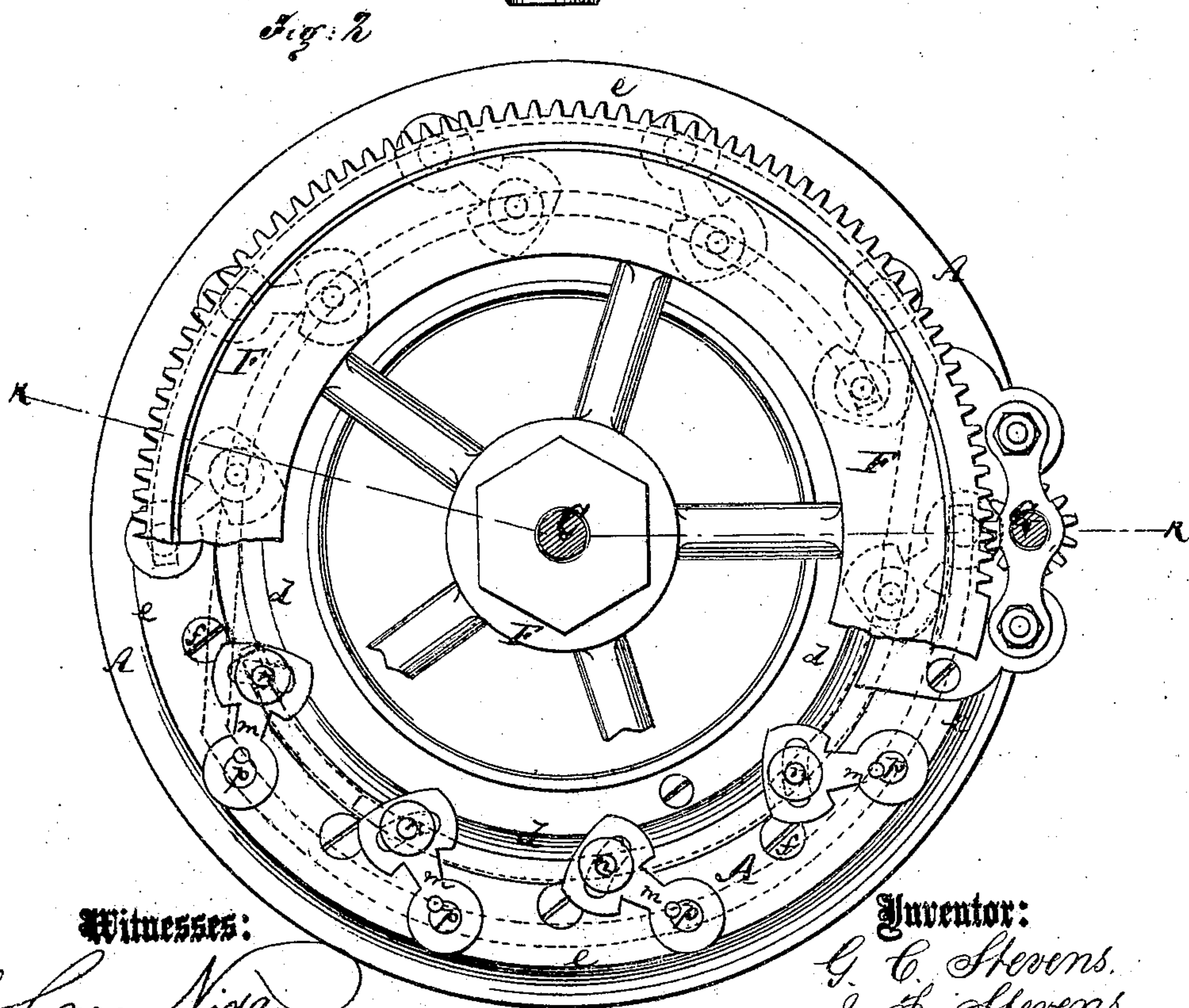
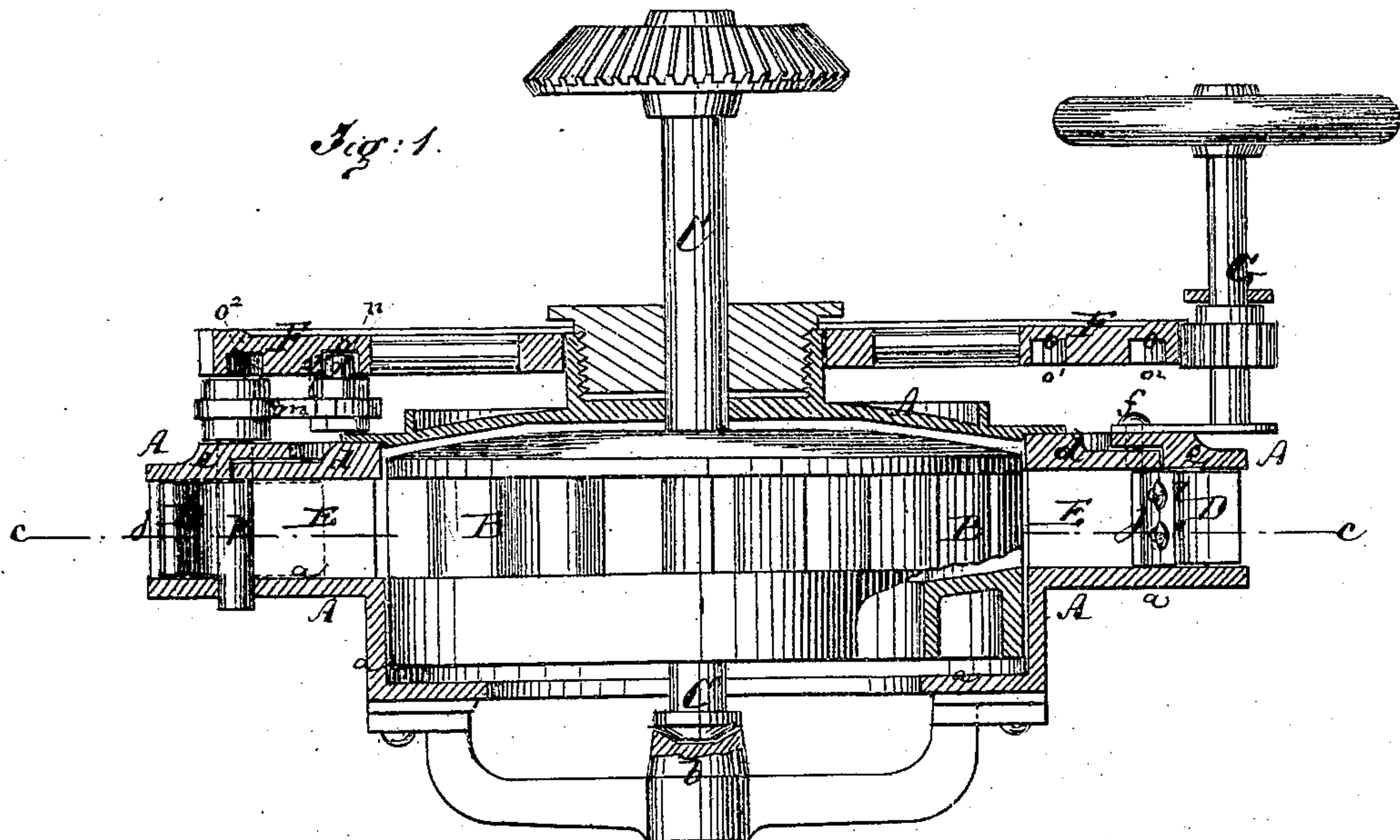


