

No. 624,349.

Patented May 2, 1899.

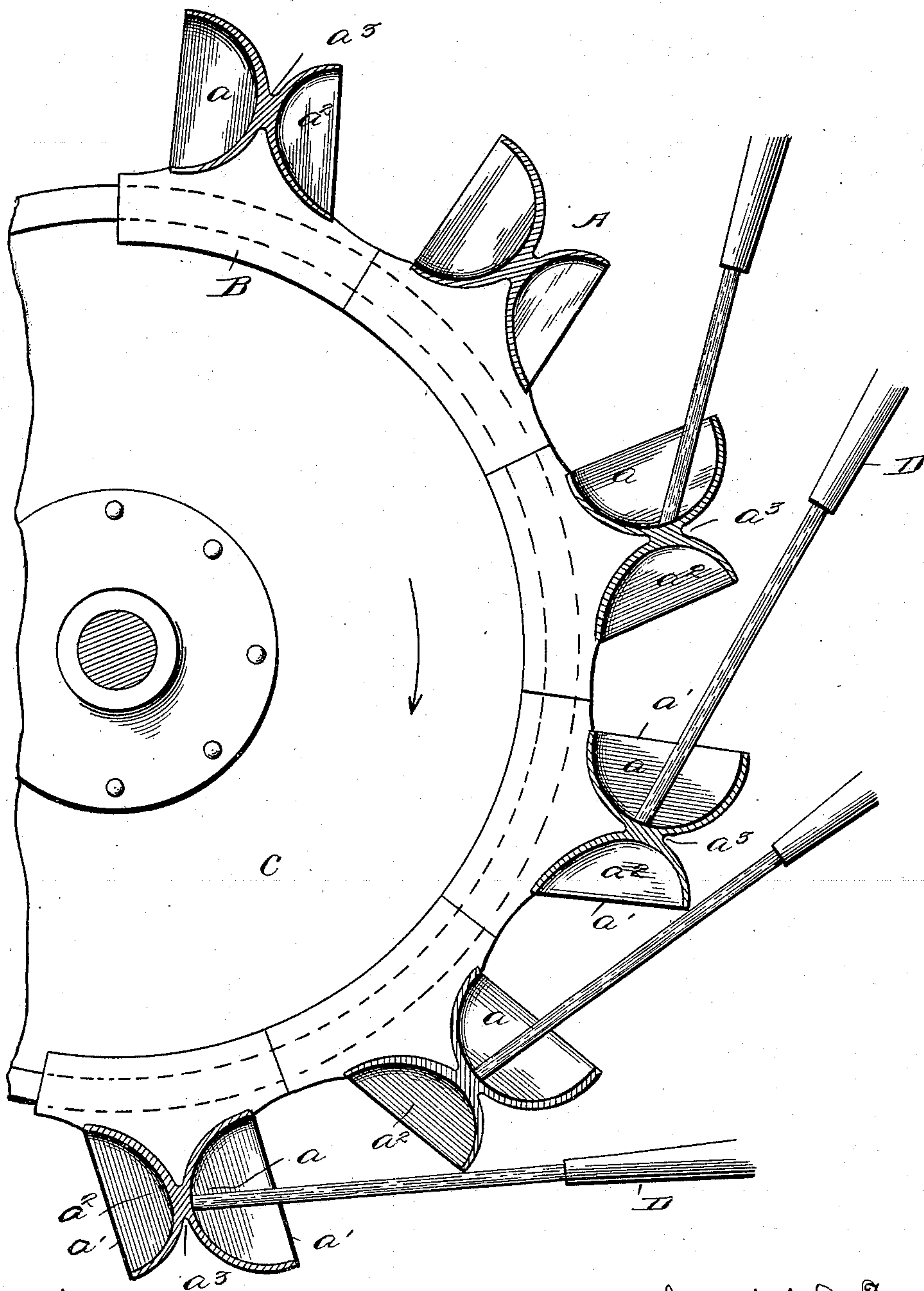
A. H. LIGHTHALL.
BUCKET OR VANE FOR WATER WHEELS.

