(No Model.) 2 Sheets—Sheet 1.

J. H. STAPLES.

TURBINE WATER WHEEL.

No. 511,716. Patented Dec. 26, 1893.

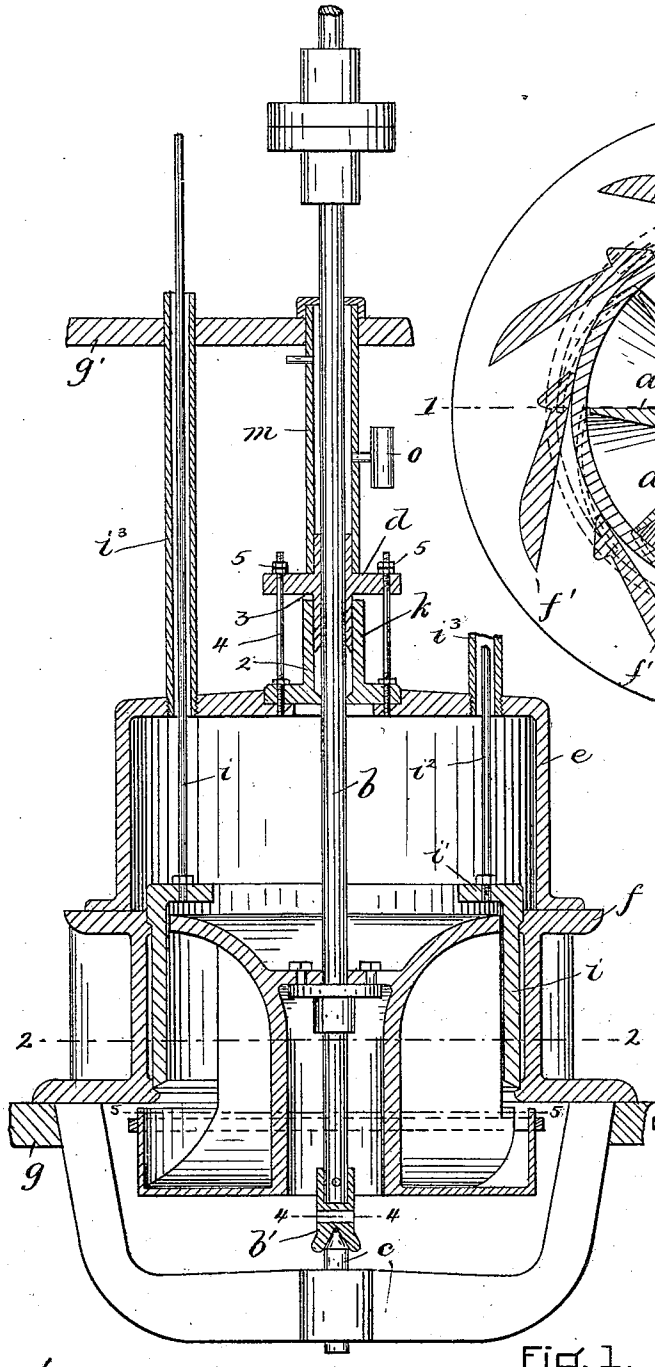

Fig. 1.

