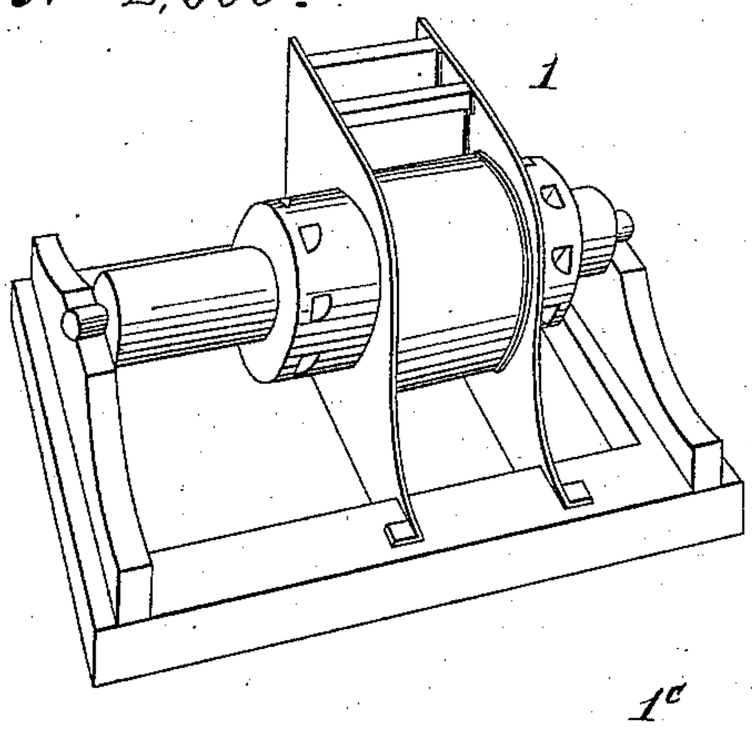
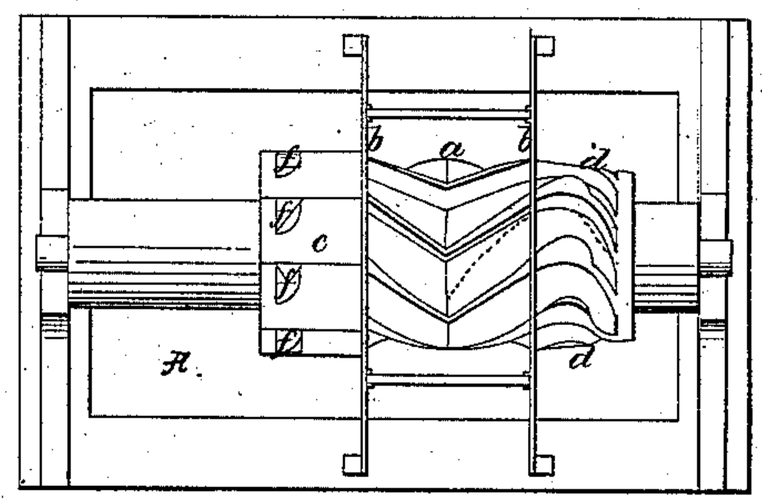
E. & J. Whitney & W. F. Card,

Water Wheel,

No. 2,665. Patented June 11, 1842.

1





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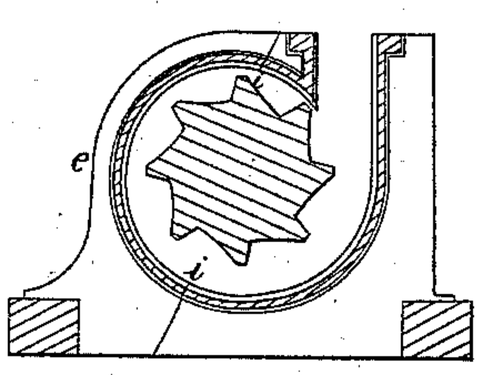

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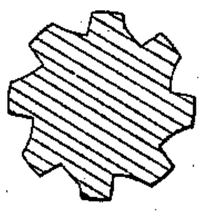

