(Model.) 2 Sheets—Sheet 1.

C. R. TOMPKINS.

TURBINE WATER WHEEL.

No. 259,947. Patented June 20, 1882.

Fig 1.

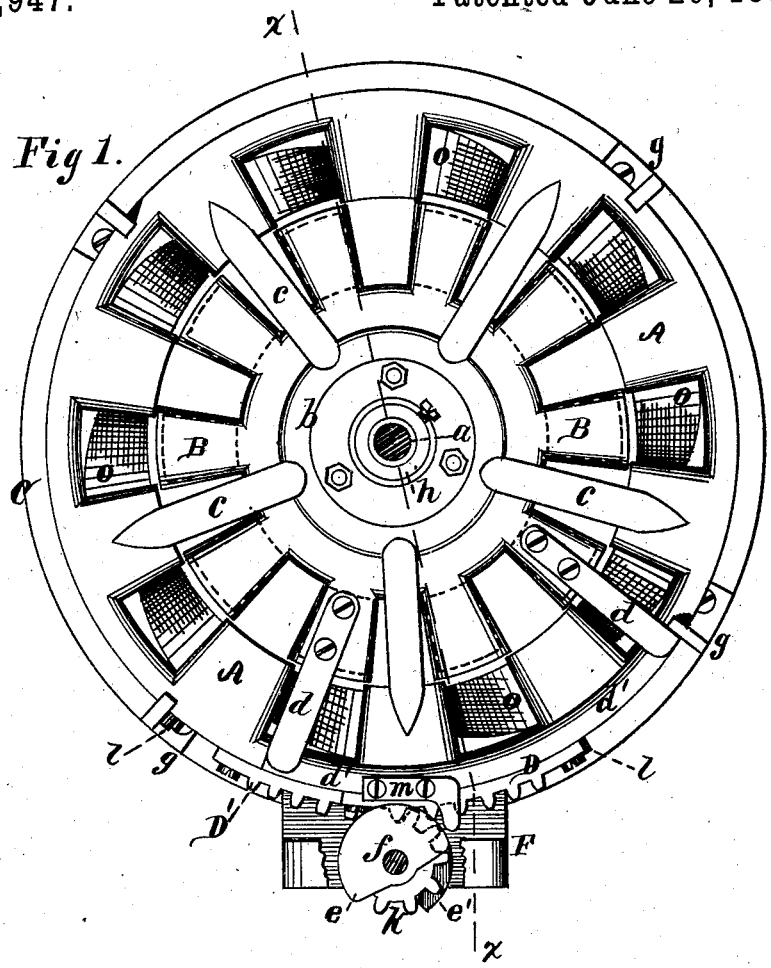
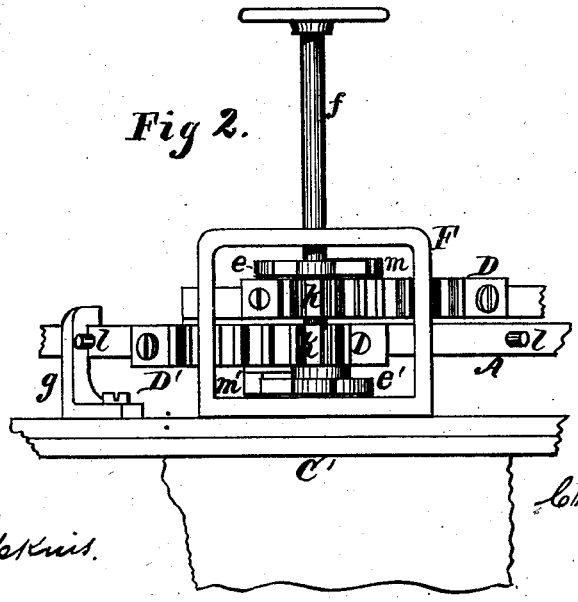


Fig 2.



Attest:
Henry B. Smith
Daniel W. Tompkins.

Inventor:
Charles R. Tompkins

(Model.) 2 Sheets—Sheet 2.

C. R. TOMPKINS.

TURBINE WATER WHEEL.

No. 259,947. Patented June 20, 1882.

Fig 3.

