

J. L. RODGERS.
Turbine Wheels.

No. 156,102.

Patented Oct. 20, 1874.

Fig. 1.

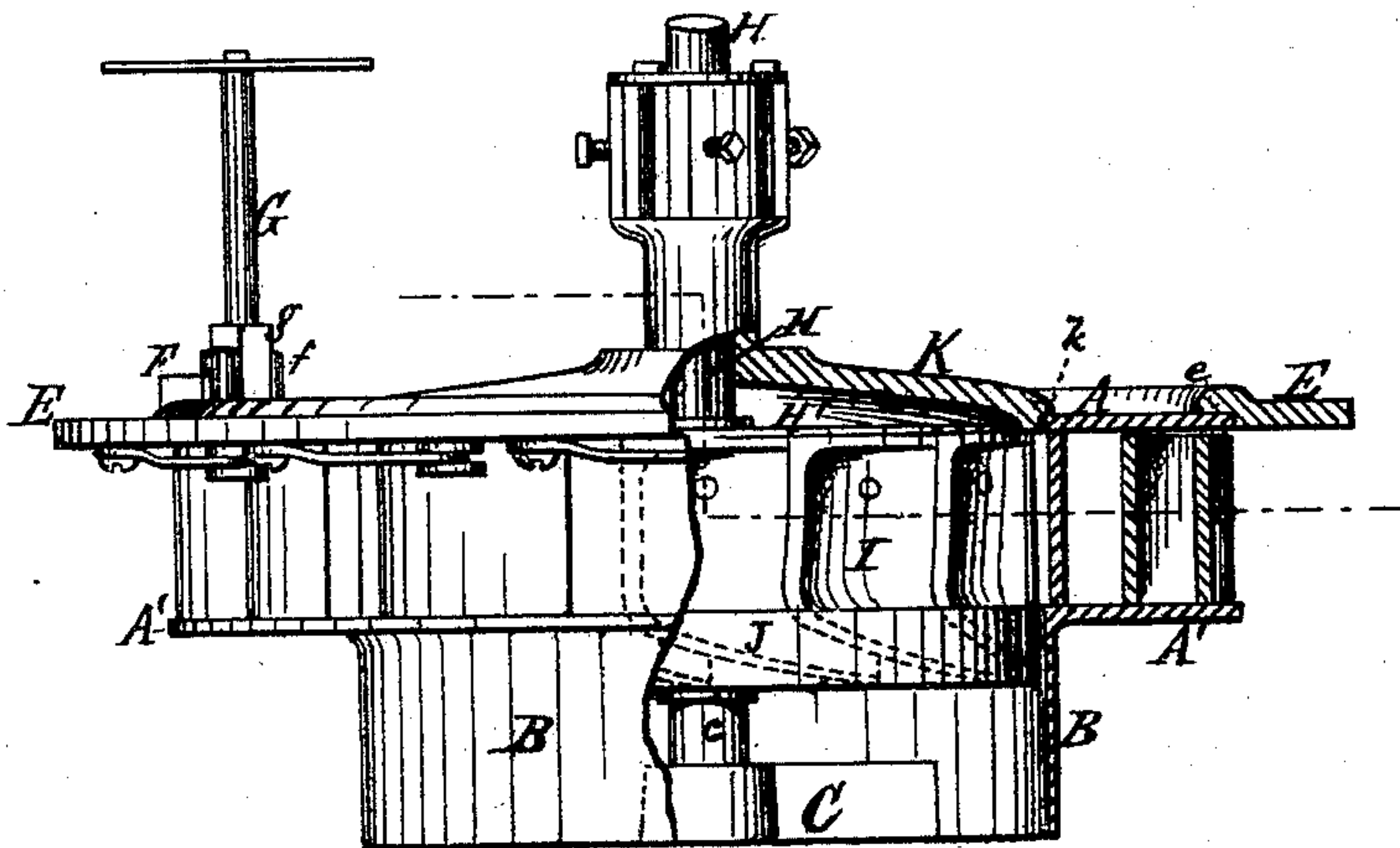


Fig. 2.

