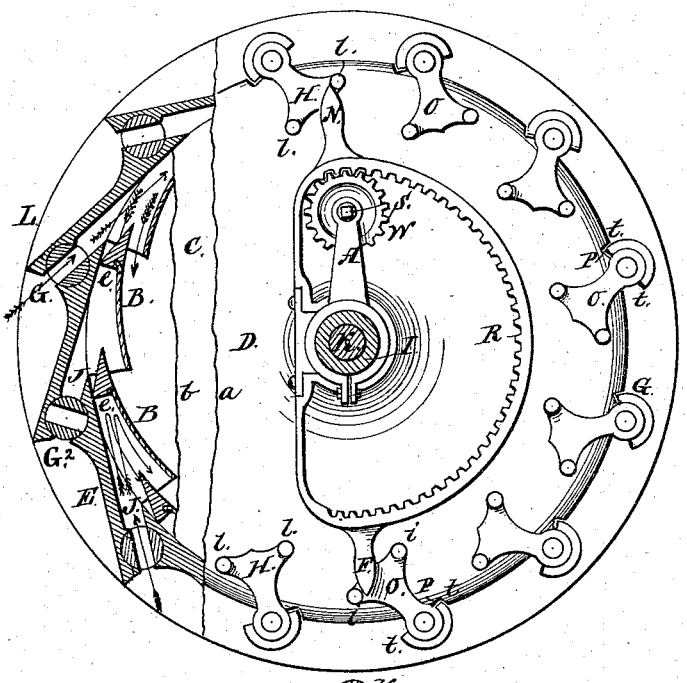
E. B. COPE.

Water-Wheel.

No. 164,909. Patented June 29, 1875.

Fig. 1.



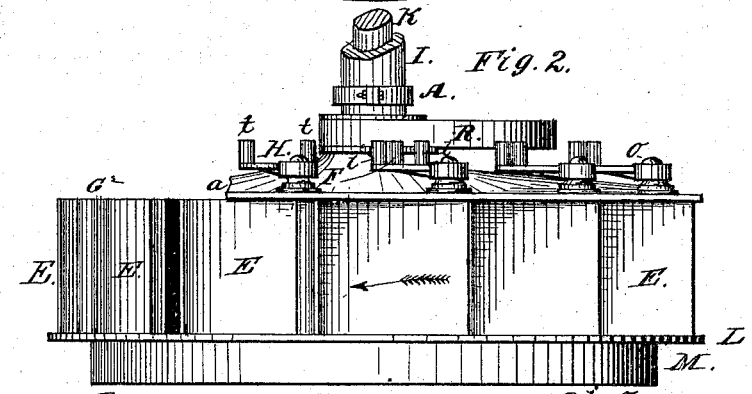


Fig. 2.

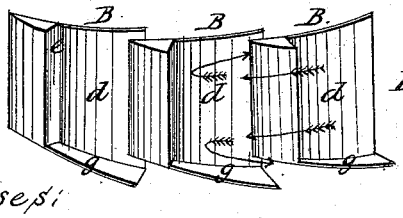


Fig. 3.

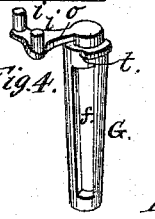


Fig. 4.

Witnesses:

F. Sharpless Hickman

Joseph H. Thorne

Inventor:

Ennor B Cope

UNITED STATES PATENT OFFICE.

EMMOR B. COPE, OF WEST CHESTER, PENNSYLVANIA.

IMPROVEMENT IN WATER-WHEELS.

Specification forming part of Letters Patent No. **164,909**, dated June 29, 1875; application filed April 27, 1875.

To all whom it may concern:

Be it known that I, EMMOR B. COPE, of West Chester, county of Chester and State of Pennsylvania, have invented certain Improvements in Water-Wheels, of which the following is a specification:

The first part of my invention relates to the arrangement of a series of chutes and buckets, so constructed that the percussion-face of each bucket shall be at right angles, or nearly so, to the direction of the water impinging upon it. It relates also to the peculiar form of the bucket, the front part of which is in the form of a wedge, with the edge forward, the back of the wedge forming the percussion-face of the bucket, the object of this part of my invention being to secure the full force of the water due to its impact or percussion, and also to reduce the resistance of the water in its eduction to the rotation of the wheel.

The second part of my invention relates to the construction and operation of the gates, for the purpose of opening and closing the chutes or spouts separately or in pairs, the object of this part of my invention being to combine with a turbine water-wheel a series of balanced gates opened and closed separately or in pairs that can be ground into seats, admitting them between the guides that can be readily taken out and refitted or replaced, and that can be kept perfectly water-tight.

The third part of my invention describes the mechanism employed to open and close the gates, the object being to open them separately or in pairs, and thereby develop more percentage of power than is usual in using wheels at partial gate.

