J. A. JOHNSEN.

FRICTION TURBINE.

APPLICATION FILED NOV. 1, 1911.

1,056,338.

Patented Mar. 18, 1913.

2 SHEETS—SHEET 1.

Fig. 1.

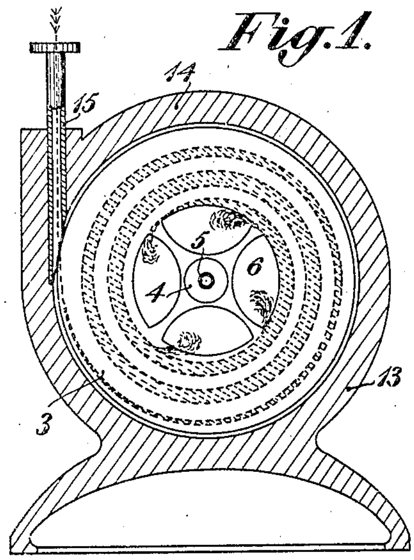


Fig. 2.

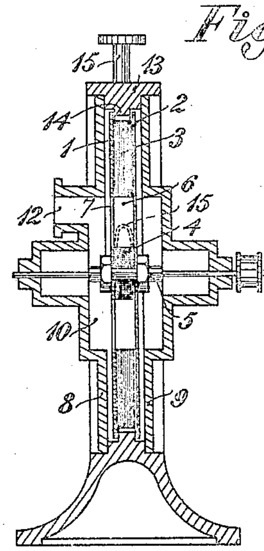


Fig. 4.

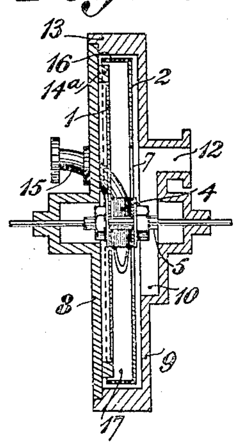
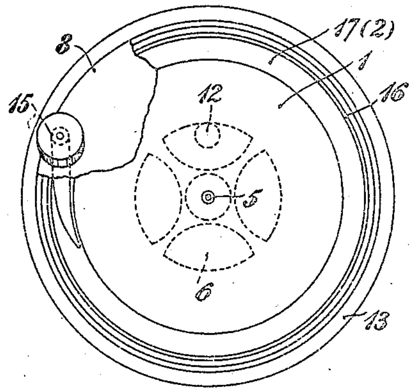


Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 5.

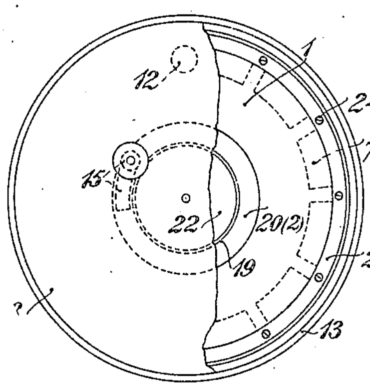


Fig. 6.

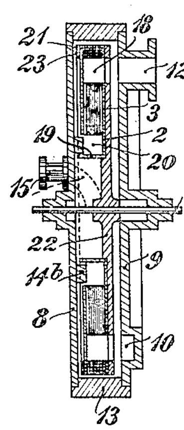


Fig. 7.

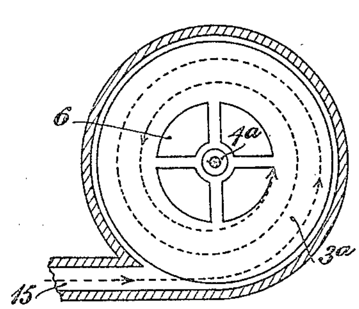


Fig. 8.

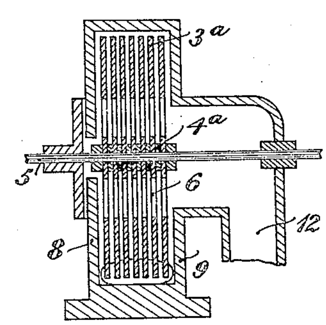
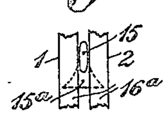


Fig. 9.

