WILLIAM A. CROWELL.

Water-Wheels.

No. 126,877. Patented May 21, 1872.

Fig: 1.

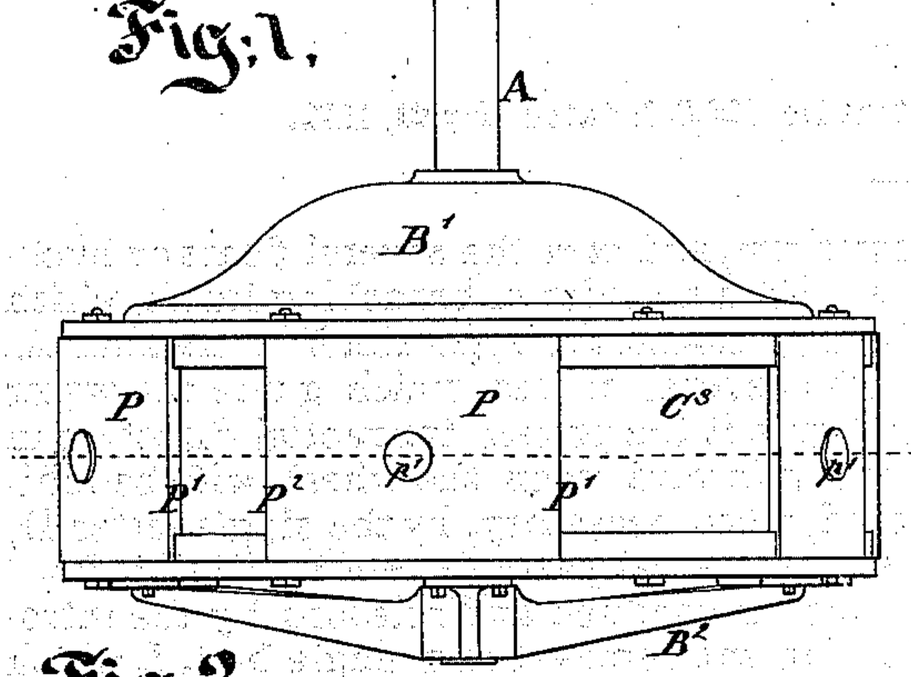


Fig: 3.

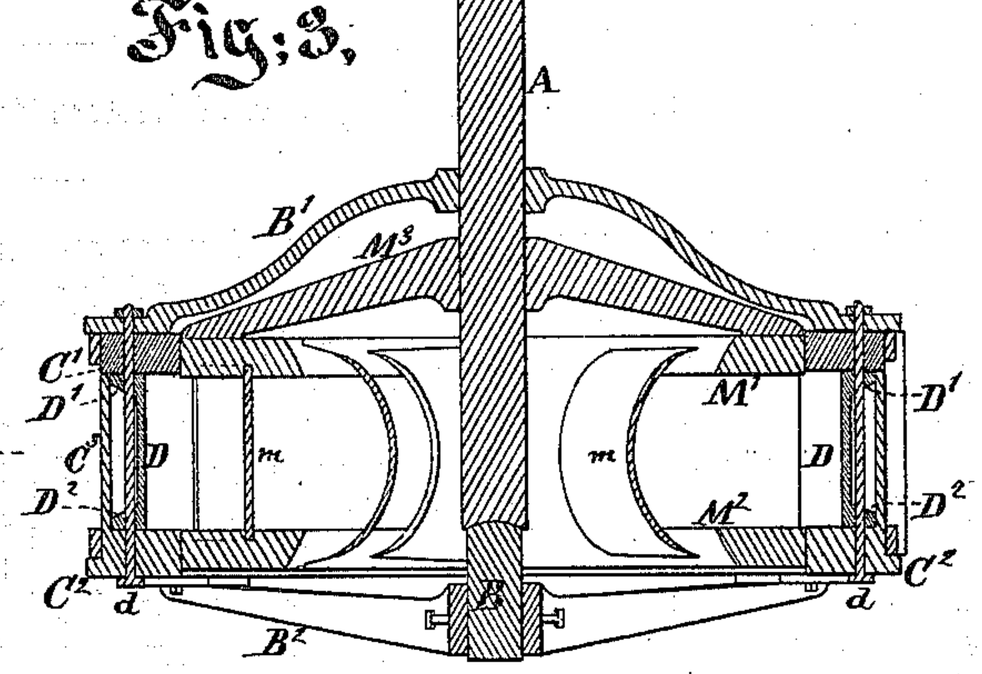


Fig: 2.