(Application filed Aug. 8, 1898.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1



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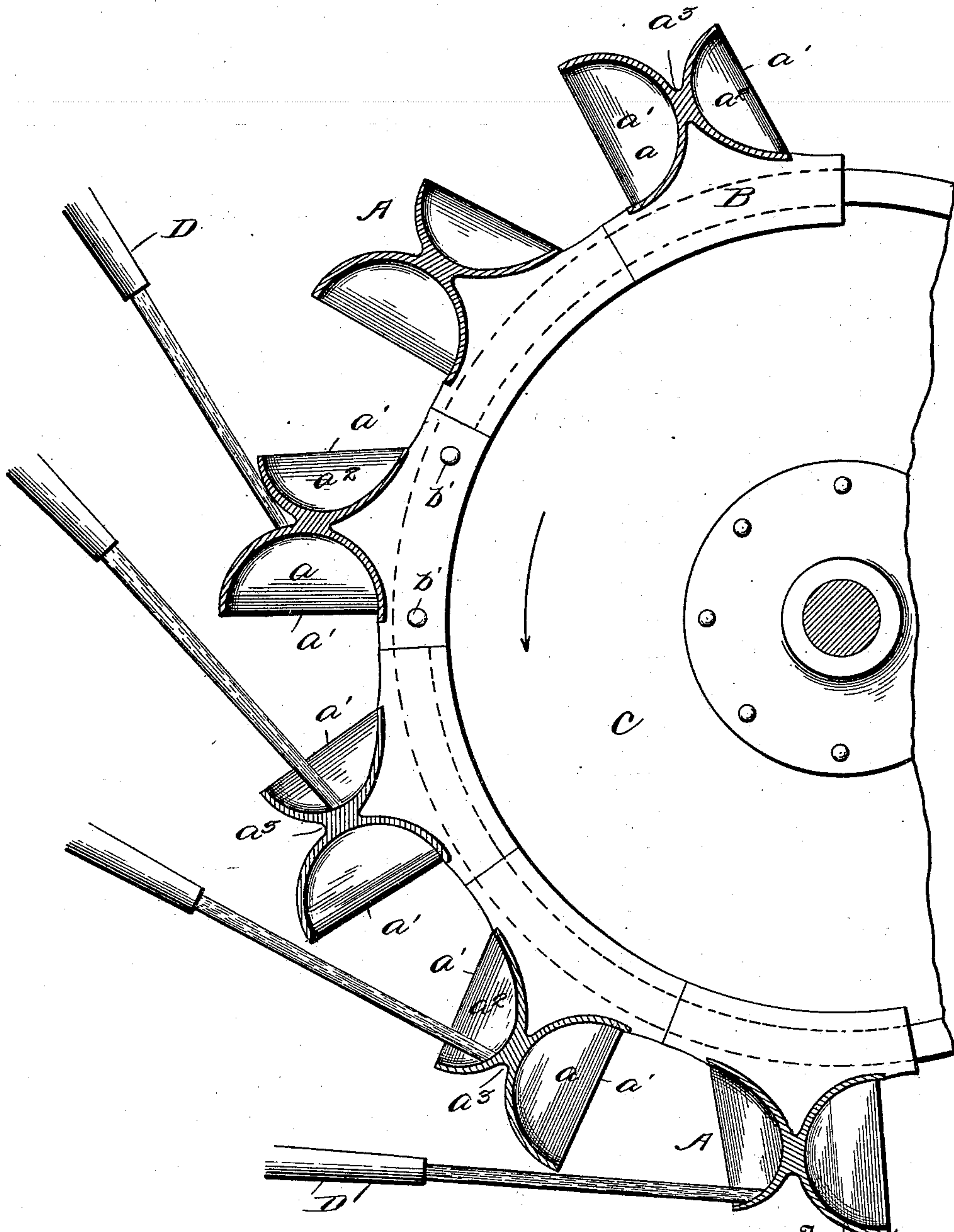
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Fig 2.



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Fig. 3.