Fig. 10.



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UNITED STATES PATENT OFFICE.

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FRICTION-TURBINE.

1,056,338. Specification of Letters Patent. Patented Mar. 18, 1913.

Application filed November 1, 1911. Serial No. 658,023.

To all whom it may concern:

Be it known that I, JONAS ALBERT JOHNSEN, of No. 20 Laessoesgade, Copenhagen, in the Kingdom of Denmark, mechanical engineer, have invented certain new and useful Improvements in Friction-Turbines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The object of the present invention is a turbine of the kind in which the direction of movement of the driving agent and that of the surface of the rotor coincide, and where the reaction between the driving agent and the rotor is based on friction. For the purpose of increasing the efficiency the rotor is composed of a large number of thin adjoining disks in order to present a large surface, and the path of the driving agent is through the narrow spaces between the disks so that the driving agent is finely divided up during its working action.

Compared with an already proposed construction of similar nature, by which the length of the path traveled through by each particle of the driving agent in the rotor is less than one revolution, the main feature of the present invention is that the driving agent (fluid, steam, compressed air or the like) in the rotor is caused to move relatively in a radial direction so as to be capable of effecting several revolutions consecutively with increasing or decreasing radius that is to say the motive medium travels in spiral paths in frictional contact with the plates. Through this arrangement the value of one of the factors upon which the efficiency depends *i. e.* the length of the line on the rotor-surface against which a particle of the driving agent can cause friction, is considerably increased.

Another means by which the efficiency of the present invention is increased is to construct the outer disks of the rotor so as to form a kind of lock surrounding the inlet so that the driving agent, as soon as it leaves the nozzle is mainly surrounded by co-revolving surfaces, as will be hereinafter described.

A third means for increasing the efficiency is to considerably increase the number of disks in the rotor by making these disks very thin, for instance from 0.05 to 0.5 mm., and arranged at correspondingly small intervals.

The working spaces of the rotor need not absolutely be disk-shaped, they might also be conical, cylindrical or spherical. In such cases, of course, the thin conical, cylindrical or spherical bodies must be suitably stiffened. The relative movement of the driving agent will by such forms of construction not take place in a radial direction but either in a combined radial and axial (in the conical and spherical form), or in an axial direction only (in the cylindrical form of construction).

The drawing shows schematically four forms of constructions of the invention, Figures 1, 3, 5 and 7 in cross sections vertical to shaft, and Figs. 2, 4, 6 and 8 in cross-sections parallel to shaft. Figs. 3 and 5 also show part of the cover of the turbine casing, while the bedplate of the turbine is omitted in Figs. 3 to 7. Figs. 9 and 10 show details.

For simplicity's sake the examples dealt with only relate to single stage turbines without compounding. The rotor is assumed to be made of adjacent disks, and the relative direction of the driving agent to be radial. The driving agent is let in tangentially to a circle with its center in the axis, and leaves the rotor in another circle of larger or smaller radius.

In the forms of construction shown on Figs. 1 to 6 the rotor consists of a pair of outer disks 1 and 2 so rigid as not to be liable to bend by the pressure of the driving agent. Between these outer disks are arranged a considerable number of disks 3 with interposed distance pieces 4. As mentioned the disks 3 may be so thin as not to be able—when at rest—to keep rigid, and are only straightened out during and by rotation. The distance pieces 4 may be as thin as the disks 3 so that a narrow space is formed between two following disks and between the two outermost of the disks 3 and the disks 1 and 2.

On account of the very small thickness of the parts 3 and 4 these are not drawn each with two lines in Figs. 2, 4 and 6; the disks 3 outside the distance pieces are simply shown as closely adjacent lines, and where they are shown together with the distance pieces 4 the drawing is hatched. On Fig. 4 the distance pieces 4 are shown without the disks 3.

Each of the disks 1, 2, 3 and 4 in Figs. 1 to 4 are provided with a central hole for the shaft 5, and the disks 3 are in the vicinity of the said hole, provided with suitable openings 6 so that the rotor, near the shaft or immediately outside the portion filled up by the distance pieces 4, present cavities extending axially across the rotor, and which through corresponding openings 7 in the outer disks 1, Fig. 2 or in the outer disk 2, Fig. 4, or in both the outer disks communicate with a chamber 10 arranged either in the one or in both walls 8 or 9 of the turbine casing. Chamber 10 is provided with an outlet 12.

