

No. 624,350.

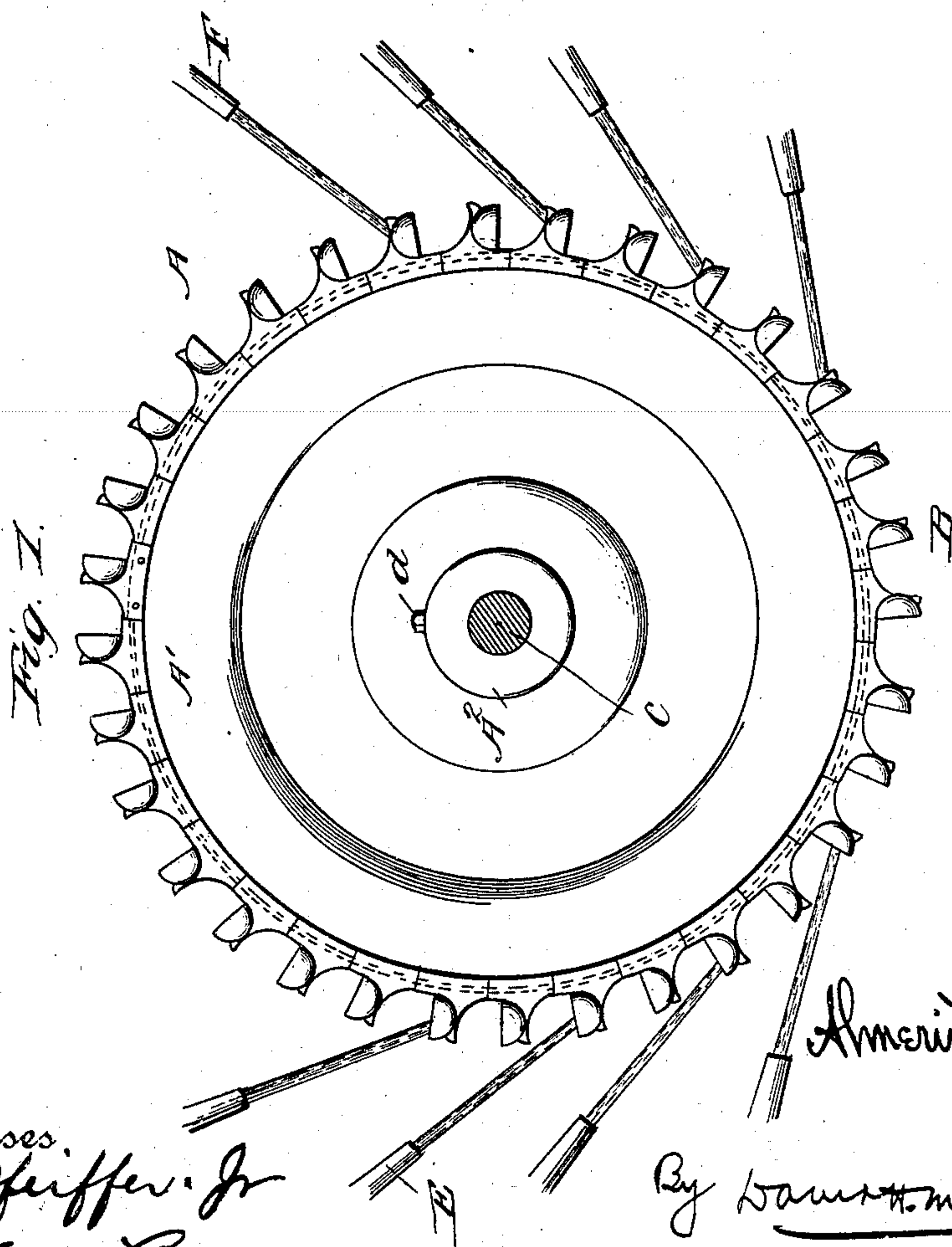
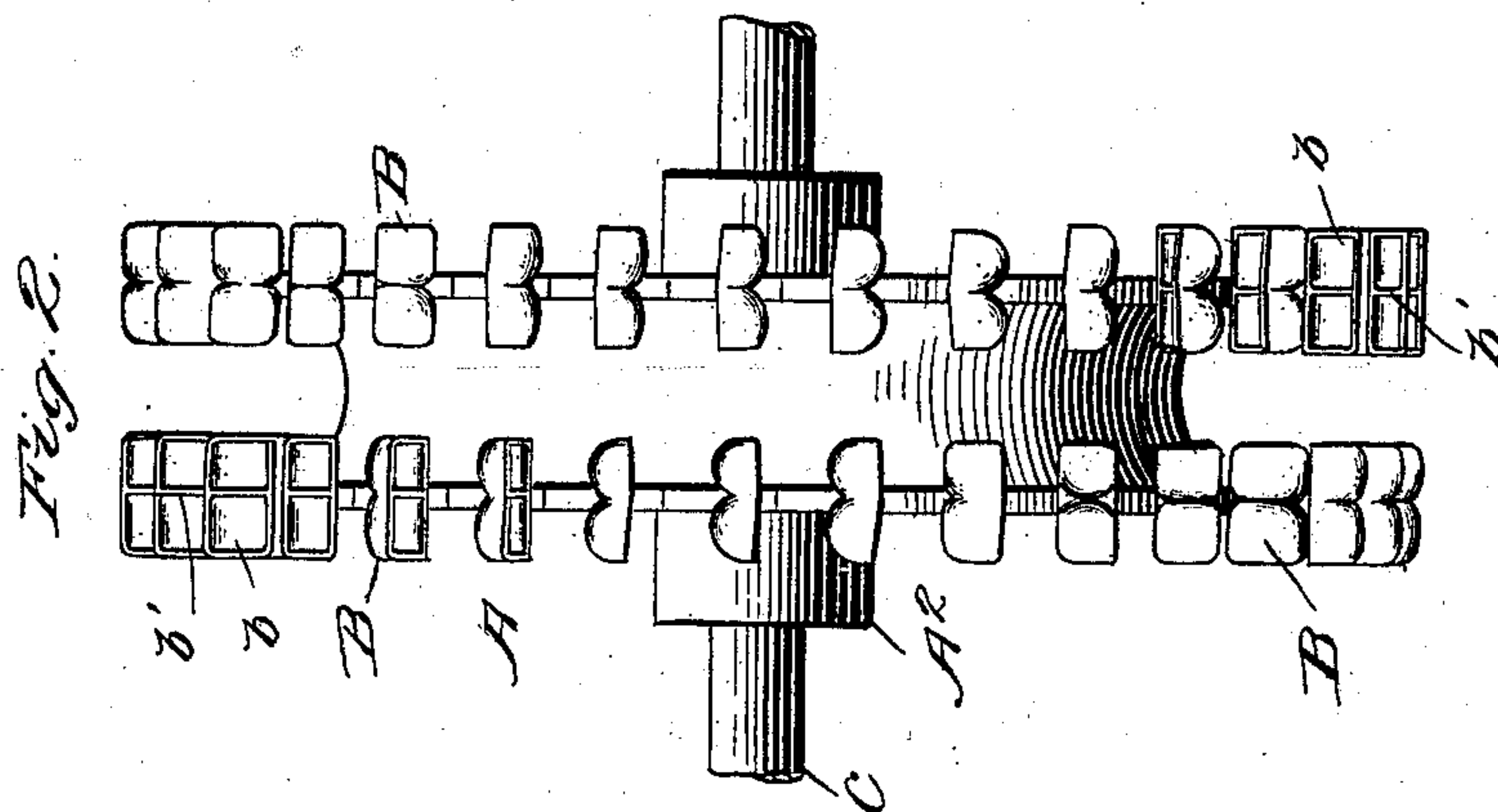
Patented May 2, 1899.

