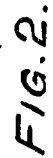


APPLICATION FILED AUG. 12, 1913.

Patented Aug. 4, 1914.

2 SHEETS—SHEET 1.



Prof. H. Kitchel.
Palmer Watson

Ernst Muhl
BY J. S. Prentner
ATTORNEY.

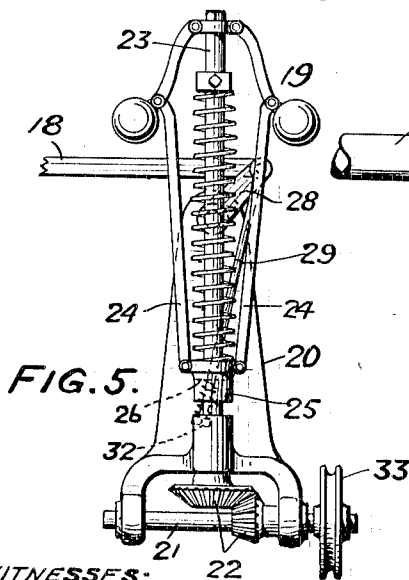
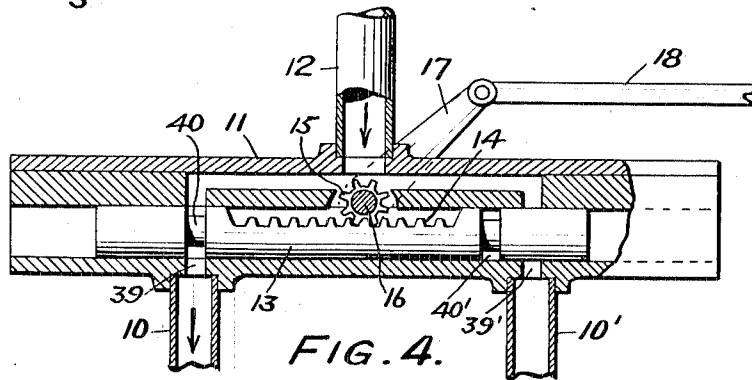
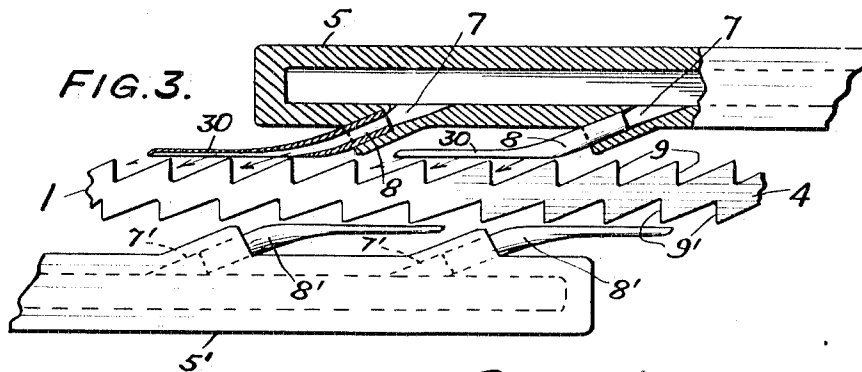
E. MÜHL.
TURBINE.

APPLICATION FILED AUG. 12, 1913.

1,105,992.

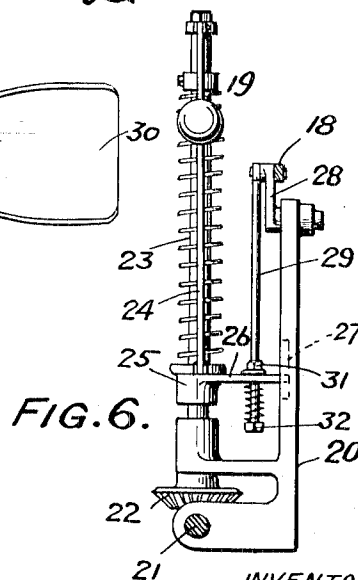
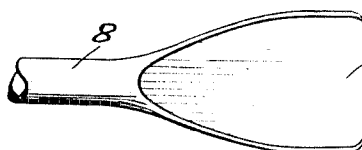
Patented Aug. 4, 1914.

