

J. S. RECHARD.
Turbine Water-Wheel.

No. 220,034.

Patented Sept. 30, 1879.

Fig. 1.

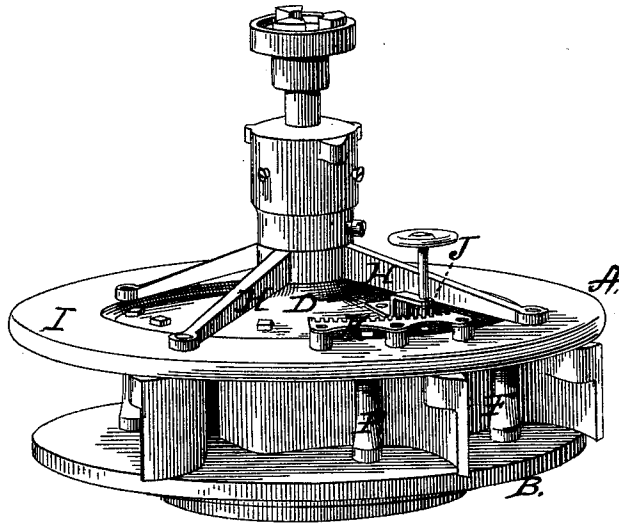
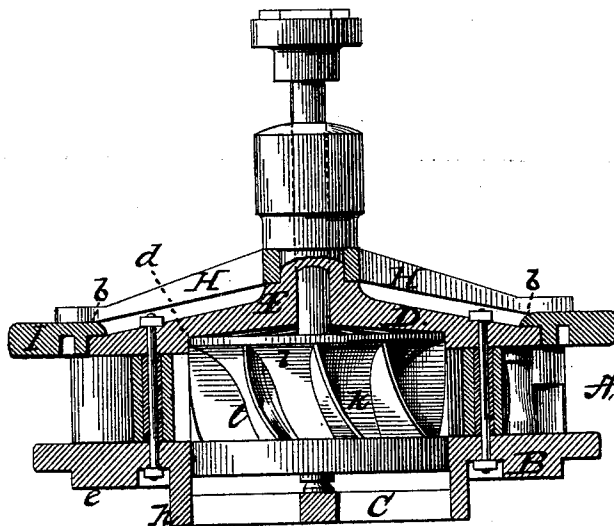


Fig. 2.



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Fig. 3.

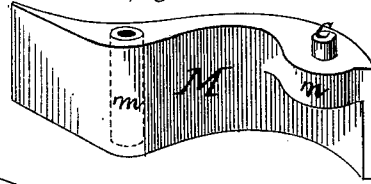


Fig. 4.

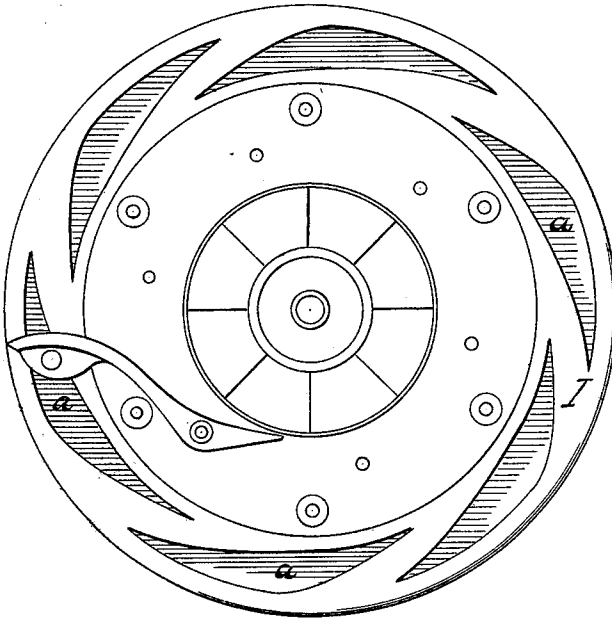
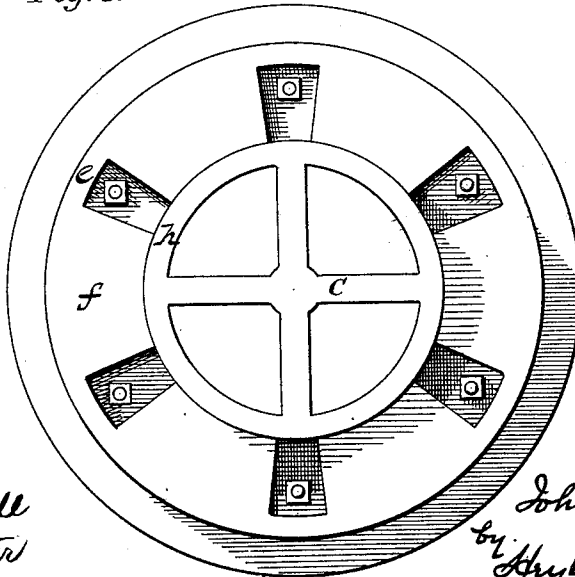


Fig. 5.



