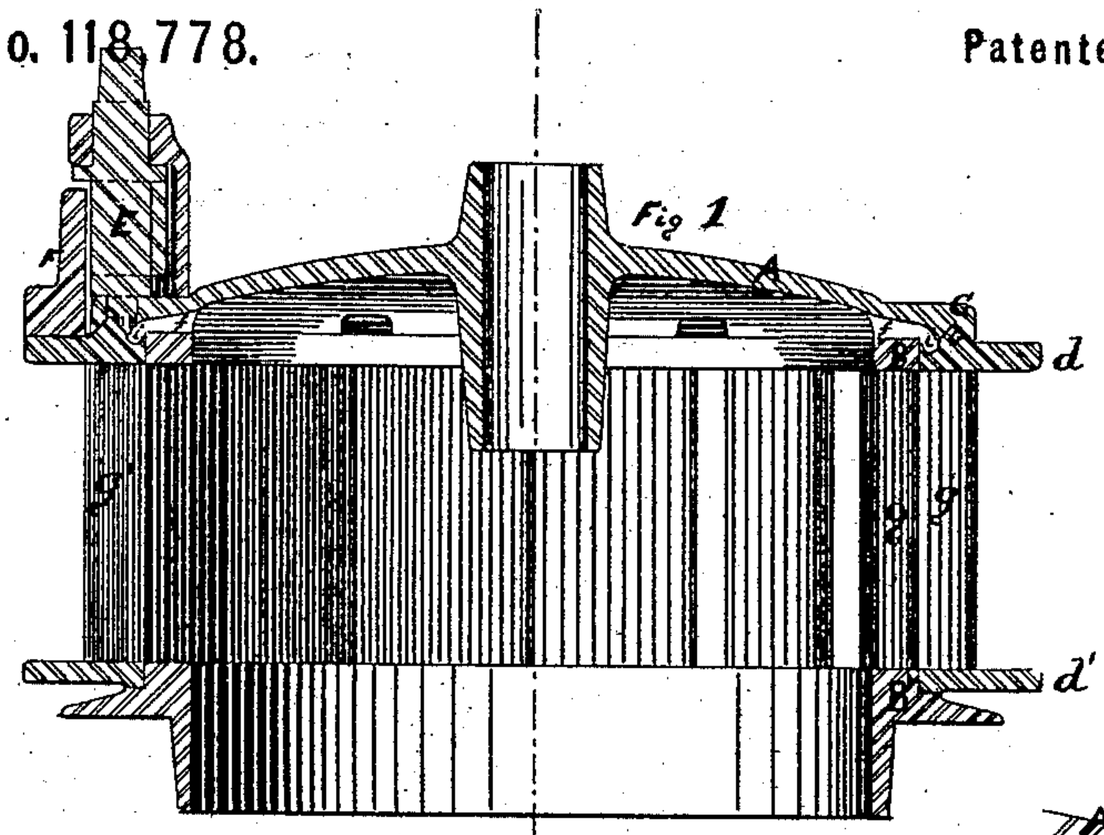
BAYLEY & CROWELL

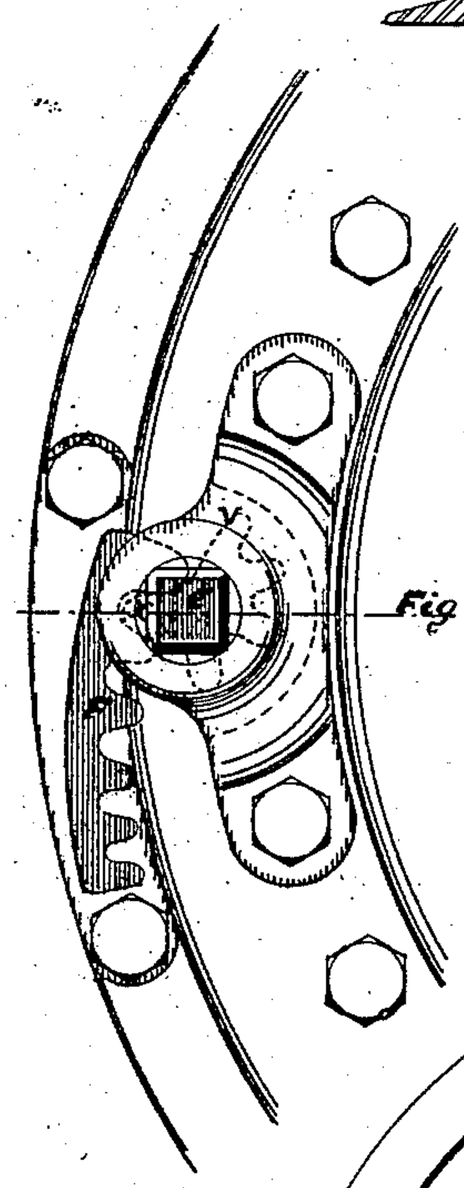
IMPROVED WATER WHEEL CASE.