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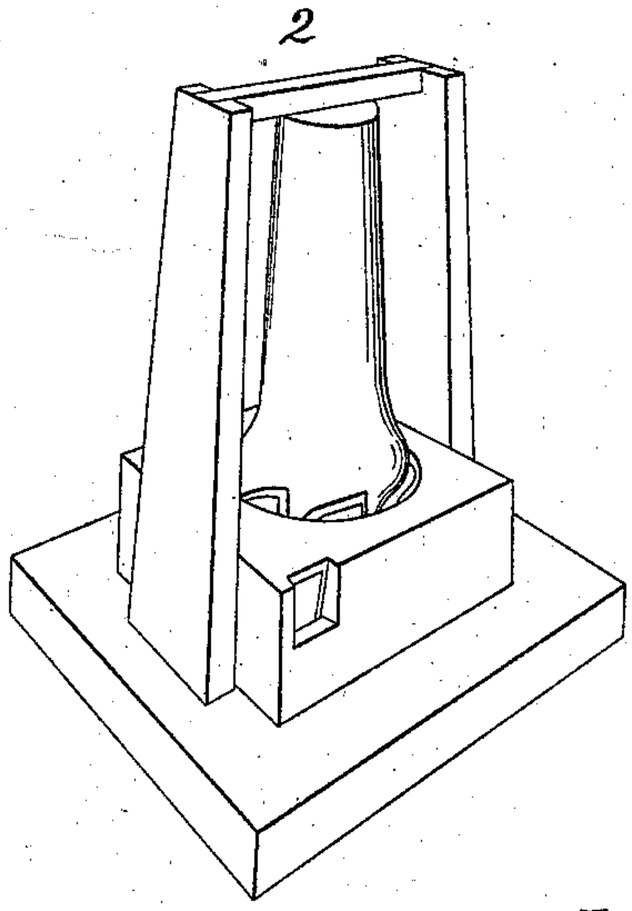

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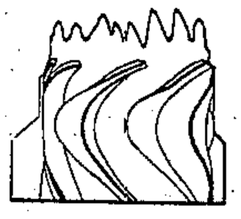

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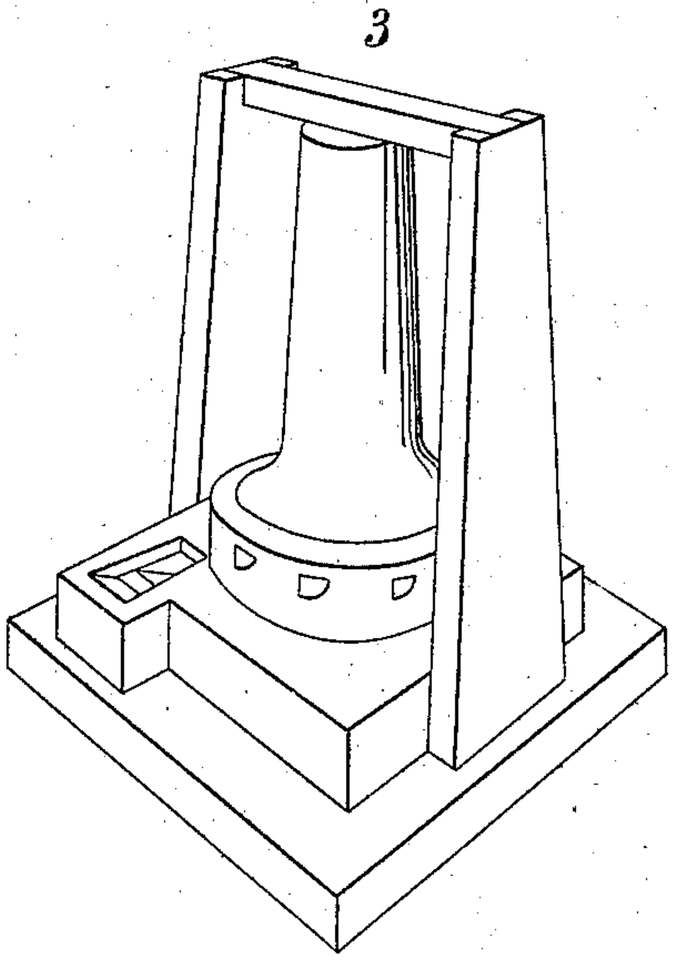

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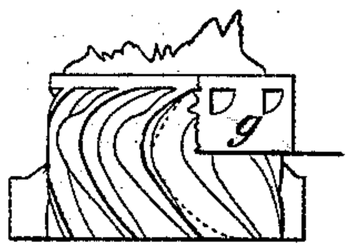

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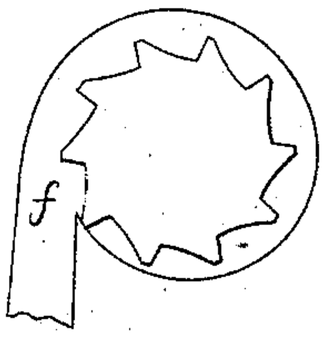

UNITED STATES PATENT OFFICE.

ESAU WHITNEY, JACOB WHITNEY, AND WILLIAM F. CARD, OF BURNS, NEW YORK.

IMPROVEMENT IN REACTION WATER-WHEELS.

Specification forming part of Letters Patent No. **2,665**, dated May 11, 1842.

