(No Model.)

S. L. BERRY.

WATER WHEEL.

No. 493,239. Patented Mar. 14, 1893.

Fig. 1.

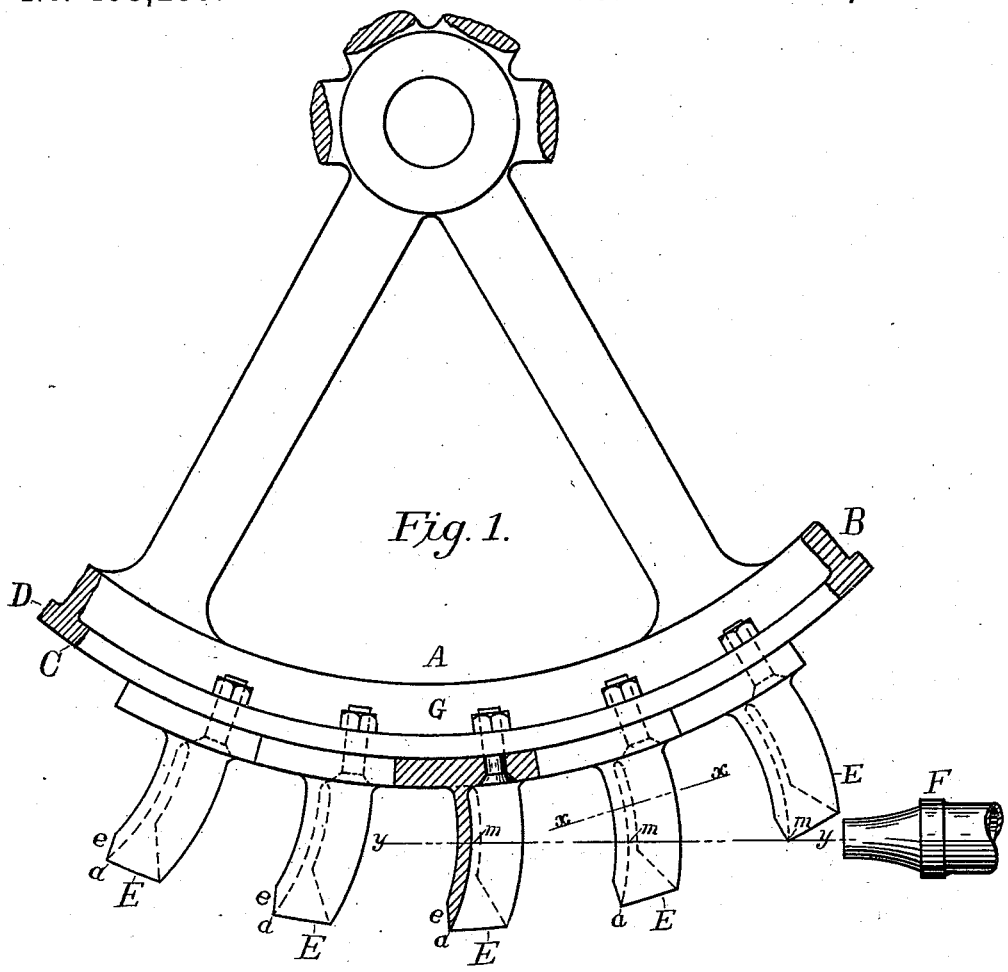


Fig. 2.

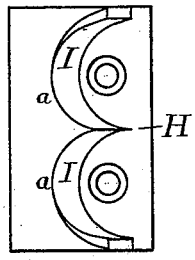
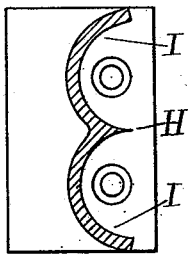


Fig. 3.



Witnesses.
Wilson D. Bentley.
Carlton Cornwell.

Inventor.
Seneca L. Berry
By his Atty
John Richards

UNITED STATES PATENT OFFICE.

SENECA L. BERRY, OF SAN FRANCISCO, CALIFORNIA.

WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 493,239, dated March 14, 1893.

Application filed May 14, 1892. Serial No. 433,013. (No model.)

To all whom it may concern:

Be it known that I, SENECA LUCIEN BERRY, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Water-Wheels; and I hereby declare the following specification, with the drawings accompanying and forming a part of the same, to be a full, true, and exact description of my invention.

My invention relates to what are called tangential or impulse water wheels, impelled by water discharged thereon by a nozzle or nozzles, tangential to the wheel's periphery, and consists in forming the buckets with a double curved bottom presenting a sharp dividing apex in the center to split the stream or streams of water discharged on the wheel, and also curving the buckets in the opposite plane so they will present a convex surface, normal to the stream of water, in all positions of the buckets being acted upon.