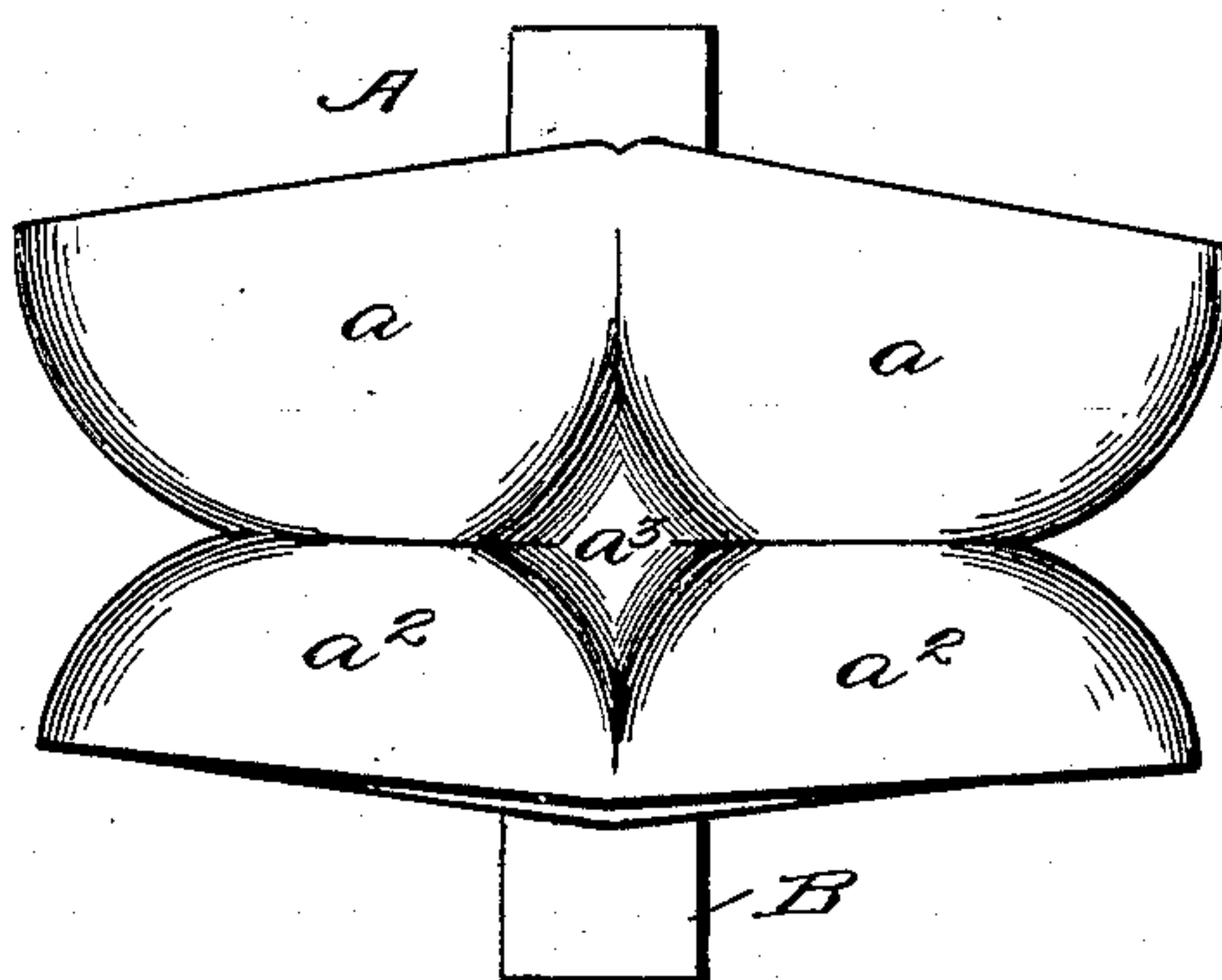


Fig. 6

