No. 653,788. Patented July 17, 1900.

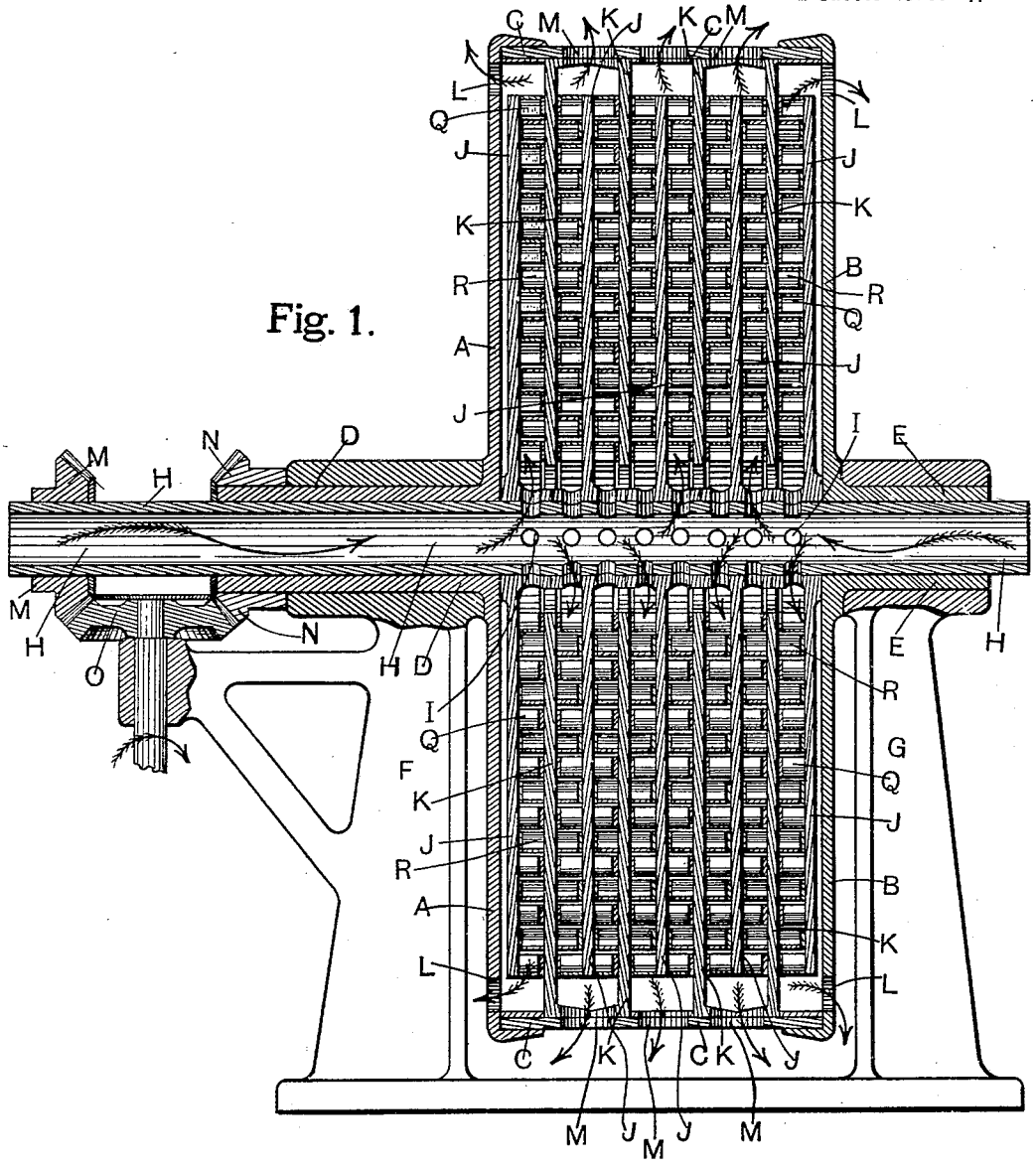
J. F. BRADY.

STEAM TURBINE.

(Application filed Nov. 4, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



WITNESSES:

Frank. S. Lewis

Michael. A. Flynn

INVENTOR:

John F Brady

By his atty.

Osedr Snell

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 653,788. Patented July 17, 1900.

J. F. BRADY.

STEAM TURBINE.

(Application filed Nov. 4, 1899.)

(No Model.) 2 Sheets—Sheet 2.

