

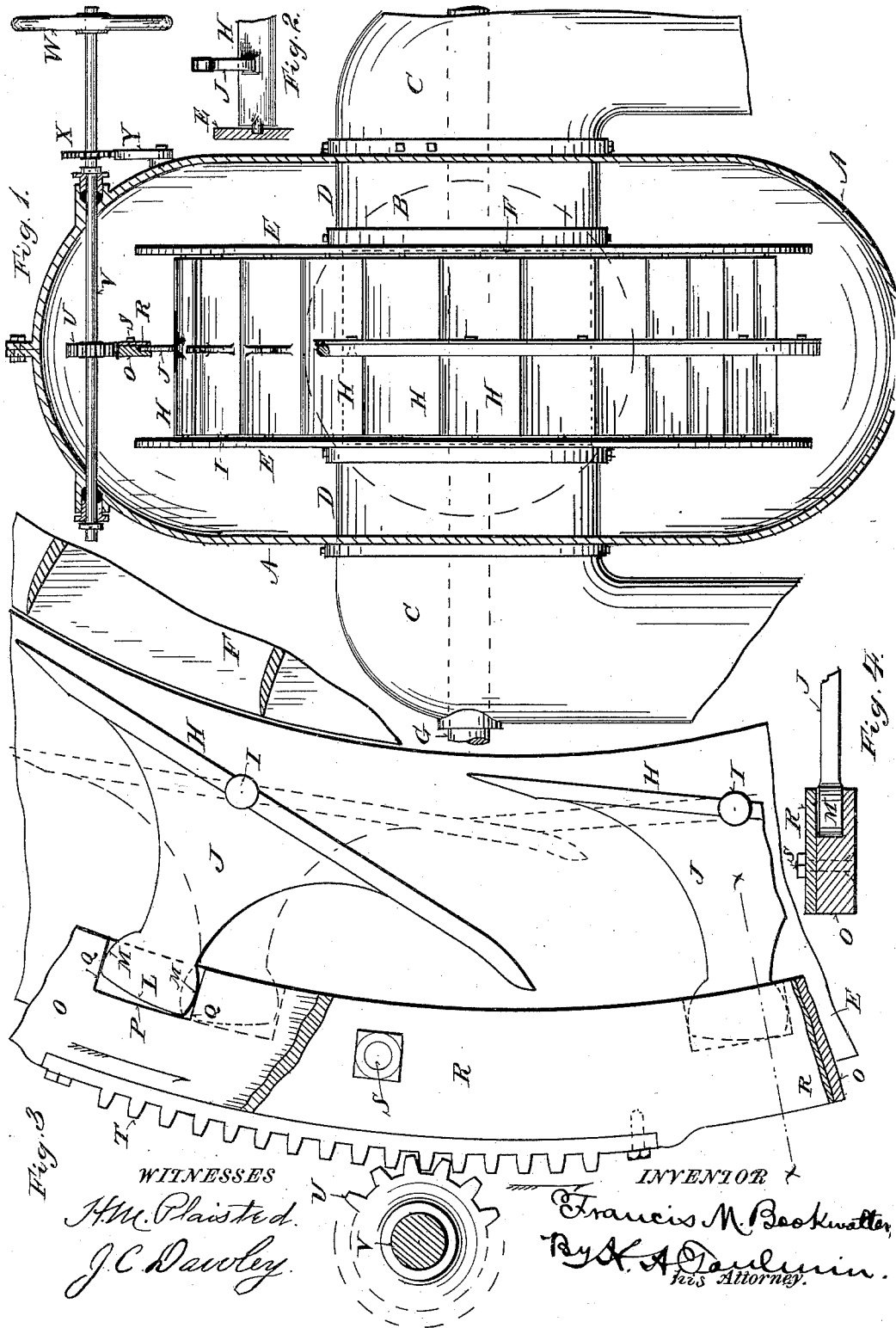
(No Model.)

2 Sheets—Sheet 1.

F. M. BOOKWALTER.
WATER WHEEL.

No. 465,812.

Patented Dec. 22, 1891.