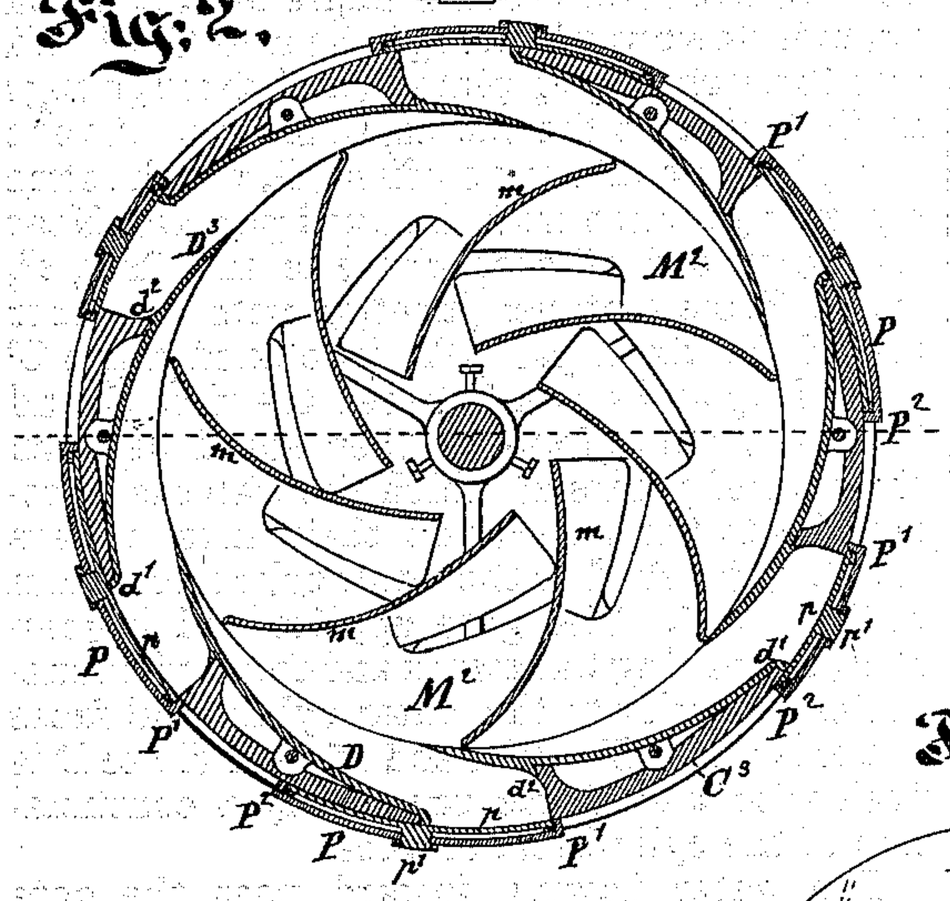


Fig: 4.

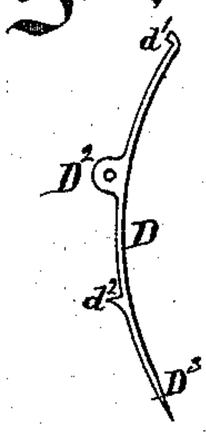


Fig: 5.

