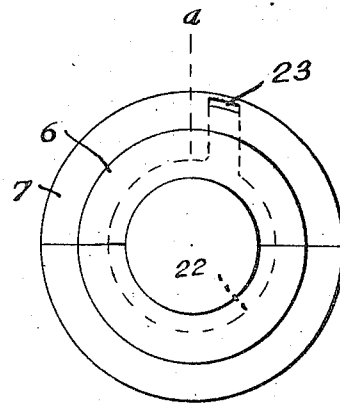


Fig. 3

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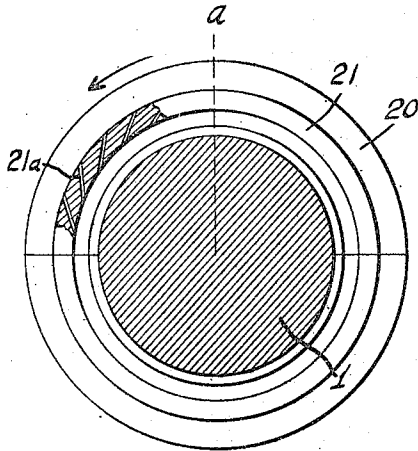


Fig. 4

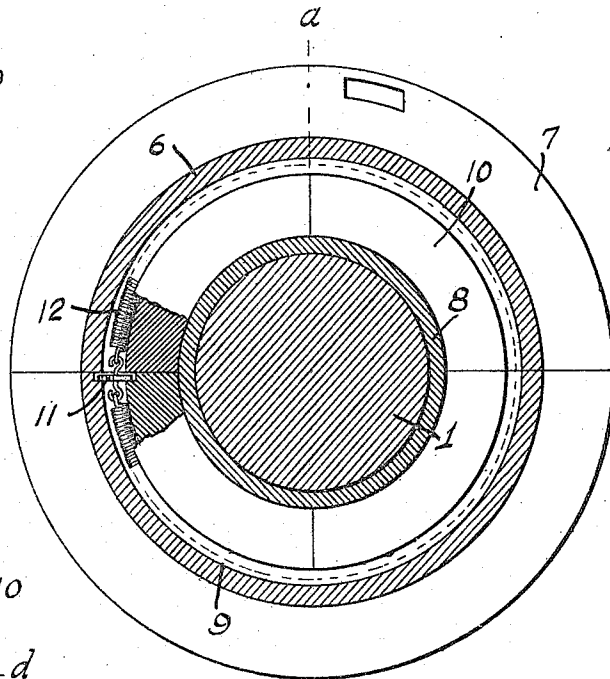


Fig. 5

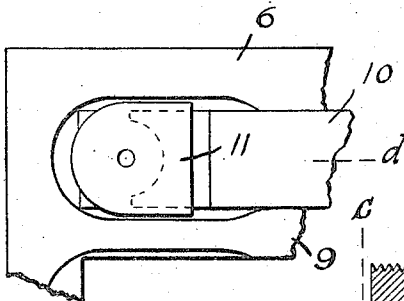


Fig. 6

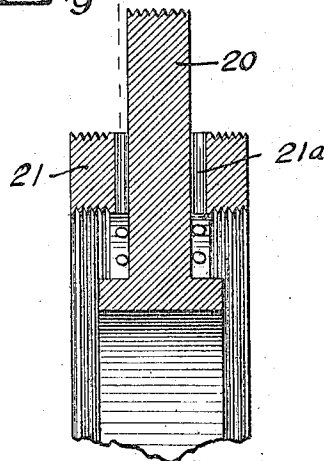


Fig. 7

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UNITED STATES PATENT OFFICE.

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PACKING.

1,233,347.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, THOMAS HALL, a citizen of the United States, residing at Ridgway, Elk county, Pennsylvania, have invented certain new and useful Improvements in Packing, of which the following is a specification.

The present invention pertains to packing designed to prevent or lessen leakage past a rotary running fit and aims particularly at packing designed for use on steam turbines where the shaft passes out through the heads of the turbine casing. In a steam turbine there is a tendency at the high pressure end for steam to leak out of the casing at the point where the head of the casing surrounds the shaft, and at the low pressure end of a turbine where partial vacuum is employed, there is a tendency for air to leak into the casing and break down the vacuum to greater or less extent. My invention is applicable at either end of the casing of a steam turbine.

My invention will be readily understood from the following description taken in connection with the accompanying drawings in which:—

Figure 1 is a vertical diametrical section through the packing, the section being in the plane of line *a* of Figs. 2, 3, 4 and 5:

Fig. 2 an elevation of the outer face of the structure, the shaft appearing in section in the plane of line *b* of Fig. 1:

Fig. 3 an elevation of the inner face of the carbon-case:

Fig. 4 an elevation of a face of one of the impellers mounted on the shaft, portions appearing in vertical section transverse to the shaft in the plane of line *c* of Figs. 1 and 7:

Fig. 5 vertical section of the carbon-case, &c., in the plane of line *d* of Figs. 1 and 6:

Fig. 6 a plan at a portion of one of the joints of the carbon-case: and

Fig. 7 a diametrical section of a portion of one of the impellers, in the plane of line *a* of Fig. 4.