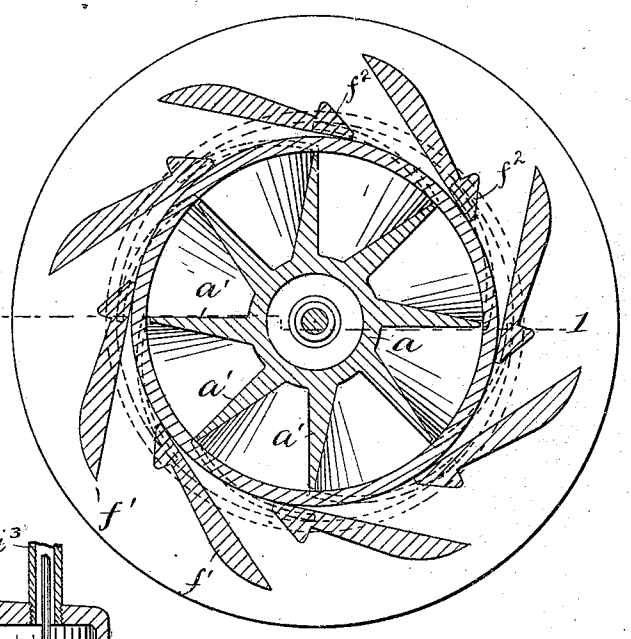

Fig. 2.

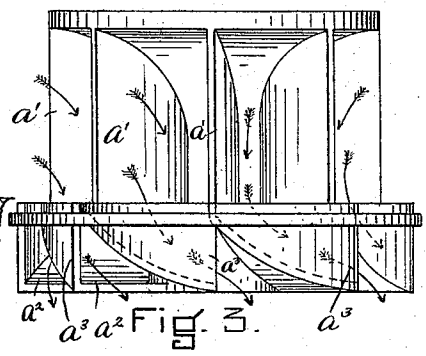

Fig. 3.

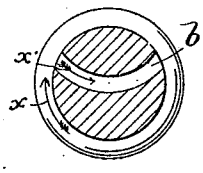

Fig. 4.

WITNESSES.

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A. D. Harrison.

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(No Model.)

2 Sheets—Sheet 2.

J. H. STAPLES.

TURBINE WATER WHEEL.

No. 511,716. Patented Dec. 26, 1893.

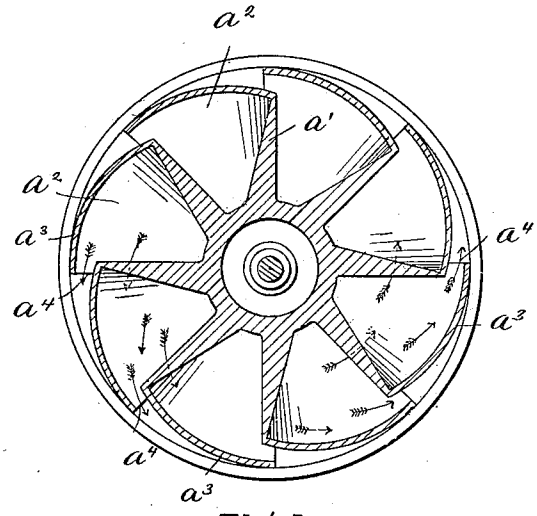

Fig. 5.

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UNITED STATES PATENT OFFICE.

JOHN H. STAPLES, OF CHARLESTOWN, MASSACHUSETTS.

TURBINE WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 511,716, dated December 26, 1893.

Application filed May 10, 1892. Serial No. 432,429. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. STAPLES, of Charlestown, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Turbine Water-Wheels, of which the following is a specification.

This invention has for its object, first, to increase the water-delivering capacity of a turbine wheel, so that more water can be passed through a wheel of given size than heretofore; secondly, to provide improved means for lubricating the shaft of a turbine wheel with water; and, thirdly, to provide certain improvements relating to the means for operating the gate of a turbine wheel.

To these ends, the invention consists in the improvements which I will now proceed to describe and claim.

Of the accompanying drawings, forming part of this specification: Figure 1 represents a vertical section of a turbine water wheel provided with my improvements, and a portion of the flume in which the wheel is located, the section being on the plane of line 1—1, Fig. 2. Fig. 2 represents a horizontal section on line 2—2, Fig. 1. Fig. 3 represents a side elevation of the turbine removed from its casing. Fig. 4 represents a section on line 4—4, Fig. 1. Fig. 5 represents a section on line 5—5, Fig. 1.

The same letters of reference indicate the same parts in all the figures.