A. H. LIDTHALL.  
WATER WHEEL.

(Application filed Aug. 8, 1898.)

(No Model.)

2 Sheets—Sheet 1.



Witnesses.  
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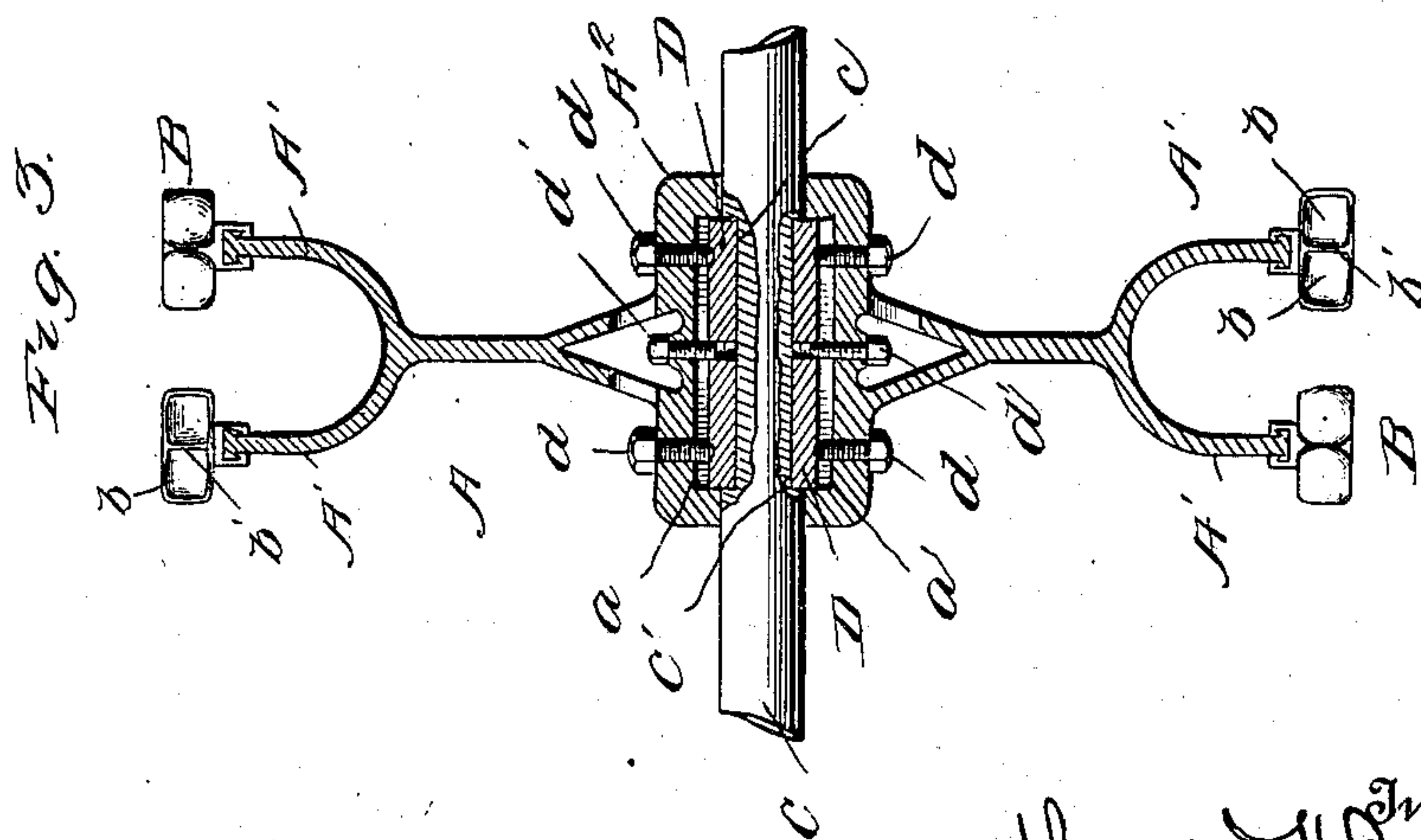
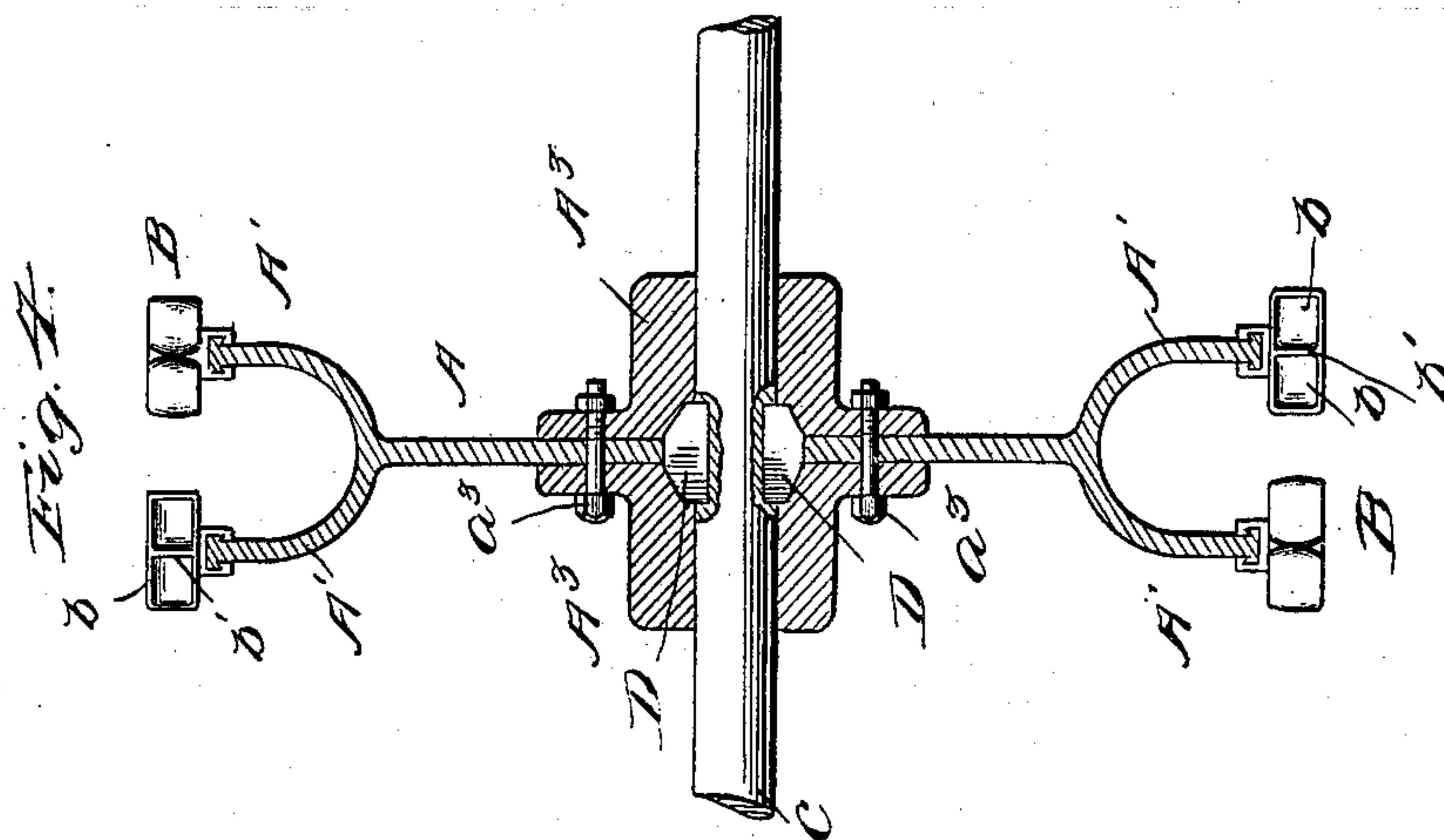
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2 Sheets—Sheet 2.



