

(No Model.)

M. A. REPLOGLE.

DISCHARGE GATE FOR TURBINE WATER WHEELS.

No. 534,623.

Patented Feb. 19, 1895.

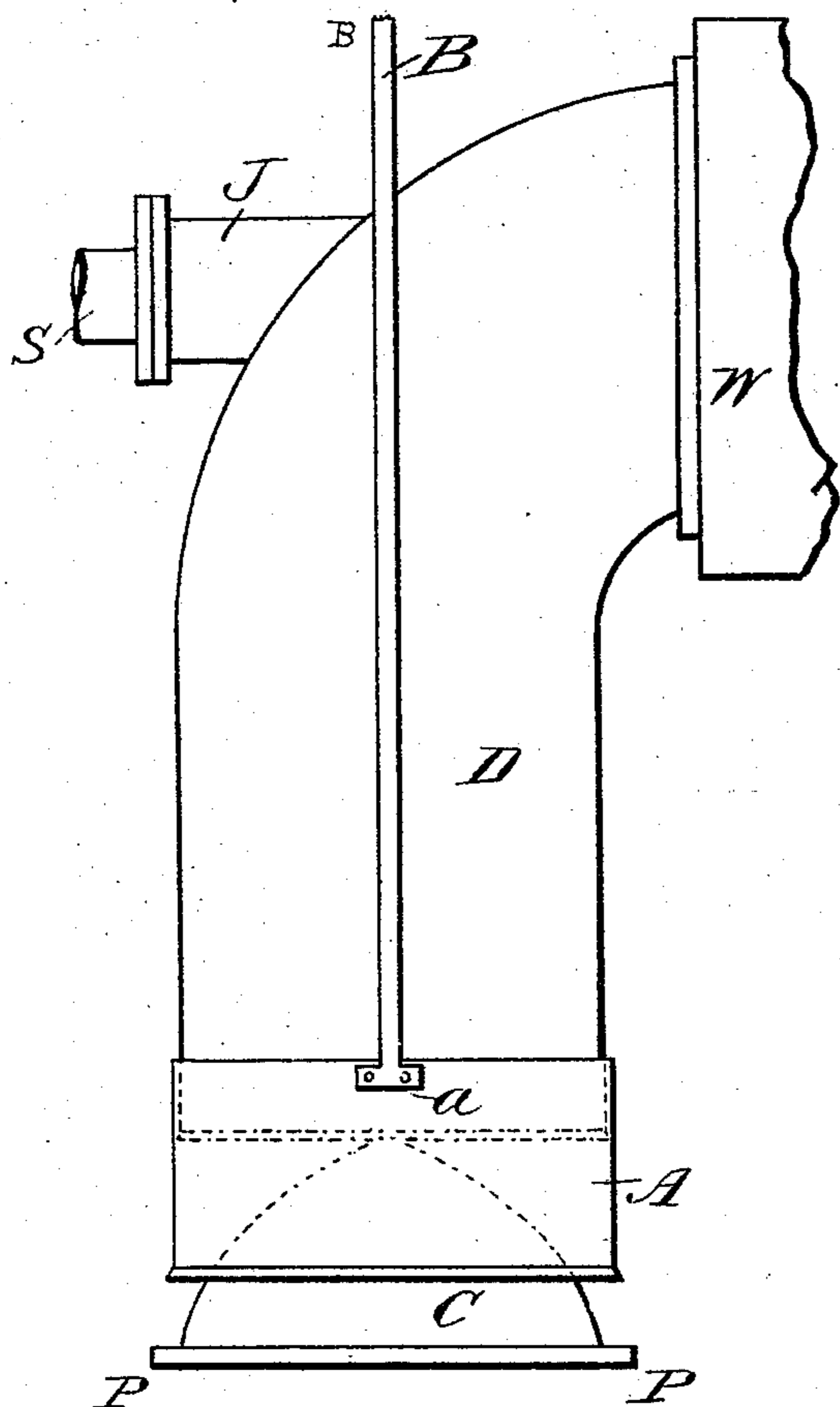


Fig. 1.