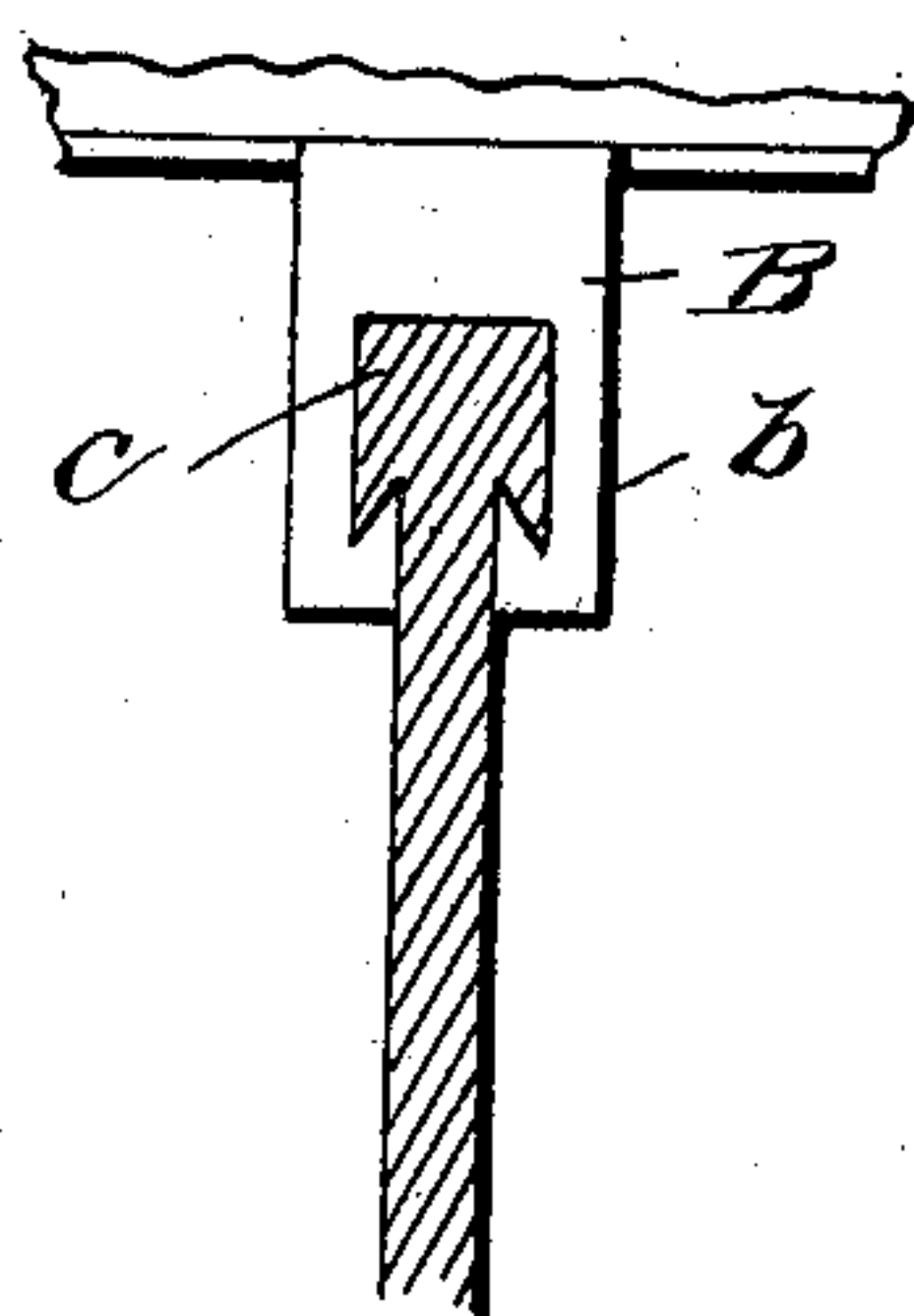


Fig. 4.

