(No Model.) 2 Sheets—Sheet 1.

J. B. McCORMICK.

WATER WHEEL.

No. 265,689. Patented Oct. 10, 1882.

Fig: 6

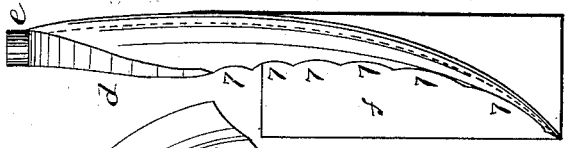


Fig: 5

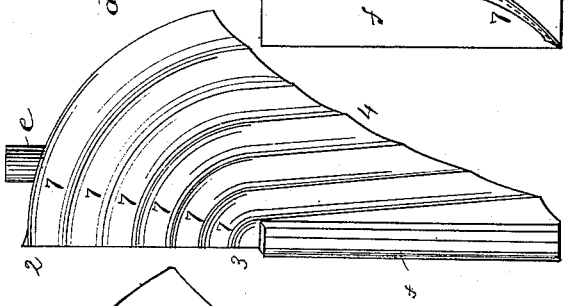


Fig: 3.

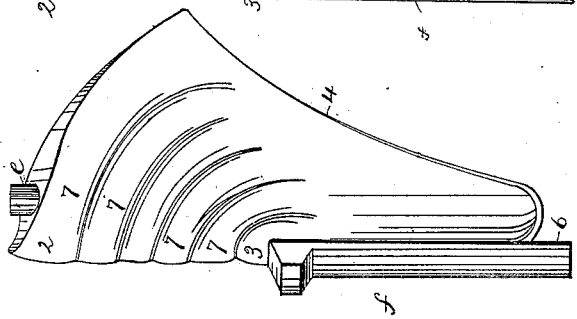


Fig: 7

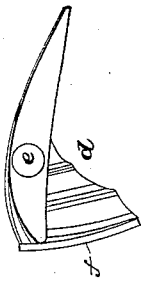


Fig: 4

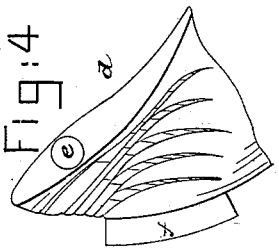


Fig: 1.

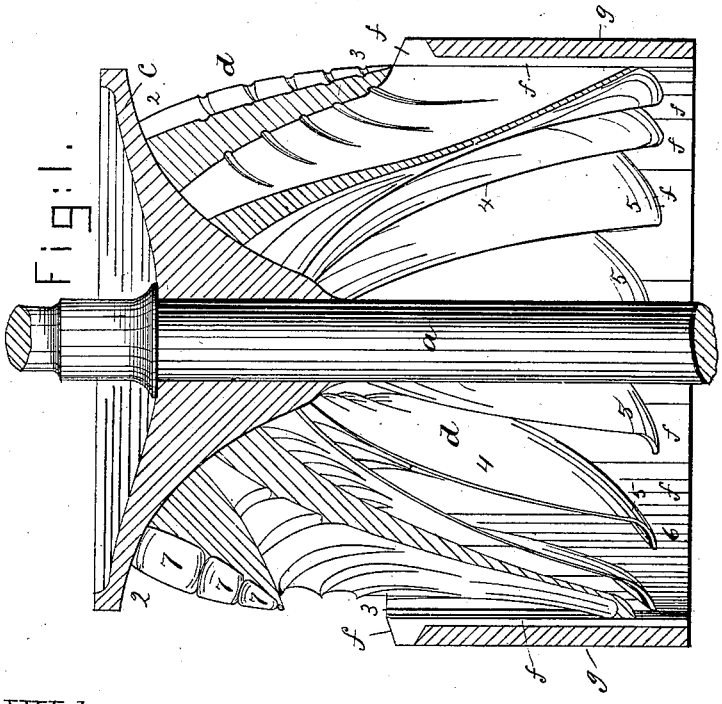
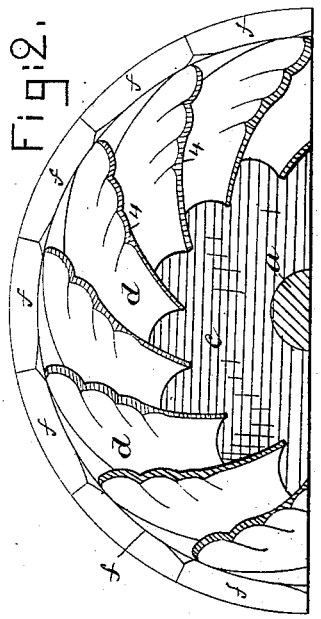


Fig: 2.



