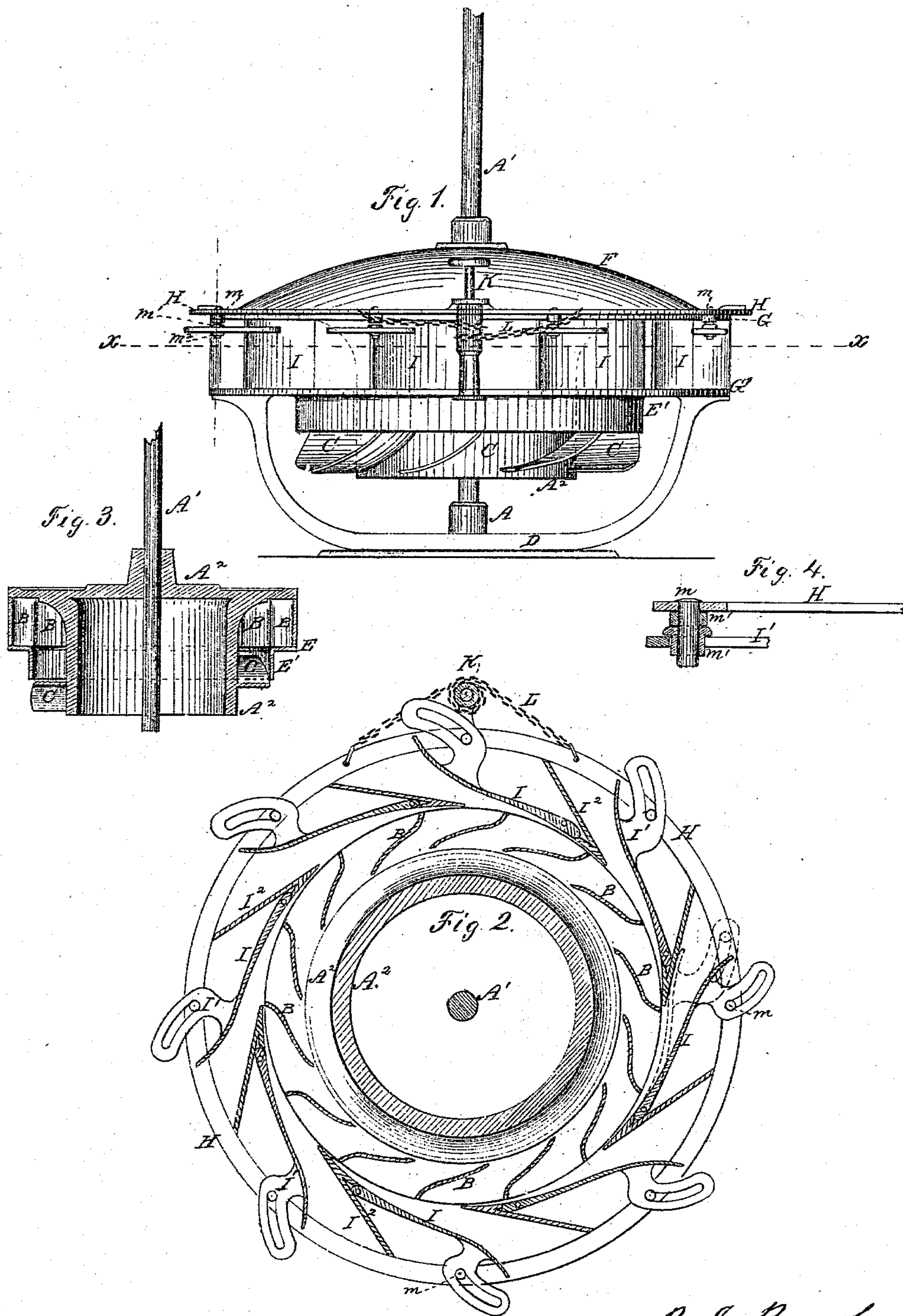


No. 109,099.

PATENTED NOV. 8, 1870.

B. J. BARBER.  
WATER WHEEL.



Witnesses  
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# United States Patent Office.

BENJAMIN J. BARBER, OF BALSTON SPA, NEW YORK.

Letters Patent No. 109,099, dated November 8, 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, BENJAMIN J. BARBER, of Balston Spa, in the county of Saratoga and in the State of New York, have invented new and useful Improvements in Water-Wheels; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawing making a part of this specification, in which—

Figure 1 is an elevation of my improved wheel, showing the case in which it works, the gates for regulating the flow of water to the wheel, the means of operating them, the shaft, and a portion of the lower or discharge-buckets.