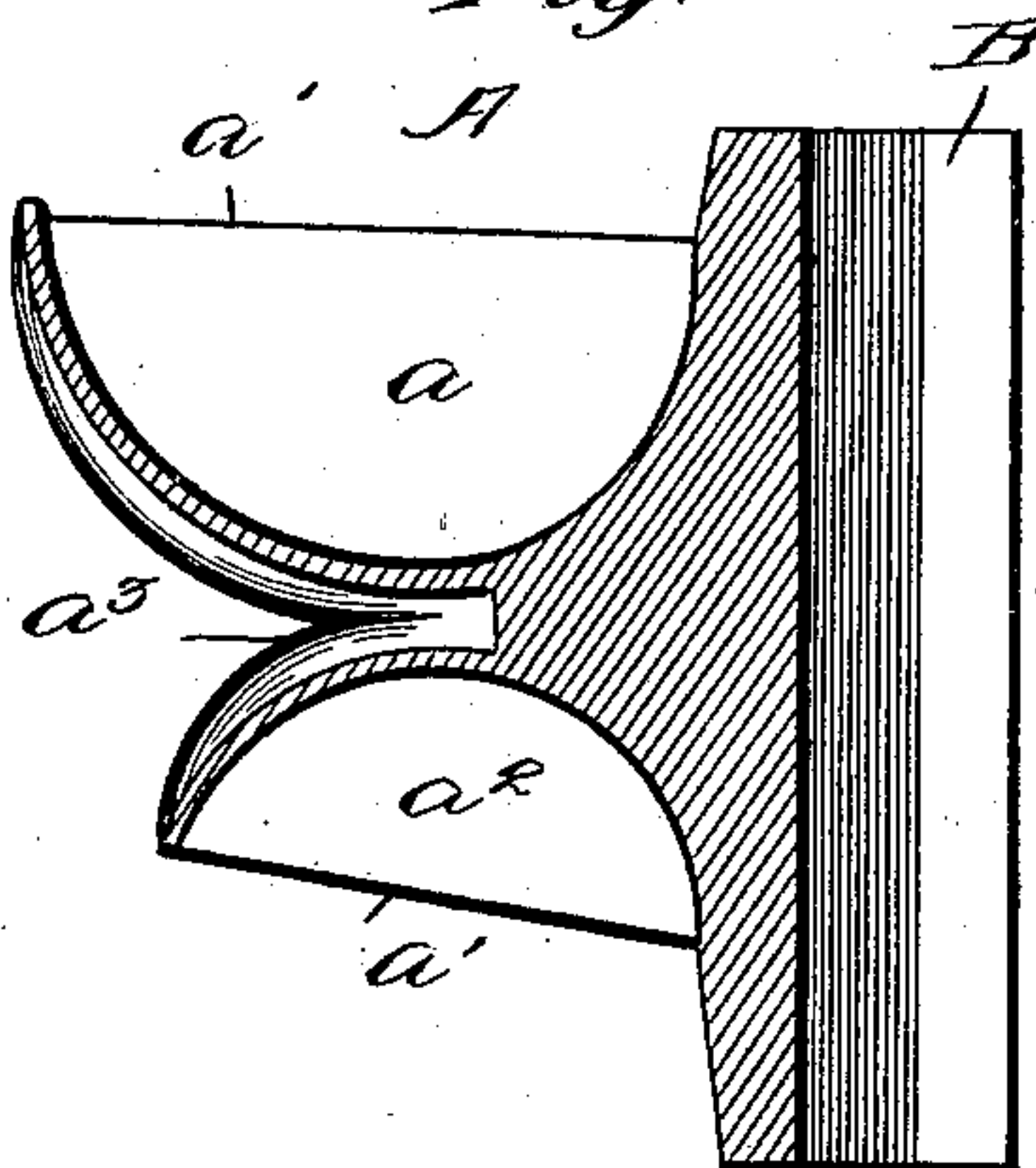


Fig. 7

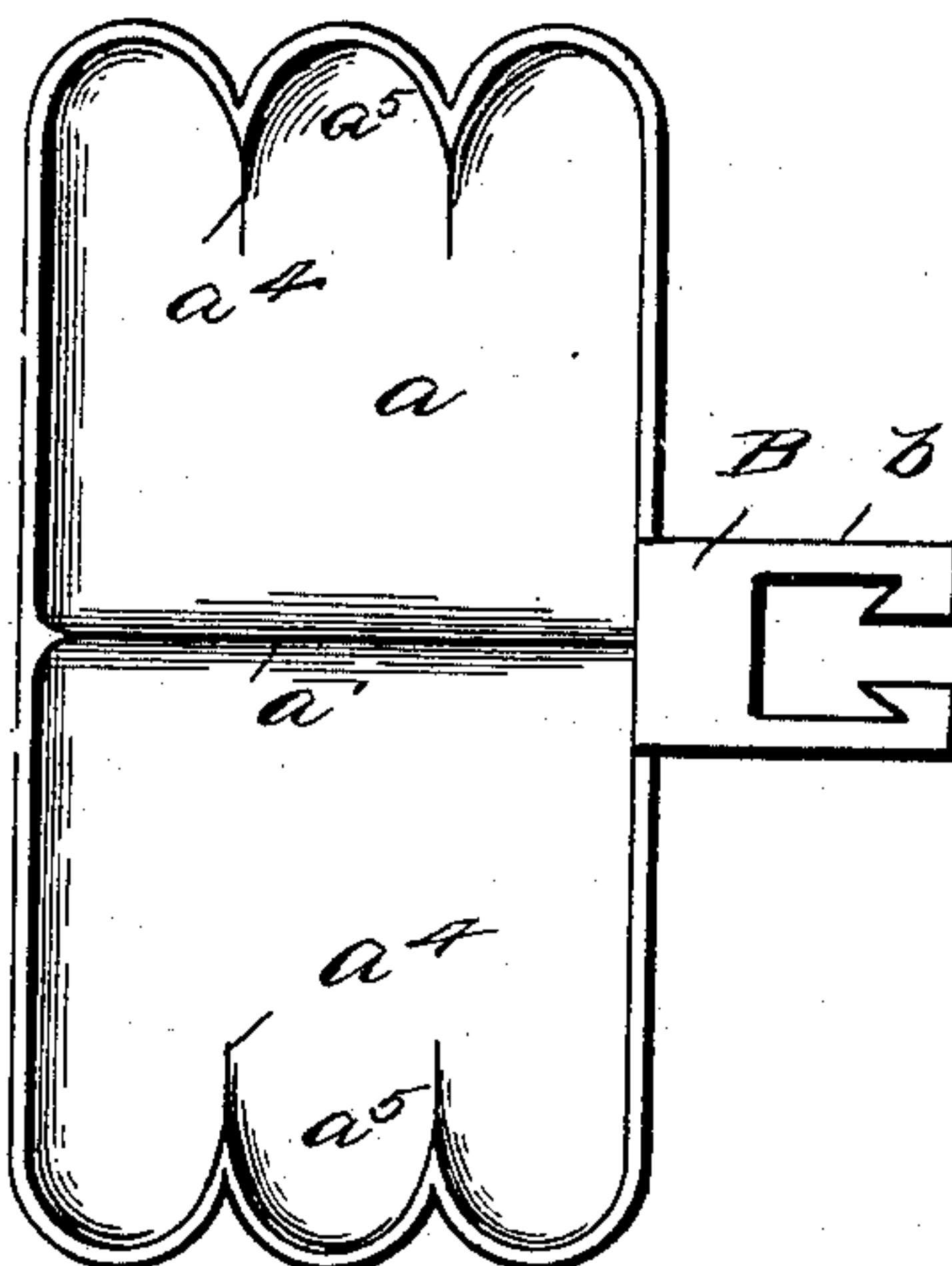