A diversity of scale is employed in the drawings.

In the drawings:—

1, indicates the shaft of a turbine:

2, one of the casing-heads through which the shaft passes, this casing-head to be horizontally divided, as usual:

3, a bore in the casing-head considerably larger than the shaft and concentric with it:

4, a counterbore in the outer face of the casing-head, concentric with the shaft:

5, one of the wheels of the rotor, fast on the shaft:

6, a carbon-case surrounding the shaft and fitting bore 3 in the casing head, this carbon-case being divided along a diametrical line:

7, a flange formed on the outer portion of the carbon-case and fitting the counterbore in the casing-head:

8, rings and nuts, presenting no novelty, surrounding the portion of the shaft projecting through the casing-head, their purpose being to serve as clamps for securing other devices to the shaft and to serve as renewable journal-surfaces on the shaft where likely to be worn by frictional packing:

9, a pair of inwardly open circular recesses in the carbon-casing, the walls of these recesses being parallel with each other:

10, a carbon ring fitting sidewise in each of these recesses, the bore of these rings fitting the shaft or such enlarged renewable portion of it as is represented by the appropriate one of the rings 8, these carbon-rings being formed of segments united on radial lines, the carbon-rings being of less diameter than the recesses 9 which hold them, the peripheries of the rings being in the form of concave grooves:

11, a plate disposed radially in the outer portion of one of the joints of each carbon ring and projecting radially and sidewise therefrom, the side projections of this plate engaging a suitable recess formed in the joint of the carbon-casing:

12, a helical spring, like a spring garter, surrounding each carbon-ring and lying in the peripheral groove thereof and having its ends attached to the plate 11 pertaining to that ring, the illustration showing the ends of the spring as being hooked to hooks, carried by the plate:

13, a diametrically divided, impeller-casing surrounding the shaft outside the casing-head:

14, a flange at the inner end of the impeller-casing, this flange fitting within the counterbore of the casing-head and against the flange of the carbon-casing:

15, screws securing the impeller-casing and carbon-casing to the casing-head:

16, the chamber at the inner face of the casing-head, between the casing-head and the contiguous rotor wheel, this chamber to be taken as typifying a portion of the turbine-casing under pressure or under partial vacuum;

17, a head secured against the outer end of impeller-casing 13, this head forming the outer wall of the impeller-casing;

18, parallel sided grooves formed in the impeller-casing concentrically around the shaft;

19, annular grooves formed in the side walls of grooves 18;

20, impeller-disks secured to the shaft and disposed one within each of grooves 18, the disks being considerably narrower than the grooves and having their peripheries running with fair closeness to the peripheral walls of the grooves;

21, annular wings projecting out from the sides of the impeller-disks into the grooves 19, the lateral surfaces of these wings being at some little distance from the flat faces of the annular grooves, and the inner and outer circular surfaces of the wings fitting fairly close to the inner and outer circular walls of the grooves;

21^a, passages extending outwardly through wings 21;

22, an annular groove in the carbon-case around the shaft and outwardly beyond the carbons;

23, a passage leading from groove 22 and adapted to be connected with some low-pressure point of the turbine; and

24, pipes connected with the grooves 18 in which the impeller-disks run, there being, preferably, a pipe connected at each side of each disk.

The carbon disks are to be fitted nicely together and into their grooves; the plates 11 prevent the rotation of the carbon disks and serve as means for connecting the ends of the springs; the divided character of the carbon case and the impeller case permits of the ready assembling and removal of the parts; ring 8 engaged by the carbons avoids contact between the carbons and the shaft and provides for renewability.

Water is supplied to the grooves 18, and the rotation of the impellers causes the impellers to act as the rotor of a centrifugal pump forcing the water under more or less pressure to the periphery of the grooves and forming a seal at the periphery of the impellers. The broad idea of thus forming a water seal by means of impellers is now new, but in usual constructions the water passages of the impellers have been in their sides, requiring the sides of the impellers to be rather close to the walls of the grooves in which the impellers ran. In the present

case, owing to the fact that the water passages are in the wings of the impellers, the sides of the impeller disks may be at such distance from the sides of the grooves in which the impellers run that provision is made for such endwise adjustment of the shaft as is called for in the operation of the turbine.

In the exemplification the passages 21^a through the wings of the impeller are illustrated as being tangential to a circle struck from the center of the shaft and as being holes extending outwardly through the wings, and as being in complete circumferential series. But none of these specific features are material, as the passages may be radial and need not be in continuous circumferential series, and they need not have outer walls in the wings. The impeller-wing acts as the rotor of a centrifugal pump, working in virtue of centrifugal force of the water, and the motion for the water is not produced by the passages but by the trailing walls of the passages. It is only essential that the side of the impeller-disk shall carry one or more impelling agents working out from the side of the impeller-disk into the annular groove in the side wall of the groove in which the impeller runs, and that the depth of the annular groove and width of the main groove and the thickness of the impeller-disk and the projection of the impelling agent or agents be such as to permit of the axial adjustment of the impeller-disk, without interfering with the action of the impelling agent or agents upon the water at the side of the disk.

