2 Sheets—Sheet 1.

A. J. HOPEWELL.

Turbine Water-Wheel.

No. 214,660. Patented April 22, 1879.

Fig. 1.

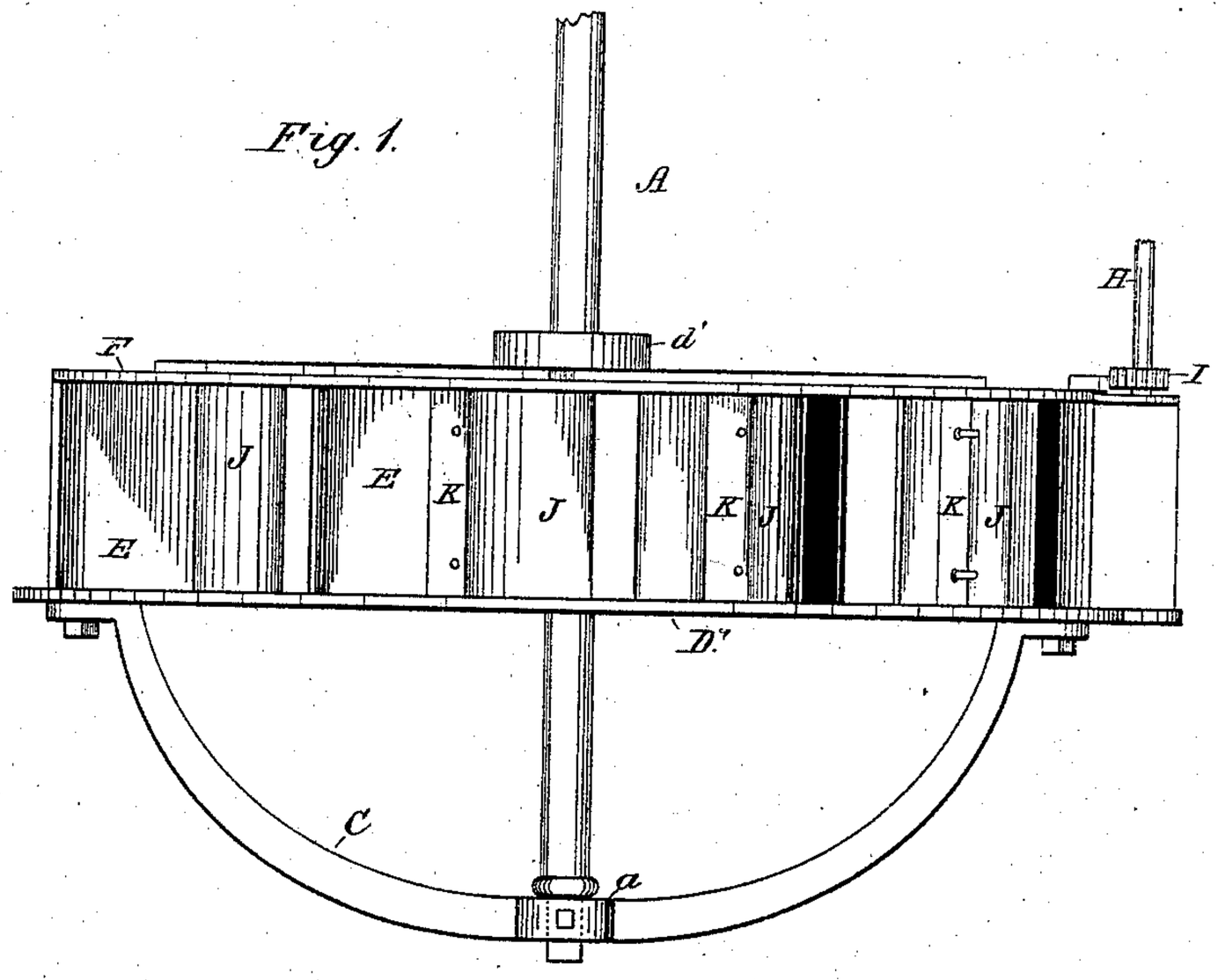
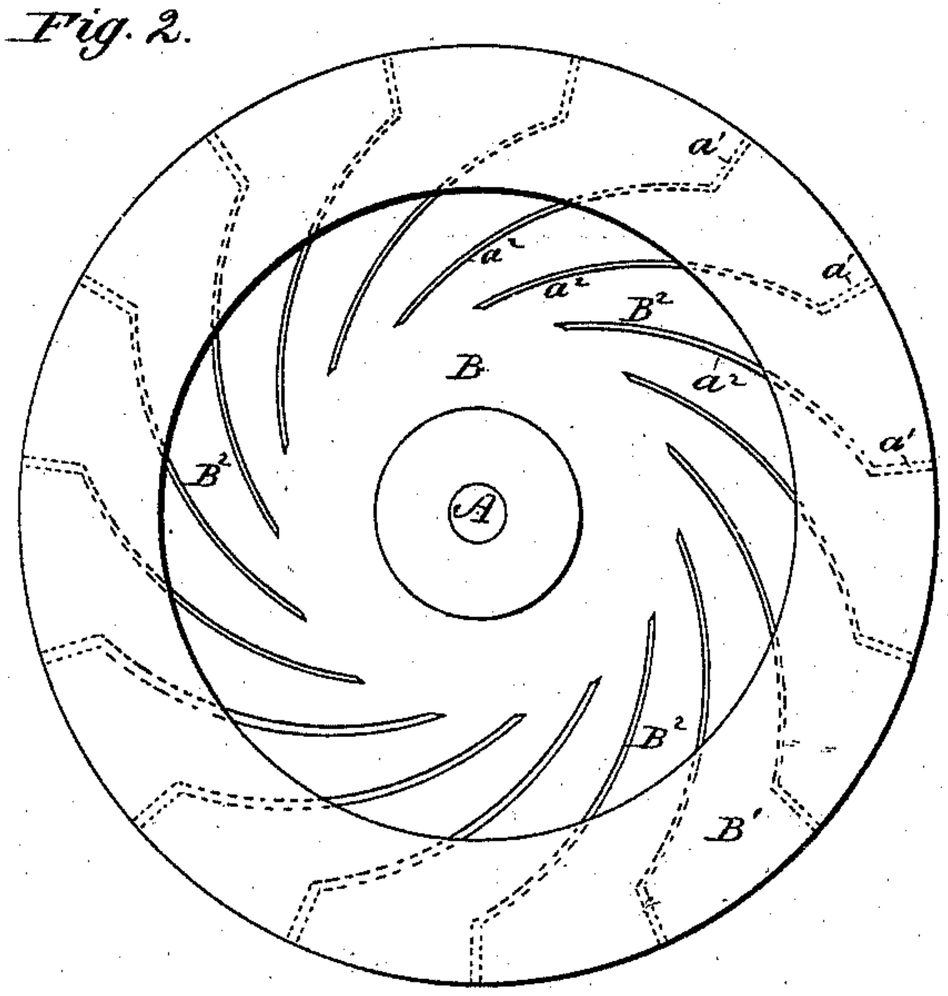


