



# United States Patent Office.

ELIPHALET DOUGHERTY, OF NORTH LEWISBURG, OHIO, ASSIGNOR TO HIMSELF AND J. M. HOOD, OF SAME PLACE.

Letters Patent No. 103,725, dated May 31, 1870.

## IMPROVEMENT IN WATER-WHEELS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, ELIPHALET DOUGHERTY, of North Lewisburg, in the county of Champaign and in the State of Ohio, have invented certain new and useful Improvements in Water-Wheels; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing and to the letters of reference marked thereon making a part of this specification.

The nature of my invention consists in so constructing the wheel and the case of the wheel that, in the application of the water, an equal and uniform pressure of the column of water against the buckets of the wheel, from top to bottom, will be secured, and so as to prevent regurgitation of the lower strata of the column of water while acting on the wheel; or if the wheel moves with lower strata of water, that the upper strata may not be too slow and not have their power, the wheel and case being so constructed as to secure the full force of the water at the top of the column as it acts on the wheel, and at every intermediate point to the bottom of the column, and thereby securing the greatest possible force of the water.

In order to enable others skilled in the art to which my invention appertains to make and use the same, I will now proceed to describe its construction and operation, referring to the annexed drawing, in which—

Figure 1 is a plan view, and

Figure 2 is a side view of the wheel.

Figures 3 and 4 are portions of the wheel, showing the shape of the buckets.

The casing A A' is constructed in conical form, exhibiting ratchet-shaped projections B B, to form the apertures or gates. The outer ends of these ratchet-shaped projections, being part of the top, A', of the case, are elevated or raised, so as to give the water a downward direction. The bottom A of the case is not a horizontal plane, but dips toward the center. This dip in the bottom of the case I make equal to the downward curve of a jet of water spouting under the head it is designed to work the wheel.

Between the projections B B and the bottom A of the case are placed plates C C, as shown in fig. 1.

On the inner ends of the plates C C are hinged the movable gates D D, constructed in the peculiar form shown in fig. 1, said gates being outside of the line that describes the circumference of the wheel; in opening, moving outward and upward, following the dip of the bottom of the case.

At the outer end of the gate or double scroll D is a pin, *a*, which is inserted in the slot on the sloping arm E, extending from the outer circumference of the ring G. This ring is placed in suitable guides on the

top A' of the case, and is turned by means of pinion *b* and ratchet *d*, so as to open or close the gates D D.

The upper or outer sides of these double scrolls are as much shorter as the difference in the speed of the water at the bottom of the column, and that at the top divided by the number of scrolls. The hinges are placed sloping, so as to allow the scrolls or gates to follow the dip of the bottom rim of the case.

In the construction of my wheel, so as to obtain an equal and uniform pressure of the water from the top to the bottom of the column, so that the motion of the wheel corresponds with the motion of the water at every point of the head, I make my wheel of bevel shape on the edge; that is, the two heads of the wheel of unequal diameter, and by the following rules:

First, draw a horizontal line; erect a perpendicular line from it. Then, from the point of intersection, lay out half the diameter of the wheel on the horizontal line. From a point on the perpendicular line, indicating the height of the head of water the wheel is to work under, draw a line to the last mentioned point on the horizontal line. This line will show the bevel of the wheel, and, as the water passes through the sluices in the case and comes in contact with the wheel, it meets with resistance, consequently making the line of depression greater. I construct the bottom rim of the wheel with one-third more dip than the bottom of the case, so as to keep the weight of water from bearing upon the bottom rim of the wheel, and causing friction on the step.

It will be seen that the whole arrangement of the wheel and case is made from and dependent on the the height of the head it is intended to work under, it being the only perfect rule that can be used or applied to the construction of water-wheels.

H represents the wheel, made of cast-iron or other suitable metal, with the desired number of buckets, the buckets being varied in number according to the size of the wheel, which is governed by the height of the head and quantity of water. The width of the bottom rim is equal to about one-twelfth of the diameter of the wheel and dips, or is depressed. The dip of the bottom of the case is as the depression of a jet of water spouting under the head the wheel is to work under. To ascertain the proper dip of the bottom rim of the wheel, I dip or depress it one-third lower than the dip of the bottom A of the case. The dip of the top rim of the wheel corresponds with that of the bottom rim.

The buckets I I of the wheel are laid off in the following manner:

I divide off the rim into as many equal parts as I desire to have buckets, by lines drawn from the center to the circumference, then draw a circle inside, leav-

ing a space the width of the rim. I divide one of these spaces on the outer circle into three equal parts, as seen in fig. 4. With one point of the dividers at  $x$  describe the arch  $yz$ ; then draw a straight line from the curve of the arch  $yz$  to the outer curve of the inner circle at  $s$ . The curve  $yz$  and straight line  $zs$  show the curve and length of the bucket. The straight line  $zs$  should be a tangent to the arch  $yz$  and to the inner circle.

The height of the wheel or distance between the rims is governed by the quantity of water to be issued. The buckets do not rest perpendicularly on the bottom rim, but lean forward in the direction the wheel is to run, so that the water in its depressed course through the wheel will strike the bucket at right angles. The upper edge of the bucket is shorter than the lower edge, so that upward lines touching the outside and inner ends of the buckets will form the outward lines of a cone, in conformity to the rules given for the conical form of the wheel.

This peculiar form of the buckets will permit the water of the upper and lower parts of the column to strike and issue from the buckets at the same instant, thus securing a uniform pressure and uniform issue of all parts of the water.

Having thus fully described my invention,

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

1. The casing  $A A'$ , constructed and arranged as described, with ratchet-shaped projections  $B B$  and

plates  $O C$ , substantially as and for the purposes herein set forth.

2. The double scrolls or gates  $D D$ , constructed as described, and hinged in an inclined or sloping position at the inner ends of the plates  $O C$ , substantially as and for the purposes herein set forth.

3. The combination of the ring  $G$ , arms  $E E$ , pins  $a a$ , and scrolls or gates  $D D$ , constructed and arranged to operate substantially as and for the purposes herein set forth.

4. The conical-shaped wheel  $H$ , provided with buckets  $I I$ , when constructed as described, according to the rules, and for the purposes herein set forth.

5. The combination of the casing  $A A'$  and the conical-shaped wheel  $H$ , with its buckets  $I I$ , when constructed as described, according to the rules, and for the purposes herein set forth.

6. The combination of the casing  $A A'$ , projections  $B B$ , plates  $O C$ , gates  $D D$ , ring  $G$ , arms  $E E$ , pins  $a a$ , wheel  $H$ , and buckets  $I I$ , all constructed and arranged substantially as and for the purposes herein set forth.

In testimony that I claim the foregoing, I have hereunto set my hand this 6th day of December, 1869.

ELIPHALET DOUGHERTY.

Witnesses:

H. D. GOWEY,  
J. F. HUNTER.