

**N. C. ROBERTS.**  
**Water-Wheels.**

No. 140,544.

Patented July 1, 1873.

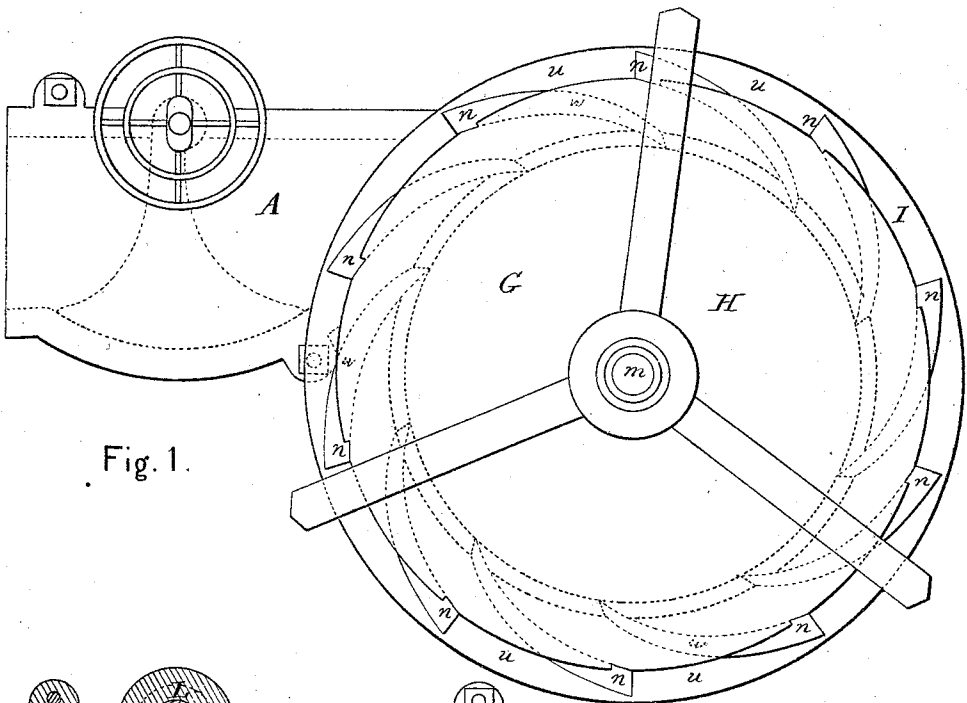


Fig. 1.

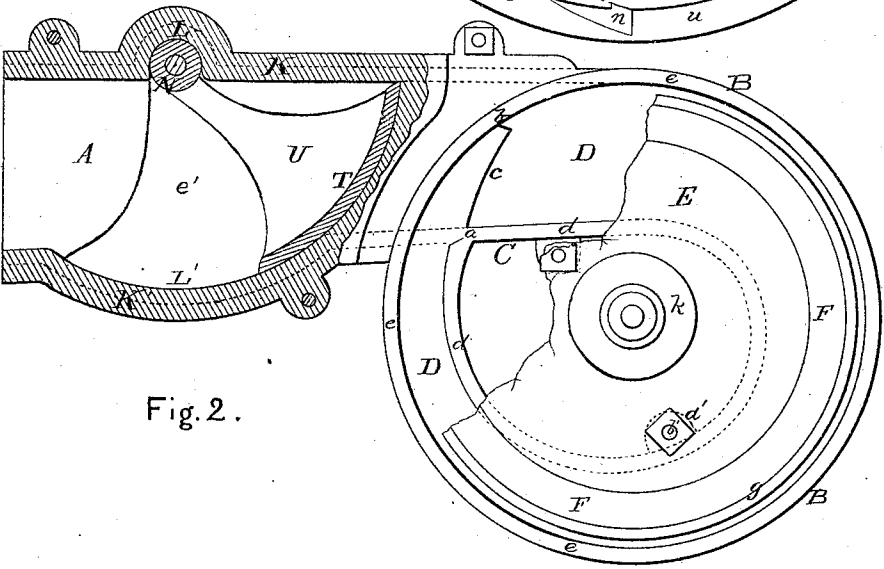


Fig. 2.

WITNESSES.

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## IMPROVEMENT IN WATER-WHEELS.

Specification forming part of Letters Patent No. **140,544**, dated July 1, 1873; application filed April 12, 1873.

*To all whom it may concern:*

Be it known that I, NORMAN C. ROBERTS, of Waterville, in the county of Oneida and State of New York, have invented a new and valuable Improvement in 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.

Figures 1 and 2 of the drawings are representations of plan views of my water-wheel. Fig. 3 is a sectional view of the same. Fig. 4 is a side view.

This invention has relation to certain improvements in turbines, consisting, first, in the construction and novel arrangement of the wheel and curb or fore-bay, so that the wheel can be placed either side upward, constituting it an under-draft or over-draft wheel, as may be desired; second, in the construction and arrangement of the concave or dish-shaped water-guide, in contact with the inner or scroll wall, and having its peripheral flange inclined upward and outward toward the outer wall, and extending somewhat higher than its upper edge; third, in the arrangement of the opening in the center of said water-guide, and of the removable shouldered step in connection therewith, said opening having a greater diameter than that of the wheel-shaft; fourth, in connection with the conical flange of the water-guide in the construction of the buckets having curved lateral walls upwardly and inwardly inclined, and the parallel upper and lower walls upwardly and outwardly inclined at an angle corresponding to the angle of the said flange of the water-guide; and, fifth, in the vertical cylindrical gate-wall having arms connected with the operating-shaft journaled at one side of the spout, said gate being received in a horizontally-curved recess in the opposite wall of the spout.

