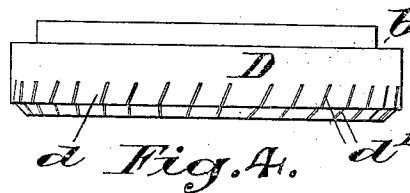
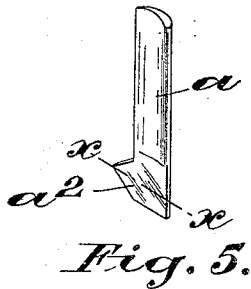
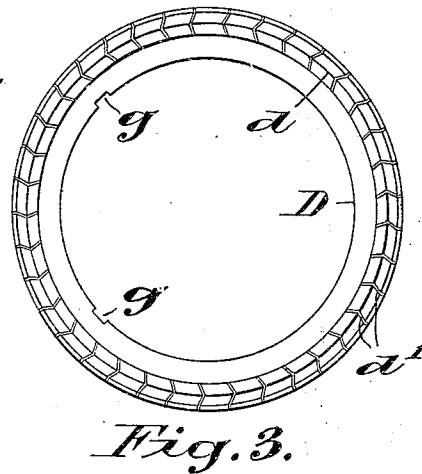
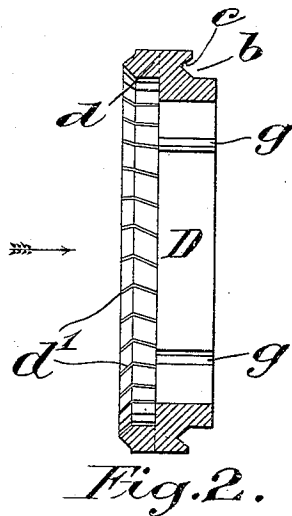
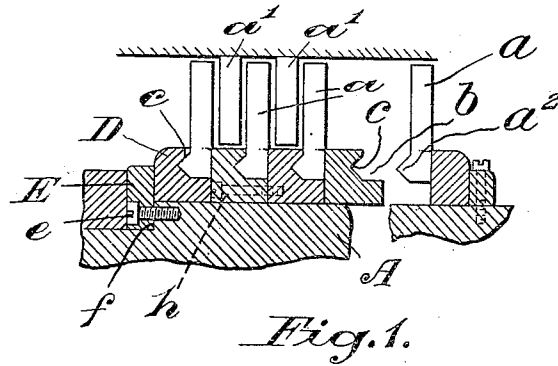


J. KNIGHT.
POWER TURBINE.
APPLICATION FILED OCT. 29, 1907.

955,648.

Patented Apr. 19, 1910.



Witnesses

W. C. Abbott
W. C. Abbott

Inventor
Joseph Knight

By *J. R. Rapping*
Attorney

UNITED STATES PATENT OFFICE.

JOSEPH KNIGHT, OF HOLYHEAD, ANGLESEA, ENGLAND.

POWER-TURBINE.

955,648.

Specification of Letters Patent.

Patented Apr. 19, 1910.

Application filed October 29, 1907. Serial No. 399,761.

To all whom it may concern:

Be it known that I, JOSEPH KNIGHT, a subject of the King of Great Britain, and residing at Holyhead, Anglesea, England, have invented certain new and useful Improvements in Means of Fixing Vanes or Blades of Power-Turbines, of which the following is the specification.

This invention relates to means of fixing vanes or blades of power turbines.

According to this invention in its preferred form, as herein shown, the vanes or blades are made of thin plates of metal which are held in place and locked therein by rings which are passed, in the case of outwardly projecting blades, over the cylindrical surface around which the vanes or blades are arranged when in place, and in the case of the inwardly projecting vanes or blades are pushed up within the cylinder within which such vanes or blades are arranged when in place. The root of each blade is formed with a forward or backward projection which enters within a groove of a ring, and is thereby securely locked when the ring has been tightened up in place.

Except in the case of end rings of a set and a set of rings used simply for a single ring of vanes, which need to be modified in a manner which will be obvious, each ring is formed at one side with a rabbet, and in the shoulder at the inner end of the rabbet is formed a groove which runs around the ring, and the other side of the ring is formed with a projection which runs therearound and is adapted to fit into the rabbet and groove of the next adjacent ring at such side; and this projection is formed with a number of slots clear therethrough to receive the inner ends of the blades, the inner end of each blade being exactly of the shape and size, in side elevation, as the transverse section of the projection; and thus when all the blades for one ring of blades have been placed in position within their corresponding slots, and the next adjacent ring at the side at which the projection stands out has been pushed up into place against the ring into which the blades have been fitted, the blades are securely locked between the two rings, and so on for all the blades of a complete set. The portions of the blades which project with projections of rings into the

grooves of other rings are, preferably, formed at the edges of the blades which are toward the incoming motor fluid in the forward running of the turbine. All the rings are passed over feather keys carried by the part around or within which they are fitted, and it is preferred to secure the rings together, face to face, by means of screws passed each through one ring and screwed into the next.

In applying the invention to the type of turbine set forth in the specification accompanying an application by me of even date herewith, in which an inner rotating member having exterior vanes or blades is surrounded by an outer rotating member having inwardly projecting vanes or blades, and also outwardly projecting vanes or blades, and which latter member is surrounded by a fixed casing having inwardly projecting vanes or blades, the vanes or blades which project from the inner rotating member, and those which project outwardly from the outer rotating member, are fixed by rings which are passed along over cylindrical surfaces around which the vanes or blades are arranged when in place, and the vanes or blades which project within the interior of the outer rotating member, and those which project within the interior of the fixed casing, are fixed by rings which are pushed along within the cylindrical portions within which the vanes or blades project when in place; and, in the case of the type of turbine set forth in the said specification in which vanes or blades are carried by parts which are formed in halves for the purpose therein stated, the rings which are used to fix the blades of the parts which are formed in halves are also themselves formed in halves so as to be removable with the halves by which they are respectively carried.