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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN TURBINE WATER-WHEELS.

Specification forming part of Letters Patent No. **220,034**, dated September 30, 1879; application filed June 30, 1879.

To all whom it may concern:

Be it known that I, JOHN S. RECHARD, of York, in the county of York and State of Pennsylvania, have invented new and valuable Improvements in Turbine Water-Wheels; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, and to the letters and figures of reference marked thereon.

Figure 1 of the drawings is a representation of a perspective view of my improved water-wheel. Fig. 2 is a central sectional view. Fig. 3 is a perspective view of the improved gate. Fig. 4 is an under-side view of the cam-ring, showing only one gate in position. Fig. 5 is a bottom view of the base-plate.

This invention relates to certain improvements in the construction of water-wheels, especially of that class known as "turbine," which rest on the floor of a pen-stock; and they consist, principally, in the novel construction of a casing or frame for the inward-flow turbine water-wheel composed of a re-enforced bottom plate with a series of cavities or recesses on its under surface to receive the nuts of the fastening-bolts, a spider for supporting the wheel-spindle, a stationary recessed crown-plate, a sliding cam-ring for operating the journaled gates, a series of columns interposed between the crown and bottom plates, and a plurality of non-corrosive bolts; also, in the novel construction of a bottom or base plate adapted to rest on the floor of a pen-stock; also, in the combination, with a stationary crown-plate, of a cam-ring having an inwardly overlapping flange protecting the intervening joint, and a series of cam-faces acting directly on the journaled gates; also, in the novel construction of the curved gates; and, finally, in the combination and arrangement of parts, as will be hereinafter more fully set forth, and pointed out in the claims.

The object of my invention is to simplify the construction of the parts, and have the fewest parts possible which shall be effective in operation, doing the work as well as, if not better and quicker than, ordinary wheels of this class.

By the novel construction and arrangement of parts in my improved wheel I overcome and

obviate a great many of the difficulties experienced in wheels of this class now in use.

In the accompanying drawings, forming a part of this specification, the letter A represents the case proper of the turbine wheel, consisting of the bottom plate B, spider C, crown-plate D, and hub E, with a series of columns, F, preferably movable, arranged between the bottom and crown plates to sustain the parts to each other. Immediately above the crown-plate on the hub E is arranged a hub having a series of arms, H, extending radially to a ring, I, located at the outer end of the crown-plate.

The hub, radial arms, and ring may all be united by casting, or the ring may be bolted or riveted to the arms.

The upper surface of the ring is provided with a raised segment of a rack, K, which may be bolted thereto or cast therewith to engage with a pinion, J, mounted on the upper surface of the crown-plate of the wheel. The under side of this ring I is made with a plurality of recesses, terminating at the forward and rear surfaces in cam-faces *a*, substantially as shown in Fig. 4 of the drawings. These recesses do not extend entirely through the ring, as they are intended only as mediums for operating the pivoted gates. The inner diameter of the ring, now called "cam-ring," I, is of the same diameter, practically, as the outer diameter of the crown-plate, and is provided with an overhanging lip or inwardly-projecting flange, *b*, extending into the crown-plate of the wheel to keep the joint clear and to protect the same from sand and rubbish which might gather on the wheel-case. The outer diameter is intended to be the same as the extreme outer diameter of the gates when open. This cam-ring and crown-plate are even or flush, or nearly so, on their lower side, with the exception of the cam-recesses or cavities corresponding to the number of gates in the wheel.

The inner and under side next the shaft of the crown-plate is circularly recessed at *d*, about the size in diameter as the wheel proper, (see Fig. 2,) to receive that portion of the wheel proper above the buckets, and from the circle to its outer edge it is straight or horizontal. The object of forming this circular recess is to obviate the tottering or shaking of

that portion of the wheel adjacent to the crown-plate, and to give steadiness in the movements of the wheel.

M represents the gate, made of a curved shape, substantially as shown, and constructed with an enlargement or bulge, M, near its inner feather end, which is perforated to receive the securing-bolt, and a side lug, n, at its outer upper end, with a small pin projecting therefrom upwardly. These gates are made as follows: A brass or other non-corrosive metal bushing or tube for each gate is arranged in the mold at the point of enlargement after the pattern has been removed, the flask closed, and the metal (cast-iron) poured in the usual manner, so that the metal shall surround the bushing for the pivot. By this mode of manufacturing the gates I do away with the cores, and cast the gate, the side lug, and vertical pin in one piece.

The pivots used in connection with these gates should be made of brass or other non-corrosive metal, so that the gates will work freely and not bind.

The gates are so arranged between the bottom and crown plates of the wheel, and so pivoted that their inner ends shall be a little beyond the center of pressure.