To all whom it may concern:

Be it known that we, ESAU WHITNEY, JACOB WHITNEY, and WILLIAM F. CARD, of Burns, in the county of Allegany and State of New York, have invented a new and useful Improvement in the Construction of Water-Wheels; and we 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, in which—

Figure 1 is a perspective view of a double wheel on a horizontal shaft. Fig. 1^{A} is a plan at *c* on section and top view of wheel with the vent-band C removed at the end *d d* to show the construction of the spiral buckets. Fig. 1^{B} is a section of wheel and chamber at *a* and elevation of cast-iron plates at *b b* on Fig. 1^{A}. Fig. 1^{C} is a transverse section of wheel at *d d* to show the swell of the buckets. Fig. 3 is a perspective view of a single wheel on a vertical shaft standing in a frame and inclosed by its scroll and vent-band. Fig. 3^{A} is a section of chamber and elevation of wheel with part of the vent-band *g* removed to show the form of the buckets under the vent-band and the passage of the water. Fig. 3^{B} is a plan of chamber of wheel. *h* is the aperture for admitting water. Fig. 2 is a perspective view of a single wheel with a standing curb. Fig. 2^{A} is a section of chamber and elevation of wheel. Fig. 2^{B} is a plan of chamber and wheel. *f* is the aperture for admitting water.

c on Fig. 1^{A} is the vent band or casing, also *g* on Fig. 3^{A}; and *f f f f* are the ventways or orifices for discharging the water.

The dotted lines on Fig. 1^{A} and 3^{A} show that the buckets may vary in curvature.

The nature of our invention and improvement is such as to combine the different powers of water in one operation upon the wheel by a peculiar form and arrangement of our buckets in combination with the scroll in which it turns and the vent-band through which the ventways are made for the discharge of water, the arrangement being such as to cause the water to strike directly upon the buckets of the wheel as it enters the scroll and impel it by its direct action and afterward by its gravity as it passes the curve of the buckets toward the ventways within the vent-band, causing in its escape to communicate a reacting force.

To enable others skilled in the art to make and use our improved wheels, we will proceed to describe their construction and operation.

We construct our shafts, gudgeons, cranks, and other fixtures in any of the known forms, placing them vertical or horizontal, as may be required, and affix thereto buckets of wood or iron (by bolts or otherwise) of nearly a sickle form, putting the straightest part at the entrance of the water, so as to receive the direct action of the water as it enters upon the wheel.

We in general form our buckets by carving them in the timber of the shaft, having prepared the shaft of sufficient size for the whole wheel. After having put in the gudgeons or crank and other journals for the bearings of such wheels we place the shaft in a suitable position for turning it to its proper shape and size, and when so turned and prepared we draw as many parallel lines as we intend to make buckets in the wheel, making them at equal distances on the circumference of the wheel lengthwise of the shaft, and then draw the circular lines for the face or upright side of the buckets, so as to bring the extreme points of the buckets to one of the parallel lines and the sag or bow of the bucket to the next parallel line, placing the longest part at the entrance of the water in order to receive the direct action of the water, and then draw the lines for the back side of the buckets in such a manner as to form a swell or enlargement in the bucket at the shortest curvature where it first enters under the vent-band, as shown at *d d*, Fig. 1^{A} and section 1^{C}, which prevents a cross-current in the discharge of the water and gives it a greater reacting force. The swell is nearly of a semi-lunar form on the outer surface where the vent-band covers it. The face of the bucket is to be so formed as to stand nearly central to the shaft, having a slope on the back side of not more than forty-five degrees to prevent friction when they pass through the water in the scroll, as seen at section, Fig. 1^{B}, and then wind as they go under the vent-band where they pass the swell more perpendicular, as shown at section 1^{c}, being brought round until the discharging-points

come at right angles with the shaft, where the space between the buckets must be brought to a proper shape and size to discharge the given quantity of water.

Where timber is not easily obtained sufficiently large for the entire wheel, shafts may be enlarged where the buckets are to be formed by fixing thereto blocks or pieces of wood in such a manner as to form the entire circle of the wheel; then carve the buckets, as above directed; or wheels may be made by preparing the shafts of a proper size to receive the buckets, and then put on cast-iron buckets with spikes or screws, having the exterior form like those made of wood and the interior or that part next to the shaft to be made hollow; or wheels may be cast whole of iron and attached to iron shafts.

The vent band or casing to that part of the wheel outside of the scroll may be made of wood or iron and fastened with bands or otherwise. We make them of wood by forming staves of a proper circle to fit the wheel, being about one and a half inch thick and wide enough to cover the wheel from one ventway to another, as shown at *c*, Fig. 1[A]; or where the distance is too great for one stave we make two to each section of the wheel, taking care in every case to place one joint at the discharging-point of each bucket so as to form the ventway in one edge of the stave of a proper slant to fit the plane of the bottom of the space between the buckets.

