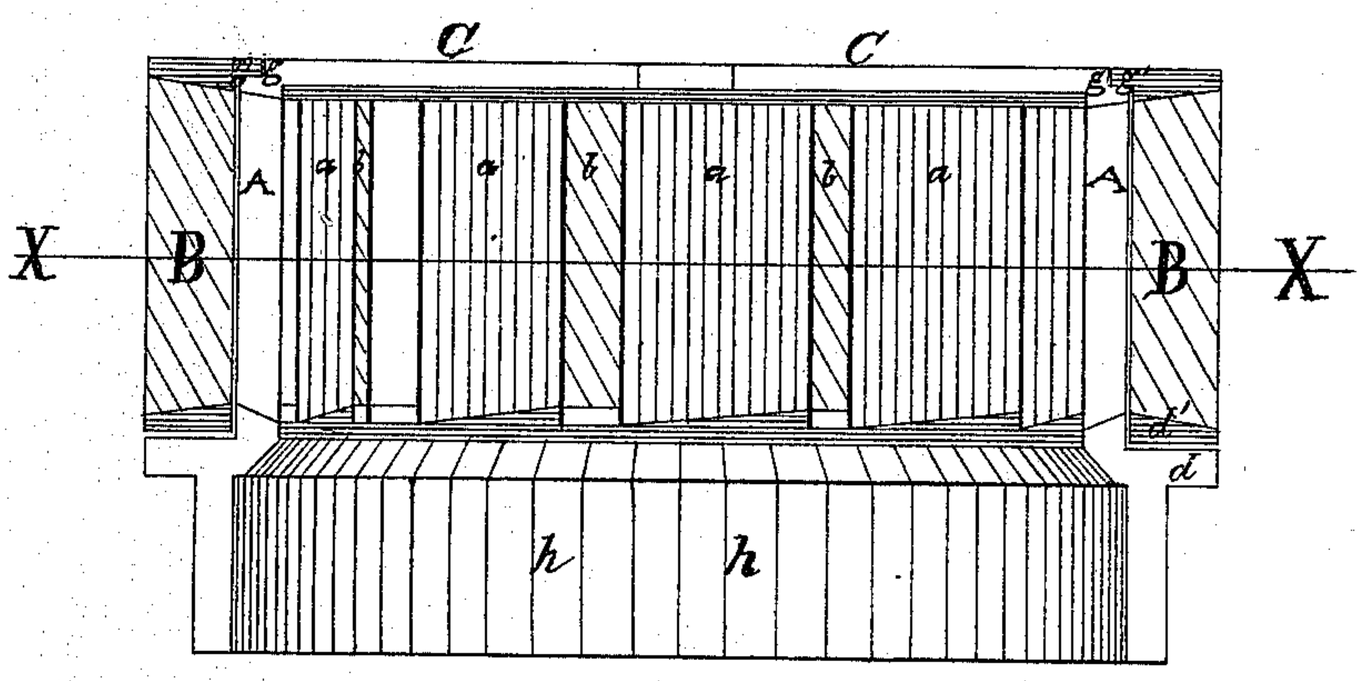