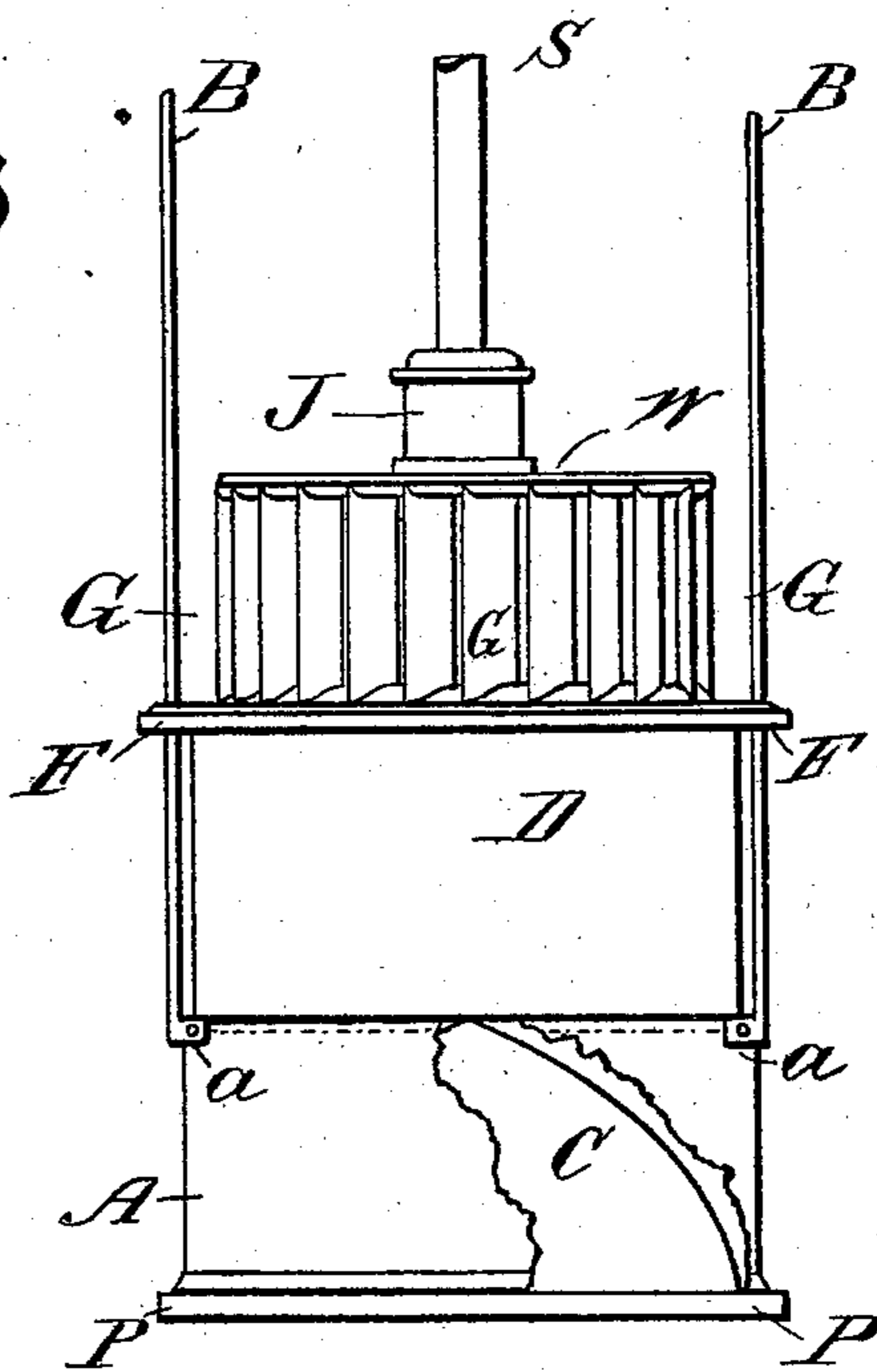


Fig. 2.

