No. 881,474. PATENTED MAR. 10, 1908.

A. JUDE.

TURBINE MOTOR.

APPLICATION FILED AUG. 14, 1906.

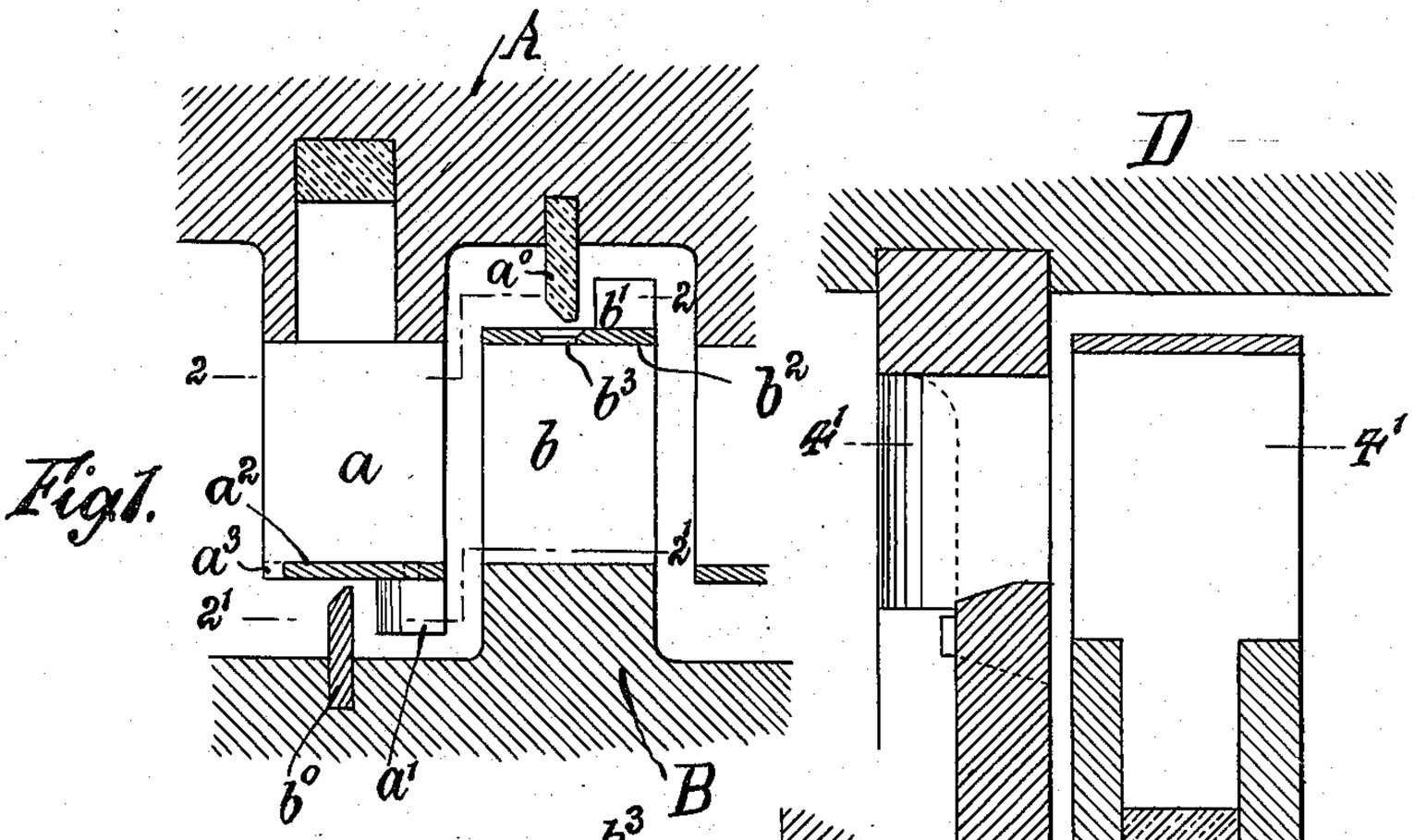


Fig. 1.