Witnesses.

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B. J. Noyes.

Inventor.

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by Crosby & Gregory.

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(No Model.) 2 Sheets—Sheet 2.

J. B. McCORMICK.

WATER WHEEL.

No. 265,689. Patented Oct. 10, 1882.

Fig. 8.

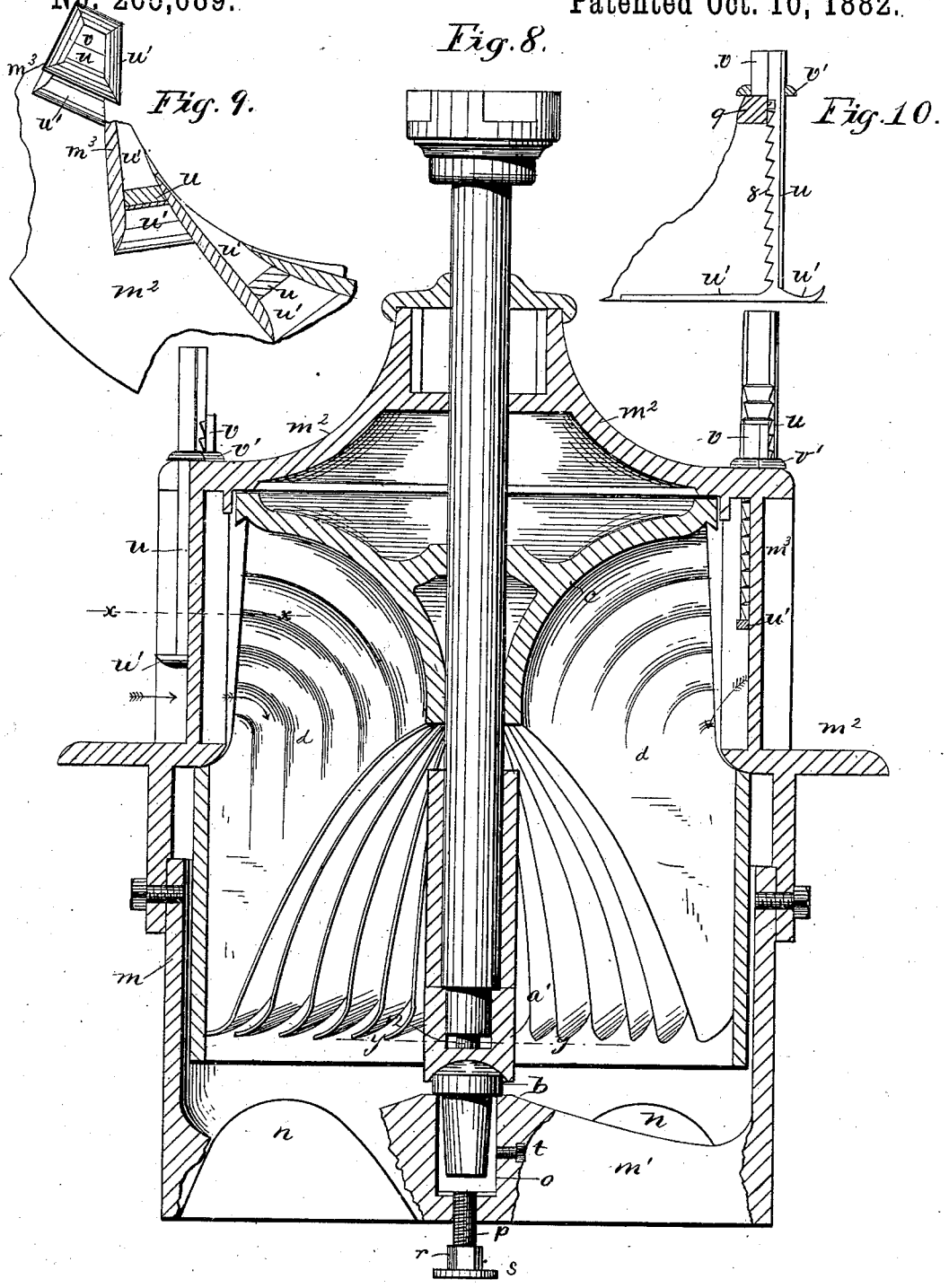

Fig. 11.

Witnesses
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UNITED STATES PATENT OFFICE.