Figure 2 is a horizontal section, on line  $xx$  of fig. 1, showing the arrangement of the wheel within the case, the stationary chutes for directing the water to the buckets of the wheel, the manner of pivoting the gates thereto, the form of such gates, and the means for operating them.

Figure 3 is a vertical central section of the wheel, showing the arrangement of the two sets of buckets, and the form of the center or hub to which they are attached.

Figure 4 is an elevation of the friction-rollers, which work in the segmental slots in the arms, which are attached to the gates.

Corresponding letters refer to corresponding parts in the several figures.

This invention relates to that class of water-wheels in which two sets of buckets are used, the first set for receiving and utilizing the impact of the water, and the second to utilize the gravity of the same water as it is leaving the wheel; and to this end,

It consists—

First, in a novel chute for directing the water to the wheel; and

Secondly, in a novel form of buckets for utilizing the gravity of the water; and

Thirdly, in a novel device for opening the gates which control the admission of water to the wheel; and

Lastly, in certain combinations and arrangements of some of the parts of which the wheel and case are composed, as will be more fully explained hereinafter.

In water-wheels of the class or type to which this belongs, it is important that provision be made for the proper admission of the water to the wheel, so that its impactive force may be utilized to the best advantage in propelling the wheel; and

Secondly, that the arrangements of its parts be such that the gravity of the water, as it falls upon the lower set of buckets, shall have the opportunity

of doing its full share of the work of driving such wheels; and

Thirdly, it is of the first importance that adequate provision be made for the discharge of water from the wheel at the instant when the forces above alluded to have been thus expended, in order that the wheel may be relieved from the weight as well as the friction of such water.

To accomplish the above-recited results in a better manner than has heretofore been done is the object of the present invention; and

To enable those skilled in the art to construct and use my improved wheel, I will proceed to describe it, referring to the annexed drawing, which forms a part of this specification.

A in the drawing refers to the step upon or within which the lower end of the shaft  $A^1$  of the wheel rotates. It may be of cast-iron, and have a plate of steel placed in it for the shaft to rest on; or it may rest upon a block of hard wood, or of any other suitable material.

$A^2$  refers to the hub or center of the wheel, it consisting of a plate or disk, with a projecting hub upon its upper surface, for the reception of the shaft  $A^1$ , to which it is firmly secured.

From the lower surface of this disk or plate there projects a flange, the length of which is to be equal to the depth of the two sets of buckets which are attached to it.

The outer diameter of this flange is to be such that, when the buckets are attached to it, a wheel of the required diameter will be formed, its upper end being curved outward, as shown in fig. 3, for the purpose of giving a downward direction to the water.

B B refer to the upper set or series of buckets, which are to be of a form substantially such as is shown in fig. 2, their outer ends being provided with a sharp curve, for the purpose of enabling them to receive the impact of the water, and afterward allow it to pass between the one upon which it strikes and the one which precedes it without its volume being broken or shattered, and with but very little friction.

The upper ends of these buckets are rounded upon their inner edges, to fit the under surface of the center  $A^1$ , so that the two may form a guide to the water as it passes from these buckets, and direct it in an unbroken volume upon the lower set of buckets.

C C refer to the lower series of buckets just referred to, which, like the upper series, are secured to the center  $A^2$ , their length being such as to cause them to extend in a spiral form along the surface of



said center, as shown in fig. 1, thus giving them very much the form of the blades of a wheel for propelling a vessel usually denominated a "propeller."

Owing to the peculiar form of this series of buckets, it becomes necessary to reduce their number, as compared with the number of the upper series, and, consequently, in practice, there will not be more than about one-half the number in the lower series that there is in the upper one.

Another and a very important feature in the construction of these buckets is, that their outer diameter is only about two-thirds as great as that of the upper series, as a consequence of which the compressing of the water, while it is acting upon them, is caused, and thus the full force of its gravitating action secured, which, as above remarked, is regarded as of vital importance.

D refers to a foundation, upon which the step of the wheel rests. It may be of the form shown in the drawing, or of any other suitable form.

E refers to the lower ring or plate of the wheel, there being an aperture through its center, the diameter of which is equal to the outer diameter of the lower series of buckets.

This plate has a downwardly-projecting flange, E', the depth of which is equal to, say, one-third, more or less, of the depth of the lower buckets, the outer surfaces of which are secured to it.