In the drawings: a represents the central portion or hub of a turbine water wheel, and a' a' represent the blades or buckets extending outwardly from said hub. The general form of the hub and of the buckets is or may be the same as in many well-known turbines. I have here shown the vertical portion of each bucket as having one side radiating from the axis of the wheel, and its other side tangential to a circle outside of the said axis. The upper portion of each bucket is substantially vertical, and its lower or delivering portion a^2 is curved or inclined, as usual, so that the water which enters the wheel in a substantially horizontal direction, after impinging upon the vertical portions of the blades, acts upon the lower portions of the blades in passing downwardly, so as to give the wheel an impulse in the same direction as that caused by its first impingement against the vertical portions of the blades. Heretofore, the outlet for the water from the wheel having buckets with vertical upper portions has been either wholly at the bottom of the wheel below the lower ends of the inclined portions of the blades, or both at the bottom and between the outer edges of said inclined portions. When the water has been allowed to escape outwardly between the outer edges of the inclined portions of the blades, no provision has been made for utilizing its force, consequently considerable power has been lost in all wheels that have been constructed to facilitate the escape of water by allowing it to escape outwardly between the inclined portions of the blades.

In making my wheel, I have had two objects in view, viz: first, to provide a free egress of water from the lower portion of the wheel; and, secondly, to enable the escaping water, in passing outwardly between the inclined portions of the buckets, to exert a force or leverage upon the wheel, to aid in its propulsion. To this end, I provide hoods a^3 at the outer ends of the spaces between the inclined portions a^2 of the buckets, said hoods being eccentrically arranged with reference to the axis of the wheel, each joining the outer edge of one of the buckets and being carried gradually outward from the axis of the wheel, and forward toward and to a point beyond or outside of the edge of the next bucket, so that each hood is separated from the bucket in advance of the one to which the hood is connected by an open space or outlet a^4, as best shown in Fig. 5.

The form and arrangement of the hoods a^3 will be best understood by reference to Figs. 3 and 5, in which it will be seen, particularly by following the course of the arrows marked on said figures, that the water passing downwardly between the vertical portions of the buckets and along the curved lower ends of the buckets, in the usual way, is also permitted to pass outwardly or away from the axis of the wheel, and, in so doing, to exert pressure or leverage on the hoods a^3, and finally to escape through the outlets a^4. The hoods a^3, arranged as shown relatively to the blades

or buckets a', are a new feature in turbine wheels, and enable the water to escape rapidly without any sacrifice or loss of power by the outward movement of the water from the axis of the wheel. It will be seen, therefore, that the loss of power or pressure which the water experiences in its outward movement from the axis of the wheel, is compensated for by the increased leverage which it exerts upon the wheel by impinging upon the hoods a^3.

b represents the shaft to which the wheel is secured, said shaft being supported at its lower end by a step bearing c below the wheel, and at its upper portion by a bearing d suitably affixed to the dome or chamber e that surmounts the casing f within which the wheel is located.

g g' represent respectively the bottom and top of the flume which conducts water to the wheel, the casing f being attached to the bottom of said flume in any suitable way. The casing is provided with the pitchwaters or guides f', which guide the water to the buckets of the wheel.

i represents the gate, which controls the admission of water to the buckets, said gate being of circular form, and arranged to be interposed between the casing and the outer ends of the buckets, as shown in Fig. 1, when closed. The upper end of the gate is provided with an inwardly-projecting flange i', to which are connected the vertical rods i^2, whereby the gate is raised and lowered. Said rods extend upwardly through the chamber e that receives the gate when the latter is raised, and through tubes i^3 extending from the top of said chamber to the top of the flume, the object of said tubes being to prevent the upward escape of water around the gate-lifting rods i^2 when the gate is opened.

Any suitable mechanism may be used to raise and lower the gate through the rods i^2, and, as mechanism for this purpose is well-known, I have not shown it in the drawings.