The fastening bolt or pivot, forming the pintle upon which the gates work, is passed through the crown-plates, gates, and bottom plates, and secured to the under side of the bottom plate by nuts or other equivalent means resting in recesses. This method of connecting or pivoting the gates upon their bearings should be such that their outer ends when open shall not extend beyond the outer edge of the cam-ring.

The pins or studs *c* on the upper surface of the gates, near their outer ends, rest loosely in the recesses of the cam-ring, so that when the cam-ring is moved in one direction by means of the pinion and segmental rack or other mechanical means, the cam-surfaces of the cam-ring will come in contact with the studs of the gates and open them. When the cam-ring is moved in the opposite direction half its travel, the gate is free to close by the pressure of the water, thus making the gates self or automatic closing to that extent, or the return-stroke may be completed, causing the cam-surface to come in contact with the studs of the gates and compel them to close.

The upper surface of the bottom plate B of the case is straight or perfectly plain, and the outer edge may be rounding; but the under surface of the plate is re-enforced by the thickness *e* and the filling-pieces *f*, the latter being preferably connected with the circular vertical flange *h* of the plate. By re-enforcing the plate in this manner a series of recesses or cavities is formed to receive the nuts of the connecting-bolts, so that no projections shall extend beyond the lower surface to interfere with the base plate resting snugly on the floor of the pen-stock.

The spider C is constructed in the usual manner and secured to the circular flange *h* of the bottom plate by means of bolts. The office of the re-enforcing pieces *e* and *f*, forming a component or integral part of the bottom plate, is, when the position of the columns is considered as being in the same vertical plane, to rest on the floor of the pen-stock, so that the pressure of water, and curved in the direction of the movement of the water will have no tendency to spring or strain the bottom plate.

The wheel I have shown, and which I prefer to use, consists of the hub *i*, conical crown *k*, and buckets *l*. These buckets are secured to the conical crown by means of bolts, or they may be cast solid therewith, so as to lean a little forward from a radial line in the direction of the movement of the water, and curved in the direction of the movement of the water. The lower end of the shaft carrying the wheel is stepped on the wooden pin of the spider.

By the foregoing construction it will be seen that the bottom plate is strengthened and will have no tendency to spring or yield under the pressure of the water; and also, it will be seen that the gates are much longer from their pivots to the outer ends, thus making a long water-guide; and again, that the studs on the gates are short and come in close proximity to the cam-ring, obviating any twisting tendency of the gates in their duty, and enabling the whole series to be immediately and simultaneously operated without any tendency to derangement of the parts.

I am aware that non-corrosive metals have heretofore been used in journal-bearings; but I am not aware of any turbine water-wheel prior to my invention that has its gate-bearings and connecting-bolts made of a non-corrosive metal by which corroding and binding of the gates are materially obviated, as in the wheel described herein.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The casing or frame for a turbine water-wheel to rest on the floor of a pen-stock, consisting of the re-enforced bottom plate B, with a series of cavities, spider C, stationary recessed crown-plate D, sliding cam-ring I, with inwardly-overlapping flange *b*, column *F*, and the non-corrosive connecting-bolts, all arranged as shown and described.

2. The bottom plate of a casing for a turbine-wheel, having its under surface provided with a series of recesses or cavities arranged between the filling-pieces to receive the nuts of the connecting-bolts, as described, and for the purposes set forth.

3. In an inward-flow turbine water-wheel, the cam-ring having an inwardly-overlapping flange, and a series of cam-faces on the under surface, in combination with the crown-plate, substantially as and for the purpose set forth.

4. The curved gate hereinbefore described for a turbine water-wheel, constructed with the enlargement or bulge near its feathered end

for the vertical perforation and non-corrosive bushing, the side lug at its outer upper end, and a pin or stud extending upwardly from the side lug, as shown and described.

5. In a water-wheel, the combination of a series of gates having their working-bearings formed of a non-corrosive metal, and a corresponding series of bolts formed of a similar non-corrosive metal, passing through the bearings of the gates, whereby the corroding and binding of the working-bearings of the gates are obviated, as and for the purpose set forth.

6. The combination, with a water-wheel, of the stationary crown-plate, the outer movable cam-ring, bottom plate, and a series of gates journaled directly to the crown and bottom plates, and operated by the cam-ring through the medium of mechanism, substantially as described.

7. In a water-wheel, the combination, with a series of journaled gates having at their

upper surfaces small pins, of an overhanging sliding ring, independent of the crown-plate, having on its under surface a series of cam-recesses, corresponding to the number of gates, to regulate the gates for the admission of water to the wheel, as described.

8. The improved turbine water-wheel hereinbefore described, consisting, essentially, of the re-enforced bottom plate, B, with a series of cavities, spider C, stationary recessed crown-plate D, sliding cam-ring I, a series of gates, M, journaled directly to the crown and bottom plates, and a conical crown-wheel, substantially as set forth.

In testimony whereof I have hereunto subscribed my name.

JOHN S. RECHARD.

Witnesses:

JOHN W. WALTER,
W. B. G. RAMBO.