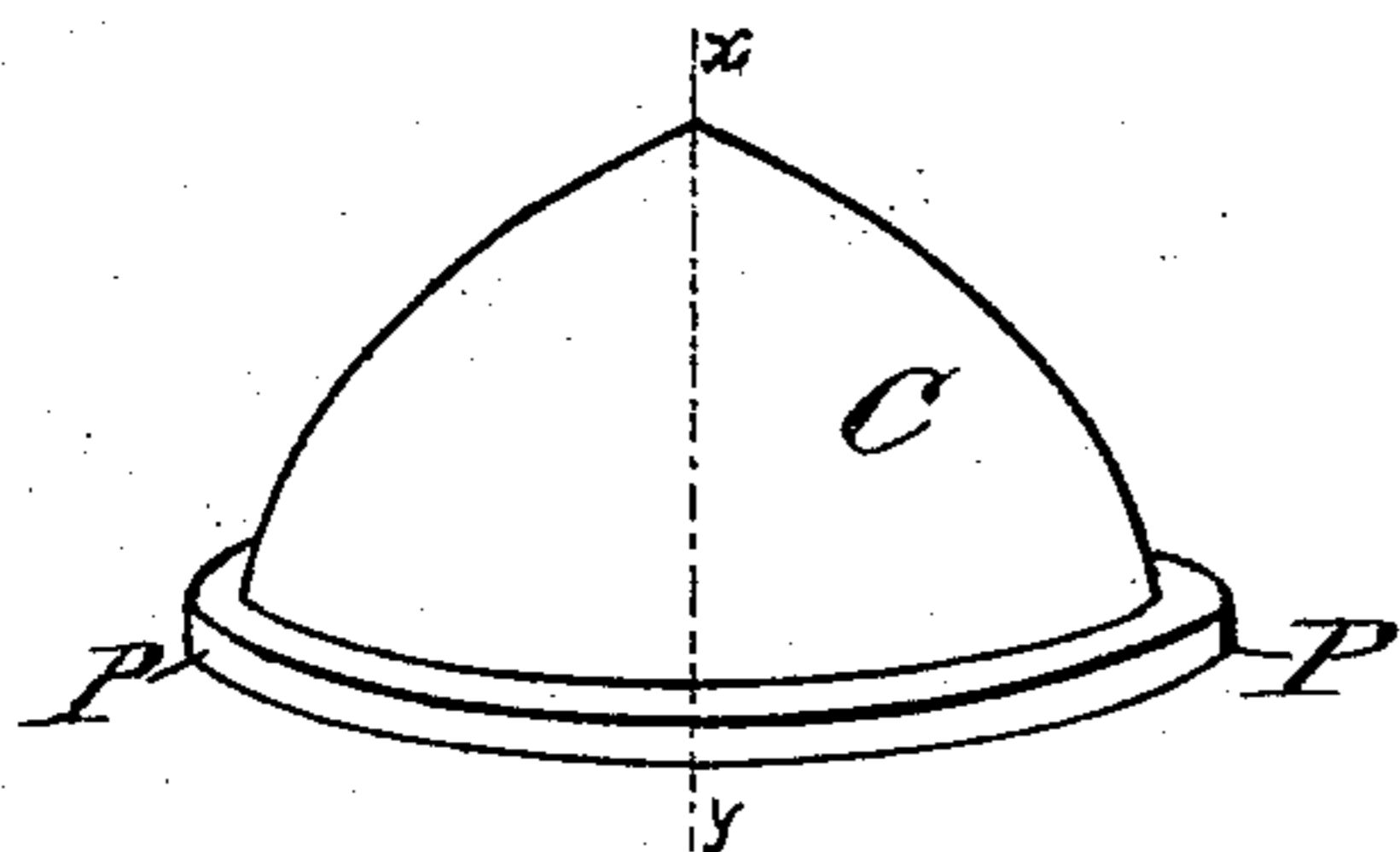


Fig. 3.