In the accompanying drawings, Figure 1 is a plan, showing the arrangement of gates, chutes, guides, and buckets, the crown-plate of wheel and dome of casing being cut at the lines *b* and *a*, and removed on the left hand, in order to uncover these parts. Fig. 2 is a side elevation. Fig. 3 is a perspective view, showing the arrangement of the buckets in the wheel. Fig. 4 represents a gate out of the casing.

Reference being had to the drawings, C, Fig. 1, is the crown-plate of the wheel. It is secured to shaft K in the usual manner. The parts marked B are the buckets. They are made in two parts. The front part is in the shape of a wedge, and is a part of the crown-plate casting. *e* is the back of the wedge, and is the percussion-face of the bucket. It is also a plane perpendicular to the crown-plate, and radial to the circle of rotation. The tail of bucket B is made of one piece of metal, wrought-iron or steel being suitable. These plates are forged and placed in the mold, and cast permanently into the wedge-shaped projection and crown-plate of the wheel, strengthening every part of the bucket.

In Fig. 3, *d* is the upper part of the tail-plate. It is curved inward sufficiently to give an inward or central discharge to the water, striking the upper part of the bucket. *g* is the lower part of the tail-plate. It is bent outward from part *d*, and its edge extends to the extreme circumference of the wheel. It also inclines downward sufficiently to form a discharge-opening underneath the bucket behind it. This opening is shown at Fig. 3. The arrows indicate direction of water.

The casing of the water-wheel—of which D is the dome, E E the guides, L the base, ring, or curb, and M the draft-tube—is cast in one piece. It is bored out true, and the wheel turned up on the face and fitted into it. J J are the chutes or spouts tangent to the rim of the wheel. They are made somewhat larger than the gate-openings, to avoid friction. Holes are bored through the dome and curb in such places as to form a cavity between guides E E. These holes are reamed tapering, into which the gates are fitted and ground perfectly water-tight. G G are the gates. The perspective view, Fig. 4, shows their construction. They are cylindrical in form, excepting that they are slightly tapering, and have an elongated aperture, *f*, through them corresponding to the chute and slightly smaller, through which the water flows to the wheel G^2.

Fig. 1 represents one of the gates closed. On the top of gates G G are fitted arms, with two round projections on the ends of each.

In Fig. 1 the gate-arms on the right-hand side are designated by O and *i i*, and those on the left-hand side by H and *l l*. These arms are designed to open and close the gates by means of suitable mechanism operating in combination with them. Shoulders *t t*, Fig.

1, stop the motion of gate G at the proper point, either opened or closed, by striking against stop *p* on dome D.

The mechanism for operating the gates is shown in Fig. 1. R is a segment, with internal cogs rotating upon stem I. Upon the extremities of segment R are fixed hands N and F, hand N striking projections *l l* on arms H, and operating upon all the gates on the left hand side of the casing separately, hand F operating in like manner upon projections *i i* of arms O on the right-hand side of the casing. Motion is given to hands N and F by means of shaft S, wheel W, and segment R, each hand performing a half-revolution forward in opening, and backward in closing, the gates G G. By changing the position of hand N or hand F the gates can be operated alternately.

Hitherto almost all water-wheel gates have been objectionable, either on account of wasting a great deal of water after having been a short time in use, or, if tight, liable to stick fast, or to be very hard to operate. I have, therefore, applied the cylindrical gate to my wheel, and made it tapering throughout its length—that is, larger at the top than at the bottom. The openings *f* through the gates have parallel sides, and are made smaller than the chutes, for the purpose of making the point of compression in the gate. The wear consequent upon operating the tapering gate has a tendency to keep it perfectly water-tight, and the friction in its seat will hold it in place wherever turned without extra mechanism for that purpose.

The eduction and discharge openings in turbine water-wheels should bear certain proportions to each other, in order to give the best results. In almost all turbines this proportion is destroyed when using a partial gate, from the fact that each eduction-opening is closed partially, while the discharge-openings remain the same.

I propose to remedy this defect by admitting the quantity of water required through the necessary number of gates fully open, while the balance remain entirely closed, thereby maintaining the same relative proportions in the openings throughout.

I make no claim to a straight cylinder-gate with an eduction-opening through it, the same being pivoted upon trunnions or fastened into the casing, and the series operated simultaneously. Nor do I claim a bucket with flanges having a central and downward discharge, and a percussion-plate radial to the wheel, all these devices being old and long in use.

I claim—

1. The bucket having its front part made wedge-shaped, and tail *d g* curved, as shown, to form a central and downward discharge, substantially as shown and described.

2. The combination of the tapering gate G, straight opening *f*, arms O, projections *i i*, shoulders *t t*, chutes J, and guides E E, substantially as and for the purpose set forth.

3. The combination of shaft S, wheel W, segment R, hands N and F, arms O and H, pins *i i* and *l l*, and gates G, substantially as and for the purpose hereinbefore set forth.

EMMOR B. COPE.

Witnesses:
F. HAINES,
W. P. MERCER.