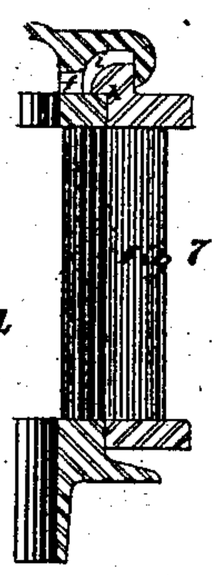
[118.]

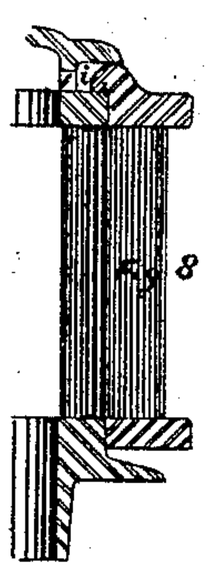
No. 118,778. Patented Sep. 12, 1871.

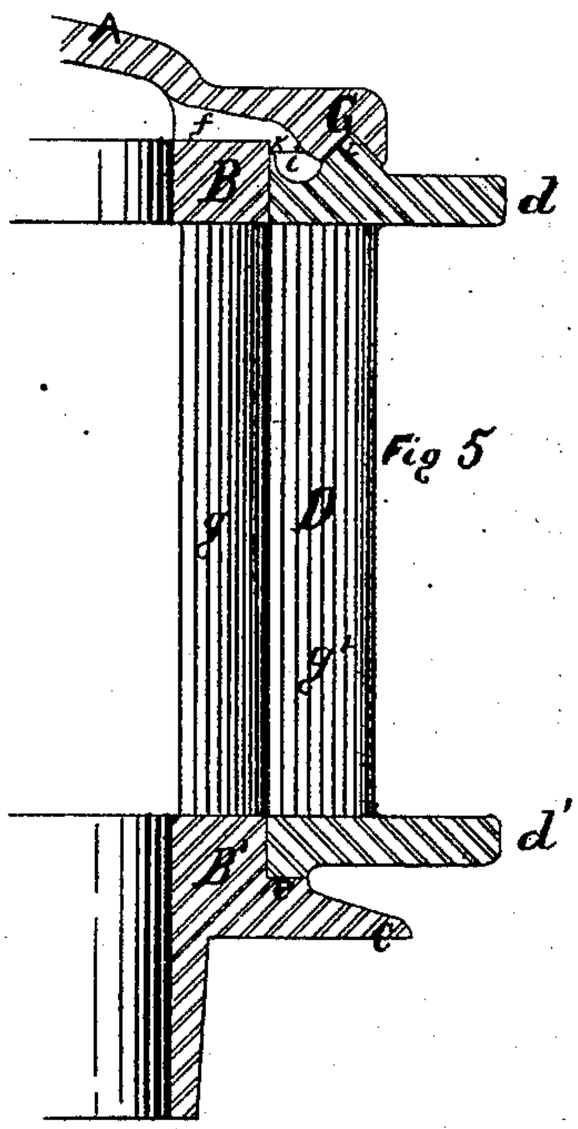
Fig 1

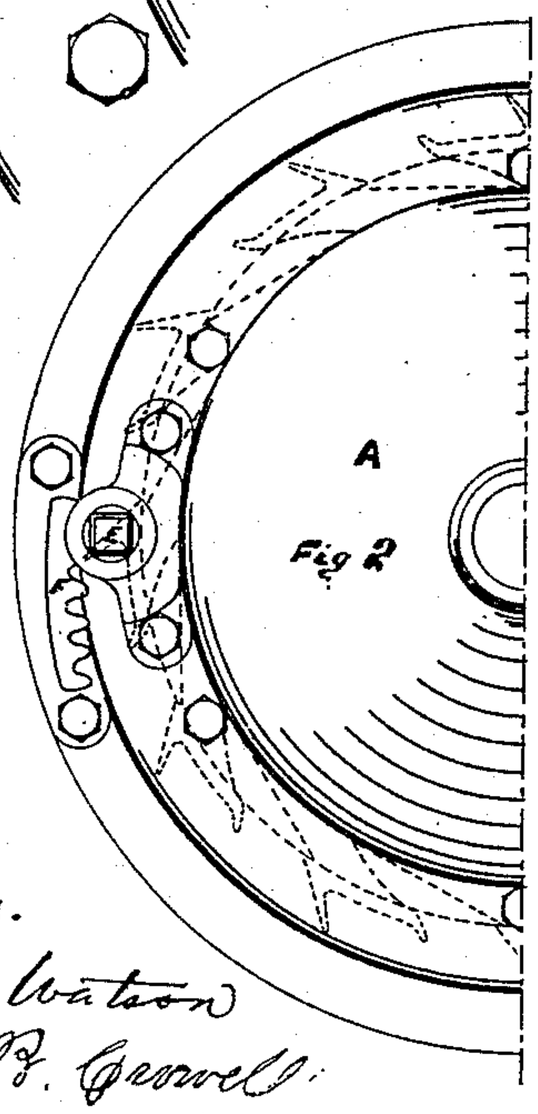


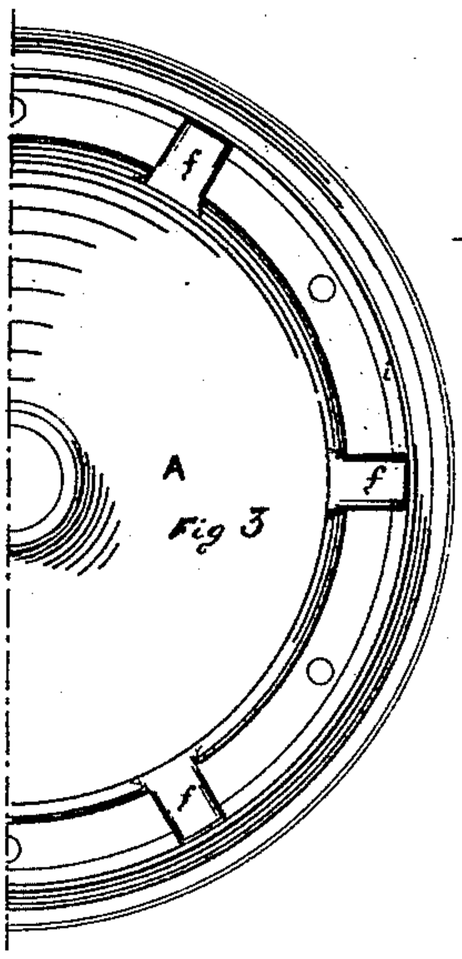












Witnesses.

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UNITED STATES PATENT OFFICE.

WILLIAM BAYLEY AND ABNER P. CROWELL, OF WILMINGTON, DELAWARE.

IMPROVEMENT IN WATER-WHEEL CASES.

Specification forming part of Letters Patent No. 118,778, dated September 12, 1871.

To all whom it may concern:

Be it known that we, WILLIAM BAYLEY and ABNER P. CROWELL, both of the city of Wilmington and county of New Castle, in the State of Delaware, have invented certain new and useful Improvements in Turbine Water-Wheels, of which the following is a specification:

The objects of our invention are: First, to provide an improved means of guiding and sustaining the register-gate of a turbine water-wheel, by the use of which the weight of the gate is wholly or partially sustained by the hydrostatic pressure of the water, and the bearing, by which the gate is guided, is on the top of the gate, entirely shielded from dirt or grit; and our improvement consists in providing the case of a turbine water-wheel with a flange projecting out and over its gate, and an opening or openings communicating from the interior or discharge-chamber of the case to a chamber over the gate, and between it and the aforesaid flange, or on the inside edge of the gate, thereby wholly or partially relieving the gate of the hydrostatic pressure on its top side and causing it to be lifted by the excess of pressure under the bottom side, as hereinafter more fully set forth. Second, to provide an improved means of operating the gates of a turbine water-wheel, whereby very great leverage can be obtained where it is most required; and our improvement consists in providing a peculiar rack and pinion, so constructed that the pitch-line of the pinion commences at a point very near its center of rotation, gradually diverging from that center in the form of a spiral curve, as hereinafter more fully set forth.