2 SHEETS-SHEET 2.



WITNESSES:

Art. M. Kitchel.
Palmer Watson



INVENTOR
Ernst Mühl
BY *J. S. Prentice*
ATTORNEY.

UNITED STATES PATENT OFFICE.

ERNST MÜHL, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR OF ONE-HALF TO OTTO DONATZ, OF TRENTON, NEW-JERSEY.

TURBINE.

1,105,992.

Specification of Letters Patent.

Patented Aug. 4, 1914.

Application filed August 12, 1913. Serial No. 784,299.

To all whom it may concern:

Be it known that I, ERNST MÜHL, a citizen of the United States, and a resident of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Turbines, of which the following is a specification.

This invention relates to turbines, and particularly to such as are adapted to convert the kinetic energy of a fluid, like steam, into the mechanical energy of a rotating wheel. The principal distinction between this and any other known type of turbine is, that whereas the present day turbine is driven peripherally, my improved turbine is driven facially.

One of the principal objects of my invention is a turbine wheel provided with blades which project axially from its faces and are adapted to receive the impulses of a jet of steam directed by a nozzle.

Another object is a turbine wheel which may be cast in one piece and adapted to be rotated in opposite directions.

Another object of my invention is a turbine wheel driven facially by a fluid under pressure and provided with such a perfect exhaust as to obviate the necessity of packing.

A still further object of this invention is a facially driven turbine wheel adapted to run at a constant speed.

A still further object of this invention is to provide a simple, inexpensive, durable, economical and efficient means for converting the kinetic energy of a moving fluid into the mechanical energy of rotation.

To the accomplishment of the recited objects and others coordinate therewith, the present embodiment of my invention comprises the method and means hereinafter described, illustrated in the accompanying drawings, and embraced within the scope of the appended claims.

In the said drawings:—Figure 1 is an elevation of a facially driven turbine intended to be operated by steam; Fig. 2 is a central section thereof; Fig. 3 is a partial development thereof; Fig. 4 is a longitudinal section of a valve box in connection therewith; Fig. 5 is an elevation of a governor in connection therewith; Fig. 6 is a side view thereof, and Fig. 7 is a fragmentary view of a nozzle.

In the drawings, 1 designates a wheel provided with a hub 2 adapted to be mounted on a shaft 3, and with serrated faces 4. A steam chest 5, supported by a bracket 6 to face the wheel, is provided with ports 7. Each port carries a nozzle 8 adapted to direct a jet of steam against a blade 9 of a tooth of the serrated ring which faces the chest, along the face which connects the crest of a tooth with the root of the blade, and the lip 30 of the nozzle which is adapted to bridge the crests of at least two teeth.

The steam chest is fed by a pipe 10, which is connected by a port 39 with the pocket of a valve box 11 supplied with steam by a main 12. In the valve box is mounted a slide valve 13 having a port 40 and provided with a rack 14 in mesh with a gear 15 mounted on a shaft 16 which is carried by the box 11. On the shaft 16 is also mounted a crank 17 which is pivotally connected with a rod 18.

A ball governor 19 is vertically supported by a bracket 20 which is provided with bearings for a horizontal shaft 21. The shaft carries a bevel gear 22 in mesh with a similar gear which is mounted on the governor spindle 23. The governor balls which are adapted to revolve with the spindle are connected by rods 24 with a collar 25 slidingly mounted on said spindle. The collar is provided with a horizontal arm 26 adapted to slide in the vertical slot 27 of the bracket 20. On top of said bracket is pivotally mounted a crank 28 which is pivotally connected with a suspended lever 29 and with the rod 18. The lever 29 is projected through a central perforation of the arm 26, which carries a perforated nut 31 adapted to form a floating fulcrum for the lever. The free end of the lever carries a nut 32 which supports a spring wound on the lever under the arm 26.

The governor shaft 21 carries a pulley 33 adapted to be belt connected with a similar pulley mounted on the wheel shaft 3, which is horizontally supported by bearings of the pedestals 34. The wheel shaft carries a pulley 35, for which may be substituted either a gear or coupling, adapted to transmit the power developed by the wheel. The wheel is mounted in a casing 36 which is provided with an exhaust 37 and with a draft hole 38.

