

No. 748,678.

PATENTED JAN. 5, 1904.

H. WOLKE.

TURBINE.

APPLICATION FILED APR. 19, 1901.

NO MODEL.

2 SHEETS—SHEET 1.

Fig. 1.

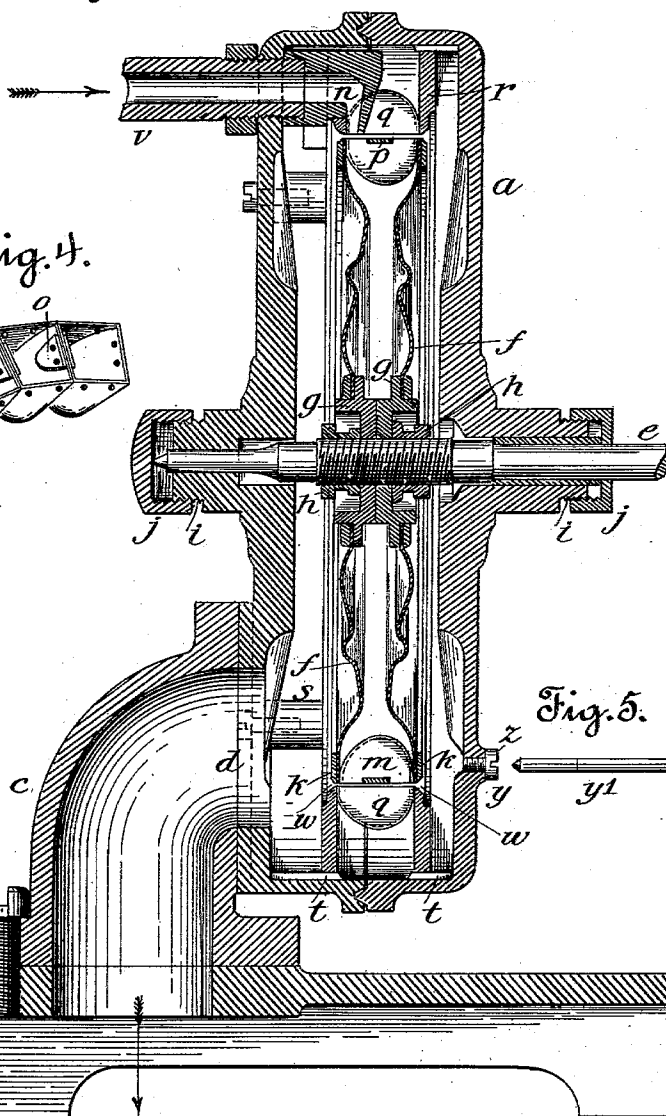


Fig. 3.

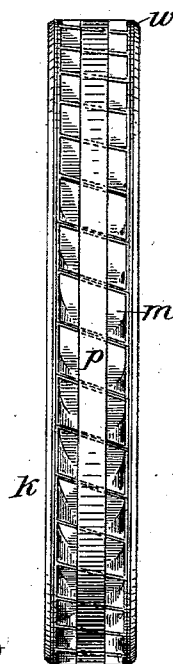


Fig. 4.

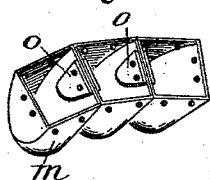
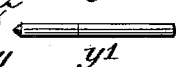


Fig. 5.



Witnesses.