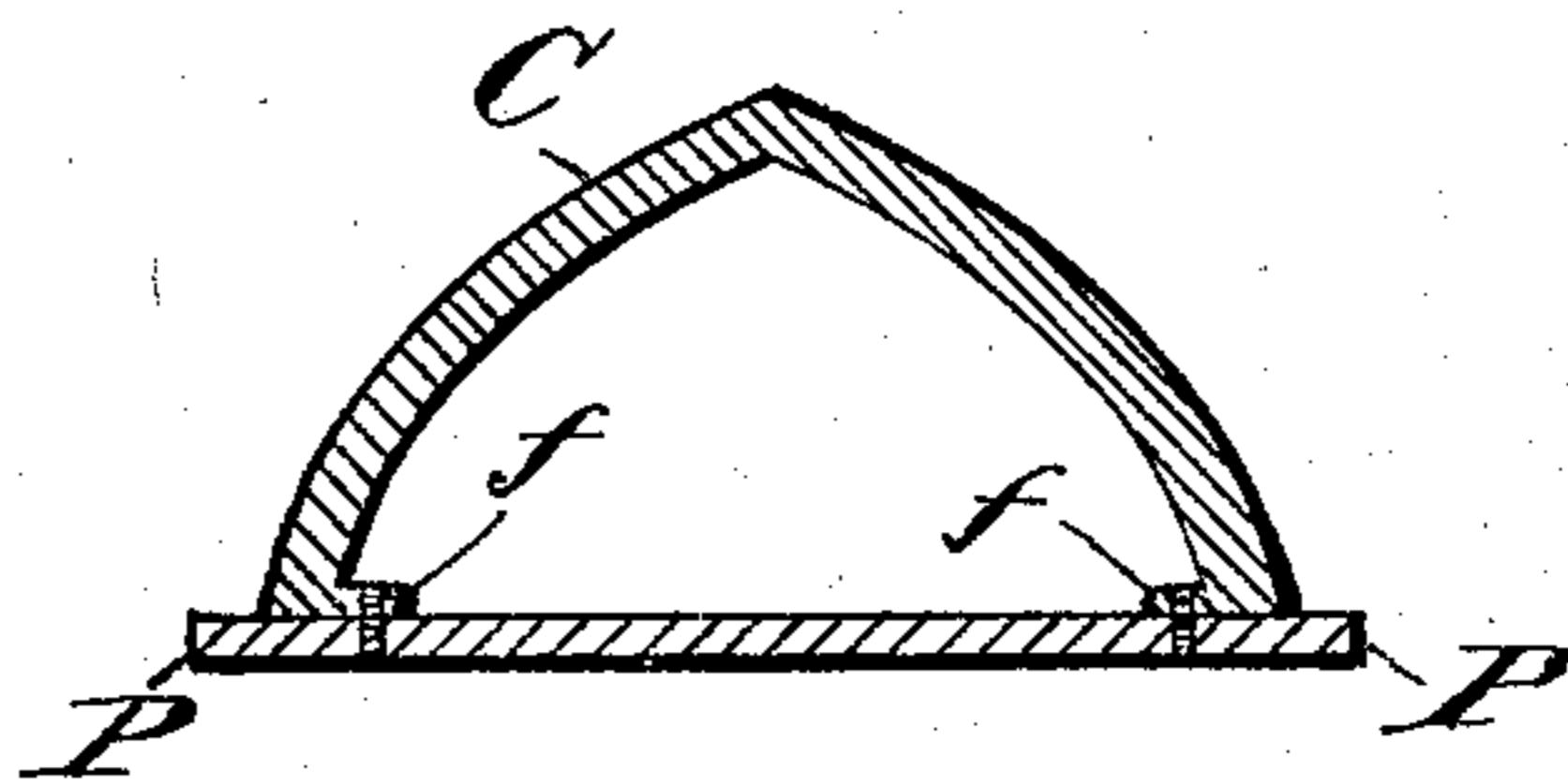


Fig. 4.

Witnesses:

Geo. W. Milnes  
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Inventor,

Mark A. Replogle,  
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# UNITED STATES PATENT OFFICE.

MARK A. REPLOGLE, OF CEDAR FALLS, IOWA.

## DISCHARGE-GATE FOR TURBINE WATER-WHEELS.

SPECIFICATION forming part of Letters Patent No. 534,623, dated February 19, 1895.

Application filed January 26, 1894. Serial No. 498,096. (No model.)

*To all whom it may concern:*

Be it known that I, MARK A. REPLOGLE, a citizen of the United States, residing at Cedar Falls, in the county of Black Hawk and State of Iowa, have invented a new and valuable Improvement in Discharge-Gates for Turbine Water-Wheels, of which the following is a specification.

The object of my invention is to facilitate the governing or regulating of turbine or similar water-wheels by the aid of a discharge gate the construction of which is illustrated in the accompanying drawings, in which—

Figure 1 represents my invention used in connection with the draft-tube of a vertically revolving water-wheel. Fig. 2 is the same used with a wheel which revolves horizontally. Fig. 3 is a view in perspective of a base plate and core which constitute the essential feature of my invention. Fig. 4 is a vertical section on the line  $xy$  of Fig. 3.