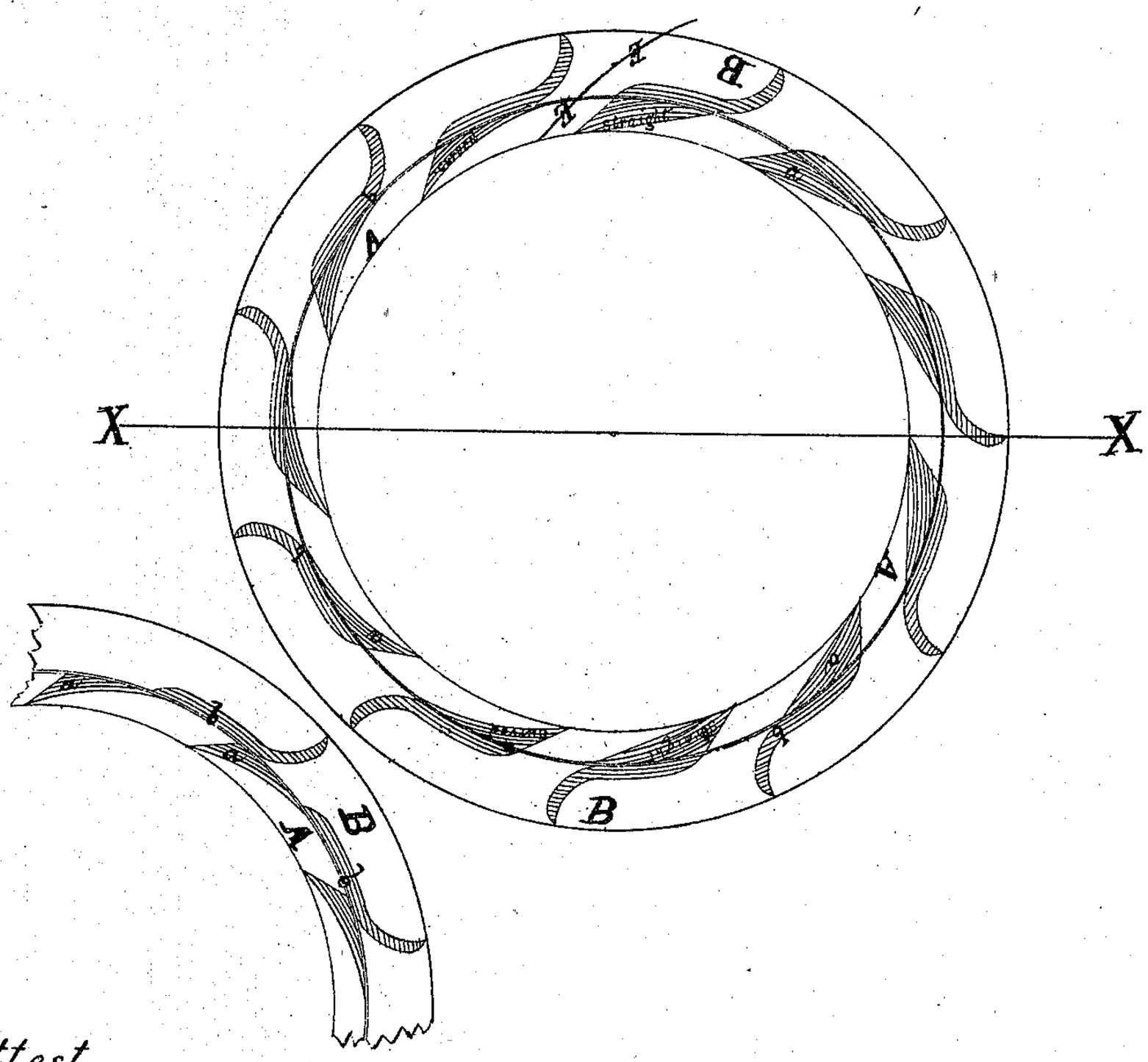
J. O. Joyce,

