No. 819,635. PATENTED MAY 1, 1906.

J. G. CALLAN.

# PACKING FOR ELASTIC FLUID TURBINES.

APPLICATION FILED AUG. 11, 1904.

Fig. 1.

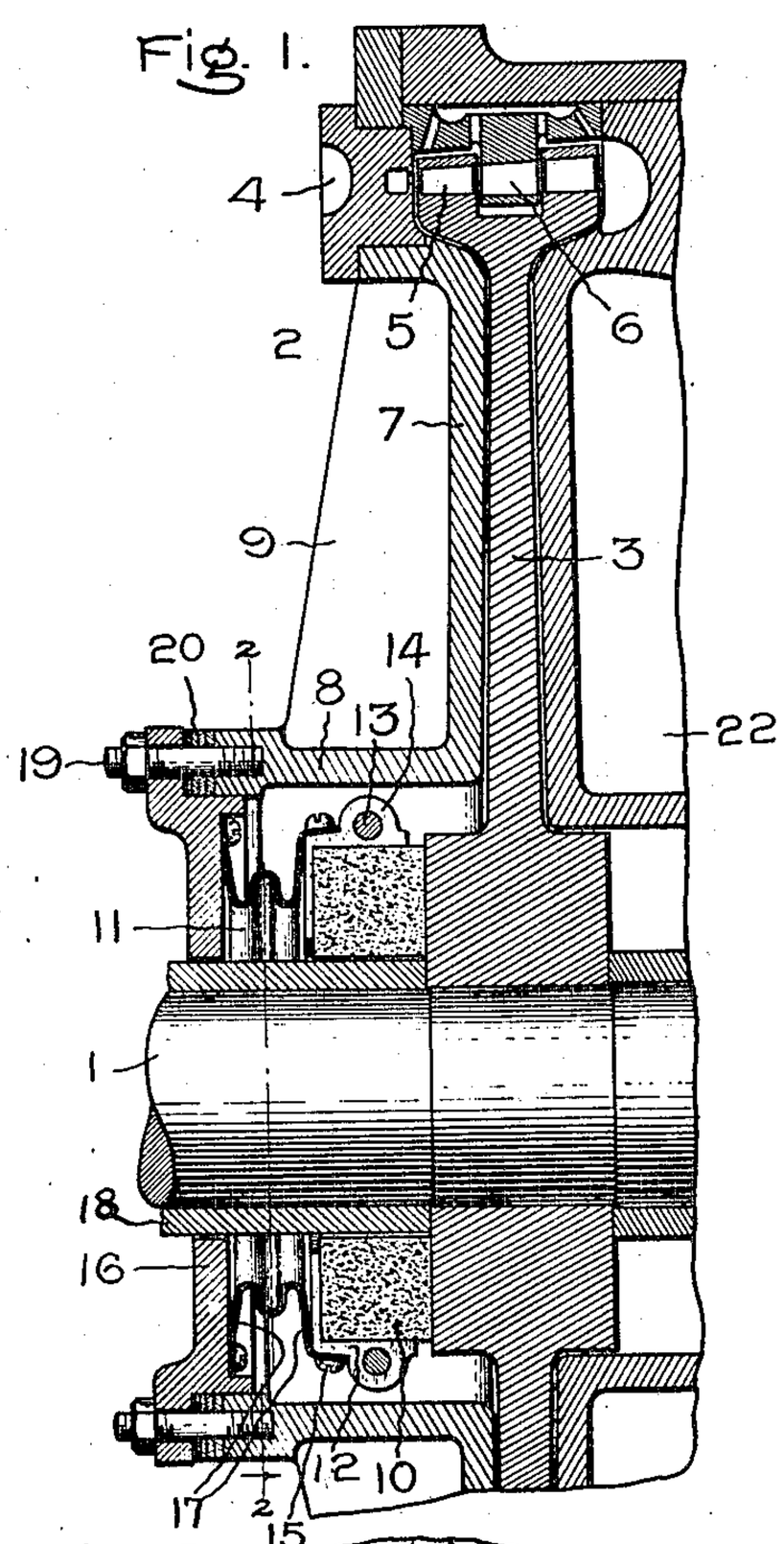



Fig. 3.