By reference to the drawing, the opera-

tion of the turbine is as follows:—Steam is forced by the pipe 12 into the pocket of the box 11 around the cylindrical port 40 of the valve 13 which registers with the port 39, and thence by the pipe 10 into the chest 5. Steam jets are discharged by the chest ports 7 through the nozzles 8 against the blades 29 whose roots are connected with the crests of the teeth beyond the mouths of the nozzles, which crests are bridged by the lips of the nozzles, constituting substantially an expanded portion of the nozzle. The expanded steam jet as it strikes the blade causes the wheel to rotate and is at the same time diverted by the blade to discharge facially at an angle with the direction of the jet, which prevents any back pressure. The governor shaft 21, which is adapted to be driven from the wheel shaft, transmits its motion to the spindle 23. The spring coil wound on the spindle is adapted to prevent the centrifugal movement of the balls when the speed of the turbine wheel is constant. Any increased speed of the wheel causes the balls to move centrifugally. The centrifugal movement of the governor is communicated to the collar 25 by the connecting rods 24 to cause it to move upwardly together with its arm 26. The nut 31 which is forced to slide upwardly on the lever 29 causes its arm which is connected to the crank 28 to rock in the direction of the spindle 23, which forces the rod 18 to rock the valve crank 17 in the direction of the pipe 12. This movement is communicated to the valve which is caused to slide in a direction opposite to that of the rod 18 and to partly close the port 39. The spring coil on the lower arm of the lever 29 is adapted to restore the normal condition, whenever there is a tendency for the speed to decrease.

Having thus described a one sided turbine, those conversant with the art will find no difficulty to make a double acting turbine, I therefore illustrated in the drawing a reversible turbine. As shown in the drawing, the turbine wheel is also provided with a second serrated ring having blades 9' adapted to be impelled in a direction opposite to that of the arrow heads by jets from nozzles 8', through ports 7' of the chest 5' fed by a pipe 10' which is connected with the valve box by a port 39' controlled by the valve port 40'. To reverse the turbine, it is only necessary to swing the crank 17 to a position opposite that shown in Fig. 4, whereby the port 39 is closed and the port 39' opened, and the lever 29 is rocked in a position opposite to that shown in Fig. 4. When the crank 17 is moved from the

position shown in Fig. 4 into an opposite position, it must be moved through the position wherein it is at right angles with the valve, which brings the valve to a position in which both ports are closed to cause the turbine to stop before it is reversed. With the above described arrangement it becomes impossible for the turbine to reverse itself, as the perpendicular position of the valve crank causes a dead center.

The construction and arrangement thus far shown and described is considered sufficient where the object is simplicity, low initial cost, rough and ready usage, and capable to be operated by an unskilled person. But without departing from the principle of this invention it can be so modified as to produce a highly efficient machine and economical in the consumption of steam. The faces of the wheel may be provided with a series of rings, each ring provided with a modified series of blades, to be acted upon by jets adapted to direct the steam in stages and to utilize almost its entire range of expansion.

In its broader aspect my invention, therefore, comprehends the employment not only of the various means described, but of equivalent means for performing the recited objects, and it is desired to reserve the right to effect such modifications and variations thereof as may come fairly within the scope of the appended claims.

What I now claim as new and desire to protect by Letters Patent, is—

1. In a turbine, a wheel, a closure therefor, a nozzle inside the closure and facing the wheel, means for forcing steam through said nozzle, said closure provided with an exhaust for said steam, and with a draft hole adapted to force said steam through the exhaust.

2. In a turbine, a wheel adapted to be moved by the action of a fluid thereon, a closure therefor provided with means adapted to convey the moving fluid to the wheel, said closure provided with an exhaust, and with a draft opening adapted to force the moving fluid through said exhaust.

3. In a turbine, a wheel, a closure therefor, means for conveying steam through the closure to the wheel, said closure provided with an exhaust and with a draft opening to force the steam through the exhaust.

In testimony whereof I hereunto affix my signature in the presence of two subscribing witnesses.

ERNST MÜHL.

Witnesses:

PALMER WATSON,
ALBERT M. MOORE.