Fig. 2.



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2 Sheets—Sheet 2.

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Fig. 3.

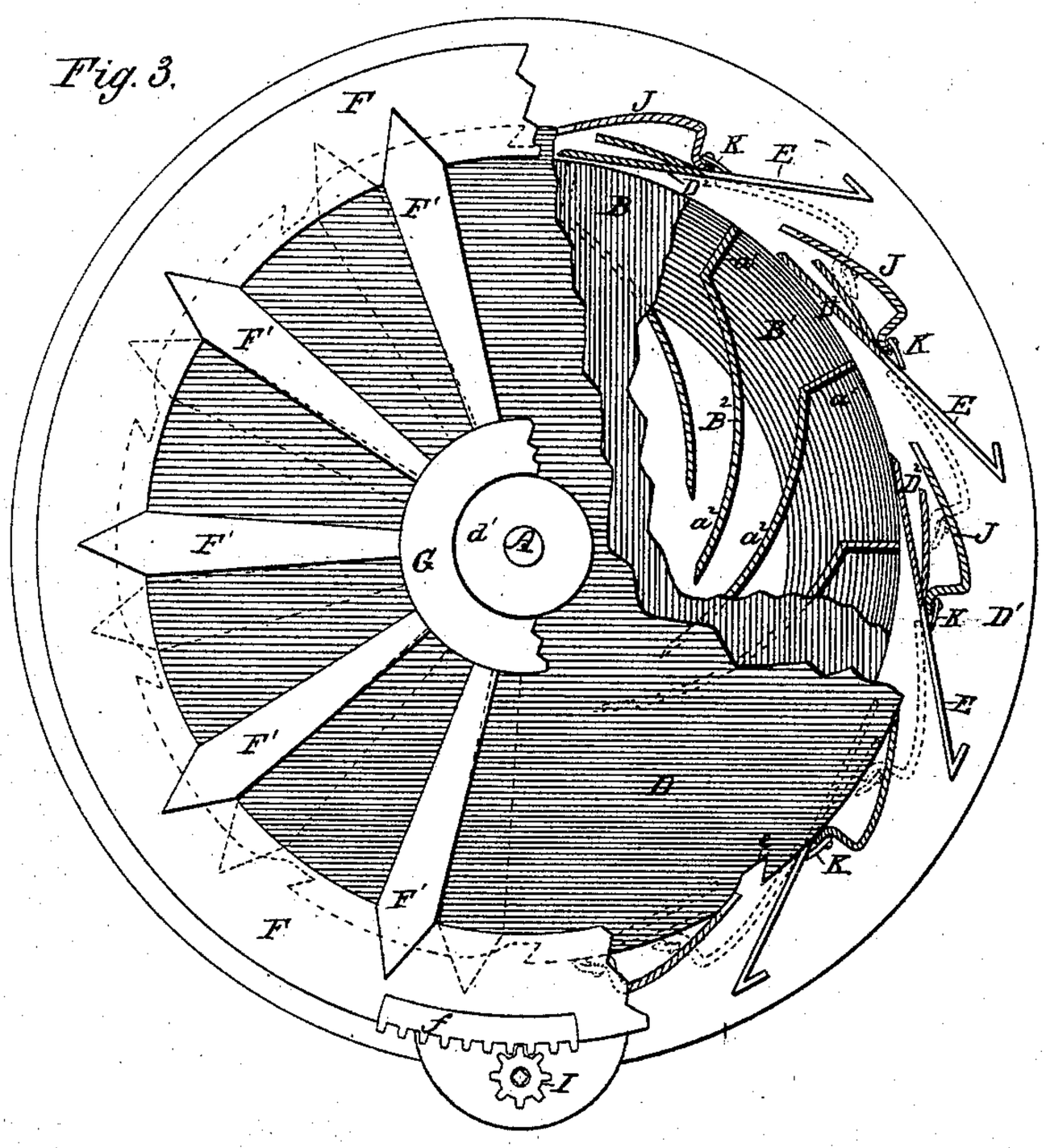
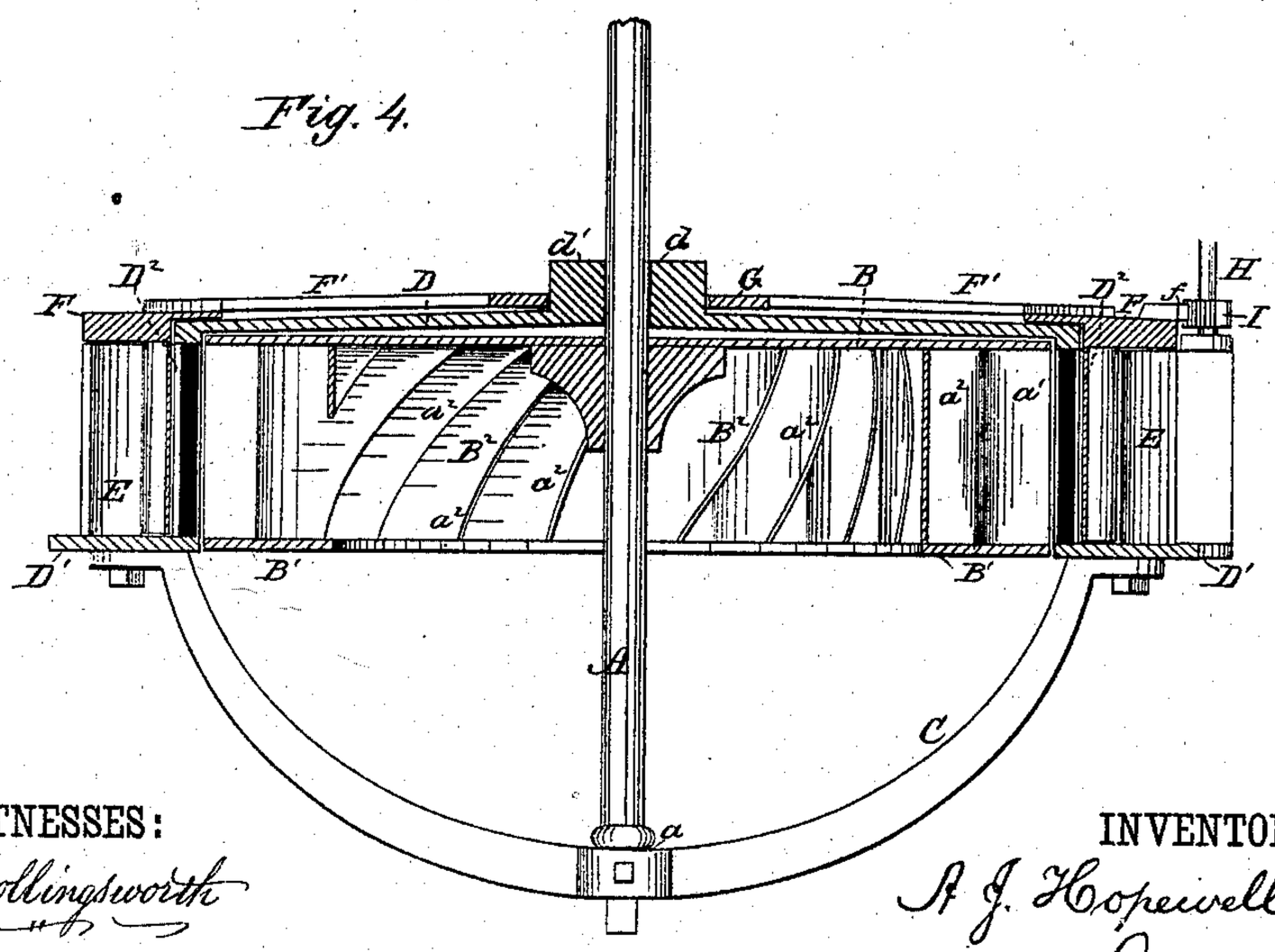


