S. M. SMITH.

TURBINE WATER-WHEEL.

No. 185,788. Patented Dec. 26, 1876.

Fig. 1.

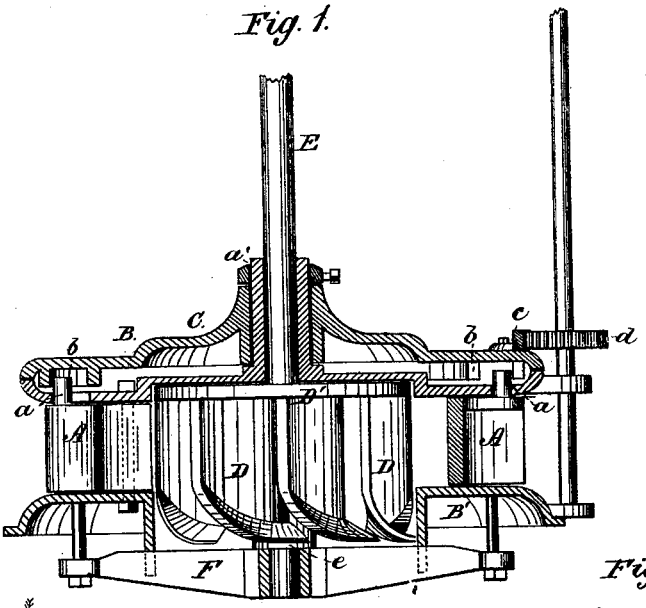


Fig. 2.

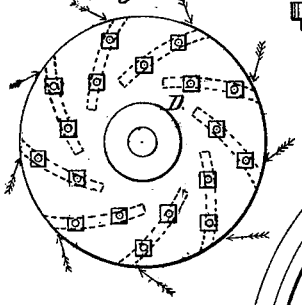


Fig. 3.

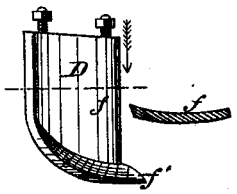
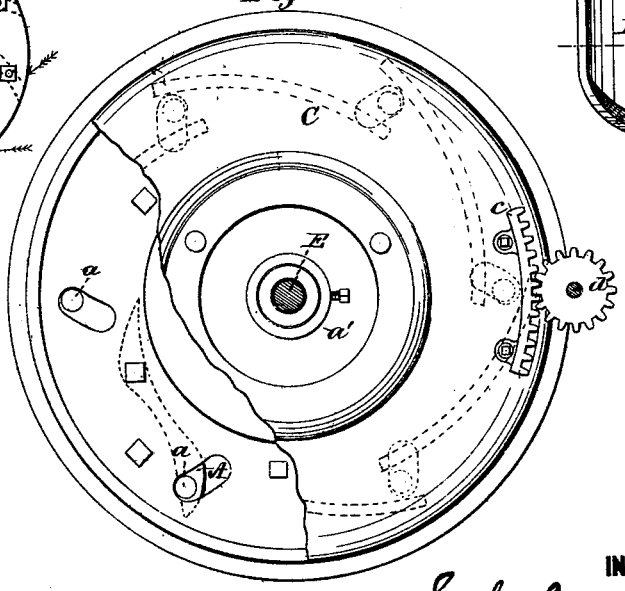


Fig. 4.



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STEPHEN M. SMITH, OF YORK, PENNSYLVANIA.

IMPROVEMENT IN TURBINE WATER-WHEELS.

Specification forming part of Letters Patent No. **185,788**, dated December 26, 1876; application filed December 9, 1876.

To all whom it may concern:

Be it known that I, STEPHEN M. SMITH, of the city and county of York, and State of Pennsylvania, have invented a new and useful Improvement in Turbine Water-Wheels; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming part of this specification, in which—

Figure 1 is a vertical section of the case, showing the wheel therein; Fig. 2, a plan view of the wheel attached, with the shape and arrangement of the buckets shown in dotted lines and the direction of the incoming water indicated by arrows. Fig. 3 are details of one of the buckets; Fig. 4, a plan view, with a portion of the upper plate broken away.