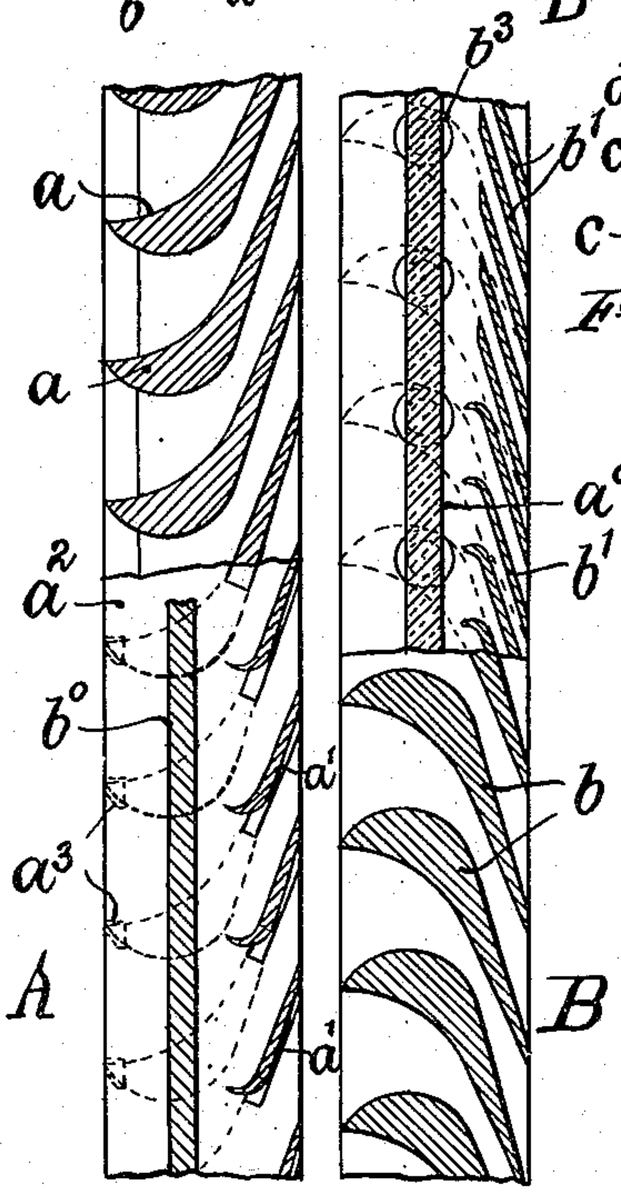


Fig. 2.

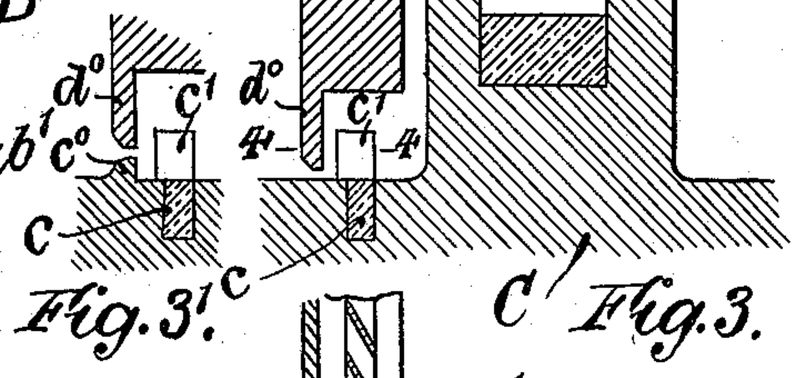
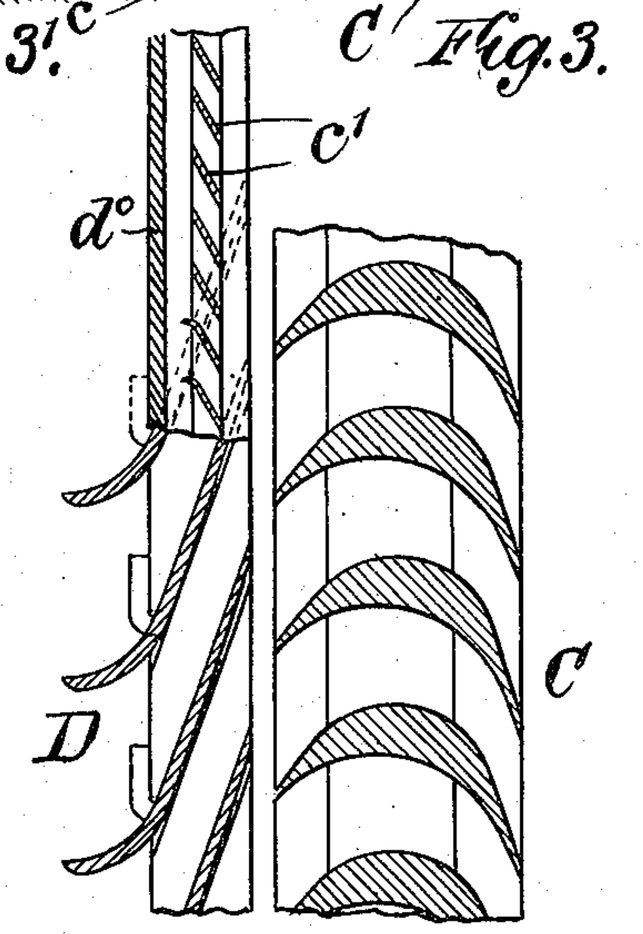