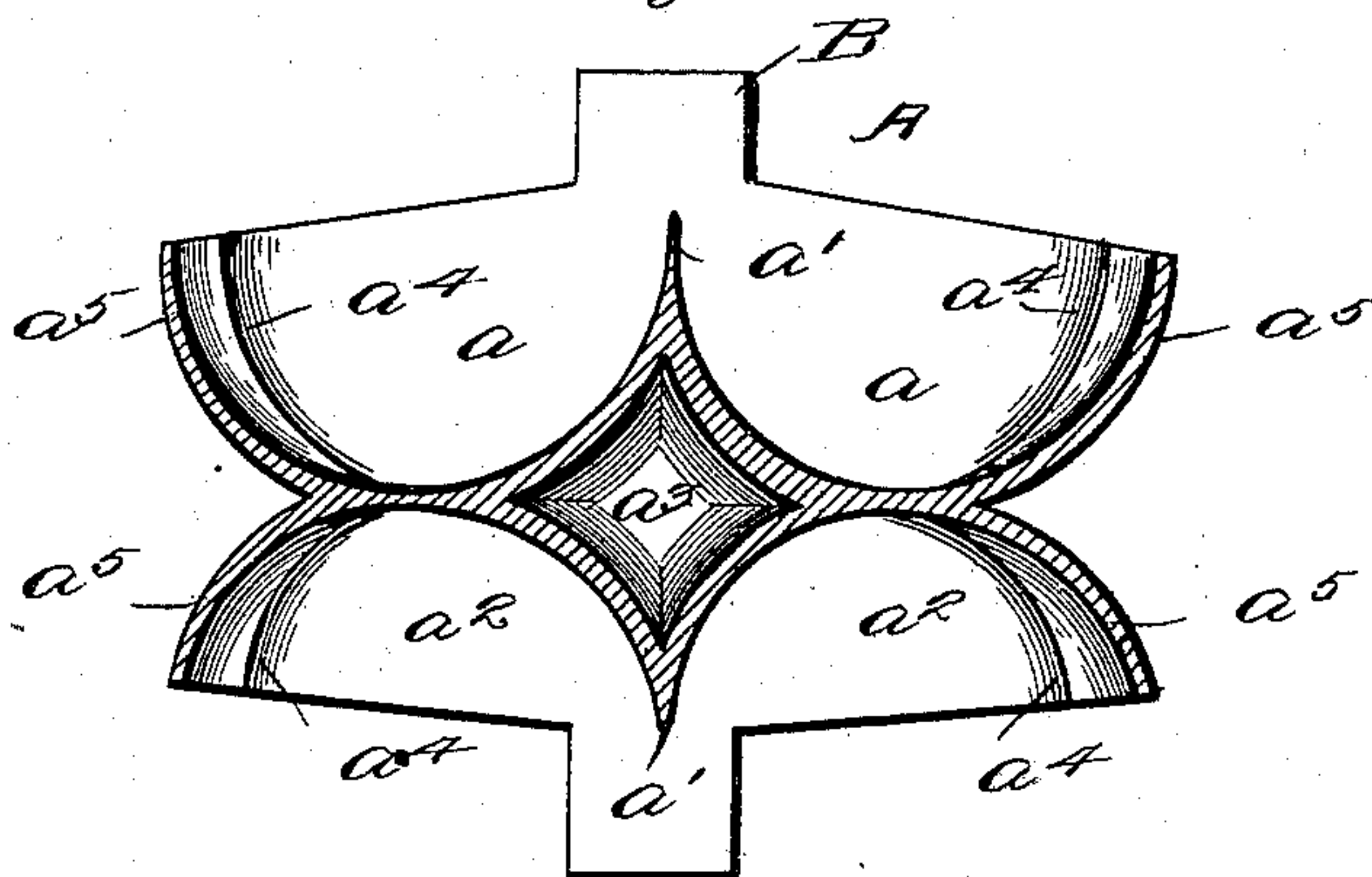


Fig. 5.