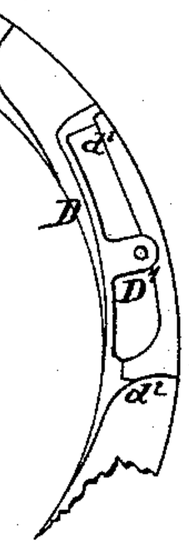
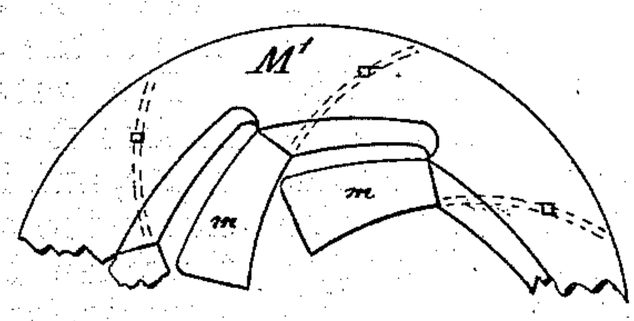


Fig: 6.



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UNITED STATES PATENT OFFICE.

WILLIAM A. CROWELL, OF LIME ROCK, TOWN OF SALISBURY, CONN.

IMPROVEMENT IN WATER-WHEELS.

Specification forming part of Letters Patent No. 126,877, dated May 21, 1872.

Specification describing a certain Improvement relating to Water-Wheels, invented by WILLIAM A. CROWELL, of Lime Rock, in the town of Salisbury, Litchfield county, Connecticut.

The invention relates to the construction of the chutes and the adjacent parts which guide the water in its introduction to the wheel; to the gate and its adjuncts, which regulate the admission of the water to the chutes; and to the construction of the wheel itself, which receives and utilizes the power of the water.

The following is a description of what I consider the best means of carrying out the invention. The accompanying drawing forms a part of this specification.

Figure 1 is a side elevation of the wheel with the chutes and gate in the proper position relatively thereto. It will be understood that exterior to these is a scroll or flume, as the case may be, by means of which the water is presented with its full pressure to the exterior of the gate. Fig. 2 is a horizontal section through the same parts. Fig. 3 is a central vertical section through the same. Fig. 4 is a plan view of one of the chutes detached. Fig. 5 is a plan view, showing a different chute, which is substituted at will for that shown in Fig. 4, with the effect of consuming less water and, of course, yielding less power. This Fig. 5 shows the chute in the proper relation to the adjacent parts of the wheel. It will be understood that the form shown in Fig. 4 is to be used in the same general relation to the other parts; but the form is such in Fig. 4 as to allow the inlet and discharge of more water. Fig. 6 is a plan view of a portion of the wheel. The dotted lines show the form of that portion of the floats which is concealed under the rim.

Similar letters of reference indicate corresponding parts in all the figures.

A is the shaft, stepped in any ordinary or suitable manner upon the adjustable pivot B, which is firmly fixed in a spider, B^2, bolted upon the lower rim C^2 of the casing which confines the chutes. There is an upper rim, C^1, corresponding to the lower rim C^2, to which upper rim C^1 is firmly bolted a top plate, B^1.

The entire wheel will be referred to, when necessary, by the single letter M, and the several parts by M^1, M^2, &c.

M^1 is the upper rim of the wheel, and M^2 the lower rim, and *m m* the several floats or buckets. M^3 is a spider or branching frame, which rigidly connects the upper rim M^1 to the shaft A.

The several chutes, which guide the water and give it the proper tangential direction in flowing inward upon the wheel, will be indicated, when necessary, by the single letter D, and the several parts thereof by D^1, D^2, &c.

Each is confined and released by the introduction and removal of a single bolt, *d*, which extends downward through the rims C^1 C^2, and also through the top plate B, and through lugs D^1 D^2 formed on the chutes, as shown. At one end of each chute is an offset, d^1, which forms a proper junction with the fixed part C^3. Near the other end of each chute is an offset, d^2, which forms a proper junction with the other end of the fixed part C^3. The fixed parts C^3 extend up and down between the rims C^1 and C^2 of the chute-frame. They stand between the several points at which the water is introduced into the wheel, and their exteriors are carefully finished to the outer cylindrical form of the wheel. The gate applies and is operated, by turning backward and forward, immediately exterior to the outer cylindrical faces of these parts C^3. The end of each chute D is flush with and forms practically a continuation of the cylindrical surface.