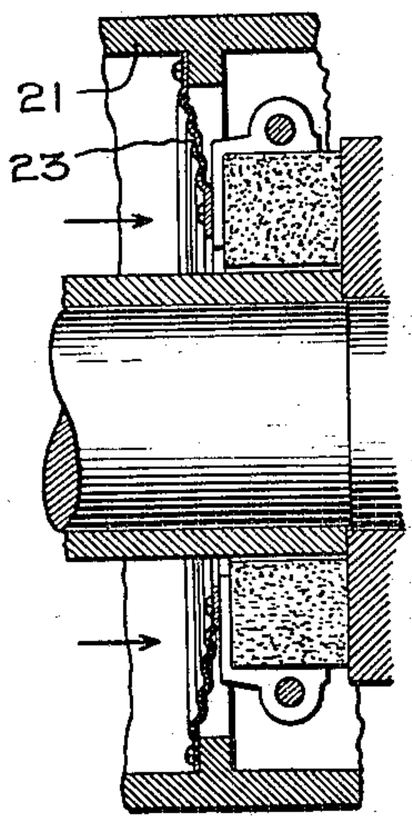
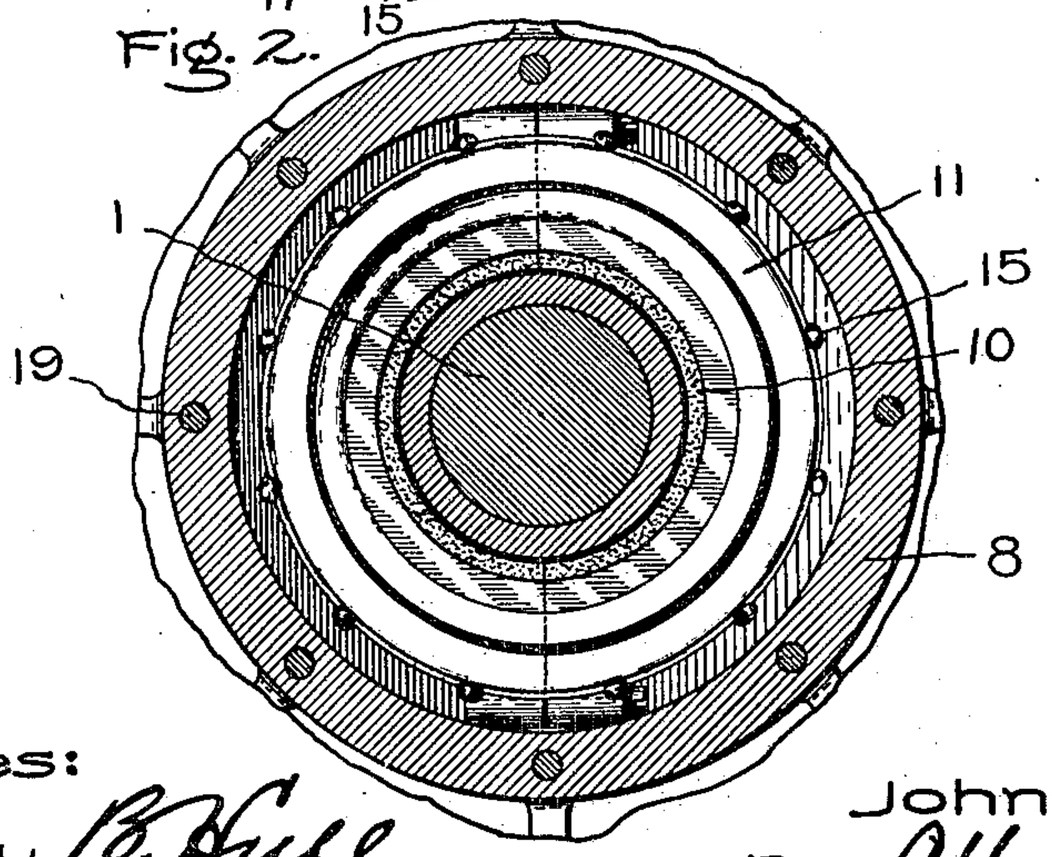



Fig. 2.