JOHN B. McCORMICK, OF HOLYOKE, MASSACHUSETTS, ASSIGNOR TO THE HOLYOKE MACHINE COMPANY, OF SAME PLACE.

WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 265,689, dated October 10, 1882.

Application filed October 25, 1881. (No model.)

To all whom it may concern:

Be it known that I, JOHN B. McCORMICK, of Holyoke, county of Hampden, State of Massachusetts, have invented an Improvement in Water-Wheels, of which the following description, in connection with the accompanying drawings, is a specification.

My invention relating to water-wheels is shown embodied in a turbine wheel in which the water is received at the periphery and is discharged downward therethrough, and has for one of its objects such construction of the buckets as to cause the different portions of the water entering simultaneously at different heights on the wheel, also to clear the buckets simultaneously. The water entering at the top of the inlet-opening of the wheel has less head and correspondingly smaller velocity than that entering at lower points, the velocity of the water increasing, according to well-known laws, from the top to the bottom of the said openings. In other words, the water that enters the upper part will traverse a smaller space in a given time than that entering at points below it, and the points at which the water entering at the same moment at different depths from top to bottom of the inlet will arrive at the end of a given interval will form a definite curve, which may be determined theoretically from well-known mechanical laws of movement of liquids, or may be determined or verified experimentally.

One part of my invention consists in terminating the buckets at their discharge-edges in a curve of this nature, it being concave to the axis or shaft of the wheel, and closely approximating a parabola in form.

The invention also consists in extending the staves below the lower extremity of the buckets.

The invention also consists in a bucket having its acting face provided with corrugations, to thus enable the water to be better retained thereon.

The invention also consists in making the corrugations on the acting faces of the buckets, by which the water is guided, increasing in width from the bottom to the top portion thereof, so that substantially equal amounts of water will pass through each of the said corrugations.

It also consists in details of construction of the casing in which the wheel is mounted, and the gate therefor, as hereinafter described.

Figure 1 is a vertical longitudinal section of a water-wheel embodying my invention. Fig. 2 is a transverse section on line *x x* of Fig. 8, looking in the direction of the arrow; Figs. 3 and 4, side elevation and plan view, respectively, of one of the buckets; Figs. 5 and 6, side and edge elevations of a modified form of bucket giving greater power, but with less percentage as compared with the amount of water; Fig. 7, a top or plan view thereof; Fig. 8, a vertical section of the wheel and its case; Fig. 9, a partial transverse section thereof in line *x x*, Fig. 8; Fig. 10, a side elevation of a portion of the case and one of the gates; and Fig. 11, a horizontal section of the lower portion of the shaft on line *y y*, Fig. 8.

The shaft *a*, having at its lower end a bearing-piece, *a'*, resting on the step *b*, is provided with a hub, *c*, to form a support for the upper portions of the buckets *d*, properly curved, as shown in Figs. 3 to 7, to fit the said hub, and provided with holding-studs *e* to enter sockets therein. The buckets are shown as provided with staves *f*, they being made of the same piece with the buckets; but the said staves might be omitted. The lower portion of the buckets and staves, if employed, will be inclosed within a band or ring, *g*, either shrunk upon or cast with the said buckets and staves to hold them and the buckets securely in place; or, if desired, the entire wheel may be cast in one piece. The water entering at the upper portion, 2, of the bucket is under less head and consequently moves with less velocity than that entering at the different points below it, that at the lowest point, 3, of the inlet-opening having the greatest head and velocity, and consequently a column of water entering between the points 2 and 3 will traverse different distances in a given interval of time. The edge 4 of the bucket over which the water is discharged is made as a curve approaching a parabola in shape, and from the innermost point of discharge to or almost to the periphery of the wheel is concaved toward the shaft *a* of the wheel, this curve containing the points at which the different portions of the said col-

umn of water will arrive simultaneously, so that by this arrangement the water will enter, pass through, and discharge from or clear the buckets with a steady, regular flow, expending its entire energy upon the wheel, instead of a part of the water clearing the wheel before the rest, which, dragging behind, clogs the wheel and causes a portion of the energy of the water to be expended upon itself in producing eddies. The parabolical space (best seen in Fig. 8) beyond the discharging-edge 4 of the buckets and around the shaft *a* affords good clearance to the expended water. In order to increase the efficiency of the wheel, the buckets are inclined backward at an increasing angle to the flow of water near the lower part of their discharge portion, as shown at 5, Fig. 1, thus producing "displacement" of the water or increasing its action on the buckets as it is leaving them.

