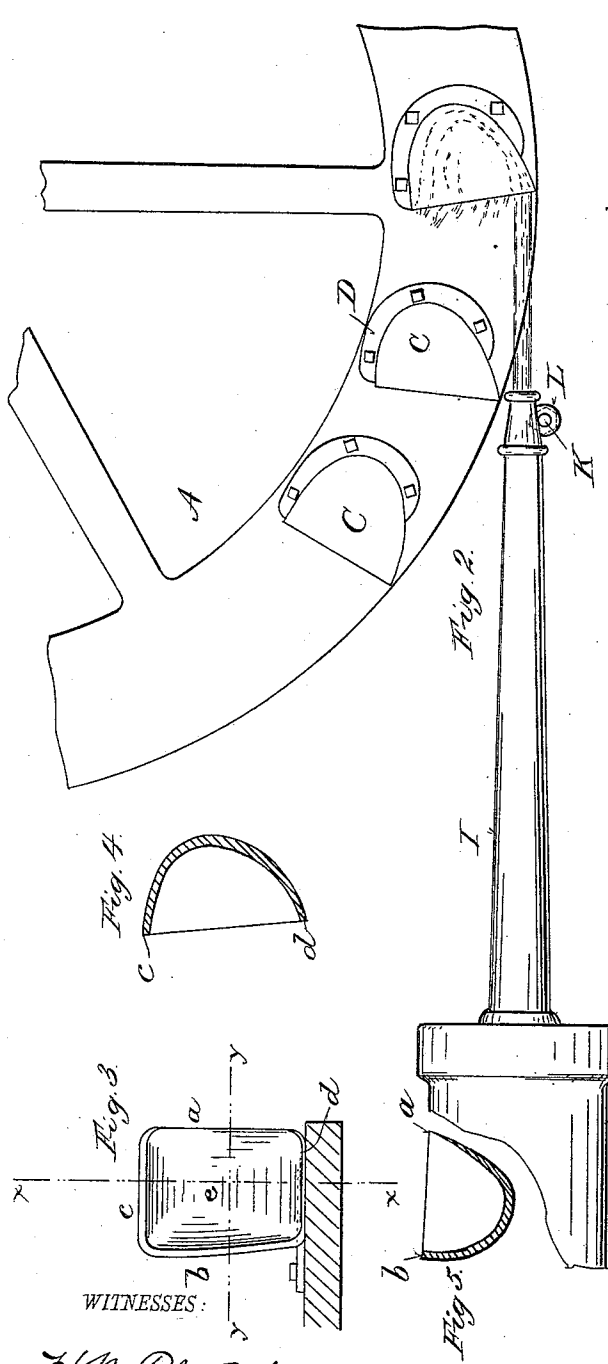
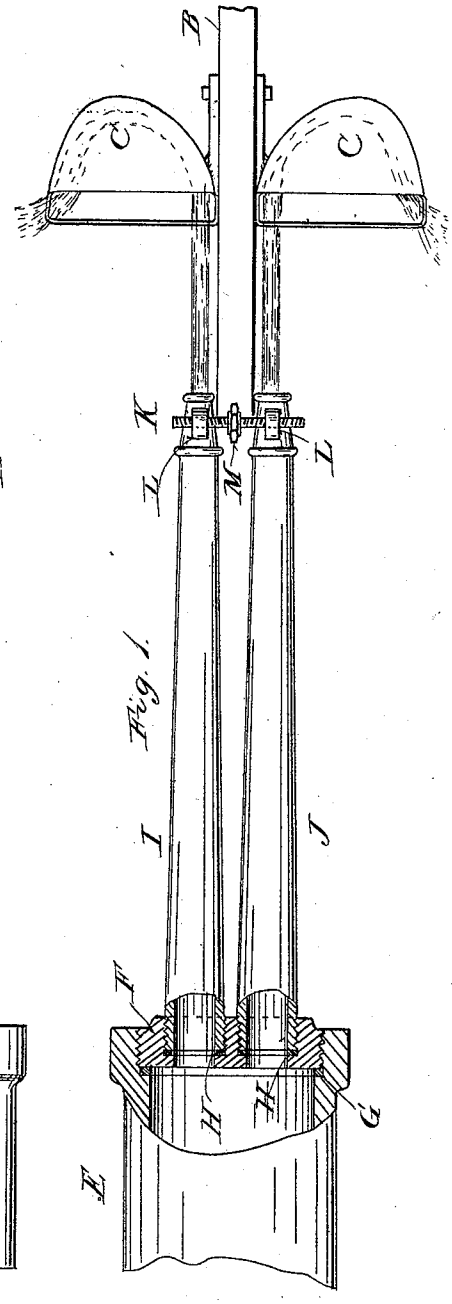
(No Model.)

F. M. BOOKWALTER.

WATER WHEEL.

No. 451,259. Patented Apr. 28, 1891.





WITNESSES:

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UNITED STATES PATENT OFFICE.

FRANK M. BOOKWALTER, OF SPRINGFIELD, OHIO.

WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 451,259, dated April 28, 1891.

Application filed September 29, 1890. Serial No. 366,544. (No model.)

To all whom it may concern:

Be it known that I, FRANK M. BOOKWALTER, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Water-Wheels, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in that class of water-wheels known as "hurdy-gurdy wheels," wherein the buckets carried by the wheels are revolved by the momentum or force of streams of water projected under high pressure; and my improvements have reference to the position of the buckets on the wheel and to their form or construction, and have reference also to the nozzles through which the water is projected, all of which will hereinafter more fully appear, and be pointed out in the claims.