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UNITED STATES PATENT OFFICE.

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

BUCKET OR VANE FOR WATER-WHEELS.

SPECIFICATION forming part of Letters Patent No. 624,349, dated May 2, 1899.

Application filed August 8, 1898. Serial No. 688,077. (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 Buckets or Vanes for Water-Wheels; and I do 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, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

15 This invention relates to water-wheels of the class known as "impact" water-wheels and which receive their impelling force from a stream or from streams of water under pressure directed into buckets or vanes attached to or near the periphery of the wheel.

20 The primary object of the present invention is to provide a water-wheel of the class referred to supplied with buckets or vanes of such construction that the greatest amount of force may be communicated from a stream of water to a wheel through the buckets or vanes into which the stream is successively introduced.

30 Further, the object of the present invention is to provide buckets or vanes for water-wheels of the kind referred to by the use of which, applied to a wheel and in connection with opposing controlled streams of water, a wheel may be revolved in either direction at will, the bucket or vane being so formed that a stream or streams of water applied to one portion or portions of the bucket or vane to drive the wheel in one direction will not be interfered with and its force lessened by contact with other parts of the bucket or vane than the part or parts against which it is directed.

45 With these objects in view the invention consists, essentially, of a bucket or vane for water-wheels comprising two oppositely-arranged pairs of concave surfaces, the surfaces on one side being of less width than those on the other.

50 Further, the invention consists of a bucket or vane for water-wheels composed of two oppositely-arranged pairs of cups, the walls

of the cups converging, forming an exterior indentation.

Further, the invention consists of various novel details of construction whereby the objects of the invention are attained.

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

Figure 1 is a side elevation of a water-wheel having my improved buckets or vanes applied thereto and showing four streams of water directed upon the buckets or vanes to impel the wheel in one direction. Fig. 2 is a view similar to Fig. 1, showing four streams of water directed upon the buckets or vanes to impel the wheel in one direction opposite to that in which it is driven by the streams of water as shown in Fig. 1. Fig. 3 is a front view of my bucket or vane detached from a wheel. Fig. 4 is a sectional view of the bucket, the section being taken at one side of the center and on a line at right angles to the axle of the wheel to which the buckets are applied. Fig. 5 is a sectional view of the bucket, the section being taken on a line at right angles to that on which the section shown in Fig. 4 is taken. Fig. 6 is a sectional view showing the manner of attaching the buckets to the wheel, and Fig. 7 is a plan view of a bucket or vane.

In the drawings, A represents the main body of the bucket or vane, and B represents a rear extension or shank by which the bucket is attached to a wheel.

On one side of the main portion A of the bucket or vane are the concave surfaces or cups α , which receive the impact of the streams of water when the wheel is revolved in the direction indicated by the arrow in Fig. 1 of the drawings. These cups are separated and one side of each formed by a rib or projection α' , which rib or projection is, as shown clearly in Fig. 5, sharp at its upper or outer edge and gradually widens out from a short distance from its upper edge and forms one face of each of the two cups α . The other three sides of what are shown as four-sided cups are formed by sides corresponding in shape to the central rib or projection—that is, all the sides are sharp on their outer edges and gradually converge toward the lower portion of the pockets. From the central ridge

or projection the front and back edges of the cups incline slightly downward to the outer ends, so that in the turning of the wheel to which the buckets are attached the water projected into the cups is first discharged at the outer ends.

Oppositely arranged to the cups a are described are two cups a^2 , which correspond in all particulars as to form to the cups a . The cups a^2 are of less width than the cups a , as clearly shown in the drawings, and therefore extend a less distance beyond the periphery of the wheel to which the buckets or vanes are attached than the cups a .

The outside faces of the four cups of each bucket or vane correspond in contour to the inner faces thereof, and therefore there is formed in the outer front face of each bucket or vane an outside indentation or pocket a^3 , the walls of which are formed by the outer walls of the four pockets described.

The outer side wall of each cup has formed on its inner face a series of sharp-edged ridges a^4 , which begin at points near the bottom of the cups and gradually increase in width up to the top of the outer wall. The sides of the ridge are concave, and therefore they form in the inner faces of the outer walls curved grooves a^5 , shallow at their inner ends and gradually increasing in depth as they extend outward.

