

No. 866,958.

PATENTED SEPT. 24, 1907.

A. PATSCHKE.
STEAM TURBINE.

APPLICATION FILED DEC. 31, 1906.

2 SHEETS—SHEET 1.

Fig. 1.

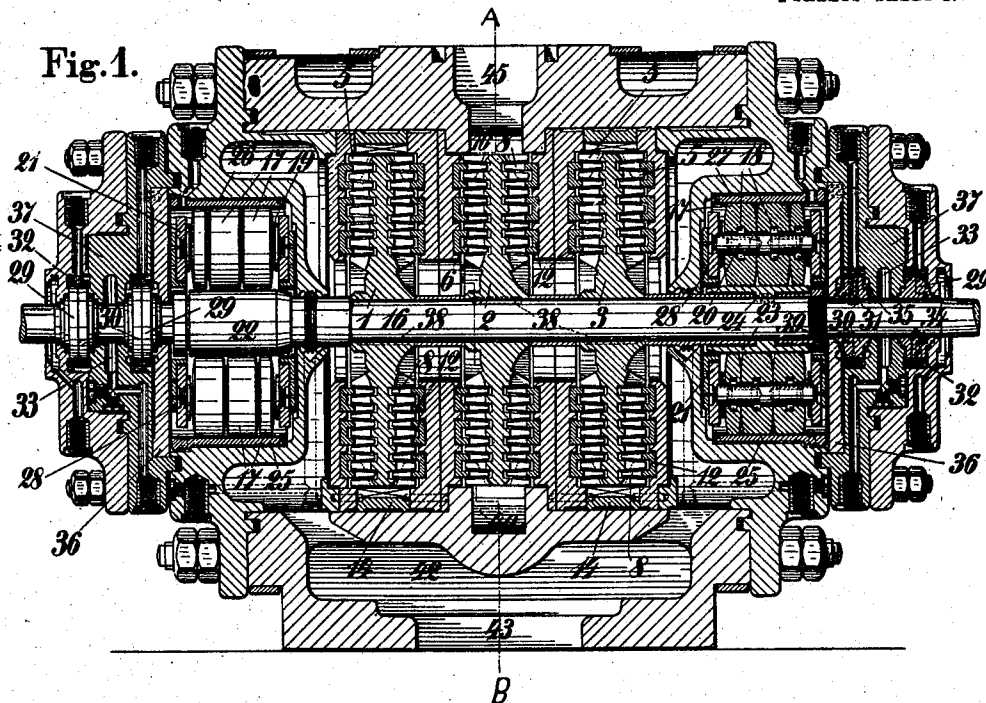
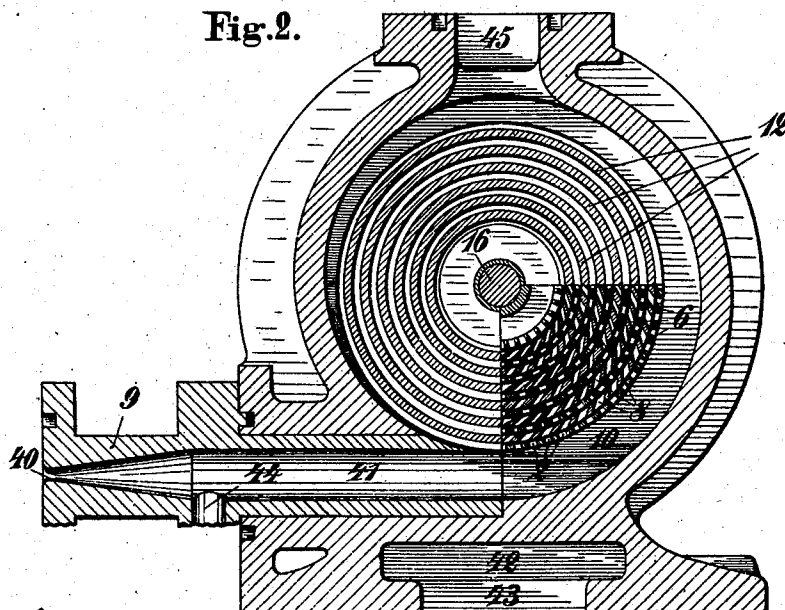


Fig. 2.



Witnesses:
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Inventor:
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2 SHEETS—SHEET 2.

