2 Sheets--Sheet 1.

H. VAN DE WATER.

Turbine Water-Wheels.

No. 140,602. Patented July 8, 1873.

Fig. 1

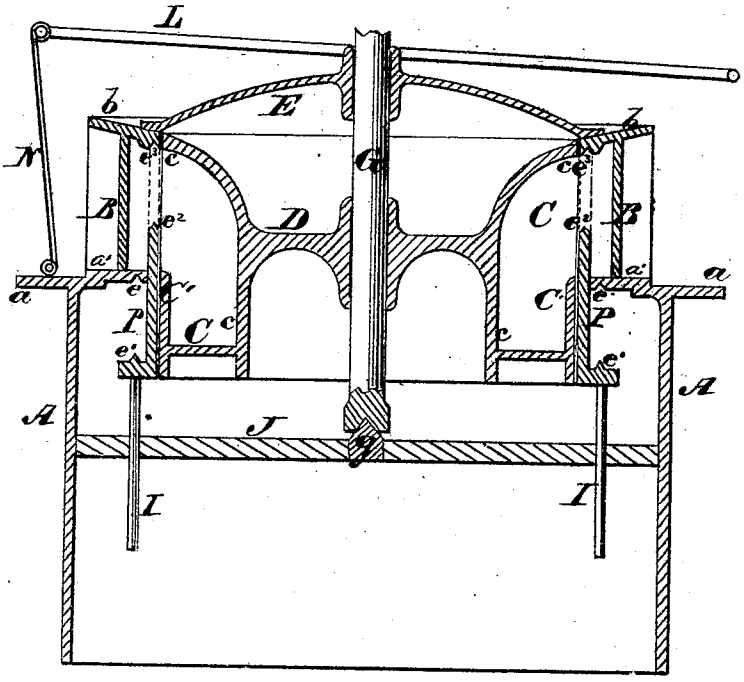
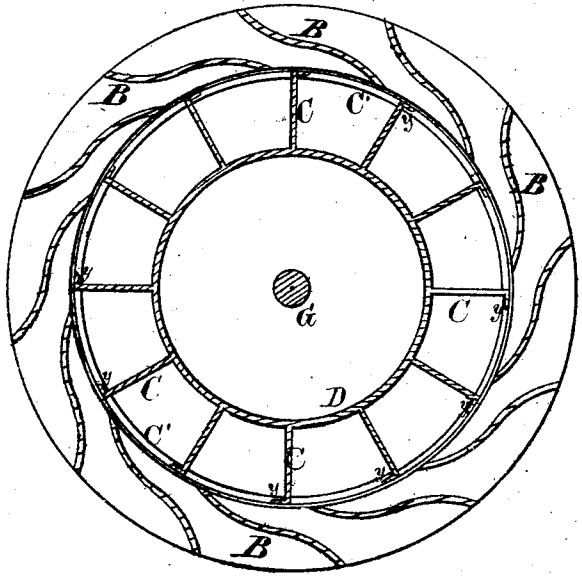


Fig. 2



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2 Sheets--Sheet 2.

H. VAN DE WATER.

Turbine Water-Wheels.

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Fig. 3

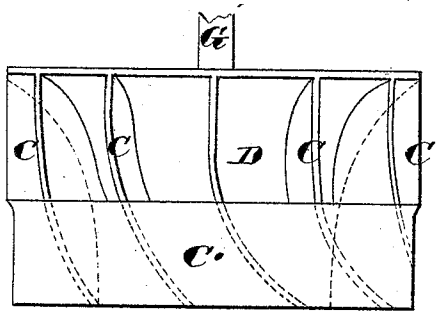
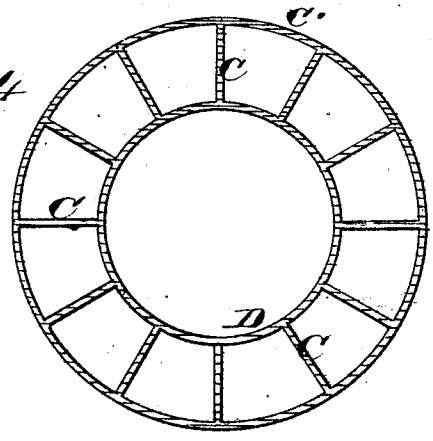


Fig. 4



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UNITED STATES PATENT OFFICE.

HENRY VAN DE WATER, OF ROCHESTER, NEW YORK.

IMPROVEMENT IN TURBINE WATER-WHEELS.

Specification forming part of Letters Patent No. **140,602**, dated July 8, 1873; application filed September 28, 1872.

To all whom it may concern:

Be it known that I, HENRY VAN DE WATER, of Rochester, in the county of Monroe and State of New York, have invented a new and Improved Water-Wheel; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings making part of this specification, in which—

Figure 1, Plate 1, is a diametrical section through the water-wheel. Fig. 2, Plate 1, is a section taken horizontally through the guides. Fig. 3, Plate 2, is a side view of the buckets belonging to the wheel. Fig. 4, Plate 2, is a section taken horizontally through the buckets.

Similar letters of reference indicate corresponding parts in the several figures.

This invention relates to certain novel improvements on the water-wheels of the turbine kind, for which Letters Patent were granted to me bearing date, respectively, on the 2d day of June, 1863, the 10th day of April, 1866, and the 31st day of August, 1869.

The following description of my invention will enable others skilled in the art to understand it.