Preference is to be given to the completely annular form for the wing.

The groove in which the impeller runs may be provided with an annular groove in one of its sides only and in such case the impeller-disk would be provided with impelling agents upon a single one of its faces, and it is desirable that such a groove and impelling agent should be on the low pressure side of the impeller-disk. The forming of the impeller-disks with wings on each face, and the forming of the main grooves with annular grooves in each of their walls has the advantage of permitting the packing to be applied at either end of a turbine casing.

Provision for a single impeller will take care of a given pressure, but the addition of an impeller will take care of a heavier pressure, and it is obvious that the system of construction is such that the number of impellers employed may be multiplied to any desired extent.

The threading of the circumferential surfaces involved in the packing is preferably to be in screw form in such direction of pitch that they will tend to screw the water toward the side of the system under the

higher pressure, or, in other words, to offer greater resistance to the passing of fluid from the higher pressure to the lower pressure location.

5 A single carbon ring may be employed or there may be two or more of them, the system lending itself to the employment of any desired number of the rings. The fitting of the carbon rings upon the shaft, or upon
10 ring 8 which they engage, prevents in a satisfactory degree the outward leakage of steam, and if leakage occurs to any considerable extent, the leaking steam will find its way to recess 22 and may be conveyed out
15 through channel 23 and admitted to the turbine case at any turbine stage which can utilize the pressure of the leaking steam. The carbon rings are particularly adapted for dealing with particularly high pressures at
20 the inlet end of a turbine and they are not detrimentally affected by the heat of steam at the highest usual pressures. One or more carbon rings without the impeller adjuncts will perform satisfactorily under some conditions, and the impellers without the carbon rings may be employed satisfactorily under other conditions, while under still other conditions the carbon and impeller systems may be employed in conjunction.

30 I claim:—

1. Packing comprising, a rotating body provided with a circular exterior surface, an impeller-case surrounding said surface and having an inwardly open impeller-groove
35 provided in one of its side walls with an annular groove, an impeller-disk carried by said body within said impeller-groove and adapted for sidewise movement therein, an impelling agent projecting from a face of the impeller-disk into said annular groove
40 and adapted, as the impeller-disk turns to rotate the water in the impeller-case and cause it to move outwardly by centrifugal force, said annular groove surrounding the
45 impelling agent on three sides, and a conduit for supplying water to the groove in the impeller-case, combined substantially as set forth.

2. Packing comprising, a rotating body
50 provided with a circular exterior surface, an impeller-case surrounding said surface and having an inwardly open impeller-groove provided in one of its side walls with an annular groove, an impeller-disk carried by
55 said body and disposed within said impeller-groove and adapted for sidewise movement therein, an annular wing formed on a side of the impeller-disk and projecting into said

annular groove, said annular groove surrounding said wing on three sides, water- 60 passages extending outwardly through said wing, and a conduit for supplying water to the impeller-groove, combined substantially as set forth.

3. Packing comprising a rotating body 65 provided with a circular exterior surface, an impeller-case surrounding said surface and having an inwardly-open impeller-groove provided in one of its side walls with an annular groove, an impeller-disk carried by 70 said body and disposed within said impeller-groove and adapted for sidewise movement therein, an impeller-agent formed on a side of the impeller-disk and projecting into said annular groove, said annular groove sur- 75 rounding said impelling-agent on three sides, said impelling-agent provided with helical threads, the pitch of which is toward the direction of higher pressure, and a conduit for supplying water to the impeller- 80 groove.

4. Packing comprising, a rotating body provided with a circular exterior surface, an impeller-case surrounding said surface and provided with a plurality of inwardly 85 open impeller-grooves each of which is provided in one of its side walls with an annular groove, impeller-disks carried by said rotating body and disposed within said impeller-groove and capable of sidewise move- 90 ment in the grooves, impelling agents projecting from the sides of the disks into the annular grooves, each such annular groove surrounding its corresponding impelling-agent on three sides and conduits for sup- 95 plying water to the impeller-grooves, combined substantially as set forth.

5. Packing comprising, a rotating body provided with a circular exterior surface, an impeller-case surrounding said surface and 100 having an inwardly open impeller-groove provided with an annular groove in each of its side walls, an impeller-disk carried by said body and disposed within said impeller-groove and adapted for sidewise movement 105 therein, impelling agents projecting from the sides of the impeller-disk and into said annular grooves, each annular groove surrounding its corresponding impelling-agent on three sides and a conduit for supplying 110 water to the impeller-groove, combined substantially as set forth.

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