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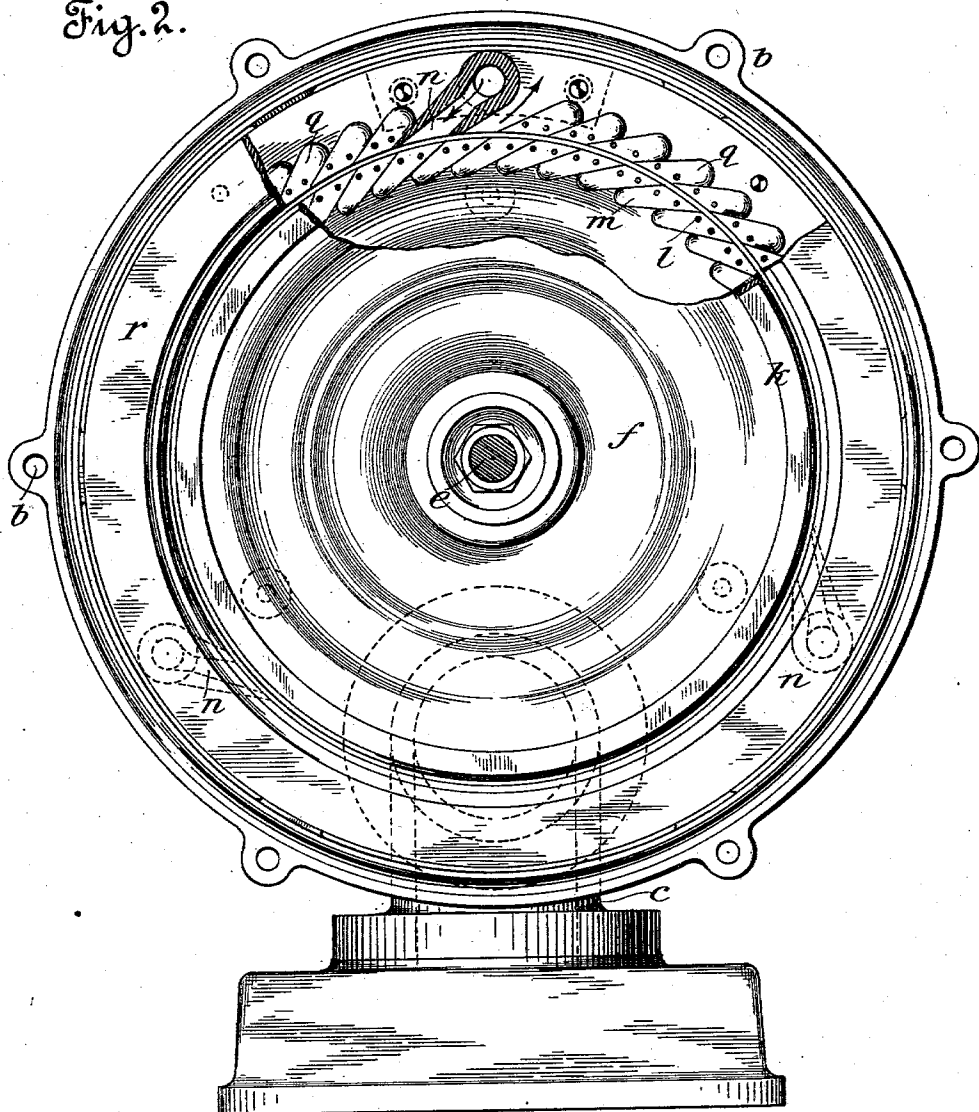
H. WOLKE.
TURBINE.

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NO MODEL.

2 SHEETS—SHEET 2.

Fig. 2.



Witnesses.

H. H. Steverdel.

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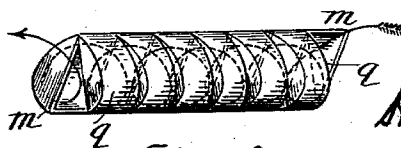


Fig. 6.

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HERMAN WOLKE, OF SAN FRANCISCO, CALIFORNIA.

TURBINE.

SPECIFICATION forming part of Letters Patent No. 748,678, dated January 5, 1904.

Application filed April 19, 1901. Serial No. 56,625. (No model.)

To all whom it may concern:

Be it known that I, HERMAN WOLKE, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Turbines, of which the following is a specification.

My invention relates to power-wheels or turbine-motors operated by the impact of jets of liquid or of fluid in a liquid or a vaporized state.

My improvement is a comparatively low speed turbine even when operated at high pressure and develops extraordinary power at such comparatively low speed.