Water Wheel Case.

No. 105,808. Patented July 26. 1870.





Attest
C. F. Ingalls
M. Bennet

Inventor:
Jacob O. Joyce

UNITED STATES PATENT OFFICE.

JACOB O. JOYCE, OF DAYTON, OHIO.

IMPROVEMENT IN CASES FOR TURBINE WATER-WHEELS.

Specification forming part of Letters Patent No. **105,808**, dated July 26, 1870.

Be it known that I, JACOB O. JOYCE, of the city of Dayton, in the county of Montgomery and State of Ohio, have invented a certain new and useful Improvement in Cases for Turbine Water-Wheels. The following is a full, clear, and exact description thereof, reference being had to the accompanying drawing, making a part of this specification, in which—

Figure 1 represents a vertical section through the case; Fig. 2, a horizontal section on a line, X X, of Fig. 1, showing the chutes open; Fig. 3, a section of Fig. 2, with the chutes closed.

Similar letters of reference in all of the figures refer to like parts of the case.

The nature of my invention consists, first, in constructing the case for turbine water-wheels in two parts, one stationary, the other revolving, each uniting in forming the chutes and gates, in which the water is introduced through spiral chutes with converging throats, to the buckets of the wheel, and exposing the entire receiving-surface of the buckets to the direct action of the impinging currents passing in columns through converging chutes, preserving the same manner of delivery at full or any partial opening of the chutes, and avoiding swinging gates; second, in constructing the case in two such parts that the same tangential line of delivery of the columns of water admitted to the wheel, in the manner above named, at full or any partial opening of chutes, the converging throats being the only part of the chute affected in regulating the amonnt of water used; third, in combining a stationary and revolving case, by means of an annular journal-bearing, with shouldered grooves turned upon the periphery of the crown of the inner case and upon the inner edge of the upper flange of the outer case, in such a manner that the bearings form a close friction-joint, while the corresponding parts of the two cases are kept from contact, but forming close joints, and giving an easy control of the revolving case.

To enable others skilled in the art to make and use my invention, I will proceed to describe the same with reference to the drawing.

The case is composed of two parts, A and B, each cylindrical, A upon the outer and B upon the inner surface, preferably of iron, and cast in one piece.

The inside case, A, is stationary, consisting of flange *d*, which is intended to rest on the bottom of the flume or pen-stock supporting the case and wheel.

A discharge-tube, *h*, is attached to the flange, and extends downward, cylindrical in shape, as seen in Fig. 1, and should be slightly larger in diameter than the wheel.

A series of columns, arranged circularly on the flange, *a a a*, extend up to the crown-plate *c*. These guides are of the length corresponding to the depth of the wheel, and are of sufficient distance apart to form between their faces converging throat of the chutes, from which they are drawn to an edge or point, terminating at their extreme inner ends, so as to complete the chutes, and to deliver the several columns of water upon the entire receiving-surface of the buckets, subjecting equally every part of the same to the impinging current, their outer faces being cylindrical, and intended to form a joint with the inner faces, *b b b*, but without contact. The case can be easily fitted by lathe-work. These guides, with the corresponding parts of the guides of the case, *b b b*, form the chutes E, and regulate the supply of water passing through the chutes to the wheel. These guides are rigid, and cast or united to flange *d'* at the bottom and plate *c* at the top.

Crown-plate *c* is a circular plate attached to the guides, and of the same diameter, and forms the top or cover to the case, a shaft of the wheel passing through the center of this plate, which may be drilled, and bearing made to support the same.

An angular shouldered groove, *g*, Fig. 1, is turned on the periphery of this crown-plate, to form the bearing on which to support and revolve case B.

Case B is composed of a series of spiral-shaped columns, *b b b*, or guides, firmly attached at the top and bottom by flanges *g'* and *d'*, between which they are arranged circularly, and of the shape shown in Fig. 2.

The upper flange has a shouldered groove, *g'*, fitting into groove *g*, forming a bearing, which supports and holds the several relative

portions of cases A and B in exact parallel position, without contact and friction, (save at the bearings,) forming close joints.

By means of an ordinary rack and pinion, stepped on the flange of the crown *c*, the case B can be easily revolved backward or forward.

The inner faces of guides *b b b* are cylindrical, and made to conform to and form a close joint with guides or columns *a a a*. The cylindrical form of the flanges and guides of case B enables it to be easily fitted by ordinary lathe-work.

The revolving case B encompasses case A, supported and turned on the bearings *g g'*, and when in the relative position shown in Fig. 2 forms a spiral chute-case. These chutes *e e* have converging throats at the confluences of cases A and B, which, receiving the water in spiral direction, conducts through the chutes to the wheel. Experience has proved this form of chute, with the converging throat or point of issue, as shown in Fig. 2, to be the best, and is formed by the junction of guides *a a a* with guides *b b b*.

It will be seen that the buckets of the wheels, which are intended to revolve just within the inner end of the guides *a a a*, are subjected in every part of their outer surface to the direct action of the impinging current of water.