In the accompanying drawings, A represents the draft-tube, which may be cylindrical or tapering, and which is constructed with an external flange, *a*, around its upper edge, as well as an internal flange, *a'*. From the internal flange *a'* rise the guides B, between which are the sluice-ways for the entrance of water from the penstock into the buckets. Each guide B is curved, and presents the form shown, for the purpose of directing the water into the buckets of the wheel D to the best possible advantage. On top of the guides B is a ring, *b*, which is cast with them, and which flares outwardly or is inclined, so as to form a continuation of the curved portions of the hub D for the purpose of directing the water downwardly into the buckets and preventing any such reaction of the water at the sluice-ways as would tend to cause it to escape over the top of the wheel D. Inside of the guides B is the wheel D, which is keyed to a vertical shaft, G, that is supported upon a bridge-tree or spider, J, by means of a conical step, *g*. This wheel D is closed on top by means of a stationary cover, E, which is bolted on top and near the inner edge of the inclined ring *b*, as shown in Fig. 1. Through this cover the wheel-shaft G passes, being steadied and guided by means of a suitable hub, lined with Babbitt metal at the center of the cover, said hub being kept tight from sand and grit by a suitable packing-ring of leather, held in position by adjustable rings of metal applied in any suitable manner. The wheel D, represented, consists of a hub and buckets.

In one of my former patents, above referred to, the hub of the wheel therein shown presented the form of the frustum of a cone inverted upon a cylinder, and at the junction of the two was an abrupt obtuse angle.

In another of these patents I obviated this difficulty by making the hub and the buckets in the same form as I now represent them, but still I experienced a difficulty from the abrupt angle which was formed at the junction of the buckets with the guide; and to obviate this difficulty I have devised the inclined top ring *b* of the guides, said ring, by the form of its under surface, when applied in connection with the hub and buckets, forming an uninterrupted continuation of the buckets.

It will be seen from an inspection of the drawings that the external surface of the hub of my present wheel presents an unbroken surface, *c*, from its upper to its lower end, the lower portion being a right cylinder terminating above in a gradually curved, or concaved and outwardly-flaring, surface; and that the ring *b*, by its form, continues the upper part of the hub out to the front of the gates on a gradual rise. By this form of hub and the ring combined with it the inflowing currents of water are not interrupted or broken, and therefore they do not react outwardly; at the same time the water will act upon the wheel with the proper lifting force. The buckets C are arranged at regular intervals apart around the hub D, and are partially inclosed by a narrow band or ring, C'. The upper portion of each bucket is perpendicular to a horizontal plane for a short distance; then a gradual curve is presented, terminating in a flat portion, which is inclined at an angle of about twenty degrees, more or

less. In a horizontal section, taken in any plane through the wheel, the edges of the buckets are in a line radiating from the axis of the wheel. In order to prevent the wheel from clogging or breaking, by reason of any obstruction getting between the buckets and the casing, the outer edges of the buckets are furnished with cutters, *y*, to cut away obstacles in their way. P represents the gate for entirely cutting off the flow of water through the wheel, and also for regulating the flow. This gate is circular and is allowed to receive a vertical motion, it being guided by rods I I, which work through the bridge-tree J. It is arranged between the guides B and the buckets C, and is raised and depressed by means of a hoop-lever, L, which has its fulcrum on a vibrating standard, N. The gate is connected to the lever L by means of two rods, which are not shown in the drawings. The upper edge of the gate P is preferably beveled, as at e^2, and when the gate is raised to its fullest extent this beveled edge fits into a V-shaped groove, e^3, in the ring *b*. Another V-shaped groove, *e*, is made into the flange *a'*, which, when the gate is shut, receives an annular tongue, e^1, which is on a flange projecting outwardly from the lower end of the gate, as shown in Fig. 1. By these means water will not leak through the wheel when the gate is shut.

The grooves *e* and e^3 might be changed in form without materially affecting the result, but a tighter fit can be made with the form shown than with a right-angular groove, I think.

It will be seen from the above description, first, that the circular gate P is opened by moving it downwardly, and therefore that the water, when flowing into the wheel, always flows over the upper edge of the gate under the inclined part of the wheel. In this way when the gate is partially open the inflowing water is compressed into a solid mass which tends to raise and free the wheel-shaft of friction; the water also has a downward fall and retrograde descent throughout the whole length of the buckets, or nearly the whole length thereof. Second, that the top of the wheel-case, or the dome, is so fitted as to set tightly into the guide-case, thereby acting as a bridge-tree and preventing the wheel from vibrating. Third, that the guides and the guide-case are cast in one piece, which greatly reduces the cost of manufacture and lessens the number of joints for leakage. Fourth, that the sluice-ways and buckets are continuations of one another—that is, the curved portions of the buckets terminate in sluice-ways, which gradually rise until they terminate, and that thereby the water has an unchanged course at the junction of the sluice-ways and the buckets. Fifth, that all obstructions to the revolution of the wheel will be overcome by the cutters on the buckets.

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

1. The gate P closing upward, arranged between the guides B and buckets C, and so constructed and applied in relation to grooves of the water-wheel casing that said grooves are entered and a tight joint formed at top and bottom of the gate when the gate is shut, substantially as described.

2. The ring *b* with its bottom surface forming regular or uninterrupted inclined continuations of the curved portions of the buckets of the hub, thus forming smooth flaring or funnel-shaped sluice-ways for the inflowing water, substantially as set forth.

3. The crowning or arched cap E, in combination with the inclined or flaring ring *b*, the same being applied as described and shown, whereby the ring is made to serve as an abutment for the cap E, substantially as described.

4. The cutting device *y*, applied to the buckets, so as to precede it in its path of motion and cut away any obstruction between it and the casing, substantially as described.

HENRY VAN DE WATER.

Witnesses:

HOMER H. WOODWARD,

GEORGE E. WARNER.