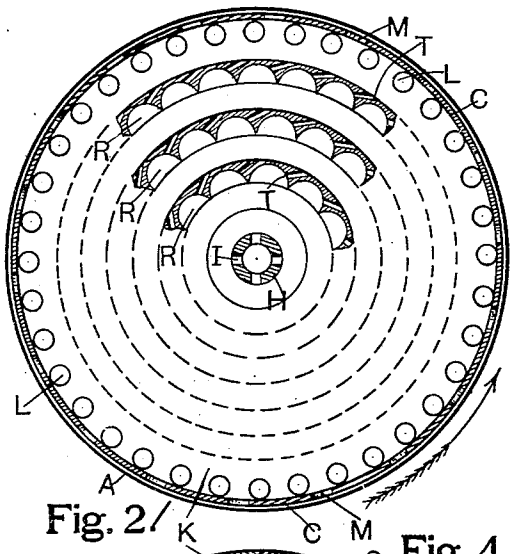


Fig. 2.

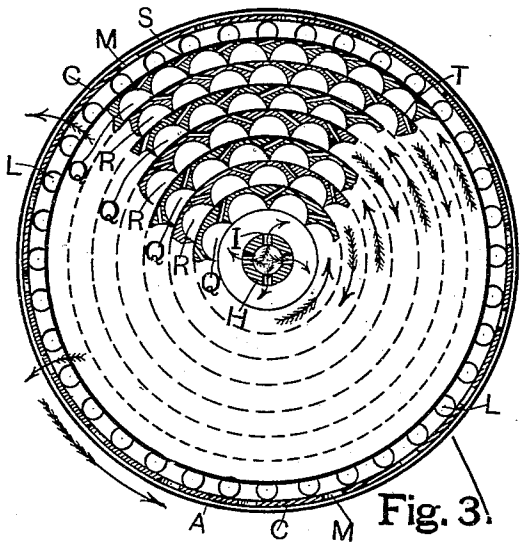


Fig. 3.

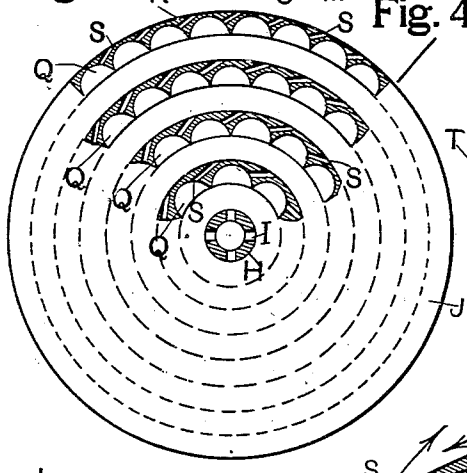


Fig. 4.

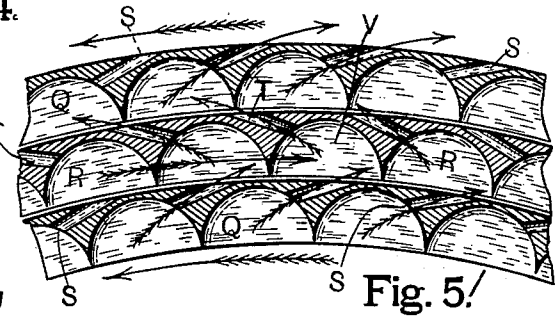


Fig. 5.

Fig. 8.

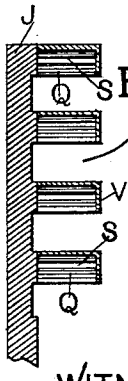


Fig. 7.

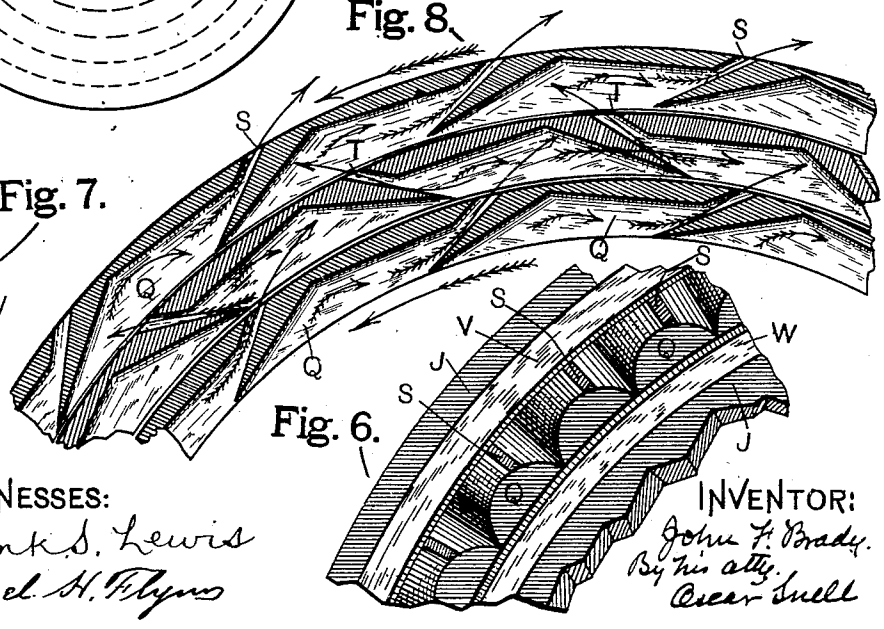


Fig. 6.