Similar letters refer to similar parts throughout the several views.

Referring to the drawings, A represents a sleeve or sliding gate operated by the aid of the reaches or rods B B attached at  $aa$  and sliding through holes or bearings in the plate F (Fig. 2). This gate is opened and closed by sliding upward and downward on the draft-tube D. The tube and gate may be circular, square or otherwise in shape, provided a core of corresponding form is used, the essential thing being that the curved surfaces of the core C bear the proper relation to the straight sides of the sleeve or gate A. For simplification, the draft-tubes D and D, and the sleeves or gates A and A of Figs. 1 and 2 respectively may be regarded as cylindrical in shape so that the core C may be conoidal in form and its base plate P circular in shape. The parts may be made of wood or metal. When made of iron or other metal, the conoidal part may be cast hollow with a flange or lugs for fastening the same to the base plate as at  $ff$  in Fig. 4.

When in operation the disk or base plate P with its core or conoid C attached must be adjusted in the bottom of the wheel-race in a horizontal position directly under the gate or sleeve A so that when the same is lowered for the purpose of closing, its lower edge or rim will fit evenly and tightly on the annular flat

surface of the disk or plate P around the base of the conoid C and the base of the conoid C will exactly fit into, fill and close the gate or sleeve A at its lower edge or rim as will appear from an examination of Fig. 2 which represents a closed gate broken away so as to show the relation of the parts when the gate is closed.

The operation of the gate will now be readily understood. The water-wheel to be governed may be considered as being within the casing W in Fig. 1 and connected to the shaft S revolving in the journal J; or in Fig. 2, the wheel which is connected to the shaft S revolving in the journal J is located within the casing W, the water being directed upon it by the fixed guides G. It is found in practice that a water-wheel is more easily governed when by means of a draft-tube and lower or discharge gate, the velocity of the water through the wheel is regulated without letting the wheel become empty as it is liable to do when an upper gate only is used. Now if the wheel is kept full, its speed with a given amount of work must depend entirely on the velocity of the water passing through it; and when the discharge gate is used this velocity will depend on the degree of gate opening, the full velocity of the "head" being realized when the gate is fully open; but experience shows that when a cylindrical discharge gate as described is lifted from a plane flat surface, the first few inches of gate motion have a greater effect on the velocity of the water through the wheel than the same amount of gate motion at any other stage of opening; or in other words, the nearer the gate is closed, the greater the effect of a given amount of gate motion, and the nearer the gate is fully open the less the effect of the same amount of gate motion. A little reflection will show that this difference is compensated by the device which I have invented, since by the aid of the conoidal core as shown, the nearer the gate is closed the less the ratio of opening to a given amount of gate motion; and the nearer the gate is fully open, the greater the ratio of opening to the same amount of gate motion. It may be mathematically demonstrated that the curvature of the sides of the core should vary slightly with the "head" of the plant at which it is used. Hence

by my device, the effect on the water-wheel may be kept in exact ratio with the gate motion at all stages of opening, in any water power plant. As the governing mechanisms generally in use, produce uniform motion at the various stages of opening, the importance of this result is apparent.

I am aware of Patent No. 13,287, in which the core having inwardly curving sides is used to aid in dispersing the water, but in the gate I have invented, the object is to prevent the too easy escape of the water in some of the stages of the gate opening and to this end the sides of the core must be curved outward as shown in my drawings, and the exact amount of curvature required is to be determined by mathematical calculation in which the "head" of water used is a factor.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a discharge gate for water-wheels, the combination of the sleeve A with the core C,

the said core C being conoidal in form and being placed within the periphery of the said sleeve in such relation that its outwardly curved sides are adapted to act in conjunction with the sides of the said sleeve in the operation of opening and closing the gate substantially as, and for the purposes specified.

2. In combination with a discharge gate for water-wheels of the kind described, the conoidal form or core C having a base-plate P in a plane perpendicular to the axis of the said conoidal form, the said plate extended so as to form an annular plane surface surrounding the base of the conoidal part, substantially as shown, and for the purpose specified.

In testimony whereof I affix my signature in the presence of two witnesses.

MARK A. REPLOGLE.

Witnesses:

H. C. HEMENWAY,  
ALFRED GRUNDY.