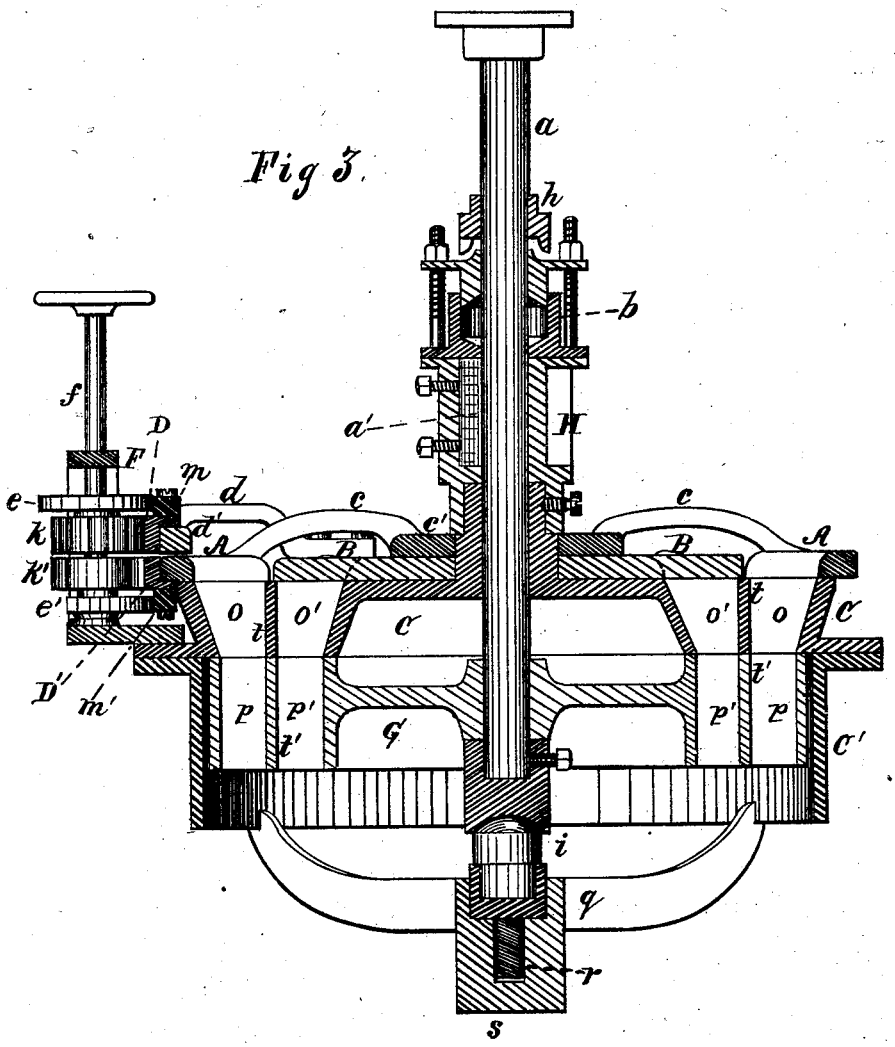
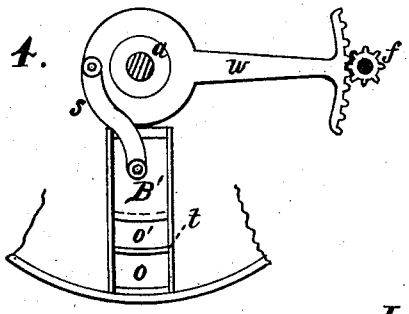


Fig 4.



Attest:
Henry D. Smith
Daniel O. Tompkins

Inventor:
Charles R. Dompkins

UNITED STATES PATENT OFFICE.

CHARLES R. TOMPKINS, OF ROCHESTER, NEW YORK.

TURBINE WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 259,947, dated June 20, 1882.

Application filed July 26, 1880. (Model.)

To all whom it may concern:

Be it known that I, CHARLES R. TOMPKINS, of the city of Rochester, county of Monroe, and State of New York, have invented certain new and useful Improvements in Turbine Water-Wheels, of which the following is a specification.