In Figs. 1 and 2 both outer disks 1 and 2 are of somewhat larger diameter than that of the disks 3 so that the rotor has a shape similar to that of a pulley with flanges. These flanges or free edges of the disks 1 and 2 inclose a ring 14 projecting from the inner cylindrical part 13 of the turbine casing, and the inlet tube 15 is carried through the ring 14. In Figs. 3 and 4 the outer disk 2 is of a larger diameter than that of disk 1, and this latter disk is somewhat larger or of the same size as the disks 3 not shown. The outer disk 2 is further provided with a cylindrical flange 16 so that between this and the outer edges of disks 3 and 1 is formed an annular chamber 17 which is open on the one side (the left or front side), and closed by a ring 14^a, projecting from the wall 8. The inlet tube 15 is carried through said ring. Thus, in both cases the lock surrounding the inlet in the manner suggested in the beginning of the specification, is formed, and the size of the fixed surfaces against which the driving agent effects useless friction, is reduced to a minimum.

The lock shown in Fig. 4 can be made double or arranged as shown in Fig. 2 whereby the design shown in Figs. 9 and 10 is obtained. In this case the part of the inlet tube 15 between the bent flanges 16^a of disks 1 and 2, is made flat so that said flanges can meet as closely as possible. The extremity of inlet tube 15 presents a flat mouth piece 15^a.

In Fig. 1 the relative radial movement of the driving agent is indicated by a dotted line. Due to the radial movement the driving agent circulates around the shaft several times with diminishing radius until it leaves the rotor. In Figs. 5 and 6 the driving agent describes a path with increasing radius, the outlet cavities 18 corresponding to openings 6 and 7 (Figs. 1 to 4) being in this case arranged near the periphery of the rotor. The disk 2 is toward the shaft provided with a cylindrical flange 19, Fig. 6, which together with the disks 3 and 1 that are cut away at the center, form an open chamber 20 corresponding to chamber 17 in Figs. 3 and 4, but in this case the inlet tube 15 is of course arranged outside the flange 19, passing through the annular projection 14^b. The distance pieces 21 are ring-shaped. The rotor formed by the disks or rings 1, 3, 2, 19 and 21 can be fixed on a special disk 22 by means of a clamping ring 23, bolts 24 or the like.

Figs. 7 and 8 in which the special outer disks and the lock around the inlet are left out, and which only display a small number of comparatively thick disks 3^a and correspondingly thick distance pieces 4^a, serve to explain the simple main principle of the invention which consists in the spiral movement of the driving agent *i. e.* that the same is circulating several times around the shaft before leaving the rotor through the cavities 6. Two or more turbines may be coupled in series in the path of the driving agent with the rotors mounted on one common shaft, the rotor of the high pressure turbine having comparatively few and large disks, while the low-pressure turbine or turbines having a great number of disks with smaller diameter. The details concerning the mounting of the rotor and its arrangement, whereby it forms a kind of lock at the inlet side with passages leading to the exhaust side may be altered in many ways, which also refers to the mounting in the turbine casing and the arrangement of this latter one.

The characteristical feature of easy reversibility of friction turbines is not impaired by the present invention. The turbine can be reversed simply by altering the inlet direction of the driving agent for instance by using two inlet tubes with common reversing device.

The reaction caused by the friction can be utilized not only as motive power but also in a pump, ventilator or other machine, in which cases the revolving surfaces through friction impart movement to the medium which is acted upon such as liquid, gases and the like. For such purposes the form of construction shown in Figs. 5 and 6 are apparently most suitable.

Having now particularly described and

ascertained the nature of this said invention and in what manner the same is to be performed I declare that what I claim is:

In a friction turbine, a rotor having a plurality of spaced plates too thin to be self-supporting, means to supply motive fluid between the plates to impart rotation to the plates and thereby bring said plates to normal shape under the frictional and supporting action of the fluid while traversing the plates and the centrifugal action due to the speed of rotation.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

JONAS ALBERT JOHNSEN.

Witnesses:
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