We make the ventways of various shapes and sizes, as circumstances require. Some are made of a quarter-circle form, as seen at *g*, Fig. 3[A], others right angle triangle, square, oblong, or triangle. In every case the ventways must be made to conform to the shape of the space between the buckets at the discharging-point. Part of the orifice must be made by cutting away the outside of one stave and part in the under or inside of the next conformable to the curve of the buckets.

Vent-bands may be made of cast-iron in the form of staves having a kind of spout formed for the ventway part indented in one edge of the stave and part raised on the other, and raise a flange or rim an inch or more wide on the end of the stave that runs next to the scroll to prevent wear and the escape of water; or they may be made of thick sheet-iron by bending it to the circle of the wheel, then space and cut slits at the discharging-points of the buckets lengthwise of the wheel, and form the ventways by indenting one side and raising the other and make a flange on the edge next to the scroll, as above directed. The vent-bands must be closely and firmly fastened to and revolve with the wheel and must run as near the scroll as may be without friction in order to prevent the escape of water at the joint.

The scroll may be made with heads of plank or plates of iron, as shown at Fig. 1[B], being connected with staves or semicircular plates, so as to form the chamber or chute for the admission of water, as shown at *h*, Fig. 3[B]. The heads or plates must be connected to the staves by grooves in the planks or flukes and flanges on the plates, being fastened together with bolts or otherwise, taking care to make it in two parts in such a manner as to admit of taking off the front part of the scroll, in order to put the wheel in or out at leisure, as seen at *i i*, Fig. 1[B], while the other part is firmly fixed to the flume or gateway. The parts may be fastened when together with hooks and staples, or links, hasps, or the like couplings.

We make chutes or scrolls for upright wheels by framing timbers together of sufficient size and length to form the height and diameter of the scroll when cut to the intended circle inside, so as to admit of the wheel standing relative to the scroll, as seen at section 3[B], and then cover the chute with planks, being fitted close to the wheel, so that the edges of the planks will admit of the vent-band revolving close to the surface of said planks, being so fastened down to the scroll that the water will not press them too hard against the vent-band, and in such a way as to admit of taking off some part in a convenient manner, in order to clear the ventways of whatever may obstruct them and take out the wheel if necessary; or they may be made with staves and heads of wood or iron, as directed for scrolls to horizontal wheels.

We make our wheels of various lengths and sizes—from three to five feet in length and from eighteen to thirty-six inches in diameter for saw-mills and other purposes requiring horizontal shafts, and on vertical shafts from ten to thirty inches high and from one and a half to six feet in diameter. We make them to discharge up or down and sometimes both ways, where there is sufficient head of water. By making double wheels, as on horizontal shafts and on horizontal shafts under low heads of water, where great power is required, we make two or more pairs or double wheels on one shaft, according to the head and fall or quantity of water required. We take from one-third to one-half or more of the length of the wheel for the chute or scroll, according to the power and motion required. We make from four to eight buckets on horizontal wheels and from four to sixteen on upright wheels, and we apply the water to vertical or upright wheels by one, two, or more apertures, as circumstances require.

We generally make our wheels straight on the periphery of the vent-band; but where a very quick motion is required we taper the ends where the staves are to be put for the vent-band, as shown at *d d*, Fig. 1[A], so as to make the diameter of the wheel as small on the outside of the vent-band at the discharging-point of the buckets as it is where it receives the water within the scroll. The principal advantages obtained by a wheel so con-

structed are, first, a saving of water by its having a direct action upon the buckets as it enters upon the wheel, both by percussion and gravitation; secondly, by its having a greater length of inclined plane for the water to act upon, in combination with its reacting force, and will run in as deep backwater as any other wheel without impediment, thereby obtaining great advantage over many kinds of wheels and a gain of power under the same head and quantity of water. They will act with equal facility on shafts horizontal or vertical. The number of wheels may be increased by pairs or double wheels on the same shaft to any extent required for any given purpose or amount of power. The size of the wheels and number of buckets are to be proportioned according to the head and fall or quantity of water to which they are applied.

What we claim as our invention and improvement, and desire to secure by Letters Patent, is—

The construction and arrangement of the buckets on the wheel by making them nearly of a sickle or falei form, as herein set forth, in combination with the scroll or chute in which it turns in closing said wheel, and the various forms of discharging apertures or ventways on the periphery of the wheel, the whole being constructed and operating as herein described, using for the construction of such wheels iron or any other material proper for such wheels.

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WM. F. CARD.

Witnesses:
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J. LEONARD.