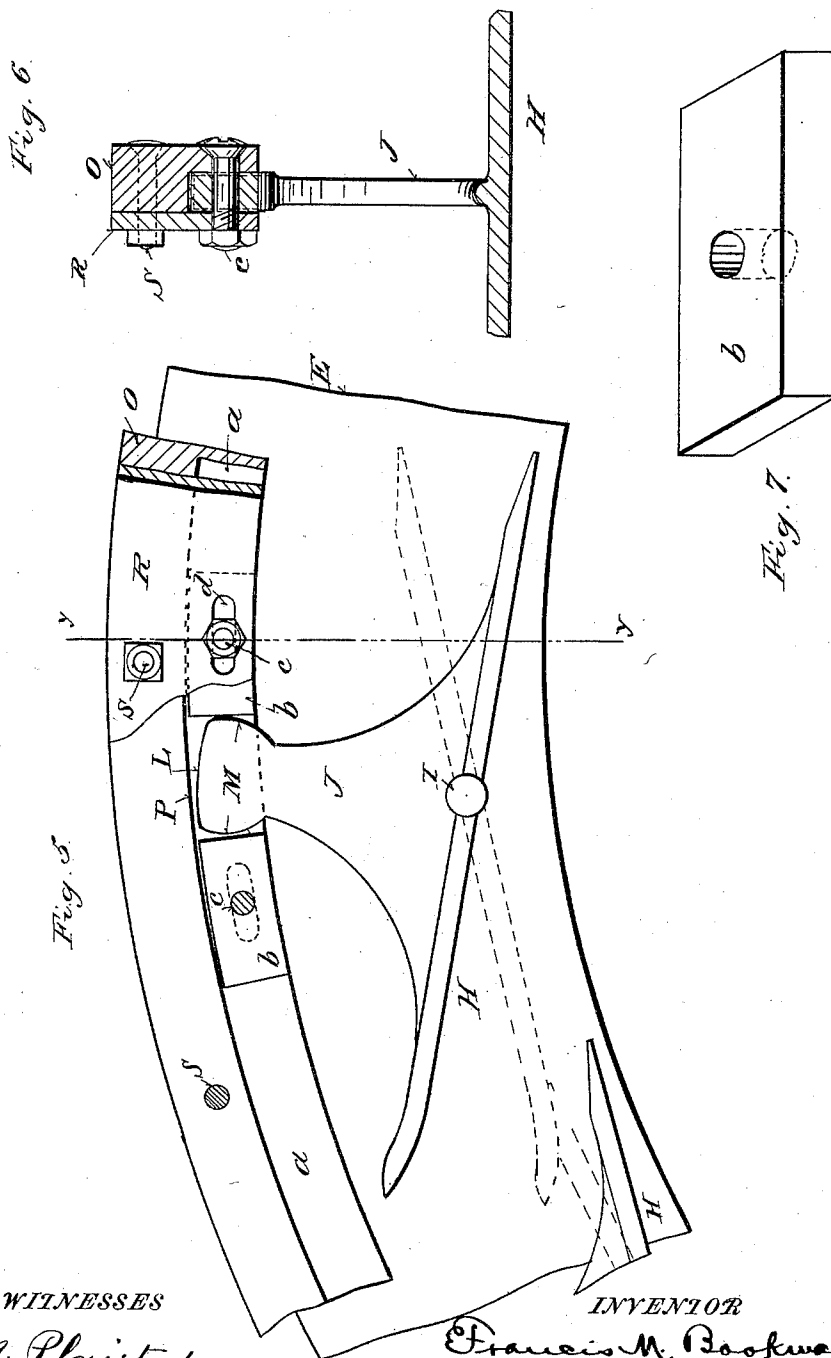
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WITNESSES
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UNITED STATES PATENT OFFICE.

FRANCIS M. BOOKWALTER, OF SPRINGFIELD, OHIO, ASSIGNOR TO THE JAMES LEFFEL & COMPANY, OF SAME PLACE.

WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 465,812, dated December 22, 1891.

Application filed March 16, 1891. Serial No. 385,228. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS M. BOOKWALTER, a citizen of the United States, residing at Springfield, in the county of Clark and State of Ohio, have invented certain new and useful Improvements in Water-Wheels, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to certain new and useful improvements in water-wheels, the improvements having such reference to the gates which control the supply of water to the wheel, and also to the mechanism by which the gates are operated or controlled.