My invention relates to certain improvements in turbine water-wheels, designed to increase the percentage of power and render the wheel more effective. Wheels of this class, as ordinarily constructed, have their buckets curved or bellied to catch the water coming from the chutes upon their concaved sides. With this form of bucket, however, I have found that the convex portion or back of the bucket, in moving into the entering streams of water, produces a back pressure upon the wheel, which detracts both from the speed of the wheel and the best utilization of the power. The object of my invention is to obviate this difficulty; to which end my improvement consists in inclining the plane of buckets in the direction of the movement of the wheel, and curving them reversely to the usual direction, so that the water strikes the convex portion of the bucket. This form of bucket throws the water well out to the periphery, where it exerts the best leverage upon the wheel, while, the curve and vertical inclination of the buckets being in the direction of the movement of the wheel, the buckets simply present a sharp edge in entering the streams of water, and do not involve the backlash and loss of power produced by the resisting-surface, which the back of the buckets curved in the usual form affords.

In the drawing my improved form of wheel is shown applied to a well-known form of case, in which a series of vertically-pivoted gates, A, are arranged between the two plates B B′ of the case, to open or close against each other to admit water to or shut it off from the wheel. These gates are provided with projecting stems *a*, which pass through slots in the upper plate, in order to be operated upon to open or close the gates by means of the superposed centrally-pivoted adjustable plate C, having spiral flanges *b*, which latter engage the stems *a*. This plate C is provided upon its periphery with a segmental rack, *c*, with which a pinion, *d*, upon a vertical shaft journaled on the case, engages to give the necessary turn to the plate to open or close the gates, the movement being effected through the hand-wheel, as shown. D D′ represent my improved form of wheel, in which D represents the buckets, and D′ the frame carrying the same. This wheel is provided with a shaft, E, extending upwardly through a tubular sleeve, *a′*, of the case to suitable connecting-gears, while the lower portion of said shaft is concaved, as usual, to fit upon the step *e*, carried by the spider-frame F, bolted to the lower side of the case.

The buckets D of the wheel may be either made separate and detached from the wheel, and fastened to the conical frame D′ by means of bolts, as shown, or they may be made of wrought-iron and have the frame D′ cast upon them in the mold, or the whole may be a solid casting. These buckets are constructed with a body portion, *f*, curved in horizontal cross-section, so as to present a convex instead of a concaved surface to the impact of the water, and with a horizontally-curved flange, *f′*, bent downwardly and to the opposite direction of the movement of the wheel.

In fixing the buckets in the wheel they are arranged at a considerable angle to the radial line, and in a vertical plane inclined in the direction of the movement of the wheel, so as to present the convex part of the body of the wheel to the inflowing water.

This construction and arrangement of the buckets secures important advantages. In the first place the curved convex portion of the body of the bucket, inclined forward, as shown, throws the water well out to the periphery, where it exerts the best effects of leverage. This inclination and curvature in-

volves no loss of power from the escape of water around the wheel, for the reason that the buckets fit up close to the rim or case, and the pocket formed between the case and bucket holds the water to its place. In the second place this same inclination and reverse curvature of the buckets permits the latter to enter the incoming streams of water edgewise, with little or no resisting-surfaces to produce backlash and loss of power in the wheel. Furthermore, also, the inclination of the buckets with the reverse curvature, together with the necessary circular character of the wheel, gives to the outer edge of the buckets a knife's edge, which readily cuts up fish, sticks, &c., and thus renders the wheel self-clearing as to obstruction.

As shown, the wheel is arranged for both a central and downward discharge; but I may make the wheel entirely central or entirely downward in its discharge, correspondingly modifying the construction of the wheel-frame, or dispensing with the bottom curved flange of the buckets and substituting therefor a rim, according to whichever modification it is desired to adopt.

Having thus described my invention, what I claim as new is—

1. The bucket D, constructed with a vertical body part *f*, curved horizontally, and having upon its convex side a rearwardly-curved horizontal flange, *f'*, substantially as and for the purpose described.

2. The water-wheel herein described, constructed with a series of buckets, D, inclined and curved in the direction of the movement of the wheel, so as to receive the water upon its convex side, substantially as and for the purpose described.

3. The wheel D, composed of a series of buckets, inclined and curved in the direction of the movement of the wheel, in combination with the spider-frame carrying the step, the case B B', and the pivoted gates A, operated by plate C, for the purpose of delivering the water upon the convex side of the wheel-buckets, substantially as and for the purpose described.

The above specification of my invention signed by me this 1st day of December, 1876.

STEPHEN M. SMITH.

Witnesses:
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