The lower end of the shaft b is provided with a step b', formed to fit the bearing c. Said step is provided with a horizontal passage b^2, extending through it, as shown in Figs. 1 and 4, the object of said passage being to permit water to flow through the step and prevent it from being heated by contact with the bearing, said passage being in close proximity to the bearing. The passage is curved, as shown in Fig. 4, to cause the rotation of the step to establish a current of water through the passage, the step rotating in the direction indicated by the arrow x in Fig. 4, while the curvature of the passage causes a flow of water in the direction indicated by the arrow x'. By the provision of a single curved passage, as shown, the step is not materially weakened, and yet the water is caused to circulate close to the bearing.

Above the chamber e is a stuffing-box k, through which the shaft b passes, said stuffing-box being composed of the main portion 2, affixed to the top of the casing, and the gland or movable portion 3, connected by rods 4 4 with the top of the casing, and rendered adjustable by means of nuts 5 5 on said rods.

m represents a tube, which extends from the gland 3 upwardly around the shaft to and through the top of the flume g^2, said tube being of sufficient size to contain an annular space surrounding the shaft.

The construction of the stuffing-box and of the tube m is such that water from the flume cannot obtain access to that portion of the shaft within the stuffing-box and tube m excepting through said tube.

o represents a filter, which is attached to and carried by the tube m and is arranged to receive water from the flume, and to conduct it into the tube m. The object of said filter is to purify the water that enters the tube m and lubricates the shaft within the stuffing box, there being no other way for the water to enter the tube and stuffing-box excepting through said filter; hence the lubricating water is freed from grit and foreign matter before it is used for lubrication. This provision of means for filtering the water used to lubricate the upper bearing of the shaft is of considerable importance, and greatly increases the durability of said upper bearing.

Another of my improvements is the form given to the inner ends of the pitchwaters or guides f'. This improvement consists in forming a beveled face f^2 on the inner end of each pitchwater, said face being on the outer side of the pitchwater and so arranged that a line extended inwardly in continuation of it, would come within the circle of the outer ends of the buckets a', so that the stream of water directed into the wheel between any two pitchwaters will strike on the sides of the buckets in a solid unbroken stream, each surface f^2 being a tangent of a circle of less diameter than the circle of the outer ends of the buckets. Heretofore the outer surface of each pitchwater has been so arranged that it is a tangent of a circle of greater diameter than the circle of the outer ends of the buckets; hence a stream entering the wheel between any two pitchwaters is broken up, confused, and deprived of a portion of its force, because the planes of the two pitchwater surfaces which form the stream intersect at a point outside the outer ends of the buckets; hence the water does not strike the buckets in a solid unbroken stream.

I claim—

1. A turbine water wheel, comprising in its construction buckets provided with vertical upper portions and which are inclined at their lower portions and have eccentrically arranged hoods at the outer ends of the lower portions, each of said hoods having its forward edge extending to a point outside the outer edge of the vertical portion of the next bucket; fixed guides or pitchwaters around and outside of the vertical portions of the buckets and having inclined guiding surfaces which are tangents of a circle within the cir-

cle of the outer ends of the buckets; and a circular gate vertically movable between the said guides or pitchwaters and the vertical portions of the buckets, substantially as described.

2. In a turbine water wheel, the step fixed to the shaft and provided with a single transverse passage in close proximity to the step bearing, said passage having its central portion located substantially at the axis of rotation of the step and each end of said passage meeting the circumference of the shaft at an angle less than that of the radius of the shaft, whereby, during rotation of the shaft, a current of water may be induced to flow through said passage from end to end, substantially as and for the purpose set forth.

3. The combination with a turbine water wheel of fixed guides or pitchwaters having at the inner ends of their outer sides inclined guiding surfaces which are tangents of a circle within the circle of the outer ends of the buckets of the wheel, the other side of each of said guides or pitchwaters being a tangent of the outer circle of the buckets, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 15th day of April, A. D. 1892.

JOHN H. STAPLES.

Witnesses:
C. F. BROWN,
A. D. HARRISON.