It will be seen that, as a consequence of the construction of this ring or plate and the buckets C, which it encircles, a bottom and a circumferential discharge for the water from the lower buckets is provided, thus insuring its escape from the wheel, both as a consequence of its own gravity, and of the centrifugal action of the wheel, as a consequence of which a considerable per cent. of advantage is gained, owing to the fact that, under this arrangement, no dead water is carried by the wheel.

F refers to a concavo-convex plate of metal, which forms the cap or cover of the wheel, its apex being provided with a boss, through which the shaft of the wheel passes, and which, to some extent, forms a support for such shaft.

This plate is bolted to the upper plate of the wheel-cover.

G refers to the plate just referred to, it consisting of a plate or ring of metal, having an aperture through it equal in diameter to the outer diameter of the wheel, and being of suitable thickness to give it the required strength.

G' refers to the lower ring or plate of the case, which is, in all respects, like the one described. These rings are set at such a distance apart as to correspond with the depth of the upper series of buckets of the wheel, they being held in position by chutes, which are placed between them, and which are soon to be described.

H refers to a ring of metal, which rests upon the upper plate of the case, and is made to surround the cap F, it being held in position by buckets, also secured to the plate F, as shown in fig. 1.

I I refer to a series of pivoted gates, there being as many of them as may be found necessary to admit the proper quantity of water to the wheel.

The interior form of these gates is of the curved form shown in fig. 2, while their outer surfaces are supplied with arms, I', in which there is formed a segment of a circle, which is so arranged that, when the gate commences to open, the leverage upon the gate is the greatest, and its movement the least in proportion to the space traveled by the pin, which works in said slot, and operates to move the gate.

When the gate has been once started from its seat, as indicated by dotted lines in fig. 2, and the greatest amount of resistance has been overcome, any subse-

quent movement in the pin through the segmental slot will give to the gate an increasing amount of movement, according to the space through which the pin moves.

I<sup>2</sup> I<sup>2</sup> refer to stationary chutes, they being placed between the two rings or plates of the case, their outer surfaces being straight, and forming the seat for the gates to close against, while their inner surfaces are curved, so as to correspond with the curvature of the inner surfaces of the buckets.

To the outer ends of the curved portions of the chutes the gates are pivoted, so that, when they are opened, more or less, the water shall be directed in a solid volume to the curved portion of the upper buckets of the wheel, and in being thus directed shall always fill the chamber formed between the bucket, the curved chute, and the wheel, thus causing each bucket to be constantly receiving the impact of the water throughout the entire revolution of the wheel.

K refers to a vertical shaft, which is placed upon the outside of the case, and held in position by brackets attached thereto.

Upon the upper end of this shaft there is placed a wheel or crank for rotating it, and that portion thereof which is between the brackets is made to receive a chain, L, the ends of which are attached to the ring H, so that, as the shaft K is rotated, the said ring shall be turned, and thus the gates opened or closed, according to the direction in which said shaft is turned.

M M refer to a series of pins, which is secured in the ring H, as shown in fig. 4, there being one to each gate.

Upon each of these pins, and just under the ring, there is placed a friction-roller, M', which is made to revolve upon the pin, its lower surface resting upon another roller, which is made to rotate upon the same pin, it being provided with a flange upon its upper end, which rests upon the upper surface of the slotted arm of the gate, its lower and reduced portions entering the curved slot thereof, the whole being for the purpose of reducing the friction, in opening and closing the gates, to the minimum.

Having thus described my invention,

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

1. The stationary chutes I<sup>2</sup>, curved upon their inner surfaces, substantially as and for the purpose specified.

2. The combination, in a water-wheel, of two sets of buckets, one, B, being of curved form, and the other, C, of the spiral form, substantially as and for the purpose set forth.

3. The curved arm upon the gate, for opening the same with varying rates of speed, and with varying amounts of power, substantially as set forth.

4. The combination of the curved gates I, the curved stationary chutes I<sup>2</sup>, and the buckets B, whereby a chamber is formed, for the action of the water, by impact, upon the buckets of the wheel, substantially as set forth.

5. The combination and arrangement of the shaft K, the chain L, the ring H, and the slotted arm I', substantially as and for the purpose set forth.

6. The arrangement of the lower series of buckets of a water-wheel, and the lower plates thereof, whereby a bottom and a circumferential discharge of the water from such buckets is obtained, substantially as and for the purpose set forth.

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

BENJAMIN J. BARBER.

Witnesses:

J. D. BANCROFT,  
L. W. BRISTOL.