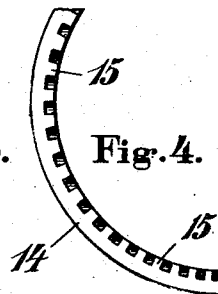
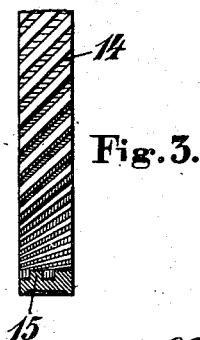
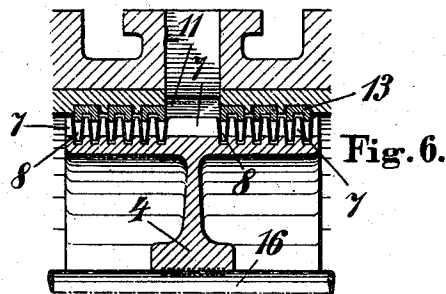
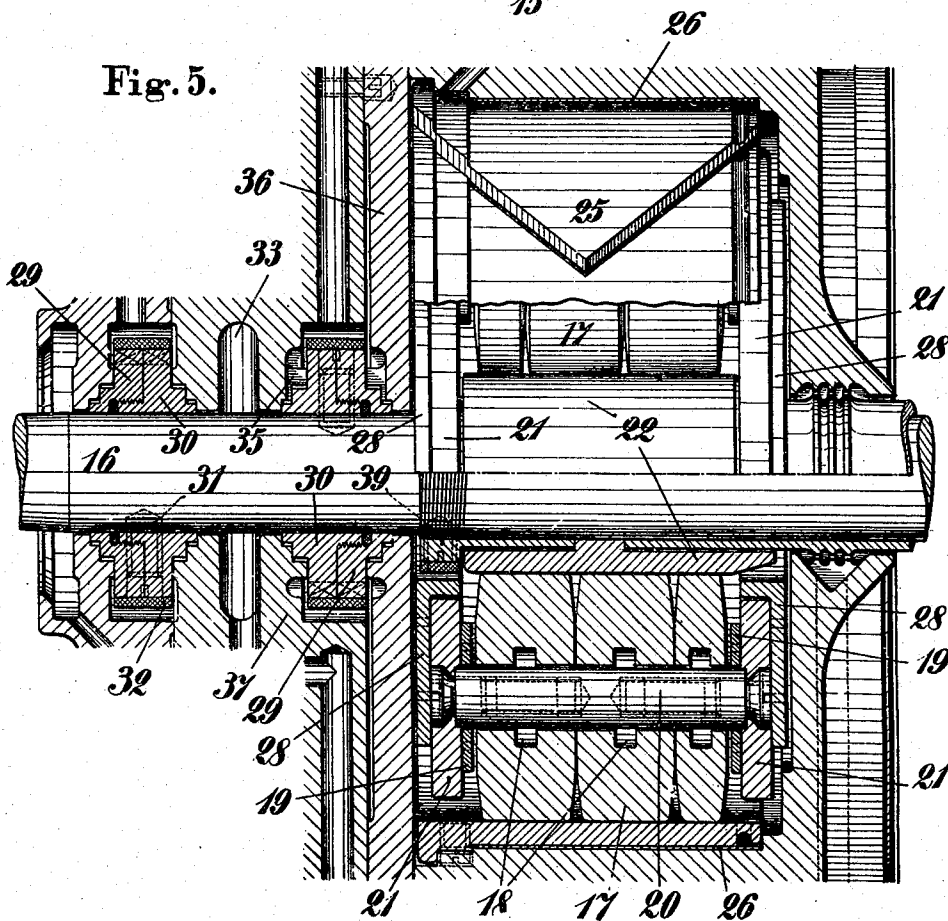


Fig. 5.



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UNITED STATES PATENT OFFICE.

ARTHUR PATSCHKE, OF DÜSSELDORF, GERMANY.

STEAM-TURBINE.

No. 866,958.

Specification of Letters Patent.

Patented Sept. 24, 1907.

Application filed December 31, 1906. Serial No. 350,252.

To all whom it may concern:

Be it known that I, ARTHUR PATSCHKE, a citizen of Germany, residing at Düsseldorf, Germany, have invented new and useful Improvements in Steam-Turbines, of which the following is a specification.

This invention relates to an improved steam turbine which is so constructed that it may be readily reversed and that it may also be utilized as a compressor.

In the accompanying drawings: Figure 1 is a longitudinal section of my improved steam turbine; Fig. 2 a cross section on line A—B, Fig. 1; Figs. 3 and 4 are details of the toothed ring; Fig. 5 is an enlarged section of the bearing, and Fig. 6 a longitudinal section, partly broken away, of a modification of the turbine.

The numerals 1, 2 and 3 indicate turbine wheels keyed to a shaft 16, and of which wheel 2 is arranged between wheels 1 and 3. Wheel 2 is provided at both sides with a number of concentric grooves, tapering in cross section, to form a series of intervening concentric beveled rings. These rings are slotted radially to form steam passages and intermediate turbine blades 6. Wheels 1 and 3 are constructed in like manner, having the turbine blades 5. Blades 5 and 6 are received in correspondingly shaped concentric grooves of stationary rings 12 that flank the turbine wheels. The axially extending concentric flanges formed intermediate said grooves and received by the grooves of the turbine wheels, are provided with inclined slots 8.