Fig. 3'.



C Fig. 3.

Fig. 4.

WITNESSES

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UNITED STATES PATENT OFFICE.

ALEXANDER JUDE, OF BIRMINGHAM, ENGLAND, ASSIGNOR TO BELLISS & MORCOM LIMITED, OF BIRMINGHAM, ENGLAND.

TURBINE-MOTOR.

No. 881,474. Specification of Letters Patent. Patented March 10, 1908.

Application filed August 14, 1906. Serial No. 330,585.

To all whom it may concern:

Be it known that I, ALEXANDER JUDE, subject of the King of Great Britain, residing at Ledsam Street Works, Birmingham, in the county of Warwick, England, have invented new and useful Improvements in Turbine-Motors, of which the following is a specification.

In turbine motors, especially those which operate with expansible fluids, a plurality of vanes which are relatively keen edged and easily deformable, formed on or secured to a rotor, are required to move rapidly past other readily deformable edges of guide blades secured to the stator, the operating fluid being required, as completely as possible, to flow from between the guide blades of one to enter between the vanes of the other.

To avoid injury it is requisite to prevent contact between the adjacent portions of the rotor and stator and to allow for wear of shaft and bearings and relative displacement due to other causes, a clearance space between the two sets of thin edged plates is essential whereby a portion of the mobile expansible fluid has an opportunity of evading duty by flowing from the place of high pressure to that of low pressure along a passage provided by the clearance space instead of passing between the guide blades and vanes and yielding energy thereto.

Now this invention relates to a method whereby the loss normally due to such leakage of fluid may be lessened, and to the means whereby the consequent saving may be effected, by providing in the clearance space a set or sets of auxiliary or secondary vanes between which the leaking fluid will be directed to flow and perform useful service.

The accompanying drawings, as representative examples, show how, under various circumstances, the utilization of leakage fluid for doing work as above indicated can be effected in accordance with this invention.

In these drawings:—Figure 1 is a sectional elevation showing a guide blade of the stator and a vane of the rotor with means for operating on the fluid which traverses the clearance space. Fig. 2 is a developed circumferential section of Fig. 1, the upper portion being taken along the line marked 2—2 and the lower portion along the line marked 2′—2′ in Fig. 1. The left-hand portion shows by dotted lines parts above the plane of section. Fig. 3 shows in sectional elevation a modified arrangement of the device. Fig. 3′ shows an alternative to a portion of Fig. 3. Fig. 4 is a developed circumferential section of Fig. 3 of which the left-hand upper portion is a section through 4—4 and the remainder a section through 4′—4′ of Fig. 3.

In Figs. 1 & 2, A represents a portion of the stator and B a portion of the rotor. To A is secured a number of guide blades a, shown in section in Fig. 2. The primary portions of these guide blades are bounded by a shrouding strip a^2 which is notched at each of its edges to permit of its being penetrated by projecting portions a^1 and a^3 of the guide blades a. The portions a^3 are riveted, and the edges of the portions a^1 after being sharpened are bent into the form and position shown in Fig. 2. In this way the shrouding strip a^2 is secured to all the guide blades.

The portions a^1 which extend beyond the shrouding strip constitute the secondary guide blades previously referred to. To concentrate on these secondary blades the fluid which normally would leak between the shrouding a^2 and the portion of the rotor adjacent thereto, a strip b^9 is secured to the rotor and forms a sort of overflow weir for the escaping fluid.

