No. 881,633. PATENTED MAR. 10, 1908.

J. STUMPF.

STEAM TURBINE.

APPLICATION FILED SEPT. 8, 1903. RENEWED OCT. 4, 1905.

Fig. 1.

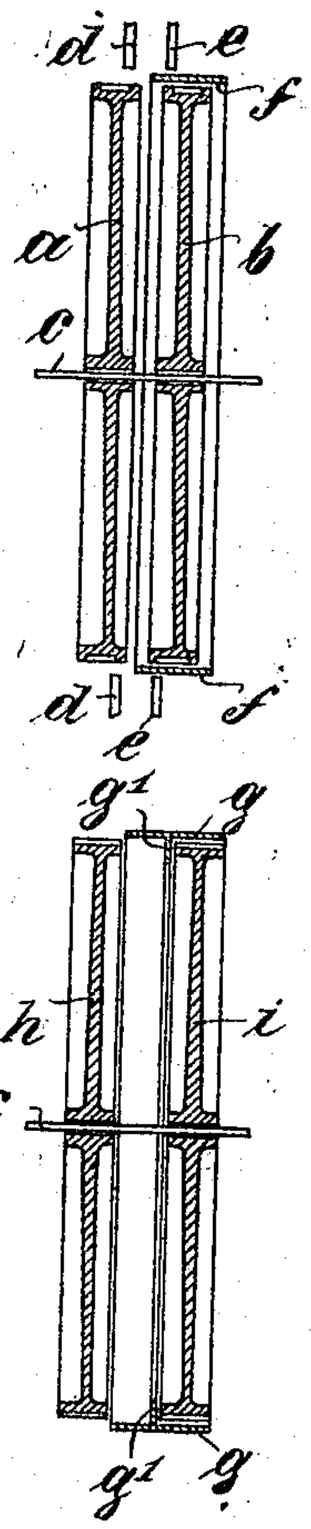


Fig. 2.

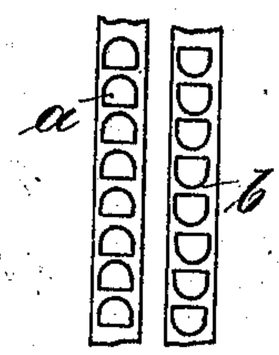
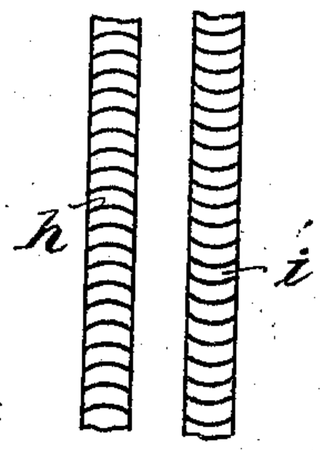


Fig. 3.

Fig. 4.



Witnesses:
Otto Scholz.
Emil Kayser.

Inventor
Johann Stumpf.
by Pierce Fiske
Attorney

UNITED STATES PATENT OFFICE.

JOHANN STUMPF, OF CHARLOTTENBURG, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

STEAM-TURBINE.

No. 881,633. Specification of Letters Patent. Patented March 10, 1908.

Application filed September 8, 1903, Serial No. 172,242. Renewed October 4, 1905. Serial No. 281,244.

To all whom it may concern:

Be it known that I, JOHANN STUMPF, a subject of the King of Prussia, German Emperor, and resident of 27 Rankestrasse, Charlottenburg, near Berlin, Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Steam or Gas Turbines, of which the following is an exact specification.

My invention relates to improvements in steam or gas turbines and more especially to such turbines, provided with several turbine wheels or with several rows of vanes or buckets.

The purpose of my invention consists in avoiding the losses arising by the resistance of the air in these vanes or buckets which are not impinged upon by the steam. In all turbines these losses effect a considerable diminution of the energy of the turbine and it has been found out that according to the density of the medium in which the vanes or buckets move, these losses can even amount to $\frac{1}{5}$ of the total energy of the turbine. These losses arising by the action of the buckets will be most considerable if one or several turbine wheels must rotate without any steam impinging upon the same. This occurs in case of turbines with several turbine wheels in which the energy of the steam is step by step utilized. If in such turbines one or several turbine wheels are to be cut out of service, these turbine wheels on account of all turbine wheels being fixed to the same shaft, are naturally rotated and in consequence thereof these turbine wheels have to overcome the resistance of the air. This resistance is still more considerable in turbines with backward and forward movement, in which turbines one or several turbine wheels are provided for the movement in one direction, and one or several others for the movement in the other direction. If in such turbines the steam impinges upon the turbine wheels which effect the movement of the turbine in one direction, the turbine wheels which are adapted to effect the movement of the turbine in the other direction, are taken along on account of being fixed to the same shaft. The vanes or buckets of these turbine wheels consequently move against the air or other fluid medium situated in the turbine casing, so that these vanes or buckets act in the manner of a ventilator and effect thereby considerable losses in the energy of the turbine. Now it has shown that this resistance of the air depends upon the free space in which the turbine wheel moves, that is to say in case only a very small free space is situated around the turbine wheel, the resistance of the air is only very small. In the most turbines it is however impossible to arrange the turbine wheels in that manner that they fit exactly into the casing surrounding the same. In several turbine wheel systems the admission nozzles and the like necessitate a special form of the casing which form renders it impossible to arrange the walls of the casing directly around the turbine wheel. Certain parts of the turbine wheels must always be left free for the inlet and outlet of the steam and these free parts of the turbine wheels effect a considerable loss during the rotation of the turbine. In order to do away with this disadvantage, I provide my new invention, which consists in arranging annular slides which can be shifted over these turbine wheels which are not impinged upon by the steam.