Fig. 4.



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UNITED STATES PATENT OFFICE.

ANDREW J. HOPEWELL, OF EDENBURG, VIRGINIA.

IMPROVEMENT IN TURBINE WATER-WHEELS.

Specification forming part of Letters Patent No. **214,660**, dated April 22, 1879; application filed February 3, 1879.

To all whom it may concern:

Be it known that I, ANDREW JACKSON HOPEWELL, of Edenburg, in the county of Shenandoah and State of Virginia, have invented a new and Improved Turbine Water-Wheel; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevation of the wheel and case. Fig. 2 is an inverted plan view of the wheel. Fig. 3 is a plan view of the case, partly broken away to show the construction of the wheel and gates. Fig. 4 is a vertical central section of the wheel and case.

My invention relates to certain improvements in that form of water-wheel in which water is admitted to the wheel through laterally-opening chutes or water-ways, and said chutes are controlled by a corresponding series of gates attached to a ring having a rotary adjustment, whereby the openings of the chutes are simultaneously regulated to admit more or less water, or shut off the same, as may be desired.

My improvements consist in the peculiar construction of the wheel and case, as hereinafter more fully described.

In the drawings, A represents the central vertical shaft, to which the wheel is affixed, and which shaft is supported at the bottom upon the step *a* of the spider-frame C, and extends upwardly through a bearing in the case, to connect with the mechanism to be driven. The wheel consists of a flat disk-shaped upper plate, B, a lower marginal ring, B^1, and intermediate buckets, B^2, all of which may be cast in one piece or formed in separate pieces and afterward bolted together. The outer portions, a^1, of the buckets B^2 are disposed between the upper plate and bottom ring in planes which are coincident with radial lines from the center of the shaft, so that the entering columns of water strike them at, or very nearly at, right angles, whereby the greatest impulse is given to the wheel. The other portions, a^2, of the buckets commence to bend about the middle of the lower ring and curve inwardly toward the shaft, with a bulge in the opposite direction from the movement of the wheel, so that the water, as it passes the bend of the buckets, strikes the prolongation of the bucket upon the convex or outer curved side of the same, and in shooting toward the center further assists in driving the wheel. The curve of these portions of the buckets is such that when the wheel is under motion it permits the water to pass very nearly in a straight line to the shaft, (which is the shortest distance for a free clearance of the water,) so that there is but little "dead water" carried by the wheel. This result is also increased by the form of these portions of the buckets, which are made to taper upwardly from the bottom ring as they curve toward the center, thus permitting a free inward and downward clearance. This construction of wheel also causes it to run with but little friction upon its bearing, for, having a continuous upper surface and an open bottom, the pressure of the water lifts the wheel as it rotates.

D is the case of the wheel. This has a flat continuous upper surface, with a central perforation, *d*, forming a bearing for the shaft, and an enlargement, *d'*, around said bearing. D^1 is the bottom ring of the case, between the inner edge of which and the outer edge of the top plate are permanently bolted or cast walls D^2, which alternate with intervening openings for the water. The outer portions of the walls D^2 are formed in the arc of the same circle as the top plate of the case, and from the inner edge of the bottom ring there extend tangentially outward the water-guides E, rigidly fixed to the case. These water-guides form tapering or contracting chutes as they approach the wheel, and serve to deliver the water upon the same at right angles to its buckets and with its greatest momentum.

To regulate the admission of water through the openings intervening between the walls D^2, a top ring, F, of very nearly the diameter of the bottom ring, D^1, is disposed upon the top of the water-guides, and is connected by radial arms F' with a central bearing, G, which surrounds the enlargement *d'* of the case, and serves to guide the ring in its rotary adjustment. Upon the outer edge of the top ring is arranged a curved rack or segmental gear, *f*, and in a suitable support outside of this is arranged a vertical shaft, H, with pinion I, which

latter engages with the rack on the ring F, and furnishes means for the rotary adjustment of the latter. To the bottom of this ring are rigidly attached the gates J, which are fitted to the circular outer surface of the walls D^2 of the case. Now, by adjusting the ring one way or the other the gates may be made to move from the walls D^2 over the intervening openings, to shut off the water, or from the openings back over the walls D^2, to let on the water, as the case may be.

To keep the joints between the gates and the walls D^2 tight, there is hinged to the back end of each gate a vertical strip, K, which is pressed by the water against the wall, and which fits tightly against the opposing surface in the adjustment of the gate, whether this be the wall D^2 or the prolonged water-guide.

When the gates are to be closed, notches *e*, Fig. 3, in the upper plate of the edge of the case serve to guide the gates to their places and hold them there. These notches fulfill, in connection with the rotary sliding gates, an important function, in that they hold the free ends of such gates against the hydrostatic pressure and guide the gates to a position in which they close tightly and prevent leakage.

In defining my invention more clearly, I would state, with respect to the wheel, that I am aware that a wheel having both an open top and bottom has been provided with buckets, the outer portions of which are arranged radially, and the inner portions curved, as in my wheel. I therefore limit my invention with respect to the wheel to the buckets, tapered upwardly toward the center in connection with the continuous top plate, whereby a free discharge for the water is obtained below. The buckets are all alike and uniform, and the frictional contact of the wheel upon its step is reduced.

Having thus described my invention, what I claim as new is—

1. The water-wheel consisting of the continuous upper plate, B, lower marginal ring, B^1, and intermedate bucket, B^2, bent as described, and tapered inwardly toward the center in contact with the top plate, substantially as described.

2. The combination, with a series of rotary sliding gates, of a water-wheel case having notches *e*, to guide and hold said gates, substantially as described.

ANDREW JACKSON HOPEWELL.

Witnesses:

ARTHUR P. BELEW,

GEORGE M. MILLER.