My turbine operates by multiple impact exerted always in the same direction upon a number of buckets—that is, the steam striking a bucket does not escape or exhaust, but is compelled to strike a second, third, or any number of buckets until its impelling force is exhausted. This is accomplished by directing the course of the motive fluid from bucket to bucket and always in the same direction by a peculiar mechanical arrangement of reacting and deflecting stationary buckets wholly or partly surrounding the rotary bucket-wheel, the motive fluid entering through one or more nozzles. The wheel-buckets and concentric stationary buckets form a confined path for the impelling fluid, in which it travels in substantially the same direction in which it started, impelling the wheel by multiple impact against successive buckets until its impelling force ceases. By means of two sets, respectively stationary and rotating, of semicircular or nearly-semicircular and tangentially-inclined buckets that coincide with their open faces, thus forming an approximately circular space between and within themselves, the motive fluid after leaving the nozzle under high pressure is directed and forced by continuous deflection around the inner periphery of said buckets to flow in substantially always the same direction, or, as it were, around a single axis, and by its impact or impinging force against the deflecting semicircular inner periphery of the wheel-buckets imparts a rotary motion to the turbine-wheel. The rotating wheel-buckets as they are passing the nozzle will advance the flow of steam to successive sta-

tionary deflecting-buckets, and the active fluid always traveling in one direction only will form loops and impart its force a number of times in succession to the rotating wheel-buckets until its impelling force practically ceases. To cause the flow of the active fluid to take a path with the least deviation from its most effective course, I have given to the buckets besides a tangential inclination an axial inclination, and the receiving and discharging ends of both the wheel and stationary buckets are set to such angles as to give the least irregular deviation to the flow of steam, which will conform very closely to a helical line.

Figure 1 is a vertical cross-section. Fig. 2 is a side elevation with the front half of casing removed. Fig. 3 is a peripheral elevation of the power-wheel. Fig. 4 is a detail perspective of wheel-buckets. Fig. 5 is a detail of centering-pin. Fig. 6 is a linear projection of wheel-buckets and casing-buckets to illustrate the course and action of the power-current.

The casing *a* is preferably of circular form and composed of two halves, air-tight, fitted together with a circular tongue-and-groove joint and secured by bolts which pass through peripheral lugs *b*. The casing is supported in any suitable way, according to the service required. I have shown it as mounted upon a hollow standard *c*, which communicates with the casing-outlet *d*. Formed in the casing-sections are bearings for shaft *e*, which carries the rotary power-wheel. This wheel or turbine is carried by a two-part hub *g g*, preferably of steel and which are clamped together upon the shaft by nuts *h h*, working upon a superficial thread on said shaft. The shaft-bearings project from the casing and have threaded ends *i*, which receive nuts *j* for adjusting the shaft and wheel to correct position within the casing. The turbine is formed from two disks *f f*, of sheet-steel or other suitable material, and are pressed or spun with concentric ribs or corrugations, so as to greatly increase their strength without increasing their weight, the intention being to combine lightness and strength, so as to avoid vibration as much as possible. The disks are further strengthened by rings *k*, of somewhat heavier material, se-

cured to their faces at the circular edges by rivets *l*, which also hold the wheel-buckets. The turbine-disks are spaced apart from each other in order to receive these buckets *m*.

5 For a proper understanding of the shape and position of the buckets relatively to the wheel-disks Figs. 2 and 3 must be compared with each other and with Fig. 1. They are placed closely together between the periph-

10 eries of the wheel-disks and are set at an angle to any tangent of the wheel and overlapping one another, Fig. 2. Further, they are of an approximately rhomboidal form in plan view, so that their meeting edges are at an

15 angle to the wheel-axis, Fig. 3. The transverse curve formed by the sides and bottom is not an arc, but is flattened on one side relatively to the other, so that the current of air, steam, water, or gas from the nozzle *n* will

20 meet with the minimum of frictional resistance along the flattened entering curve. This is illustrated at the top of Fig. 1. A series of these buckets closely set extend wholly around the circumference, completely

25 filling the space between the turbine-disks. They are riveted directly to each other and at the joints may be provided with strengthening-plates *o*, Fig. 4. For increased strength and to diminish any rotary fanning action I

30 prefer to surround the whole series with a tight-fitting circumference-band *p*, let into recesses in the bucket edges, Fig. 1. A hole *y* is also formed in the casing, through which a gaging-pin *y'* can be inserted to bear upon

35 a ring of the wheel-frame and ascertain whether or not the wheel is in proper position. This hole is ordinarily closed by a tight-fitting screw *z*.