A thin edge for the strip b^9 is advantageous because it will be less able to do damage to the guide blades in the event of contact, and also because it will offer less frictional resistance to the overflow of the fluid than if it were wider. By this invention the energy of the overflow fluid is utilized so that the reasons for obstructing the escape of the fluid by frictional resistance disappear more or less entirely.

The sheet of fluid which escapes between the shrouding a^2 and the edge of the strip b^9 impinges on the secondary guide blades a^1 and derives a whirl similar to that given to the main stream of fluid by the primary guide blades a. The tangential momentum thus imparted to the leaking fluid is utilized in driving the rotor when it presently joins the main stream and impinges on and flows between the vanes b. In a somewhat similar manner the fluid tending to leak between the shrouding b^2 of the primary vanes b and the portion of the stator adjacent thereto, which fluid has, on its passage between the guide blades a, been endowed with angular momentum, is, by means of a second overflow weir a^9, concentrated on to secondary vanes

b^1 carried by the rotor, the action thereon being like that of the main stream on the primary vanes b, with the result that the energy of the escaping fluid which would otherwise be dissipated, is caused to do useful work in urging the rotor.

The method of construction of the secondary vanes b^1 differs from that adopted in the provision of the secondary guide blades a^1. They are formed by cutting diagonal slotways in a shrouding strip b^2 of suitable profile, as shown in the upper right-hand portion of Fig. 2, and subsequently suitably bending the leading edges of the vanes thus produced, to receive the whirling fluid with the least shock. The shrouding strip is secured to each primary vane in the usual manner by riveting projections b^3 formed on the vanes into countersunk holes provided in the shrouding. This latter method of constructing the secondary vanes will enable their number to be made greater than that of the primary vanes, which is desirable in order to compensate for their shortness. This form of construction may be adopted for the secondary guide blades, alternately to that shown and described, as also may the secondary guide blade method of construction be employed for the secondary vanes.

Figs. 3, 3′ and 4 represent an alternative construction of secondary vanes. According to this a groove is turned in the boss of the rotor C into which a ring c, formed in segments, is secured. This ring is cut obliquely, to a suitable depth, forming fins c^1, the leading edges of which are bent as shown in the left-hand upper portion of Fig. 4. The stator D is formed with a thin edged inwardly projecting rim d^0 which approaches the boss of the rotor very closely. Through the annular space between the edge of d^0 and the adjoining portion of the rotor, a sheet of fluid will flow and this will be intercepted by the secondary vanes c^1, which vanes will be urged in the forward direction, and the effort of the main stream on the primary vanes will be supplemented thereby.

Fig. 3′ shows a modification in which a ring c^0 is formed on the rotor to approach the edge of d^0 and cause the sheet of fluid to be delivered at about the center of the depth of the secondary vanes. A modification similar to this could be applied to the constructions in Figs. 1 & 2.

I claim:

1. Means for utilizing the energy of fluid which tends to leak between the rotor and stator of a turbine, consisting of secondary guide blades which are interposed in the clearance spaces between the operative surfaces of the rotor and stator, to operate on the escaping fluid.

2. Means for utilizing the energy of fluid which tends to leak between the rotor and stator of a turbine, consisting of secondary vanes which are interposed in the clearance spaces between the operative surfaces of the rotor and stator, to be operated on by the escaping fluid.

3. Means for utilizing the energy of a fluid which tends to leak between the rotor and stator of a turbine, consisting of secondary guide blades and vanes which are interposed in the clearance spaces between the operative surfaces of the rotor and stator, to operate on and be operated on respectively by the escaping fluid.

4. In a turbine comprising a rotor and a stator, secondary guide blades interposed in the clearance spaces between the operative surfaces of the rotor and stator, and means for directing escaping fluid on to such secondary guide blades.

5. In a turbine comprising a rotor and a stator, secondary vanes interposed in the clearance spaces between the operative surfaces of the rotor and stator, and means for directing escaping fluid on to such secondary vanes.

6. In a turbine comprising a rotor and a stator, secondary guide blades and vanes interposed in the clearance spaces between the operative surfaces of the rotor and stator, and means for directing escaping fluid on to such secondary guide blades and vanes.

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

ALEXANDER JUDE.

Witnesses:

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