WITNESSES:

Frank S. Lewis

Michael H. Flynn

INVENTOR:

John F. Brady.

By his atty.

Oscar Snell

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN F. BRADY, OF CHICAGO, ILLINOIS.

STEAM-TURBINE.

SPECIFICATION forming part of Letters Patent No. 653,788, dated July 17, 1900.

Application filed November 4, 1899. Serial No. 735,790. (No model.)

To all whom it may concern:

Be it known that I, JOHN F. BRADY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Steam-Turbine, of which the following is a specification.

My invention relates to turbine motors which may be actuated by either steam or gas under pressure.

My object is to provide a construction which is intended as a modification and improvement on the invention in steam-turbines for which application for patent of the United States was filed by me July 24, 1899, Serial No. 724,979, and allowed August 21, 1899, my new improvements being fully described hereinafter and illustrated in the accompanying drawings, in which—

Figure 1 is an axial vertical section of the operative parts and of the several journal-bearings, the greater portion of the supporting-frame being shown in outline side elevation. Figs. 2, 3, and 4 are transverse sections of a steam-turbine in which is embodied my invention, these figures serving to illustrate the shape and disposition of a double series of rings of expansion-chambers, the steam-eduction passage-ways of one series of rings of expansion-chambers leading out in opposition to the steam-eduction passage-ways of the adjacent series of rings of expansion-chambers. Fig. 5 is a transverse section of a portion of three rings of expansion-chambers of a size adapted in practice to attain good results and which are hereinafter fully described. Fig. 6 is an inside perspective view of a portion of a turbine disk, showing the open side of a part of a ring of expansion-chambers and the outer ring-wall of the chambers and one of the channels cut into the face of the turbine disk, in which the expansion-chamber's ring-wall is disposed and revolves. The inner ends of the eduction passage-ways are also shown in the several expansion-chambers in Fig. 6. Fig. 7 is an axial section of an outer portion of one of the turbine disks, showing a longitudinal section of the peripheral and outer ring-walls of four expansion-chambers, and this figure also shows the grooves in the turbine disk in which the ring-walls of the expansion-chambers revolve. Fig. 8 is a cross-section, parallel with the face of a turbine disk, of a portion of three rings of expansion-chambers and showing the passage-ways leading out of the chambers, this form of chamber being simply a modification of the semicircular chamber illustrated in Fig. 5 and adapted to give very high results in practice.

Similar letters indicate like parts throughout the several views.

In this instance no exhaust-steam case is shown surrounding the revoluble cylindrical portion of the turbine, which latter comprises the ends A and B and the connecting peripheral cylindrical hoop C. The ends A and B each have an outwardly-projecting hollow journal, such as D and E, which are mounted to revolve in bearings at the top of the frame-posts F and G. Disposed through the hollow journals D and E is a hollow shaft H, which is connected with a supply of steam under pressure and which is perforated, as at I, through the portion thereof within the limits of the ends A and B, and thereby adapted to permit the passage of steam from the hollow portion of the shaft H to the operative parts in the interspace formed by the ends A and B and the cylindrical hoop C.

Firmly attached to hollow shaft H are several turbine disks, such as J, and firmly attached at their peripheral portions to the inside of the cylindrical hoop C are several turbine disks K, disposed between the disks J. At the axial portion of each of the disks K is a large hole, through which the hollow shaft H is disposed, the hole being so much larger than the shaft in each disk that steam may freely pass between them, as shown in Fig. 1.

At L and M are holes forming exhaust-steam passage-ways leading out of the turbine, as indicated by the arrows.

At the outer end of journal D and of hollow shaft H are miter cog-wheels M and N, which are geared at opposite sides to a miter-gear O, attached to shaft P.

In this instance instead of employing the usual guides and vanes, as is common in other steam-turbines for transmitting the motion of the steam to the turbine shafts, I have devised a series of expansion-chambers, such as Q and R in Figs. 2, 3, 4, 5, 6, and 7, which are arranged in series in concentric rings, the rings of expansion-chambers Q on disks J be-

ing separated, so as to permit the rings of expansion-chambers R on disks K to be disposed and revolve in opposite directions between the rings of expansion-chambers of disk J, so that both series of expansion-chambers revolve in substantially the same plane.