It has heretofore been customary in water-wheels to actuate the gates from one end thereof. In a recent application filed by me I have provided for actuating such gates from both ends thereof, such application being filed under date of July 5, 1890, Serial No. 357,790. I now propose to actuate the gates of water-wheels by an arm extending from each gate, and characterized by a central or substantially central position, measuring the gate lengthwise, whereby torsional strains upon the gates and the binding of their pivoted pins in the bearings, incident to operating the gates from one end, and whereby the expense of mechanism for operating both ends of the gates will be avoided, and whereby also the power employed to actuate the gates will be distributed equally upon all parts thereof.

Another feature of my invention consists in combining with this centrally-located actuating-arm of the gates an actuating-annulus provided with sockets adapted to receive the ends of these centrally-located gate-arms, such ring or annulus being provided with a suitable device to maintain the arms in the sockets and to allow of the removal of the ring from the arms.

In the accompanying drawings, forming a part of this specification, and on which like reference-letters indicate corresponding parts, Figure 1 represents a partial vertical sectional view and elevation of a water-wheel casing, the flumes and the wheel proper having my improvements applied thereto; Fig. 2, a detailed view of one of the gates; Fig. 3, an enlarged detailed view, partially in side ele-

vation and partially in section, showing my improved gates, the operating-annulus, and the manner of connecting the gate-arms with the annulus; Fig. 4, a detail sectional view in the line *xx* of Fig. 3, further showing the manner of connecting the annulus with the gate-arm; Figs. 5 and 6, similar views to Figs. 3 and 4, showing modifications; and Fig. 7, a detail view of the socket-block.

The letter A designates the metallic shell or casing into which the water is fed from a suitable source, the casing having an inlet-opening, as suggested by the dotted circle B, and being provided with the usual discharge-flumes C, attached to the sides of the casing, and having bearings to support the wheel-shaft. By preference the flumes extend within the casing, as shown at D, and support the side plates E of the water-wheel structure. Between these plates is placed a water-wheel of any approved type, the same being designated by the dotted lines F, and mounted upon the shaft G. The features so far described are not peculiar to this invention.

Coming now to the features which constitute my improvements, the letter H designates a series of gates having pivot-pins or studs I, fitted in bearings in the plates E, so as to turn thereon when operated to open or close or partially open or partially close the spaces between the gates, commonly called the "chutes," through and by which the water is admitted to the wheel. At or near the middle of the gates, measuring them lengthwise, I provide each with a rigid arm J, preferably cast in one piece with the gates, though the arm may be separately made and then rigidly secured to the gate in any desirable manner. The arms J also occupy a position substantially central, measuring the gates crosswise or in their narrower direction, so that the outer ends of the arms are approximately over or opposite the pivotal points of the gates. This latter position is not essential, but is preferred. The outer ends of the arms are preferably in the arc of a circle struck from the center of the gate-pivots, as shown at L in Fig. 3. Such gates are also preferably formed with curved walls or contact-surfaces M. The operating-annulus O encircles the gates and occupies a central po-

sition midway between the ends of the gates, and is provided with a socket for each gate-arm. These sockets receive the peculiarly-formed ends of the gate-arms and the walls P of the sockets engage with the outer ends of the gate-arms, or at least with such of the gate-arms as occupy the upper part of the circumference, and the end walls Q of the sockets engage with the contact-surfaces M of the arms. When the annulus is actuated in a rotary direction through devices hereinafter to be referred to, the walls Q operate against such contact-surfaces of the arms and such surfaces slide along such walls Q, and thereby the gates are actuated on their pivots to fully or partially open or close the chutes. The sockets in the annulus are preferably open at one side so as to admit of placing the annulus on or removing it from the gate-arms. To prevent the annulus from becoming dislodged, some means should be adopted to cover the open side of the sockets. The preferred means for this purpose consists of a thin ring R, bolted or otherwise secured to the annulus, as shown at S in Figs. 1 and 3. The annulus is also provided with a rack T, secured thereto or formed in one piece therewith. This rack is engaged by a pinion U, mounted on a cross-shaft V, having bearings in the casing A, as seen in Fig. 1, and provided with a hand-wheel W and a toothed wheel X, which is engaged by a pawl Y to secure the shaft against accidental rotation. By these means the annulus may be operated in a rotary direction, its supporting means being the gate-arms. The central location of the gate-arms, therefore, serves the twofold purpose of, first, equally distributing between the pivot-points of the gates power applied to operate them to avoid twisting and torsional tendencies and to render the control over the gates easy and reliable without unduly binding the gate pivot-pins in their bearings; and, secondly, supporting the weight of the annulus at a point practically midway between the pivots of the gates, so that neither pivot is unduly pressed against its bearings, but both pivots made to receive a practically equal share of the weight.