Witnesses:
Benjamin B. Hull
Helen Alford

Inventor:
John G. Callan,
By Albert G. Davis
Att'y.

# UNITED STATES PATENT OFFICE.

JOHN G. CALLAN, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## PACKING FOR ELASTIC-FLUID TURBINES.

No. 819,635. Specification of Letters Patent. Patented May 1, 1906.

Application filed August 11, 1904. Serial No. 220,329.

*To all whom it may concern:*

Be it known that I, JOHN G. CALLAN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Packings for Elastic-Fluid Turbines, of which the following is a specification.

My invention relates to packings which are intended for relatively movable parts to prevent the loss of fluid between them, and is designed more especially for elastic-fluid turbines.

In this class of work, where relatively high fluid-pressure is employed and the rotative speed of the parts may be considerable, the packing of the shaft is a matter which requires careful attention; otherwise the efficiency of the machine will be seriously decreased.

An elastic-fluid turbine demands a packing which, in addition to its intended function of preventing leakage, must be long-lived and self-adjusting to compensate for wear. These qualities are essential in view of the attendant expense and labor involved in dismantling a large machine to renew or adjust the parts, besides the more or less serious consequence of disabling the station power plant during repair.

I have devised a packing which overcomes to a large degree the objections previously existing, and I make use of the working pressure of the fluid as the motive element for maintaining the packing in contact with the rotating part.

In its broad aspect my invention covers a packing and means, such as a diaphragm, through which the elastic fluid is caused to act upon the packing to maintain it in effective engagement with a given part, which may be stationary or rotary. It therefore contemplates dispensing with springs or similar devices as the sole means for acting upon the packing. The diaphragm may, however, and preferably does possess a certain degree of resiliency—enough to retain the packing in contact with its seat when the turbine is idle and there is no fluid-pressure upon the diaphragm. Without such an arrangement when the turbine is started fluid might leak through the packing and operate on the back of the diaphragm, thereby tending to neutralize the effect of pressure on the front surface and frustrate the purpose of the diaphragm entirely.

My invention is capable of various embodiments, all of which will be embraced in the appended claims, though I have described and illustrated only two forms which the invention may take.

In the accompanying drawings, Figure 1 is a vertical section of a portion of the turbine, which may be a single or a multi stage turbine. Fig. 2 is a transverse section of the packing-chamber, taken on line 2 2 of Fig. 1; and Fig. 3 is a modified form of a diaphragm for the packing-ring.

Referring to the drawings, 1 represents the turbine-shaft mounted in the casing 2, 3 the bucket-wheel keyed upon the shaft, and 4 the vapor-discharging nozzles of the jet type, which discharge vapor to the wheel and intermediate buckets 5 and 6. The heads 7 of the casing may or may not be formed with a hub or extension 8; but when provided with such it serves as a chamber for receiving the packing. Radial ribs 9 are cast on the head and extend from the hub to the circumference to reinforce the same.

The packing may be used around the shaft between stages to prevent the escape of vapor from one wheel-compartment to another; but the packing is shown as applied to the shaft where the same enters the casing, so as to prevent the loss of fluid therefrom. The packing is composed of a ring of carbon 10, usually made in segments for convenience, which is arranged around the shaft 1 and engages with one side of the bucket-wheel 3, which may be formed into a hub and is carefully finished to reduce friction and to insure a close fit to prevent leakage. The packing is acted upon by a member which urges it in an axial direction, so as to maintain it in contact with the rotating part. This comprises a yielding carrier 11, arranged in the form of a bellows, which is annular in form and is assembled around the shaft of the turbine. In a broad sense the carrier constitutes a diaphragm which exerts a pressure dependent upon the pressure differences to which it is subjected. The carbon is secured in the holder 12, which comprises semi-annular parts that are secured together by bolts 13, engaging in lugs 14 at their ends. The carrier is attached at one end to the holder, as by screws 15, and is similarly attached at the

other end to the gland or removable abutment 16 of the chamber formed by the hub 8. The carrier is or may be corrugated in a direction at right angles to the shaft to give it flexibility and terminates at its ends in side portions 17, between which the fluid-pressure acts and tends to expand the carrier axially.