This rotary bucket-wheel coöperates in action with a ring of surrounding stationary

40 buckets *q* of substantially similar construction and which are held at approximately the same angles to tangents of the ring, Fig. 2, but at opposite angles to its axis, Fig. 6.

45 Any one revolving bucket will therefore coincide with a succession of open stationary buckets. The buckets *q* are secured between rings *r*, which are secured to the casing by studs *s*, Fig. 1. The inner periphery of the

50 casing is cast with series of projections *t*, against which the rings *r* bear when fitted in place, so that a clearance is left between the rings and casing, excepting where interrupted by these projections. This leaves a free

55 space for the escape of any exhaust or for waste water and also insulates the rings from the casing, so that the conduction of heat from rings to casing is mainly prevented. Entering through one of the stationary rings

60 *r* is the nozzle or nozzles *n*, connected to a supply pipe or pipes *v*, for supplying the power fluid. These nozzles discharge at the same angle as the rotary buckets receive and directly into such buckets successively, and

65 one, or preferably two, of the stationary buckets are omitted where they enter, Fig. 2.

The principle governing the operation of

this wheel is that of multiple impact in the same direction. The jet of air, steam, water, or other fluid which strikes any bucket of the

70 rotating series continues to do work upon succeeding buckets without changing its course until the impelling force has been expended, this force operating by alternating

75 action and deflection in the rotary and stationary buckets. Referring to steam as illustrative of all fluids capable of use as impelling forces, it will be obvious that a jet discharged from a nozzle into any rotary bucket

80 acts therein to impel the whole wheel and then escapes from it. The escape is necessarily into the first stationary bucket in communication, and as the steam is only slightly diminished in impelling power it is deflected

85 from that stationary bucket into the succeeding rotary bucket and produces another propulsive impact, and this alternation of action and deflection continues until the impelling force has been expended. This point having

90 been calculated with reference to the size of the wheel and the power desired, another nozzle is properly placed and discharges a second fluid-supply, which acts in like manner.

95 As many nozzles can be used in this way as are required to obtain the best and most effective results. In the drawings, Fig. 2, three of such nozzles are shown. The exhaust is

100 out between the edge rings of the rotary and stationary bucket series, which are beveled off, as shown at *w*, to diminish friction and back pressure and facilitate the escape. By

105 the omission of one or more buckets immediately back of each nozzle, as shown in Fig. 2, the exhaust will be still further facilitated. In addition the space caused by this omission

110 relieves the bucket-wheel of any pressure remaining, and thus prevents back pressure into the next nozzle or interference with the jet entering therefrom. There is thus a continuous helical course for the current of

115 steam, which forms advancing helical whirls or loops between the concentric rings of buckets, which I have attempted to delineate graphically in Fig. 6 by a horizontal projection of both sets of buckets and an arrow indicating the current. The advance of the

120 rotary wheel must be imagined; but the course of the current is the same as indicated. The jet discharged from the nozzle is directed to one side of the rotating wheel-buckets, (see

125 top of Fig. 1,) acts against its bottom, makes a turn around the same of about one hundred and eighty degrees, and leaves the bucket on the opposite side from which it entered, but in advance of its entering-point, owing to

130 the inclination of the bucket to the wheel-axis. It then enters an adjacent deflecting-bucket and there completes its advancing helical turn by another curve of one hundred and eighty degrees and is in position to again enter the wheel-buckets, but at a point in advance of its first entrance, and this is repeated until its momentum with relation to the speed of the wheel is exhausted. The

helical course of the acting fluid acting by the laws of impact causes the wheel to revolve, and in relation to the speed the helical turns or loops will be more or less elongated and their number will bear a definite relation to the pressure of the motive fluid. Thus in using steam the expansive force is conserved to the point where it practically ceases doing work at all intermediate points and practically without waste of power.