The water flowing inward past the gate strikes the exterior of the tail portion D^3 of a chute, and is deflected into a direction tangential to the wheel. It is guided inward against the wheel by the inner face of the next chute. A variation in the form of the chute greatly changes the consumption of water in the wheel with a given amount of gate. The form of chute shown in Figs. 2 and 4 are identical. With the gate full open a large quantity of water is allowed to flow inward between the chutes, because of their wide distance apart, as shown in Fig. 2. With the form shown in Fig. 5, a much smaller quantity of water is allowed to flow in between the chutes by reason of the reduced distance of the chutes from each other.

I propose to construct a number of different patterns of chutes, D, adapted to match in the same casing C^1 C^2 C^3, and to be mutually exchangeable—that is to say, all the chutes D in the wheel, Fig. 2, may be removed and their places supplied by the form of chutes shown

in Fig. 5, which will require much less water. These being held equally well by the bolts *d*, give the wheel, although otherwise of the same dimensions as before, capacity for exerting much less power with the same head of water, and the same speed, by reason of its greatly-reduced consumption of water.

A wheel with the gate nearly shut uses the water at a great disadvantage. There is a position of the gate which allows the water to act with its maximum effect, and any movement of the gate away from this position tends to decrease the effect of the water. My changeable chutes allow the manufacturer of the wheels to readily adapt his wheels—by the construction simply of one size of casings, C^1 C^2 C^3, and a number of sets of chutes, D—for the consumption of different quantities of water with a maximum effect. Then, by changing the position of the gate on the exterior, the wheel, whether adapted for large or small quantities of water, may be regulated by varying the quantity of water in the ordinary way.

It is not intended that the user of the wheel shall, under any ordinary conditions, change the capacity of a wheel by taking it apart and changing the chutes after the wheel has been once mounted in position for work. It is perfectly practicable to change these wheels from a limited consumption in summer and fall to a great consumption in winter and spring, and to thus change the wheel from a maximum to a minimum and back again to its original condition each season. Ordinarily, however, the advantage will lie immediately with the manufacturer of the wheel, by allowing him to produce wheels at an hour's notice of a given diameter, adapted for any consumption of water, the gain to the user lying mainly in the reduced price at which the wheels may be delivered and the rapidity with which an order may be filled.

The form of the buckets *m* is adapted to allow the discharge of the water not only inward, but also both upward and downward. The form is adapted, as usual, to throw the water backward in its discharge out of the wheel at the center, the design being to vent the water both upward and downward very freely when the wheel is inclosed in an open scroll, so as to allow its discharge in that manner.

It will be readily seen how the removal of the tight casing B′ and the substitution of an open-work frame or spider therefor, and the inclosing of the wheel in a scroll, will allow the water to escape upward with the same freedom as downward, the wheel being, of course, set at a sufficiently low level.

The gate has several peculiarities. Its general form is that of a ring, with openings to admit the water to the wheel. The position of the edges of the openings is important. I will designate the entire gate by P, one of the edges of each opening by P^1, and the opposite edge of each opening by P^2.

All the edges P^1 are of uniform distance apart, and are equal in number to the corresponding openings in the chute-case, which receive the water. When the gate is opened by being turned in one direction, so as to uncover the chute-openings by this edge P^1 of the gate-openings, all the chute-openings are uncovered exactly alike. But the other edges P^2 are not so spaced. There are two of the openings which are wider than the others. They are placed opposite to each other. When the gate is moved in the other direction so as to uncover the apertures from the edges P^2, the difference is very marked. In such case only two of the chutes are uncovered at a time. These are the chutes which are opposite to the extra wide openings. The quantity of water admitted to the wheel is, therefore, correspondingly reduced, and instead of admitting the water to the wheel through all the chutes, it is admitted through these two. Whenever all the chutes are to be used, the gate had better be operated the other way.