In order to make my invention more clear, I refer to the accompanying drawing, in which:

Figure 1 is a scheme showing my invention applied to a turbine with buckets, Fig. 2 shows part of the rims of the turbine wheels, Fig. 3 is a scheme showing the invention applied to a turbine with vanes, and Fig. 4 shows part of the rim of the turbine shown in Fig. 3.

In the drawing (Fig. 1) *a* and *b* are turbine wheels the buckets of which are arranged in opposite directions. Both turbine wheels are fixed to the common shaft *c*. *d* indicates the admission nozzles for the turbine wheel *a*, and *e* indicate the admission nozzles for the turbine wheel *b*. *f* is an annular slide which in the position shown is situated around the turbine wheel *b* and is separate from the wheel casing. It is to be noted that the slide acts only on the buckets which are not receiving steam. The size and shape of this slide or covering may be changed to suit the shape of the wheel buckets and the number in operation. This slide *f* can be moved by means of bars or other similar means which may be actuated by hand, by means of a governor or in any other convenient way. If the movement of the turbine is to be reversed the slide *f* has to be shifted over

the turbine wheel *a*. The slide *f* consequently avoids the losses arising by the resistance of the air in the buckets.

It will be understood that the invention may be applied to nearly all constructions of turbines and that any convenient number of turbine wheels may be arranged upon the same shaft. It will also be understood that instead of several turbine wheels one turbine wheel provided with several rows of vanes and buckets may be used. In case of using turbine wheels with vanes after the Laval-type, as shown in Figs. 3 and 4, it will be clear that the resistance of the air in the buckets occurs not only at the circumference but also at the sides of the rims and it will therefore be advantageous to arrange a slide which not only covers the circumference but also the sides of the turbine wheel rims.

In the construction shown in Fig. 3 a slide *g* is shown, which has a T-shaped cross section. The part *g'* is situated between the turbine wheels *h* and *i*. In the position shown in the drawing the slide covers the circumference of the turbine wheel *g* and the inner side of the rim of this turbine wheel. If the slide is moved to the left hand side the circumference and the inner side of the rim of the wheel *h* will be covered. If also the outside of the rims shall be covered special rings may be provided for this purpose.

It will be understood that the construction shown in the drawing is only an example and that the same may be modified in different ways, for instance instead of arranging one slide for each wheel several slides may be provided.

The invention is not only applicable for turbines with backwards and forwards movement, but can also be applied to turbines with several turbine wheels running in the same direction if one or more of these turbine wheels are to be cut out, but must rotate with the other ones.

Having thus fully described the nature of this invention, what I desire to secure by Letters Patent of the United States is:—

1. In a steam or gas turbine, the combination of a plurality of turbine wheels provided with buckets or vanes, and adjustable means for covering one of said turbine wheels.

2. In a steam or gas turbine, the combination of a plurality of turbine wheels provided with buckets or vanes, and an annular slide adapted to cover one of said turbine wheels.

3. In a steam or gas turbine, the combination of two turbine wheels provided with buckets or vanes, an annular slide adapted to cover one or more of said turbine wheels, and means on said slide adapted to cover one or more sides of said buckets or vanes.

4. In a steam or gas turbine, the combination of two turbine wheels provided with buckets or vanes and an annular slide having a flange adapted to cover the sides of said buckets or vanes.

5. In an elastic-fluid turbine, the combination of a wheel having active and idle buckets with an adjustable covering for the idle buckets.

6. In an elastic-fluid turbine, the combination of wheel buckets, a device discharging fluid against certain of the buckets, and an adjustable covering for the idle buckets.

7. In an elastic-fluid turbine, the combination of a wheel having active and idle buckets, with an adjustable covering which presents smooth surfaces to the idle buckets.

8. In an elastic-fluid turbine, the combination of a wheel having active and idle peripheral buckets, with an adjustable covering for the idle buckets which presents a smooth surface to the periphery of the wheel and a smooth surface to the side of the buckets.

9. In an elastic-fluid turbine, the combination of buckets arranged in rows, with a covering which can be shifted from one row to another.

10. In an elastic-fluid turbine, the combination of a wheel, and a complete range of idle buckets, with a covering presenting a smooth surface to the buckets for reducing the rotation losses of all of said buckets.

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

JOHANN STUMPF.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.