In the form of bucket shown in Figs. 5, 6, and 7 the junction of the bucket with the stave is a uniform curve, (shown in Fig. 6,) so that the water acts uniformly throughout its passage, this arrangement giving greater power than when the buckets are as shown in Figs. 1 to 4. The staves are preferably extended below the discharge-orifices of the buckets, as shown at 6, Figs. 1 and 3, to thus form a guide for the water after leaving the said buckets. The buckets are provided with grooves or corrugations 7 to guide the water as it passes through the wheel, the said grooves preferably gradually decreasing in width from the top portion, 2, to the bottom 3 of the buckets, as best shown in Fig. 3, so that substantially equal quantities of water will pass through them.

The general structure of the casing in which the wheel is mounted is shown in Fig. 8, the lower portion of the wheel being inclosed in the draft-tube *m*, which is provided with openings *n* for the escape of the water, through which the step *b* of the shaft *a* may also be adjusted. The said step, held in a socket, *o*, connected with the draft-tube *m* by arms *m'*, is supported upon an adjusting-screw, *p*, provided with a head, *r*, to be engaged by a wrench, and a flange, *s*, to sustain the end of the said wrench, so that it may readily be operated from the openings *n*. A set-screw, *t*, secures the step after it has been properly adjusted.

The bearing-piece *a'* is chambered, as shown at 12, about the extremity of the shaft, the diameter of which is reduced at this point, the walls of the said chamber being curved, as shown at 13, so that as the wheel revolves the water is caused to circulate through the said chamber, as indicated by the arrows, Fig. 11, just above the step, which is thus kept cool. The upper portion, m^2, of the casing contains the usual guides, m^3, (best shown in Fig. 9,) for directing the water into the buckets of the wheel. The spaces between each adjacent pair of guides m^3 are closed by a gate, *u*, provided at its lower end with a foot, *u'*, fitted to the surfaces of the said guides, as shown in Fig. 9, and thus forming the upper limit of the passage-ways for the water between the said guides, as indicated by the arrows, Fig. 8. The said gates *u u'* are all independent, and may be independently set at any desired height to adjust the size of the inlet-opening between the guides m^3, according to the amount of water-supply, which varies according to the season of the year.

Each gate is provided with a series of engaging-points, 8, (shown as ratchet-like teeth,) adapted to be engaged by a gate-supporting projection, 9, at the upper part of the casing m^2, (see Fig. 10,) to thus sustain the gate *u* at any desired height.

The casing m^2 is provided with a series of gate-fastening projections, *v*, corresponding to the gates *u*, against which the upper portions of the said gates rest, they being held with the desired one of the teeth 8, engaged by a projection, 9, by means of clasps *v'*, fitted to hold the gate up to the said projections 9 and *v*, and adapted to be removed, when desired to change the height of the gate, by bringing a different tooth 8 upon the projection 9.

This construction and arrangement obviates the expense of the complicated gate-operating devices now in use, by which all the gates *u* are operated simultaneously; but it affords an efficient means for regulating the gates from time to time to accommodate large changes in the water-supply—an advantage not heretofore attained without great expense—thus enabling the owners of small mills, who cannot afford the expensive adjustable gates, to set their gates from time to time in the most advantageous position for the amount of water at command.

I claim—

1. In a water-wheel, the bucket *d*, having its discharge-edge 4, made with the parabolic curvature shown, concaved toward the axis of rotation from the innermost point of discharge to or almost to the periphery of the wheel, substantially as described.

2. The buckets provided with water-guiding grooves or corrugations on their acting faces, substantially as and for the purpose set forth.

3. The buckets provided with a series of water-guiding grooves or corrugations, the successive grooves of the series gradually decreasing in width from the uppermost downwardly, substantially as and for the purpose described.

4. The wheel-shaft and its step, combined with the step-adjusting screw provided with wrench-faces, and a flange to support the end of a wrench engaging the said faces, substantially as described.

5. The wheel-inclosing case and a series of guides surrounding its periphery, combined with a series of independently-movable gates, one to each of the said guides, and means to fasten them at any desired height, substantially as and for the purpose described.

6. The wheel-inclosing case and its guides, provided with gate supporting and fastening

projections, combined with the series of independent gates, each provided with a series of engaging-projections, to be held by the corresponding gate-supporting projection, and the clasps to retain the said gates engaged at any desired height, substantially as described.

7. The shaft-bearing piece, chambered as described, whereby the water is caused to circulate just above the step to keep the bearing cool, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN B. McCORMICK.

Witnesses:
CHAS. W. RANLET,
MOSES NEWTON.