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# UNITED STATES PATENT OFFICE.

ALMERIN H. LIGHTHALL, OF NEW YORK, N. Y., ASSIGNOR TO HENRY A. MAURER, OF SAME PLACE.

## WATER-WHEEL.

SPECIFICATION forming part of Letters Patent No. 624,350, dated May 2, 1899.

Application filed August 8, 1898. Serial No. 688,078. (No model.)

*To all whom it may concern:*

Be it known that I, ALMERIN H. LIGHTHALL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Water-Wheels; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to jet or impact water-wheels.

The primary object of the present invention is to provide a water-wheel of the kind described which shall be simple and inexpensive in construction and by the use of which, in connection with a jet or jets of water projected on one side or the other of the wheel, the latter may be revolved with equal speed and force in either direction.

A further object of the invention is to provide a simple and easily-applied means for connecting a wheel rigidly to a shaft and for disconnecting it therefrom when desired.

With these objects in view the invention consists of a water-wheel having on the periphery thereof two parallel series of buckets or vanes having cups for receiving the impact of water, the cups of the buckets of the respective series being oppositely arranged and there being a space between the two series, so that water projected against the buckets or vanes of one series will result in turning the wheel in the opposite direction to that in which it will be turned if projected against the buckets or vanes of the other series.

Further, the invention consists of a water-wheel having a double or bifurcated periphery, each portion of the periphery being provided with a series of buckets or vanes, the openings in the respective series being oppositely arranged.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a side view of a water-wheel constructed in accordance with my invention. Fig. 2 is an end view thereof. Fig. 3 is a central vertical sectional view; and Fig. 4 is a view corresponding to Fig. 3, showing a modified form of device for attaching the wheel to its hub.