In the accompanying drawings, forming a part of this specification, and on which like reference-letters indicate corresponding parts, Figure 1 represents an inverted plan view or a view looking upward at the parts shown in Fig. 2; Fig. 2, a side elevation of a part of the wheel carrying the buckets and of the nozzle; Fig. 3, a sectional view of a portion of the wheel-rim, showing a back view from the front side; Fig. 4, a sectional view on the line *x x* of Fig. 3, and Fig. 5 a sectional view of the bucket on the line *y y* of Fig. 3.

The letter A designates a wheel, or, more properly speaking, a section of a wheel, the rim B of which is flat on either side to accommodate it to the easy and ready fitting thereto of the buckets. The buckets are indicated at C, and are provided at one side with a flange or web D, having bolt-holes which match with similar holes in the rim B. The location of the buckets on the rim is preferably such that the same holes in the rim and the same bolts will answer to secure a set of buckets. The buckets being flat on the flanged side are easily fitted to the rim by being planed off. This is a matter of importance in the construction of the water-wheel.

The buckets are preferably cast, and consist of four sides *a b c d*, which merge into one another and into the bottom *e*. The interior of the buckets is devoid of angles. The edge of the side *a* is sharp, so that the water will not be obstructed by the presence of any appreciable width, whereby the water enters the buckets with perfect readiness, passing along the side *a* toward the bottom, and is gradually directed outward by the contour of the bottom and of the sides *c* and *d*. The curvature of the sides *c* and *d* and of the bottom *e*, as shown in Fig. 4, gives the water the outward deflection. The curvature of the sides *a* and *b* and of the bottom *e* gives the water somewhat of an upward deflection in relation to the bucket, and the two deflections thus given the water result in causing its delivery from the buckets at essentially the upper part of the side *c*, or that end nearest to the side *b*. The momentum of the water acts effectively in driving the buckets, while its reaction continues to act upon the buckets and assist in the operation of driving them. The momentum and the reactionary action of the water are spent by the time of its delivery or discharge laterally at the side indicated. The obtaining of this result I do not lay claim to, but understand it to be old; but the novelty of my invention is in the peculiar contour of the bucket here described, whereby corners and angles are avoided and yet a lateral discharge of the water from the buckets secured. The combination of curves and the blending of one into the other produce this result.

Another peculiarity of my buckets lies in the fact that the edges composed of the sides *c* and *d* incline backward from the upper edge, as shown particularly in the last bucket in Fig. 2. The object of this construction is to make the knife-edge *a* where the water enters the lowest part of the bucket, whereby the buckets passing toward the stream will not obstruct it or come in contact with it, except when their interior is presented to the stream. Another feature of my bucket is that the edge *d* is preferably reduced in thickness to facilitate the entrance of the water into the buckets.

Referring now to the nozzles by which the head of water is conducted to and projected within the buckets, the letter E designates the delivery-pipe, which communicates with the head of water. An annulus F is secured into

this pipe, with a suitable gasket G to form a tight joint, and the annulus is provided with two screw-threaded openings shouldered to support the gaskets H and adapted to receive the nozzles I and J. These nozzles gradually contract in diameter toward their discharge ends and are connected near the latter ends to each other by a device capable of adjusting them to and from each other. A convenient form of device to effect such adjustment is a right and left handed screw-threaded rod K, screwed into the lugs L, carried by the nozzles and provided with a nut M by which to manipulate it. By such means the distance of the nozzles from each other is increased or decreased, and consequently the exact point for the entrance of the water into the buckets regulated. It is well known that in order to secure the maximum results the water should enter the buckets at the proper place. In the manufacture of apparatus of this kind it is more or less difficult to so locate the nozzles with respect to the line of the travel of the buckets that the streams will be projected into the buckets at the exact proper place. At least it involves a high grade of work and a consequent increase in the market price to accomplish this if the nozzles are fixed. Hence I adapt them to be adjusted. It is also preferred to widen the bucket on the outer edge *c*, so as to permit of a freer discharge of the water.

While I have spoken of the water discharging essentially along the upper half of the side C, still it may discharge over the whole or greater part of said edge.

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

1. In a water-wheel of the character described, the combination, with a wheel proper provided with a rim having opposite faces and adapted to support buckets, of buckets secured to each face and having flanges, the bottom and all the sides being curved to blend one into the other, and the peripheral or outer edge being sharpened and forming the entering edge, and the outside lateral edge forming the discharge part, such shape and blending of the sides and bottom causing such lateral discharge of the water so entering at the peripheral part, and a double nozzle mounted to direct a jet of water into each series of buckets and pointing to such outer or peripheral edge of each bucket.

2. In a water-wheel of the character described, the combination, with a wheel proper and buckets carried thereby, of a duplex nozzle, each nozzle proper being adjustable with respect to its series of buckets, and means to effect such adjustment.

3. In a water-wheel of the character described, the combination, with a wheel proper and buckets secured to the opposite sides of the rim thereof, the buckets being of substantially the type described, of a duplex nozzle and an adjusting device connecting the nozzles proper together, whereby they may be adjusted in position with respect to their respective series of buckets.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK M. BOOKWALTER.

Witnesses:
WARREN HULL,
A. N. SUMMERS.