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Improvement in Turbine Water-Wheels.
No. 130,448. Patented Aug. 13, 1872.



Witnesses:

Chas. Nida
W. A. Graham

Inventor:

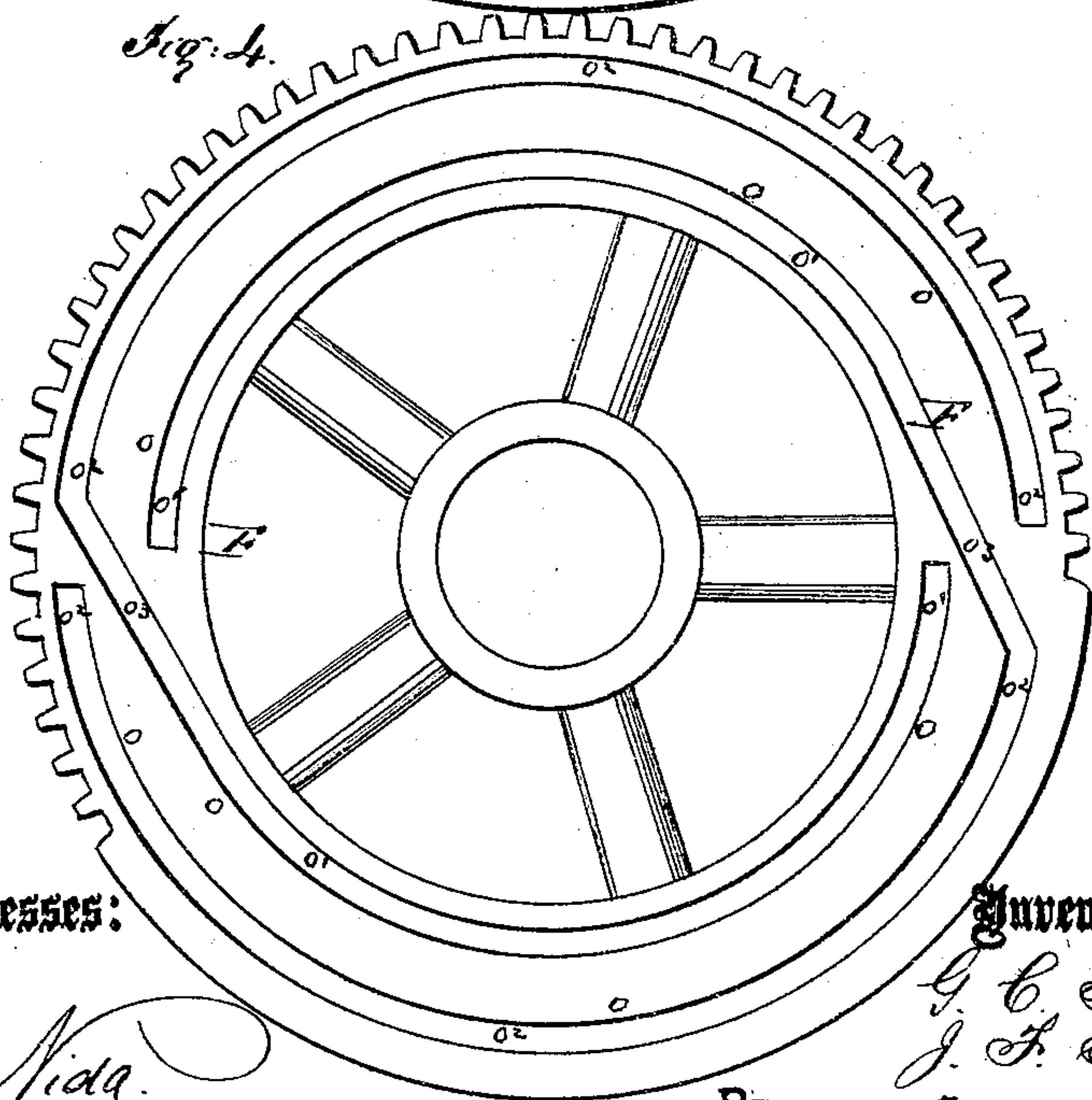
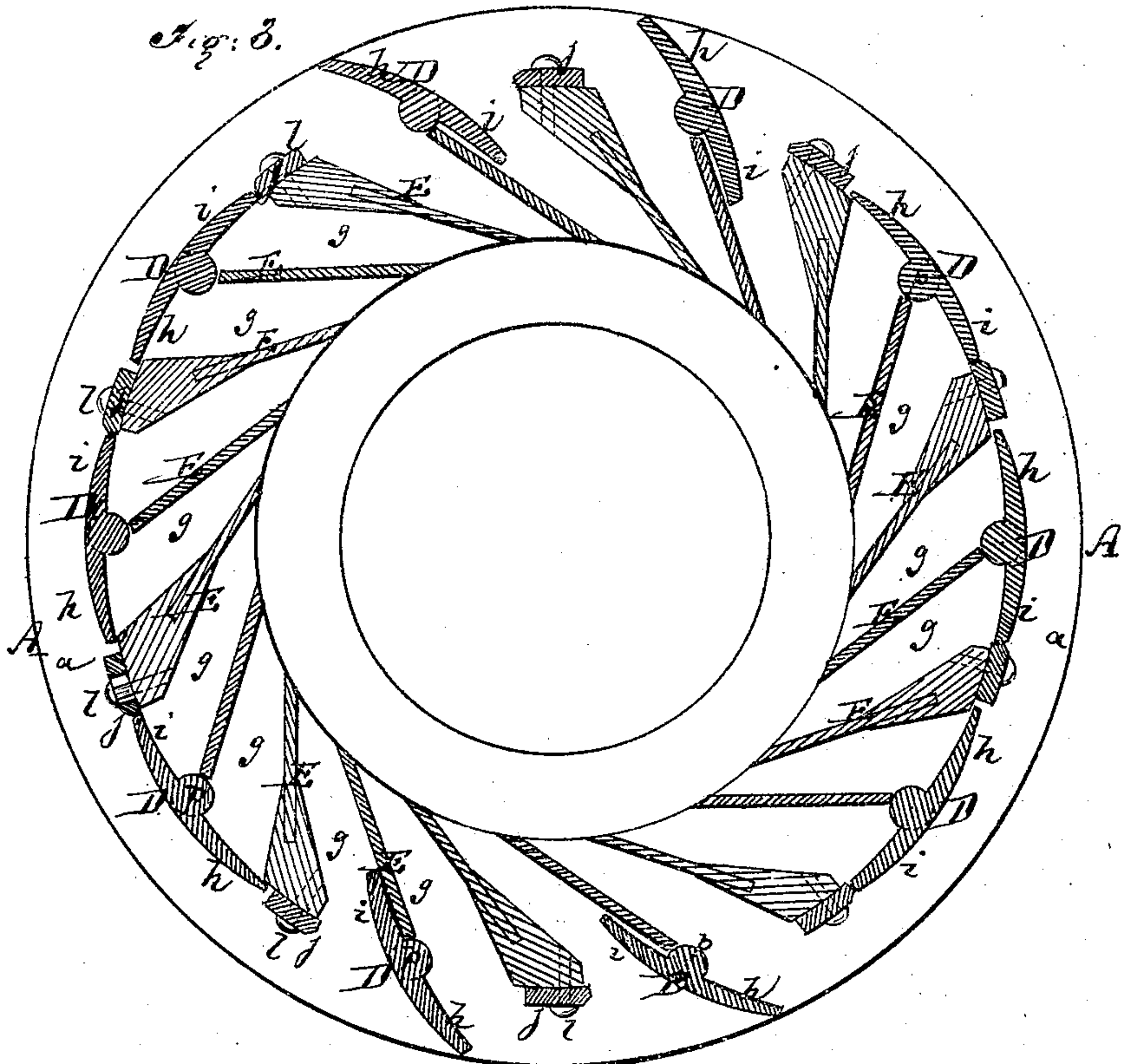
G. C. Stevens.
J. F. Stevens.