The object of my invention is to so construct a turbine water-wheel that the same percentage of power may be obtained with partial water as with the whole.

It is a well-established fact (as shown by numerous experiments and tests made by eminent hydraulic engineers) that those turbines that give the greatest percentage of power with full water give the least when shut off to partial water. The average tests show the following results: with full water from seventy-five to eighty-five per cent. of useful effect; with half-water from thirty-five to fifty per cent. of the same. With less than half-water the loss in percentage of useful effect is in still greater proportion. This falling off or loss in percentage of power is due to the decrease in velocity with which the water passes through the wheel, caused by the openings at the gates or entrance being much smaller than the discharge, and as the buckets in all well-constructed turbines are always filled with a solid column of water the velocity with which that column of water moves determines the power; and it is evident that if the openings at the gate are equal to the area of buckets in the wheel each column of water in the buckets will move with a velocity due to its head and the full force of the water will be obtained; but if the gate-openings are partially closed—say one-half, leaving the area of the buckets the same—then only one-half of the quantity of water will be admitted to the wheel, and the column of water in each bucket will descend with but half the velocity due to its head; and as the power of water is its weight multiplied into its velocity it is evident that the loss in power must be in proportion to the loss in velocity. To obviate this defect and keep up a relative proportion between the area of the gate-openings and the area of the buckets in wheel, so that the velocity of the water may by the same when partial water is used or the supply cut off, is the object of my invention, which is fully set forth and shown in the accompanying drawings, of which—

Figure 1 is a plan view, representing the chutes and gates. Fig. 2 is an elevation of the mechanism for opening and closing the gates. Fig. 3 is a vertical section, showing those parts to the left of the dotted line *x*, Fig. 1. Fig. 4 represents another form of gate that may be used, if desirable, or when more than two apartments are used.

The same letters refer to the same parts.

The object of my invention is to construct a turbine wheel suitable for variable streams; and it consists in a complete division of gates, chutes, and buckets of a water-wheel into two or more sections, so arranged and operated that the combined sections, when used simultaneously, may constitute a wheel of large capacity when the supply of water is sufficient, but also so arranged that one or more sections may be used while the remainder is cut off, whereby the capacity of the wheel may be adapted to the quantity of water obtainable, and the same percentage of the power of the water obtained as with a wheel of the same capacity constructed in the ordinary manner when using full water.

G, Fig. 3, represents the wheel, attached to the shaft *a* and inclosed within the curb C′, and resting upon the step *i*, which is secured in a hub that is supported from the bottom of the curb C′ by the arms *g*.

p p′ are buckets constructed with curves in the usual manner.

t′ is a thin plate or division, extending the whole length of each bucket and dividing the same into two sections or apartments, *p p′*.

The case C, containing the chutes, is placed over the wheel and rests upon the flange of the curb C′, to which it is securely fastened by suitable bolts. In this case C are formed the chutes *o o′*, with suitable curves to give the proper direction to the water, and said chutes are also divided by a thin plate, *t*, extending the whole length and corresponding to that of the wheel G, each face being turned off true; and when these two faces are in close contact with each other they form nearly a water-tight joint.

The water is admitted to the chutes *o o'*, and thence to the buckets of the wheel, by means of the gates A and B, Figs. 1, 2, and 3, each having an independent movement, and operated by the gate-shaft *f*, gears *k k'*, and segments D D', as shown in Figs. 1, 2, and 3, and the whole so arranged that the whole or a part of the wheel may be used, according to the supply of water or the power required, and as each part or section constitutes an independent wheel of a given capacity, both in the gates, chutes, and buckets, the same percentage of the power of the water is obtained as when the whole is used.

The gates A, Fig. 1, covering the outside set of chutes, are attached to a rim, and that to a plate fitted to the hub of the case C, Fig. 3, by arms *c*, and are operated by means of segment D', gear *k'*, and shaft *f*, Figs. 1, 2, 3, and 4.

The gates B, Figs. 1 and 3, covering the inside set of chutes, are also attached to a plate turning upon the hub of case C, and operated by the segment D, gear *k*, shaft *f*, and arms *d*, Figs. 1, 2, and 3.