Formed with the bucket or vane is a shank B , which extends rearward and has two flanges b , between which is received the periphery of the wheel C . The flanges b have indentations in their inner faces, forming a dovetail opening, and the periphery c of the wheel C is correspondingly formed, as shown particularly in Fig. 6 of the drawings. The side portions of the dovetail formed on the periphery of the wheel are cut away for a distance corresponding to the length of the shanks of the buckets, allowing the shanks to be introduced at this point to engage the dovetail and then to be moved around to the places they are to occupy. The last shank introduced is held in place in the section where the sides of the dovetail are removed by bolts b' , as shown in Fig. 2.

Impetus is given the buckets and the wheel to which they are attached by water under pressure directed against the buckets by two oppositely-arranged series of nozzles D and D' , arranged one on each side of the wheel and which are adjustably arranged to allow discharge of water therefrom at any desired angle. When water under pressure is directed through the nozzles D , it impinges upon the buckets, with the center of the stream at a point midway of the two cups a , and it is therefore equally divided, one-half of the stream being directed into each of the cups a . The impact of the water received at the point described in the successive buckets as the wheel revolves gives momentum to the wheel, the speed of revolution being governed by the quantity of water rejected and the

force under which the water is maintained before discharge. The exercise of the full force of the water is insured by reason of the fact that the discharge of the water from the cups is retarded by the ridges and grooves on the inner faces of the outer walls of the cups a . By this retardation of the discharge of the water an advantage, in addition to insuring the full utilization of the force of impact, is secured, in that the weight of the water retained in the cups is effective in moving the wheel until when the buckets reach a low position in the revolution of the wheel the water is discharged from them. The grooves in the outer sides of the cups prevent the formation of eddies in the cups, and they insure the discharge of water from the buckets in solid streams in directions to cause the streams to clear the wheel and the parts connected thereto. The form of the ridges shown and described is necessary to accomplish this. If a large surface of ridges were presented at the bottoms of the cups, the water at the time of impact would be broken up suddenly and eddies would be formed, which latter would impair the effectiveness of the impact of the water and would also prevent the discharge of the water in solid streams after the force was expended. The outer edges of the cups being lower than the remaining sides offer no resistance to the discharge of the water after passing the grooves and ridges, the water being allowed to pass outward on each side of the wheel free of all parts thereof in the direction in which it is started by contact with the central ridge, and so, as it does not come in contact with the wheel, offers no reactionary force to the onward movement of the wheel. The cups a^2 , being approximately one-half the size of the cups a , are out of line of the water projected by the nozzles D when water is being discharged against the effective parts of the cups a .

When it is desired to reverse the movement of the wheel and revolve it in the direction indicated by the arrows in Fig. 2, the flow of water through the nozzles D is cut off and water under pressure is projected against the cups a^2 through nozzles D' .

Inasmuch as the cups a^2 are of less area than the cups a and as it is desirable that so far as possible the force applied to revolve the wheel in the direction indicated by the arrow in Fig. 2 be as great as that applied to revolve the wheel in the direction indicated in Fig. 1, the exteriors of the buckets or vanes are provided with the indentation or pocket a^3 , into which the water from the nozzles is received before coming in contact with the cups a^3 , thereby materially increasing the surface for receiving impact of water when the wheel is turned in the direction indicated in Fig. 2 and increasing the efficiency of the wheel.

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

1. A bucket or vane for water-wheels com-

prising two oppositely-arranged pairs of concave surfaces, the surfaces on one side being less in width than those on the other, substantially as described.

5 2. A bucket or vane for water-wheels comprising two oppositely-arranged pairs of concave surfaces forming cups, the walls of the cups converging forming an exterior indentation or pocket, substantially as described.

10 3. A bucket or vane for water-wheels comprising two oppositely-arranged pairs of concave surfaces forming cups and provided with grooves and ridges, the outer walls of the cups being lower than the remaining walls, substantially as described.

15 4. A bucket or vane for water-wheels comprising two oppositely-arranged pairs of concave surfaces forming cups, the inner face of

the outer wall of each cup being provided with ridges, the members of each pair of cups being separated by a rib or projection sharp at its upper edge and gradually increasing in thickness from the edge, substantially as described.

5. Buckets or vanes for water-wheels having concave surfaces, forming cups, the outer walls of the cups being provided with ribs having concave sides extending from the bottom of the cups, forming grooves, substantially as described.

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

ALMERIN H. LIGHTHALL.

Witnesses:

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