This construction of the packing insures sufficient rigidity to stand transverse strains and also permits it to expand under the influence of pressure to perform its function of urging the packing into contact with the wheel. The interior diameter of the packing is larger than the shaft or shaft-sleeve 18, so as to prevent frictional engagement therewith. The carrier, in addition to its primary function, serves to center the packing around the shaft and form a fixed connection between the gland and packing which prevents leakage outside the packing and whereby the several parts can be removed as a unit. If arranged horizontally, the diaphragm should possess sufficient resiliency to keep the packing-ring in engagement with the wheel or rotary part when there is no fluid-pressure acting on it, and thus prevent fluid from escaping to the back of the diaphragm when fluid is again supplied, which would tend to oppose the effect of the fluid on the front and also permit leakage around the shaft. When used with a turbine having a vertical shaft, gravity may be depended upon to hold the packing against its seat.

The gland or removable support 16 is a flat annular disk which is carefully finished on the inner side adjacent its edge and is provided with holes at its periphery to receive the securing-stud bolts 19. Between the gland and the end surface of the hub are gaskets 20 to provide a perfect seal.

I consider carbon to be the best material for the packing, as it stands high temperatures without injury, although my invention is not to be construed as being limited thereto in all respects. Carbon also obviates the need of lubricant between the wearing-surfaces, which is an important consideration, as the presence of lubricant in the vapor is objectionable for obvious reasons when the turbine is run condensing and the water of condensation is returned to the boiler.

When the packing specified is employed between any two stages, the fixed part of the carrier may be attached to the cylindrical portion or web 21 of the box-diaphragm 22, whereas the other features of the packing remain the same. I may employ two carbon packings and connect them with a carrier of the bellows type, in those cases requiring two packings at adjacent points. The corrugations of the carrier prevent any substantial change in dimension in a transverse direction, but afford sufficient flexibility to permit longitudinal movements by reason of the fluid pressure acting between the two substantially parallel portions at the ends thereof. As the pressure in the wheel-compartments is or may be considerable, it will exert a continuous pressure upon the diaphragm and through the same upon the packing engaging the hub of the wheel. As the pressure within the wheel-compartment or shell changes, the pressure exerted upon the packing will also change accordingly.

It will be seen from the construction shown that the wear of the packing is compensated for by the movement of which the carrier is capable, so that occasional adjustment of the packing is obviated.

The diaphragm or carrier may in some cases take the form of a disk, and this is particularly advantageous where economy of space in an axial direction is desirable. Such a diaphragm is shown in Fig. 3. The disk 23 is suitably secured at its periphery to an abutment or annular shoulder 24 on the casing, and in other respects the construction is similar to that heretofore described.

In order to impart the desired tension to the diaphragm or carrier for retaining the packing-ring in contact with the wheel at all times, the parts may be so arranged as to be adjusted, or a slight dish may be given to the diaphragm, so that when it is secured in place it urges the packing against the wheel or other part, thereby preventing fluid from escaping to the low-pressure side thereof. The arrows indicate the direction in which the pressure of the steam is intended to act.

In accordance with the provisions of the patent statutes I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. An elastic-fluid turbine, comprising a casing and a rotating element therein, in combination with a packing which is maintained in engagement with the rotating element by the pressure of fluid in the casing.

2. An elastic-fluid turbine, comprising a casing, a shaft, and a wheel mounted on the shaft within the casing, in combination with a packing maintained in constant engagement with the wheel by the pressure in the casing.

3. An elastic-fluid turbine, comprising a casing, a rotating bucket-wheel mounted therein, a shaft for the wheel, a packing, and a means subjected to the pressure of fluid in the casing which maintains the packing in constant engagement with the rotating parts.

4. An elastic-fluid turbine, comprising a casing, a rotating bucket-wheel, and a shaft therefor, in combination with a packing, and means which urges the packing against the

wheel and which also contributes to prevent leakage.