No space should be allowed for the different columns of water to unite after leaving the chutes and before delivery into the buckets. This impinging current is always delivered in the same manner and with the same tangential line at full or any partial opening of chutes.

Case B revolves forward, and carries the inner end of guide *b* forward across the chute E or water-passage till it rests against the outer end of guide *a*, as seen in Fig. 3. When the chutes are completely closed a reverse movement opens the water passages or chutes and admits the water into the wheel.

To determine the respective width of case A and guides *a*, and of case B and guides *b*, the width of the chute E at the throat or point of issue is the unit of measure. The guides *b* must be of sufficient length on their inner faces to reach across the throat of the chute, and slightly lap on either end at guides *a*, as seen in Fig. 3.

It will be seen that the converging throats of the chutes conform to a curve, (called "*vena contracta*,") by the peculiar construction and combination of the cases, are the only parts of the chutes contracted or materially changed in opening or closing the passages, preserving at all times the maximum power and tangential line of delivery proportionately uniform in the various stages of partial and full openings.

Pivoted guides or swinging gates, of the shape here described, have been before used, but not with the same success, while the surface delivery of the water to the wheel was the same as here shown. The direction of the impinging current, by the turning of the gates, is constantly changed, with a corresponding loss of power. The gates, besides being liable to break at their pivots, and the number of joints causing increased friction, are more complicated and costly of construction.

To obviate these difficulties register-cases have been devised, which use rigid guides and chutes of the proper shape and desired angle, and have thin register-cases to slide back and forth or up and down the mouth of the chutes, to regulate the admission of water under the wheel. As this thin register-case is at nearly right angles with the impinging columns of water, and obstructs their passage through the chutes, causing eddies, and the *vena contracta* shape of the chutes is practically lost. Illustrations of this class cases, by reference to former Letters Patent granted to me March 24, 1868, No. 75,765.

Cases constructed as described in this specification avoid the faults common to both pivoted and register gates, and possess the advantages common to both.

Another advantage, by my method of construction, is derived by the shear-shaped guides *a a a* and *b b b*. By revolving the case B in the reverse direction, when open, all obstructions that may be caught or lodged in the converging throats of the chutes can be cut and effectually cleared away. This reverse movement is also peculiar to this device.

What I claim as new, therefore, and desire to secure by Letters Patent, is—

1. The duplex chute-case of a turbine water-wheel made in two parts, A and B, one stationary, the other rotary, the columns *a a a* of the inner case forming the inner end of the chutes, diverging from the throats formed by the columns *a a a* and *b b b* inward to the termination of the columns and chutes, the columns *b b b* of the outer case, B, forming the outer part of the chutes, converging from their outer edges to their contact with columns *a a a*, each of these chutes being tunnel-shaped, thereby subjecting the entire outer faces of the buckets of the wheel to the hydrostatic power of the impinging current of water through scroll-chutes, and avoiding angular projections and swinging gates, all constructed and arranged substantially as herein set forth.

2. The duplex case of A and B of a water-wheel, when constructed so that the rotating of the case B contracts or expands the size of the throats or issues of the chutes only, thus controlling the quantity of water admitted onto the wheel, and preserving the same tangential line of delivery, and subjecting the entire outer periphery of the wheel to the action of the water, the same at full or any partial opening of the chutes, constructed and combined substantially as set forth.

3. The duplex case A and B, with the columns *a a a* and *b b b*, forming converging and diverging chutes, when constructed with the annular journal-bearing *g g'* on the periphery

of the crown of case A and inner edge of the crown B, so that case B revolves on this annular bearing, and brings the faces of columns *a a a* and *b b b* (without material friction) in contact, the revolving of case B opening and closing the throats, all substantially as herein set forth.

4. Cases A and B, when combined in the manner substantially as shown, so as to enable case B to revolve backward over and past the chute in rear, and, by the shear contact of the guides *a a a* and *b b b*, to cut and clear away obstructions lodging in the throat of the chutes.

JACOB O. JOYCE.

Witnesses:
MICHAEL WEAVER,
W. H. BALDWIN.