In the accompanying drawings I have illustrated this invention by means of a wheel discharging its water outwardly, but the same principles can be applied in the construction of an inwardly-discharging wheel and fore-bay.

In the drawings, the letter A designates the

spout; B indicates the outer or circular wall of the fore-bay; and C, the inner or scroll wall, which gradually approaches the outer wall, terminating at the point *a* when it joins its first portion. The bottom D of the fore-bay gradually rises from its level at the spout until it terminates at the point *b* of the outer wall, a free edge, *c*, extending from the point *a* to the point *b* extending obliquely upward and outward, as the upper edge *d* of the wall C is below the upper edge *e* of the wall B. E designates the top or upper water-guide of the fore-bay. This consists of a circular disk-shaped or concave plate, being level in its central portion, and rising at its circumference in the form of a conical flange, F, which extends upward and outward, terminating in a free circular edge, *g*, somewhat within and above the level of the edge *e* of the wall B. An opening, *h*, somewhat larger in diameter than the shaft of the wheel is made centrally through the plate E, and serves for the passage of the shaft when the wheel is reversed in position, or for centering the step *k* when the wheel is arranged as indicated in the drawings. The step *k* is provided with a flange or shoulder, *l*. When the wheel is reversed, making it an under-draft wheel, it is stepped by the use of an independent spider, on which the step *k* may be mounted. The wheel G consists of an upper plate, H, through the center of which passes the shaft *m*, and a lower plate, I, annular in form, and connected to said upper plate by the curved walls *n* of the buckets. The upper plate G is circular, and its surfaces have a double curvature, being convex centrally at *r*, this convex surface gradually becoming concave near the periphery, and forming the upper walls *s* of the buckets *u*. The lower walls *v* of said buckets are formed by the annular plate I, which has the form of the circumscribing surface of an inverted frustum of a cone, flaring upward and outward parallel with that portion of the plate G which forms the tops of the buckets. The lateral walls *w* of the buckets are formed by curved partitions, which are inclined inward and upward, being at right angles, or nearly so, with the top and bottom walls of the buckets. The lower circumference of the wheel is provided with a lip, *y*,

which fits over the upper edge of the outer wall of the fore-bay; and the plate E is provided on its under side with lugs  $a'$  or other devices whereby it is kept in position on the inner or scroll wall of the fore-bay. Connecting-bolts  $b'$  extend through lugs  $c'$  of the scroll-wall and through the plate E, and the parts are secured by the nuts  $d'$ . The top of the spout A may be secured by bolts. The side walls K K' are recessed at L L', respectively, for the reception of the operating-shaft N and the gate T, which are connected by the sector-shaped arms U. These arms are plane plates of little thickness, and they move in flat angular recesses,  $e'$ , in the top and bottom walls of the spout. The gate has the form of a part of cylinder, having its axis coinciding with the axis of the operating-rod. The curved plate of the gate is thin, but is sufficiently strengthened by its connection with the wide ends of the sector-shaped arms, the circular end of the gate being conjoined with the arc of the sector-arms throughout its length. Water entering through the spout when the gate is open will not be obstructed by the gate, its operating-shaft, or the connecting-arms. Entering the fore-bay it will be guided upward and outward through the continuous opening  $h'$ , between the plate E and the edge of the outer wall of the fore-bay, directly into the mouths of the buckets, from which it will be discharged at their outside or circumferential openings. The pressure of the water is kept even by the gradual taper of the fore-bay, so that as the volume is lessened by the discharge through the buckets the head is kept uniform throughout the opening  $h'$ .

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

1. The concave or dish-shaped water-guide E having the peripheral portion F inclined to

correspond with the angle of the bucket of the wheel secured on the inner wall, and extending outward, leaving a continuous opening,  $h'$ , between its outer edge and the edge of the outer wall, substantially as specified.

2. The combination, with the water-guide E having a central opening,  $h$ , larger in diameter than the shaft  $m$ , of the shaft and the removable shouldered step  $k$ , substantially as specified.

3. The wheel, consisting of the upper plate H having the convex center and the annular concavity near its circumference merging into the inclined edge  $s$ , the lower conical annular plate I parallel with the part  $s$  of the upper plate and the upwardly and inwardly inclined curved partitions  $n$ , substantially as specified.

4. The combination, with the concave water-guide E having a free edge,  $g$ , of the wheel having the buckets inclined at an angle corresponding to the angle of the water-guide, and the fore-bay having a rising helical bottom, an inner scroll-shaped wall, and an outer circular wall of different heights, substantially as specified.

5. The gate, consisting of the shaft N, the cylinder-plate T, and the sector-shaped arms U, substantially as specified.

6. The combination of a gate having arms extending from the operating-shaft across the spout to the closing plate T, with the spout recessed in its top and bottom and in each side, substantially as specified.

In testimony that I claim the above I have hereunto subscribed my name in the presence of two witnesses.

NORMAN C. ROBERTS.

Witnesses:

GEO. L. BUCKINGHAM,  
HENRY WALSH.