In order that the invention may be clearly understood, and readily carried out, I will now proceed to describe, by way of example, a practical application of the same, as applied to a turbine of the type set forth in the said specification accompanying an application by me of even date herewith.

Of the drawings:—Figure 1 is a fragmentary sectional view taken longitudinally through a portion of a turbine provided with my improvements, showing the corresponding sides of several rings of vanes or

blades fixed in the manner of this invention around a portion of a rotating member of the turbine; Fig. 2 is a section taken longitudinally of the turbine, through the middle of one of the rings used in fixing the vanes or blades around a rotating member of the turbine; Fig. 3 is an elevation of the ring shown in Fig. 2, looking in the direction of the arrow in such figure; Fig. 4 is a plan view of the ring shown in Fig. 3; Fig. 5 is a perspective view of one of the vanes shown detached from the rings, and Fig. 6 is a section taken through the root of the vane on the line $x-x$ in Fig. 5.

15 A is the inner rotating member of the turbine. The vanes a are locked in position around the outer surface of the member A by rings D which surround such surface. The vanes a as shown in Figs. 5 and 20 6 are made of thin plate metal, and each ring D is formed with a rabbet b in one of its edges which is away from the surface of the member A, around which the ring is placed, and in the shoulder or vertical face of this rabbet is formed a groove c , conveniently of V-shaped section, as shown, and each ring is formed at its other face with a projection d adapted to fit within the rabbet and groove of the adjacent ring at such 30 side, the projection being of the same size and shape as the rabbet b and groove c .

Clear through the projecting portion d of each ring are cut a number of slots or slits d' to receive the inner ends of the vanes, the 35 inner end of each vane being formed with a projection a^2 and being exactly of the shape, as seen in side view in Fig. 1, and as indicated in Fig. 5, of the transverse section of the projection taken in the plane of one of 40 the slots or slits d' ; and thus, when all the vanes for one ring have been placed in position within their corresponding slots, and the next adjacent ring on the side at which the projection d stands out has been pushed 45 up into place against the ring into which the vanes have been fitted, the vanes are securely locked between the two rings, and so on for all the vanes of a complete set.

To guard against the vanes tilting forward, it is preferred that the portions a^2 thereof which project with the projections d of rings into the corresponding grooves c of other rings, shall be formed at the edges of the vanes which are toward the incoming 55 motive fluid. The rearmost ring of a set is formed without a rabbet at its rear face and butts against the face of a plain ring or collar which is fixed around the member A, and the foremost ring of such set is held 60 back by a ring or collar E which is tightened up, by means of set-screws, such as e , against such foremost ring and against a shoulder f of the member A. All the rings of a set are formed with grooves g , (see Fig. 3) to pass

over feather keys carried by the member A; 65 and it is preferred to secure the rings of a set together, face to face, by means of screws h passed each through one ring and screwed into the next.

The rings shown are for fixing series of 70 vanes around a rotating member, but it will be readily understood that series of vanes a may be correspondingly fixed by means of rings pushed up inside a cylinder whether the same constitutes an outer rotating mem- 75 ber or a fixed casing, this arrangement being obvious without need for special illustration.

Although the invention has been specially described, by way of example, as applied to 80 a particular type of turbine, it is of course applicable to turbines generally, and the details may be modified somewhat as will be obvious.

Having fully described my invention, what 85 I claim and desire to secure by Letters Patent, is:—

1. In a turbine, a plurality of rings abutting one against another and a series of 90 blades, one ring being provided at one side with a lateral projection extending around it and provided with slitted openings wherein the roots of the blades are received and another ring having a recess to receive the 95 projection and an annular groove within the back face of the recess, and the roots of the blades having laterally projecting parts which enter within the annular groove.

2. In a turbine, a plurality of rings abutting one against another and a series of 100 blades, one ring being provided at one side with an annular recess and an annular groove within the back face of the recess and another ring being provided with a lat- 105 eral projection extending therearound and adapted to fit within the said recess and annular groove and provided with slitted openings wherein the roots of the blades are received, and the roots of the blades having 110 laterally projecting parts which enter within the annular groove.

3. In a turbine, a plurality of rings abutting one against another and a plurality of 115 circular rows of blades, one end ring being provided at one side with a lateral projection extending around it which is provided with slitted openings wherein the roots of one circular row of blades are received and the next ring having a recess to receive the projection and an annular groove 120 within the back face of the recess and the roots of the blades having lateral projecting parts which enter within the groove, such ring formed at its other side with a lateral projection corresponding to that of the said 125 end ring and for the like purpose, and any further succeeding ring, except the other end ring, if any such further ring is re-

quired, corresponding to the second described ring, and the other end ring having a recess to receive the projection of the ring adjacent thereto and an annular groove within the back face of the recess corresponding to the recess and annular groove aforesaid.

In witness whereof I have hereunto signed my name this 19th day of October 1907, in the presence of two subscribing witnesses.

JOSEPH KNIGHT.

Witnesses:

ROBERT G. GROVES,
J. E. S. LOCKWOOD.