PER

Mumford
Attorneys.

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PER

Wm. L.
Attorneys.

UNITED STATES PATENT OFFICE.

GEORGE C. STEVENS AND JOSIAH F. STEVENS, OF AYER, MASSACHUSETTS.

IMPROVEMENT IN TURBINE WATER-WHEELS.

Specification forming part of Letters Patent No. 130,448, dated August 13, 1872.

Specification describing a new and useful Improvement in Turbine Water-Wheels, invented by GEORGE C. STEVENS and JOSIAH F. STEVENS, of Ayer, in the county of Middlesex and State of Massachusetts.

Figure 1 represents a vertical central section of our improved water-wheel, the line *k k*, Fig. 2, indicating the plane of section. Fig. 2 is a top view, partly in section, of the same. Fig. 3 is a horizontal section of the same on the line *c c*, Fig. 1. Fig. 4 is an inverted plan view of gate-adjusting wheel.

Similar letters of reference indicate corresponding parts.

This invention relates to a new gate arrangement—gate-adjusting mechanism; to a new form and construction of guides; and to an adjustable feature of the wheel-case; all with the object of improving the operation and facilitating the proper adjustment of all parts of the wheel. The invention consists in the application to turbine-wheels of a series of balance-gates, each adapted to close two chute-channels; in plates that are affixed to the chutes to insure a tight joint; in making the wheel-case vertically movable on the gates as they wear; and in making the gates adjustable in pairs.