My invention also consists in forming the buckets open as to their outer ends, and reducing the edges thereof to a thin knife-like section, so there will be no disturbance of the stream discharged on the wheel, by the buckets when entering it.

In this class of water wheels, having buckets of a double curve and a dividing apex in the center to split the stream of water, it has been the custom to either curve the buckets both ways, so as to present a concave surface to the water, both transverse to and in the plane of rotation, or else to form them with straight lines on their bottom in the plane of movement. In my invention, the object is to present in the plane of rotation, surfaces normal to, or at a right angle with, the impinging jet or jets of water, permit its free discharge tangential to the wheel, and avoid disturbance of the stream by the entering buckets. This object I attain in the fullest possible manner by presenting a convex instead of concave surfaces to impinging water in the plane of rotation, preserving the contour of a double curve in the other plane, transverse to the course of the impinging water. I also dispense with what may be called the outer, inclosing end of such buckets, leaving them open in the form of a trough, and beveling the entering plates to an edge so as to avoid disturbance of the stream as the buckets enter and sever it.

Referring to the drawings: Figure 1 is a quadrant, or section, of a tangential water wheel provided with my improved buckets. Fig. 2 is a view normal to the base of one of the buckets, looking at its outer end, or toward the axis of the wheel. Fig. 3 is another view of one of the buckets, shown in section on the line *x*—*x* of Fig. 1.

Similar letters of reference on the different figures indicate corresponding parts thereof.

The rim A of the main wheel is usually of the section shown at B, with a central web at G and flanges C D at the sides. To these flanges is riveted, or bolted, a series of buckets E, formed in the manner shown, presenting on their front, toward the nozzle F, a convex surface in the plane of rotation, the radius of which is modified by the diameter of the wheel, so the points of impingement at *m m m*, Fig. 1, will be normal to the line *y y* of the jet of water discharged on the wheel, from the nozzle F. The transverse form of the buckets is shown in the section Fig. 3, consisting of double curves I I forming a sharp apex H at their intersection. This sharp apex or edge divides the impinging stream of water discharged by the nozzle F, splitting it into two parts, which follow the curves I I, so the course of the water is reversed in that plane, and its reactive force utilized in the fullest degree. This latter feature being well known in practice does not form any part of my invention, except in combination with curves in the other plane, which for convenience I will hereinafter refer to as the "plane of rotation." In this plane it is customary to present to the impinging stream either concave or straight faces, but in my invention these faces are curved backward, presenting a convex surface to the water, thereby maintaining, in the plane of rotation, faces normal to the line *y y* of the impinging water, during such portion of the wheel's revolution as the water is imparting its force thereto. This presentation of the faces of the buckets E will be apparent in the position of the three buckets nearest to the nozzle F, and the points of impingement *m m m*, marked thereon, Fig.

1. It will also be apparent that this backward curvature, in the plane of rotation, facilitates the escape of the water from the wheel after its effect has been delivered, and secures a tangential discharge of the same.

To further facilitate the escape of the water, and also attain sharp entering edges at *a a a*, Fig. 2, I also leave the outer ends of the buckets open in the form of a trough and bevel them off on the back, as shown at *e e e*, so that in entering the stream discharged by the nozzle F, the surfaces presented to the water are normal or transverse to its course, and thus avoid lips or angular faces to disturb the stream, or impede its effective force by the entrance of the buckets.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a water wheel driven by impinging jets, a series of buckets attached to the rim, double curved in their transverse section and also curved in the plane of rotation, as herein described, so as to present, in that plane, a convex face, normal to the impinging water, when the buckets are in the plane of the stream, in the manner substantially and for the purposes described.

2. In a water wheel driven by an impinging jet, or jets of water, a series of buckets attached thereto, formed with a double curve in their transverse section, curved also in the plane of rotation, to present curved or convex faces normal to the impinging water in that plane, the outer ends of the buckets open in the form of a trough, in the manner and for the purposes substantially as described.

3. In a water wheel driven by an impinging jet or jets, a series of buckets attached to its rim, the buckets having a double curve in their transverse section, and a backward curve in the plane of rotation, as herein described; the outer ends of the buckets open in the form of a trough, and the extreme end of the bottom and sides beveled to an edge so as to cut the jet transverse to its course, without disturbing the stream in entering, in the manner substantially, and for the purposes described.

In testimony whereof I have hereunto affixed my signature in the presence of two witnesses.

SENECA L. BERRY.

Witnesses:
ALFRED A. ENQUIST,
WILSON D. BENT, Jr.