The working of the gate by the governor to open and close the apertures from the edges P^2 will be exactly identical with the working of it by the governor from the other edges P^1. In both cases the working of the ring in one direction closes the chutes, and in the other direction opens them, the difference only lying in the fact that in opening from the edge P^2 it only uncovers two chutes, and in opening it from the edges P^1 it uncovers all the chutes.

The presence of a joint extending quite around a large wheel, above and below, induces a large leakage. To reduce this evil I fit the gate so that it does not rub against the chute-case, and then provide loosely-fitting pieces inside adapted to cover the chute apertures tightly, and to fill up as fast as the surfaces wear away.

Fig. 2 shows this feature of the invention very clearly, the parts *p* being the movable pieces. They are fitted within recesses on the inner or concave face of the ring-gate P, and are held in their proper positions laterally by flanges on the ring-gate, as shown. They are free to move only inward and outward. This need not be but to a small extent. A slight pressure inward is provided by allowing the pressure of the water to be felt on a small portion, which projects outward through the body of the ring-gate, and is packed around in a manner analogous to the packing of a piston-rod.

It is important that the packing around the small portion, which I will call *p′*, shall be tight, or else that a provision be made for the leakage away into the wheel of any water which gets behind the loose piece *p*, and between it and the gate. It is impracticable to make the work perfectly tight, and I therefore provide one or more small holes, not represented, through the movable pieces *p* to allow any water which gets between it and the body of the gate P to flow freely in.

In practice it is well to have packing around the edge of each of the loose pieces *p*, so as to

make a packed joint between it and the ring-gate P. Thus mounted, the pieces *p* press gently but tightly against the smooth cylindrical exterior of the chute-case. The force with which they press is so gentle as to offer but little resistance to the motion of the ring-gate in opening and closing; but the contact is sufficient to constitute a practically tight joint.

The buckets or floats *m* are held in the rims M^1 M^2 by having their edges sunk in grooves provided for the purpose, as shown in section in Fig. 3. The floats are also attached to the top and bottom plates by means of flanges or lugs, not represented, cast on the floats, which strengthen the floats and are let in the top and bottom plates flush, so as not to impede the water in its course or operation on the wheel, and set-screws from the top and bottom are inserted firmly in the flange or lugs—a sufficient number to make all parts firm. The rims M^1 M^2 have a width sufficient to hold the floats very firmly, by these means leaving those portions of the floats which project inward beyond the rim unsupported.

It will be understood that these portions of the floats which come between the rims, and consequently are confined in the grooves, are differently formed from the portions which project inward beyond the rims. The portions between the rims are simply curved, as shown by dotted lines in Fig. 6, while the portions which project beyond the rims are bent so that a cross-section through the bucket shows a curved outline, as seen in two of the buckets which are sectioned through these parts in Fig. 3. The curvature is of course in such direction as to throw the water backward as it emerges from the wheel.

The outer edges of the rims M^1 M^2 are perfectly circular. The inner edges are not circular, but scalloped and beveled to allow the proper support for the bucket and the free discharge of the water. This form is shown clearly in Fig. 6.

I claim as my invention—

1. The within-described arrangement of the edges P^1 P^2 of the openings in the ring-gate P, so that as the gate is opened in one direction it uncovers only a portion of the chutes, substantially as herein specified.

2. The movable pieces *p*, mounted in the ring-gate P, and adapted to move therewith, and to follow up the wear of the surfaces and form a tight joint against the chute-case, as specified.

3. The chute-casing C^1 C^2 C^3, in combination with the changeable chutes D and holding means *d*, arranged for joint operation, relatively to each other and to the inclosed wheel and external gate, as and for the purposes herein specified.

4. The buckets *m*, having the form represented and held in grooves in the rims M^1 M^2, as and for the purposes specified.

In testimony whereof I have hereunto set my hand this 18th day of March, 1872, in the presence of two subscribing witnesses.

WILLIAM A. CROWELL.

Witnesses:

SIDNEY J. ENSIGN,

J. H. BARNUM.