Referring to Figs. 5, 6, and 7, it will be seen that I have provided means for adjusting the socket-walls, so that the socket may, in effect, be located to suit the position of the gate-arms. In manufacturing water-wheels it is somewhat difficult to get the gate-pivots mathematically equidistant. Therefore I desire to arrange for compensating for any difference between the distance between the gate-pivots. The preferred way of doing this is by forming an annulus with an annular recess or rabbet *a*, and employing block *b*, adjustably secured to the annulus by bolts or screws *c* passing through openings in the blocks and slots *d* in the annulus. By this means the blocks can be adjusted to the exact position required to accommodate the arm of the gate, and the wear of the blocks and

the arm can be taken up by adjusting the blocks. The same ring or plate for closing the open side of the socket may be used in this connection as when the socket is formed in the annulus, or some other means may be employed to close this open side of the slot. It should also be observed that in either form the sockets with the arms fitted up into them, whereby the contact between the arms and the annulus is removed from the surface of the annulus, provide against interference from the sand and grit in the water, which would tend to get between the arm and the annulus if the contact between the two is not removed from an exposed position on the surface of the annulus.

I am aware that it has been proposed to carry the ring or annulus upon the arms of the gates. This in a general sense I disclaim. In such case, however, the power applied to actuate the gates was not applied practically midway between the gate-pivots, nor was the connection between the gate-arms and the ring or annulus such as embodied in this invention, nor yet was the weight of the annulus distributed equally between the pivots of the gates.

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

1. In a water-wheel, the combination, with a wheel proper and its inclosing structure, of gates pivoted in said structure and having arms located substantially midway their length, the outer ends of the arms having a curved supporting-surface and curved contact-surfaces, and an annulus also centrally located and having sockets which receive the ends of the arms.

2. In a water-wheel, the combination, with pivoted gates having arms, of an annulus having sockets, one side of the sockets being open, and a ring or plate secured to the annulus to cover the open side of the socket.

3. In a water-wheel, the combination, with a wheel proper, its inclosing casing, and operating means mounted in said casing and extending outside of it for hand manipulation and inside of it, of a gate-operating annulus encircling the gates midway their length and adapted to receive gate-arms, said operating means having an engaging device also located midway the length of the gates and engaging with said annulus, and a series of pivoted gates having each a rigid arm extending therefrom at a point substantially midway its length, said arms being received by the annulus and supporting and maintaining the annulus against lateral displacement.

4. In a water-wheel, the combination, with pivoted gates having arms extending therefrom about midway their length, of an annulus having sockets which receive said arms, the ends of the sockets slidably engaging with the adjacent ends of the arms when the annulus is actuated, and the arms supporting the annulus, and means to actuate the annulus.

5. In a water-wheel, the combination, with
a wheel proper and its inclosing structure, of
gates pivoted in said structure and having
rigid arms located substantially midway their
5 length, and an annulus supported by said
arms and also centrally located and having
sockets whose walls are adjustable, the sock-
ets receiving said arms.

6. In a water-wheel, the combination, with
10 the wheel proper and its inclosing structure,
of gates pivotally mounted in said structure

and having arms, and an annulus supported by
said arms and having sockets whose walls are
adjustable for the purpose described, such
sockets receiving the ends of the arms. 15

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

FRANCIS M. BOOKWALTER.

Witnesses:

OLIVER H. MILLER,
H. M. PLAISTED.