The turbine wheels are manufactured in the following manner: Into the turbine wheels are first cut concentric grooves, (Figs. 1 and 2), or axial parallel grooves, (Fig. 6), trapezoidal in cross section. Then in radial or axial direction, prismatic slots having a semi-circular base are so cut into the turbine wheel, that the projections obtained form the turbine blades. Owing to their trapezoidal cross section and to the semi-circular base of the prismatic cell-slots, the blades are formed in the shape of a feather, so that great stability is insured, notwithstanding the great number of steps in the turbine and the smallness of the turbine blades. The turbine wheels may also be made, although less advantageously, by first cutting the radial or axial slots and subsequently providing the concentric or axial and parallel grooves.

Steam or other pressure medium enters nozzle 9 at 40 and passes through pipe 41 into an annular duct 10 which gradually decreases in width. Within this duct the steam acts upon the circumference of wheel 2, where it is divided into two currents that flow along both sides of said wheel. The steam passes alternately through the radial slots of wheel 2, and through the inclined slots 8 of rings 12. During this zig-zag travel of the steam, oblique slots 8 direct it against the radial blades 6 of wheel 2, so as to rotate the latter. After the steam has passed wheel 2, near the axis thereof, it passes along such axis to then flow through the corre-

sponding slots formed on the inner faces of wheels 1 and 3, thus also rotating such wheels. At the periphery of wheels 1 and 3, the steam passes through the inclined grooves formed between the teeth 15 of stationary rings 14. The steam now acts upon the blades 5 formed on the outer faces of wheels 1 and 3, in the same manner as it had previously acted upon the blades of wheel 2. After the steam has passed wheels 1 and 3, it flows into chamber 42 whence it passes through opening 43, either into a condenser (not shown), or is discharged. If the direction of the steam is reversed, *i. e.*, if it enters through openings 43 and is discharged through pipe 41, the turbine will rotate in the opposite direction, as will be readily understood.

During the forward movement of the turbine, ducts 44 and 45 are closed, while during its backward movement, such ducts 44 and 45 are opened for the discharge of the steam.

If it is desired to use the turbine for an air compressor or similar device, shaft 16 is rotated by suitable means, (not shown), the medium to be compressed entering at 43.

Shaft 16 is supported by anti-friction rollers 17 having oil grooves 18 and engaging sleeves 22 and 23 which are secured to such shaft as at 24. Rollers 17 turn on pins 20 which are carried by rings 21 inclosed within split boxes 25. Rollers 17 are held in position against axial displacement by disks 19 and rings 28.

Shaft 16 is embraced at each side by two pairs of double packing rings 29, 30, secured thereto by screws 31 which are tightened by rings 32. The outer sides of rings 29, 30 are stepped to engage the correspondingly stepped heads 36 and 37. Between each pair of rings 29, 30 there is provided a chamber 33, in which steam or air of atmospheric pressure is contained. The screws 31 of three of the double packing rings 29, 30 engage enlarged openings in shaft 16, so as to allow a small play of the rings, while the screw 31 of the fourth packing ring engages a socket 34 of like diameter, so that this ring is firmly held in position. For the two inner packing rings there are provided relief ducts 35, in order to reduce the steam pressure to which the rings are subjected. The recesses of shaft 16 for receiving the keys 24, 38, and screws 31, 39, are placed on diametrically opposite sides of such shaft, to prevent the latter from bending under the influence of heat.

In the modification shown in Fig. 6, a turbine wheel 4 is provided at its periphery with several rows of blades 7 cooperating with the slotted flanges 8 of rings 13, steam being admitted through passage 11.

The turbine wheels as above described may not only be used for steam turbines, but also for gas turbines, centrifugal turbine blowers, turbine pumps, turbine vacuum blowers, turbine compressors, etc., because the simple and extremely advantageous construction of the wheels permits a ready employment of many working

- steps with a small turbine volume. As the blades may be made integral with the wheel from a metal that melts at a high temperature, they will not suffer excessive strain owing to such temperature or to the centrifugal force. The turbine wheels may also be advantageously used for ship turbines, locomotive turbines and other reversible turbines, as they may be rotated in both directions, so that separate backward stroke turbines are dispensed with. In this way space and weight of the turbine is reduced with the same number of working steps. With a given volume and weight, reversing turbines may thus be constructed that contain the greatest number of working steps and which utilize large or small power units in an economical manner.
- 15 It will be seen that in my improved turbine, the steam or other pressure medium acts several consecutive times upon the different blades of the turbine, to

economize such steam. Furthermore, the direction of rotation of the turbine may be readily reversed.

I claim:

1. A turbine provided with a turbine wheel having concentric grooves of trapezoidal cross section, and intersecting radial slits to form plumose turbine blades, substantially as specified. 20

2. In a turbine, a shaft, a turbine wheel secured thereto and having concentric grooves of trapezoidal cross section, and intersecting radial slits to form plumose turbine blades, combined with a fixed ring flanking the wheel and having obliquely slotted flanges intermediate the blade-rows, substantially as specified. 25 30

Signed by me at Düsseldorf, Germany, this thirteenth day of December 1906.

ARTHUR PATSCHKE.

Witnesses:

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M. ENGELS.