The machine shown is best adapted for a steam-turbine, but with slight modifications can be used effectively as a high-pressure water-motor. The principal change would consist in reducing the number of stationary buckets, leaving only one or a few adjacent to each nozzle. This is quite practicable, as the speed of the water-jet would not be nearly so high as that of high-pressure steam. This reduction of the number of buckets enables the water to escape freely, which it could not do were a whole ring of stationary buckets used. It must be understood also that only a partial ring of stationary deflecting-buckets can be employed, if desired, instead of a complete ring; but in general practice a complete ring will be found most effective in connection with one or more nozzles.

I do not limit myself to the details of construction herein described and shown in the drawings, as I desire to avail myself of such modifications and equivalents as fall properly within the spirit of my invention.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A power-turbine comprising a casing having a series of inwardly-open and outwardly-overlapping stationary tangential buckets, and means for admitting fluid under pressure, a rotary wheel journaled in the casing having a series of peripheral outwardly-open and inwardly-overlapping tangential buckets, the two series of buckets with their open ends facing each other and forming a confined helical path, so that the fluid passes between both series of buckets in advancing helical whirls.

2. A power-turbine comprising a casing having a series of inwardly-open and outwardly-overlapping stationary tangential buckets, and a rotary wheel journaled in the casing having outwardly-open and inwardly-overlapping tangential buckets, the wheel and stationary buckets forming a confined helical path; the form of the inner space of each bucket being determined on two opposing sides by flat-faced walls approximately semicircular in outline, the semicircular edges of said walls joining at right angles with the face of an appropriately semicircular curved wall; thus forming a nearly-semicircular and flat pocket, whose bottom segment shows the three joined faces in cross-section at a U-shaped and rectangular position to each other.

3. A power-turbine comprising a casing hav-

ing a series of inwardly-open and outwardly-overlapping stationary tangential buckets, and means for admitting fluid under pressure, a rotary wheel journaled in the casing having outwardly-open and inwardly-overlapping tangential buckets, the wheel and stationary buckets forming between them a confined helical path, along which the fluid passes in advancing helical rings; the inner peripheral faces of the semicircular bucket-walls taking at the bottom sections of all the buckets, a perpendicular position to the radial lines of the centrifugal action of the whirling fluid.

4. A power-wheel bucket, rhomboidal in plan view, irregularly curved in cross-section, and having slightly-tapered ends merging into a bottom longitudinal curve.

5. In a power-turbine, a rotary wheel comprising two thin metallic disks, a shaft or axis, a wheel-hub to which said disks are secured, reinforcing-rings secured externally at the edges of said disks, and a series of peripheral buckets secured between the disks.

6. In a power-turbine, a rotary wheel, comprising two disks secured to a shaft or axis, reinforcing-rings located externally at the edges of said disks, a series of peripheral buckets arranged between said disks, and rivets for securing said rings to the disks, and said buckets between the disks.

7. In a power-turbine, a rotary wheel, comprising two disks secured to a shaft or axis, a series of peripheral buckets arranged and secured between said disks, reinforcing-plates on adjacent faces of said buckets, and rivets passing through said plates and said adjacent bucket-faces.

8. In a power-turbine, a rotary wheel having a series of peripheral buckets, in combination with a peripheral band inclosing and binding together the series of buckets.

9. In a power-turbine, a casing having a series of interior peripheral projections, rings secured in the casing in parallel planes and bearing on said projections so as to leave clearances between said projections, one or more inlet-nozzles, a discharge or exhaust pipe, a rotary wheel journaled in the casing, and buckets carried respectively by said rings and said rotary wheel.

10. In a power-turbine, a casing having stationary rings arranged in parallel planes and carrying buckets, a rotary wheel journaled in the casing and having a cooperating series of buckets, reinforcing-rings on the wheel in proximity to the casing-rings, and beveled edges to all of said rings forming a diverging circular outlet between the stationary and revolving buckets.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 6th day of April, 1901.

HERMAN WOLKE.

Witnesses:

L. W. SEELY,
F. M. BURT.