Attached to the gate-shaft *f* are two mutilated spur-gear wheels, *k k'*, provided with a sufficient number of teeth on a part of their circumference to engage with those in the segments D D', so as to move the gates the proper distance, and as the teeth in each are nearly opposite to the other the gate-shaft *f* may continue to move while one set of gates remains at rest. This enables both sets of gates to be moved alternately by one shaft, Figs. 1, 2, and 3.

To prevent either set of gates from shifting from the position in which they are left by the mutilated gear when thrown out of gear, and to insure the same tooth in the wheel entering the same tooth in the segment, cams *e e'* are attached to each gear, and so adjusted that at the same time the last tooth in either gear becomes disengaged from the segment the point of the cam passes the end of the concave hook *m* or *m'*, Figs. 1, 2, 3, and locks it, so that it is firmly held in the same position, while the gate-shaft is still turned and the other set of gates moved.

Suitable stops, *l g*, Fig. 1, are provided at the end of each segment to regulate the travel of the gates.

The segments D D', Fig. 1, may be dispensed with and teeth formed upon the outer rim of A and *d'*, if desired.

To secure a firm bearing for the shaft *a*, Fig. 3, and prevent leakage, a follower-box, H, is attached to the hub of case C by suitable screws, and provided with pockets to receive the blocks *a'*, which are adjusted to the shaft *a* by suitable screws.

At the top of the follower-box H, and secured to it, is a stuffing-box constructed in the usual manner and packed with any suitable packing, *b*, to prevent leakage.

To prevent sand and sediment from accumulating around the shaft and working into the bearing, a collar, *h*, Fig. 3, is fastened to the shaft just above the bearing and revolves with it. This collar may be plain or provided with projections, as shown in Fig. 3.

When the shaft *a* is in motion the collar agitates the water and prevents sediment from accumulating around the shaft, and when at rest the sediment rests upon the upper side of the collar and is thrown off when put in motion. This has proved very effective in preventing the shaft from being worn away at this particular part.

The form of wheel described in the foregoing specification is known as the "Jonval," and takes the water at the top and discharges it at the bottom; but I do not confine myself to any particular style of wheel, as my improvements may be applied to that class of wheels that take the water at the side and discharge the same inward and downward by dividing the chutes, gates, and buckets laterally instead of vertically, so that a part of the wheel may be used while the balance is cut off.

I am aware that water-wheels have been constructed with divisions in the buckets of the wheel, and to this particular part I make no claim; but I am not aware that water-wheels have been constructed having a complete division of buckets, chutes, and gates, and so arranged that a portion of the wheel may be cut off, leaving the balance a perfect wheel in all its parts, having a complete set of buckets, chutes, and gates, thereby forming a perfect wheel of less capacity and adapted to the power required or the supply of water.

I have shown in Fig. 4 another form of gate that may be used, if desirable. The chutes and wheel-buckets are divided by the partitions *t t'*, as before described, and are cut off by the gate B', moving radially in suitable guides or ways by means of the segment-disk *w* and link *s*, operated by the gate-shaft *f*.

In general practice two apartments are all that are required; but in cases where the stream is subject to great variations, and it is important to utilize a small quantity of water, three or more sections may be used with the same results, and in such cases I prefer the form of gate shown in Fig. 4, owing to its simplicity.

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

1. In a turbine water-wheel, the combination of a set of chutes divided in the direction of the course of the water by one or more partitions, a wheel the buckets of which have corresponding partitions, and two or more sets of cut-off gates connected to and working upon a central hub attached to the case of the wheel, substantially as shown and described.

2. In a turbine water-wheel, the combination of chutes divided into two or more compartments, wheel-buckets corresponding thereto, independent sets of cut-off gates operated by a single shaft, and automatic devices for

locking each set of gates while the others are being moved, substantially as set forth.

3. In combination with the shaft of a turbine water-wheel, a fixed collar having suitable wings or projections upon the under side and placed just above the stuffing-box for the purpose of agitating the water and preventing sand and other sediment from accumulating around the shaft and being drawn into the bearing, substantially as specified.

CHARLES R. TOMPKINS.

Witnesses:

HENRY F. SMITH,

DANIEL D. TOMPKINS.