A in the drawing represents the wheel-case. B is the water-wheel, and C its shaft. The wheel B is of suitable construction and proportions. The case A consists of the bottom plate *a*, which carries the frame for holding the step *b* of the top plate *d*, and of an outer detached continuation, *e*, of the top plate. This annular plate *e*, in part, overlaps the plate *d*, and is held down by means of screws *f f*, which allow it to be adjusted up and down. The gates D, placed within the outer part of the case A, are, with their upper edges, in contact with or close to the lower face of the plate *e*, and the latter is, by means of the screws *f f*, set further down to fit close to the gates, as the contiguous surfaces are reduced by wear. The adjustable annular plate *e* is therefore an important feature of our invention. E E are chutes or guides interposed between the gates D and the wheel B, and secured stationary to the wheel-case. Every gate D is intended to control the admission of water to two passages, *g g*, between three chutes. For this purpose each gate is pivoted near its middle by a ver-

tical pin or pins, *p*, between the plates *a* and *e*, its pivot being close to the outer end of one of the chutes, as shown in Fig. 3. The gate is thereby balanced, so that one-half of it, *h*, will swing outward, when the other half, *i*, swings inward, and, in closing, the part *h* rests against the outer end of the chute, while the part *i* fits snug to the edge of a plate, *j*, which is fastened to the outer end of the chute. The plates *j j* are, by screws *l*, secured to the ends of the alternate chutes, as shown, and are or may be slotted to be brought close to the ends *i* of the gates, as the same wear off. The ends *h* of the gates are or may be slightly longer than the ends *i*, in order to enable the water, by pressure from without, to hold the gates closed. The gates, by being thus balanced, will be easy to open under high as well as low head of water, and the control of the entire gate mechanism is thus considerably facilitated. The pivot of each gate has, at its upper end and above the wheel-case, a crank, *m*, whose wrist-pin *n* enters one or two grooves, *o o*, or channels formed in a wheel, F. This wheel is fitted loose around the shaft C, and can be turned by toothed connection with a shaft, G, or other means. The grooves or channels *o o* in the wheel F are peculiar; each is composed of two parts, *o¹* and *o²*, concentric, but of varying diameters, they being connected by an oblique portion, *o³*. The smaller parts *o¹ o¹* of the two channels or grooves are opposite each other; so are the two oblique portions *o³ o³* and the two large portions *o² o²*, as shown in Fig. 4. The two large semicircles *o²*, almost meeting at their ends, make, therefore, together, nearly a complete circle; so do the smaller semicircles *o¹ o¹*, as is also shown in Fig. 4. When all the wrist-pins *n* of the cranks *m* of the several gates are contained in the smaller parts *o¹ o¹* of the grooves or channels, as in Fig. 2, (the channels in the latter figure being indicated by dotted lines, even where part of the wheel F is removed,) all the gates will be open. When all the wrist-pins, however, are in the larger circles *o² o²*, all the gates will be closed. When the wheel F is so turned that several of the wrist-pins are in the larger, others in the smaller circles of its grooves or channels, the gates connected with the last-named pins will be opened and the others closed. When all the gates are closed and the wheel F is turned the oblique parts *o³*

of the gates will gradually convey the wrist-pins from the larger to the smaller parts of the grooves, and open the gates. At first, two gates diametrically opposite each other on the wheel-case will be opened by the two opposite parts *o*³ of the grooves; then the two gates next adjoining the two first, respectively, will be opened, leaving all the gates in the position shown in Fig. 3, and so forth. In the reverse order the gates will be closed when the wheel F is turned in the opposite direction. By this arrangement, it will be seen, the gates are controlled by pairs, of which the numbers are always diametrically opposite each other. Two gates only can, therefore, be left open, when the water-wheel is to be actuated by a small head of water or with little power; or four or six gates or more to increase the power.

The crank connection between the wheel F and the several gates is the simplest and most preferable, though other mechanism may be substituted. The wheel F may, if desired, also be so arranged with respect to its guides or channels that three gates or more, equally far apart from each other, will be opened or closed simultaneously, instead of but two, as above described. The wrist-pins *n* are or may be adjustable on the cranks *m*, in order to enable

the giving the gates a greater or less sweep in opening.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The balance-gates D D, pivoted at the middle to control two water-passages between three chutes, substantially as herein shown and described.

2. The adjustable plates *j*, applied at the ends of the alternate chute-plates for contact with the inwardly-swinging ends of the gates, substantially as specified.

3. The vertically adjustable annular plate *e*, applied to the outer part of the wheel-case above the gates, to be held close above them, as set forth.

4. The wheel F, provided with grooves or channels *o o* for jointly opening and closing two or more gates equidistant from each other, as specified.

5. The combination of the gates D, cranks *m*, and wrist-pins *n*, with the wheel F having the grooves or channels *o*, as set forth.

GEORGE C. STEVENS.

Witnesses: JOSIAH F. STEVENS.

E. H. HAYWARD,

JOHN H. TURNER.