In the accompanying drawing, Figure 1 is a side view and section of our improved case. Fig. 2 is a half-plan view in elevation of the same. Fig. 3 is a plan view of the crown-plate inverted. Fig. 4 is a plan, on an enlarged scale, of a portion of the case detached. Fig. 5 is a section of a portion of the case detached. Fig. 6 is a similar section of an old form of case. Figs. 7 and 8 are similar sections of other forms of gate-bearings.

The cylinder B′ and the ring B, connected by the columns *g*, are in this instance formed in one piece, supporting the crown-plate A, which is firmly secured to the ring B by bolts, and is constructed with an overreaching flange, G, which flange is provided with an annular bearing, *b*, on its under side, the bearing being of any suitable form. We prefer to make it as represented in Fig. 5. The cylinder B′ is also provided with a flange, *c*, extending beyond the inside line of the gate D, the bottom of which flange bears upon the floor of the penstock, in which the wheel is placed, and on its top side there is provided a narrow bearing, *e*. We prefer to place the bearing *e* on the inner edge; but it could be placed at any other point on the flange, provided an opening were made to communicate with the space back of it, so as to avail of the hydrostatic pressure against that surface. The gate D is composed of upper and lower rings *d d′*, united by columns *g′*, so arranged that the rotating of the gate causes it to open or close the spaces between the columns *g* of the case B B′.

As heretofore constructed the flanges *d d′* have been made as indicated in Fig. 6, the weight of the gate first causing it to settle upon the lower flange *c*, and the whole hydrostatic pressure, proportioned to the width of the bearing *h*, adding itself to this weight and causing the gate to move with great friction. The bearing *h*, also, being at the bottom, was at all times subject to any grit or dirt that might settle upon the floor of the penstock. To overcome these serious objections we have constructed our gate with its working bearing upon the top side instead of the bottom, only reserving a narrow bearing on its under side to hold it in place when the water is not on the case. The bearing *b* corresponds with that on the under side of the flange G.

Between the flange G and the gate D, and on the inside of the bearing *b*, we leave an open space or chamber, *i*, of a sufficient width that, when relieved of the hydrostatic pressure by means of an opening or openings, *f f f*, which communicate with the discharge-chamber of the wheel, the hydrostatic pressure beneath the gate will be sufficient to lift it and cause the gate to work upon the bearing *b*. The chamber beneath the gate D and the flange G we make continuous around the case, and communicate with the discharge-chamber by one or more openings or ports, *f*. It is obvious that the chamber *i* might be made in several sections, each communicating with the interior of the case independent of the other without changing the nature of our invention. In order to prevent leakage between the gate and case into the groove or chamber *i* we provide, on

the inside top edge of the gate, a narrow projection, *k*, faced, and bearing against the flange G on its upper edge, thereby forming a joint. The bearing *b* also forms a joint upon the outside. The openings *f f f* are made of sufficient area to freely discharge all the water that could pass into the groove *i* over the bearing *b*, and immediately insure the lifting of the gate D. In the form of balanced register-gate that we have shown in Fig. 2 more power is required to move the gate when commencing to open than when full open, which, with the old form of rack and pinion, would cause an unequal strain upon the mechanism for operating the gate. To overcome this, and equalize the power required, we apply a very peculiar spiral pinion and rack, so constructed that the pitch-line of the pinion starts near the center of its rotation, at the point *x*, and gradually diverges from it in the form of a spiral curve to the point V, making the distance from the center gradually increase to the end of its motion, where the strain is least. The pitch we graduate, it being the strongest at *x*, where the pitch-line is nearest the center of rotation, and where the strain is greatest.

It is obvious that this form of pinion and rack may also be used on gates of other form, where more power is required at one part of its motion than at its other.

We also annex sections of two other forms of gate-bearings, showing the manner of applying the chamber *i* to those forms in Fig. 7. The chamber *i* extends far enough out to relieve the bearing *h* of the hydrostatic pressure and partially lift the gate; and in Fig. 8 it only extends far enough to relieve the bearing *h* of the hydrostatic pressure.

What we claim as our invention, and desire to secure by Letters Patent of the United States, is—

1. The case A B B′, with its flange G, in combination with the gate D, when constructed with a chamber, *i*, communicating with the interior or discharge-chamber of the wheel, substantially as described, and for the purpose set forth.

2. The combination, with a turbine water-wheel case and gate, of a spiral pinion and rack, substantially as and for the purpose set forth.

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ABNER B. CROWELL.

Witnesses:
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JAMES M. WATSON.