5. An elastic-fluid turbine, comprising a casing, a rotating bucket-wheel, and a shaft therefor, in combination with a packing assembled around the shaft which engages the wheel, and a flexible means which is acted upon by the fluid-pressure in the casing to maintain the packing in contact with the wheel and which contributes to prevent leakage.

6. An elastic-fluid turbine, comprising a casing, a rotating bucket-wheel, and a shaft therefor, in combination with an axially-movable packing which is adapted to engage the wheel, and axially-extensible means adapted to maintain the packing in contact with the wheel and to automatically compensate for wear.

7. An elastic-fluid turbine, comprising a casing, a rotating element, and a shaft therefor, in combination with an axially-moving packing which is assembled around the shaft and is adapted to engage with the said element, and an axially-extensible means which is assembled around the shaft and is acted upon by fluid-pressure in the casing to maintain the packing in engagement with the element.

8. An elastic-fluid turbine, comprising a casing having a packing-chamber, a rotating bucket-wheel, and a shaft therefor, in combination with an annular packing which is adapted to bear upon a part moving with the wheel, and an annular carrier arranged in the chamber which is actuated by the fluid-pressure and which urges the packing against said part.

9. An elastic-fluid turbine, comprising a casing having a packing-chamber, a rotating bucket-wheel, and a shaft therefor, in combination with an annular packing which impinges upon a part moving with the shaft, a holder for the packing, and a laterally-extensible carrier or diaphragm attached to the holder and to the wall of the packing-chamber.

10. An elastic-fluid turbine, comprising a casing provided with a chamber, a rotating bucket-wheel, and a shaft therefor, in combination with an annular packing, a holder therefor, a removable abutment, and an annular diaphragm arranged between the holder and the abutment which exerts a lateral stress under the fluid-pressure in the casing to maintain the packing in engagement with its seat.

11. An elastic-fluid turbine, comprising a casing, a rotating bucket-wheel, and a shaft therefor, in combination with an annular packing which engages a part moving with the wheel, a holder for the packing, a corrugated annular diaphragm attached to a fixed part of the casing and to the holder which expands laterally under the fluid-pressure in the casing.

12. An elastic-fluid turbine, comprising a casing, a rotating bucket-wheel, and a shaft therefor, in combination with a segmental packing which engages a seat, a segmental holder for a packing, means for securing the segments of the holder together, a removable support or abutment, and an annular corrugated diaphragm secured to the support or abutment and holder which is removable with the former.

13. In combination, a movable element, a casing therefor, a packing for said element, means subjected to fluid-pressure in the casing for maintaining the packing in engagement with the movable element, a removable abutment fixed to the casing which carries said means, and a packing between the abutment and casing.

14. In combination, a casing, a rotating element therein, a packing for said element, a resilient carrier or diaphragm which is acted upon by fluid-pressure to maintain the packing in engagement with the rotating element, a removable abutment secured to the casing to which the carrier or diaphragm is attached, and gaskets between the abutment and casing.

15. The combination of a packing, with elastic means which supports the packing and is itself subjected to fluid-pressure for maintaining the packing in operative position.

16. The combination of a packing, with a stationary elastic means which movably carries the packing and is itself acted upon by the fluid-pressure to maintain the packing in operation.

17. An elastic-fluid turbine, comprising elements which are relatively movable, in combination with a packing which engages one of said elements, and a yielding support for the packing which is attached to the other element and is subjected to the working fluid-pressure for maintaining the packing in operation.

18. In combination, a casing containing fluid under pressure, a packing for preventing leakage of fluid, a seat for the packing, and an elastic means forming the sole support for the packing, which is arranged to hold the latter against its seat and also to coöperate with the packing to prevent leakage.

19. In combination, a casing containing fluid under pressure, a packing to prevent leakage of the fluid, a seat for the packing, and an elastic means coöperating with the packing to prevent leakage which is arranged to continually urge the packing toward its seat and forms a support that centers the packing and prevents it from turning.

In witness whereof I have hereunto set my hand this 8th day of August, 1904.

JOHN G. CALLAN.

Witnesses:

DUGALD McK. McKILLOP,

JOHN J. WALKER.