In the drawings, A represents the water-wheel, the main portion of which is preferably made of one piece of metal. On the periphery of the wheel are arranged two series of buckets or vanes B, having indentations or cups *b* therein for the reception of the impact of water from suitable nozzles, by which the water under pressure is directed against the buckets or vanes. The buckets or vanes are preferably constructed as shown, each being provided with a central rib or projection *b'*, against which the water is discharged and by which the streams of water are divided and directed into the cups. The outer edges of the cups are somewhat lower than the rib or projection *b'*, so that water projected into the cups will be discharged from the outer edges thereof free from the buckets in order to offer no obstruction by contact with them to the free revolution of the wheel.

In order that there may be a space on each side of each series of buckets or vanes B, the periphery of the wheel is bifurcated, as shown in Fig. 3 of the drawings, forming two circumferential ribs *A' A'*, to which the two series of buckets or vanes are respectively attached. This construction allows the free and unobstructed discharge of water from the inner as well as the outer faces of the buckets, and thus the water used to propel the wheel while under pressure will not come in contact with any part of the wheel except the buckets, and any impinging of the water while under pressure against any part of the wheel which might result in retarding the revolution of the latter is obviated.

The preferred means for attaching the water-wheel A to its shaft C is clearly shown in the sectional views, Figs. 3 and 4. The hub *A<sup>2</sup>* of the wheel is chambered, as shown at *a a*, and that portion of the shaft C which comes opposite the chamber is provided with corresponding indentations *c c*. Arranged in the spaces thus formed when the wheel is in place on the shaft are keys D, adapted to lie partially in the chambers in the hub and partially in the indentations in the shaft. The chambers in the hub are of a size to entirely receive the keys to allow the latter to be placed in the chambers when the wheel is slipped on the shaft. The keys are moved



to and retained in proper position in the spaces formed for their reception to connect the wheel to the shaft by the set-screws  $d$ . These set-screws extend through screw-threaded openings in the hub and bear at their inner ends against edges of the keys. Each key has a central screw-threaded opening, into which projects a screw  $d'$ , extending through the hub.

10 In arranging the wheel on the shaft the keys are drawn up into the chambers in the hub by the screws  $d'$ , and the shaft is introduced through the opening in the hub. The chamber in the hub and the indentation in the shaft are brought opposite each other, and then the screws  $d'$  are loosened, and the set-screws  $d$  are moved in forcing the keys to positions partially in both the hub and shaft. By tightening the set-screws  $d$  the keys will be firmly seated, and as a result the wheel is rigidly secured to the shaft. The loosening of the set-screws  $d$  will allow the keys to be moved back into the hub by the screws  $d'$ , allowing the removal of the wheel.

25 In the modified form of device shown in Fig. 4 of the drawings the hub of the wheel is made in two pieces  $A^3 A^3$ , by which is held the main portion  $A$  of the wheel. The parts  $A^3$  of the wheel are chambered to receive the keys  $D$ , and the parts of the hub are connected by the bolts  $a^3$ . In the modified form the keys are retained in place by the inner edge of the main portion of the wheel which bears against the keys.

35 Water under pressure from a pump or pumps or other suitable source is projected from nozzles  $E$  or  $F$  upon one or the other of the series of buckets or vanes  $B$ , according to the direction in which the wheel is to be revolved. The nozzles, of which any desired number may be employed, are arranged at

suitable angles to cause the water directed by each to the buckets at angles which will most effectively drive the wheel, and each nozzle is so located as to strike the rib or projection of each bucket of the series against which it is directed.

The buckets or vanes employed are all of the same size, so that the water from both sets of nozzles being under the same pressure and delivered in the same quantity from each, the wheel may be revolved in either direction with equal power and speed. This feature of my invention has especial advantages in the uses to which the wheel may be placed, particularly when it is employed on a vessel when quick reversal of the direction of movement and rapid attainment of full speed in either direction are essential.

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

1. A water-wheel having on the periphery thereof two parallel series of buckets or vanes having cups for receiving the impact of water, the cups of the buckets of the respective series being oppositely arranged, and there being a space between the two series, substantially as described.

2. A water-wheel having its periphery bifurcated, each portion being provided with a series of buckets or vanes having cups for receiving the impact of water, the cups of the respective series being oppositely arranged, substantially as described.

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

ALMERIN H. LIGHTHALL.

Witnesses:

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ALBERT LEU.