There are eduction passage-ways S leading out of all the rings of expansion-chambers Q of disks J tangentially in substantially the same direction relative to the circle of chambers, and all the eduction passage-ways T lead out of the expansion-chambers R in disks K tangentially in substantially the opposite direction to the passage-ways which lead out from expansion-chambers Q, as is fully illustrated in Figs. 3, 5, and 8. A face view of the expansion-chambers and the passage-ways leading out of them on the disks J and K shows these features to be the same; but when these parts are in position, one facing the other, as shown in Figs. 1, 3, 5, and 8, the passage-ways S and T will subtend an angle to a radial line from the center of the disks, one in opposition to the other, as shown in Fig. 4.

In operation steam under pressure is admitted to the hollow portion of shaft H. Thence it passes radially outwardly into the interspace outside of shaft H, where it expands within the first ring series of expansion-chambers Q, attached to disk J. Thence the steam passes outwardly through the tangential passage-ways S and into contact with the walls of the expansion-chambers R of disks K, thence outwardly through the passage-ways T into the second series of expansion-chambers Q, and so on alternately through the succeeding series of oppositely-disposed passage-ways into succeeding expansion-chambers until finally the steam passes outwardly from the peripheral tangential passage-ways from the outward and last ring series of expansion-chambers and outwardly through the exhaust-holes L and M, Figs. 1, 2, and 3. In the outward passage of the steam by virtue of the velocity acquired by its successive expansions from one expansion-chamber to another the disks J are caused to revolve in one direction and the disks K in the opposite direction, as indicated by the arrows in Figs. 3, 5, and 8.

The ring form, as indicated by the segment V in Fig. 6, of the outer walls of the expansion-chambers is adapted to revolve in circular grooves, as indicated at W, Figs. 6 and 7, and thereby prevent the steam leaking past the outer ends of the expansion-chambers and also prevent undue pressure between the opposing disks J and K.

It will be noticed that steam is admitted from the hollow shaft H through holes I only between the two outer disks J, so that no end pressure is brought to bear against the shaft.

The spaces between the end disks J and the disks A and B are very narrow and are never under any steam-pressure, since there is no communication with the live-steam space, but only with the exhaust at the periphery of the disks J. Therefore there is no necessity of a packing-gland at the outer ends of hollow journals D and E nor thrust-bearings for shaft H.

I claim as my invention—

1. In a steam-turbine, two disks peripherally connected, and each mounted apart upon a hollow journal so as to form an interspace, one or more disks each having an axial hole therethrough, and peripherally attached within the interspace to the peripheral connection of the two first-named disks, a revoluble shaft mounted axially through the journals of the first-named disks, and through the axial holes in the second-named disks, disks firmly mounted on the shaft within the interspace and disposed between the first and second named disks, passage-ways leading into the interspace between the shaft-disks from a source of steam-supply, and means attached to the shaft-disks and to the second-named disks, whereby one set of disks is revolved in an opposite direction to the other by virtue of the action of steam, substantially as stated.

2. In a steam-turbine, two disks peripherally connected, and each mounted apart upon a separate hollow journal so as to form an interspace, one or more disks each having an axial hole therethrough, and peripherally attached within the interspace to the peripheral connection of the two first-named disks, a revoluble shaft mounted axially through the journals of the first-named disks, and through the axial holes in the second-named disks, disks firmly mounted on the shaft within the interspace, and close to the first-named disks, and at both sides of the second-named disks, passage-ways for steam leading into the interspace from the hollow shaft only between the shaft-disks, a series of circles of expansion-chambers having tangential eduction passage-ways leading outwardly all in a similar relative direction, and attached to the second-named disks, and a series of circles of expansion-chambers having tangential eduction passage-ways leading outwardly all in a similar relative direction, but opposite to that of the passage-way leading out of the first-named circles of expansion-chambers, and attached to the shaft-disks, the circles of expansion-chambers of one disk disposed to revolve between or in substantially the same plane as the circles of expansion-chambers of the opposite disks, and each in an opposite direction to the other, by virtue of the action of steam, substantially as stated.

3. In a steam-turbine, a revolubly-mounted series of separated rings of steam expansion-chambers opening against the flow of steam, in combination with another revolubly-mounted series of separated rings of steam expansion-chambers opening against the flow of steam and disposed between and adjacent to the first-named chambers, a series of passage-ways for steam leading out of

the first-named chambers at an angle to their movement, and into the open sides of the second-named chambers, and a series of passage-ways for steam leading out of the second-named chambers at an angle to their movement and into the open sides of the first-named chambers, but in a relatively-opposite direction to the passage-ways leading out of the first-named chambers, for the purpose stated.

JOHN F. BRADY.

Witnesses:
MICHAEL H. FLYNN,
FRANK. S. LEWIS.