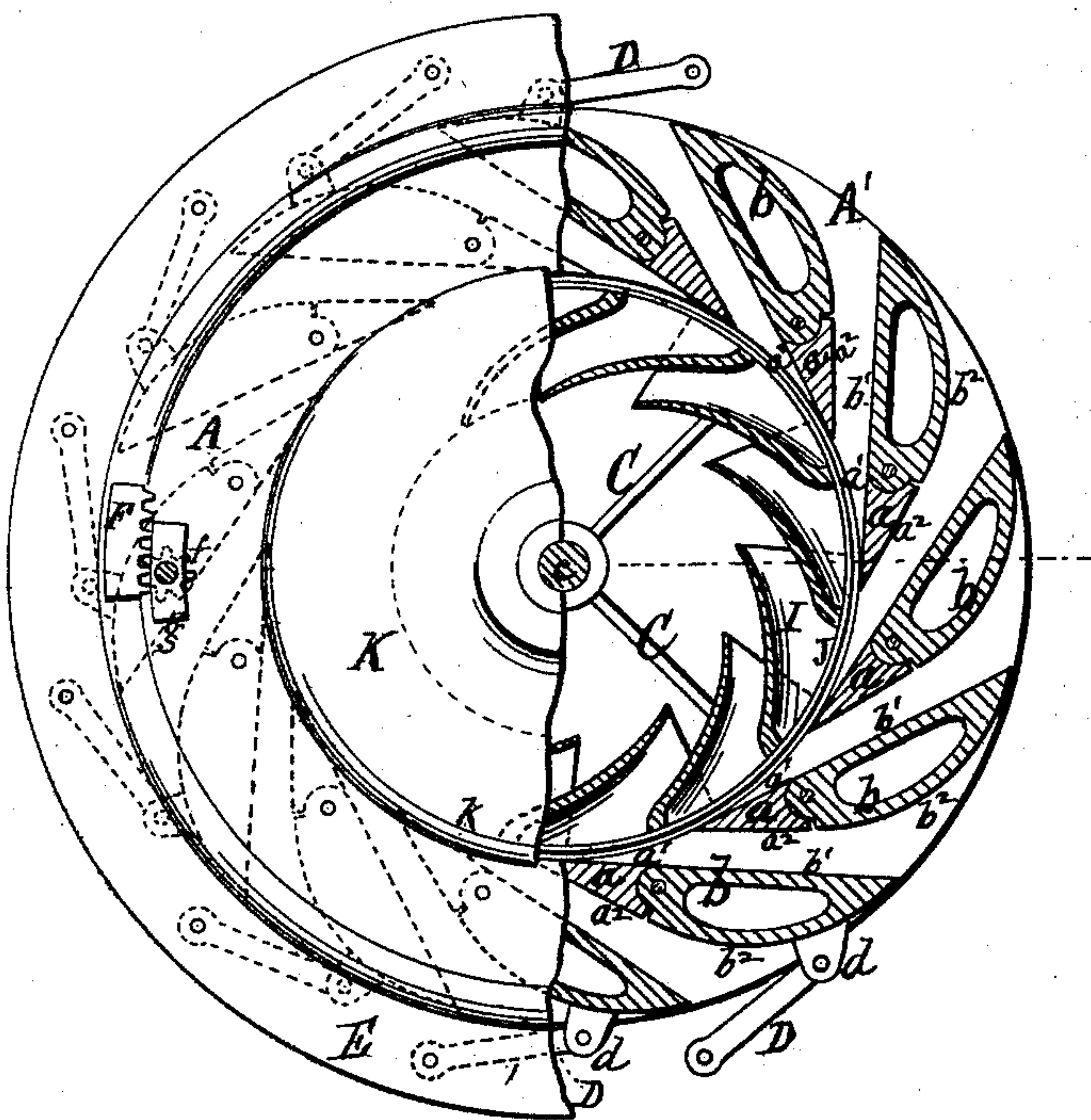
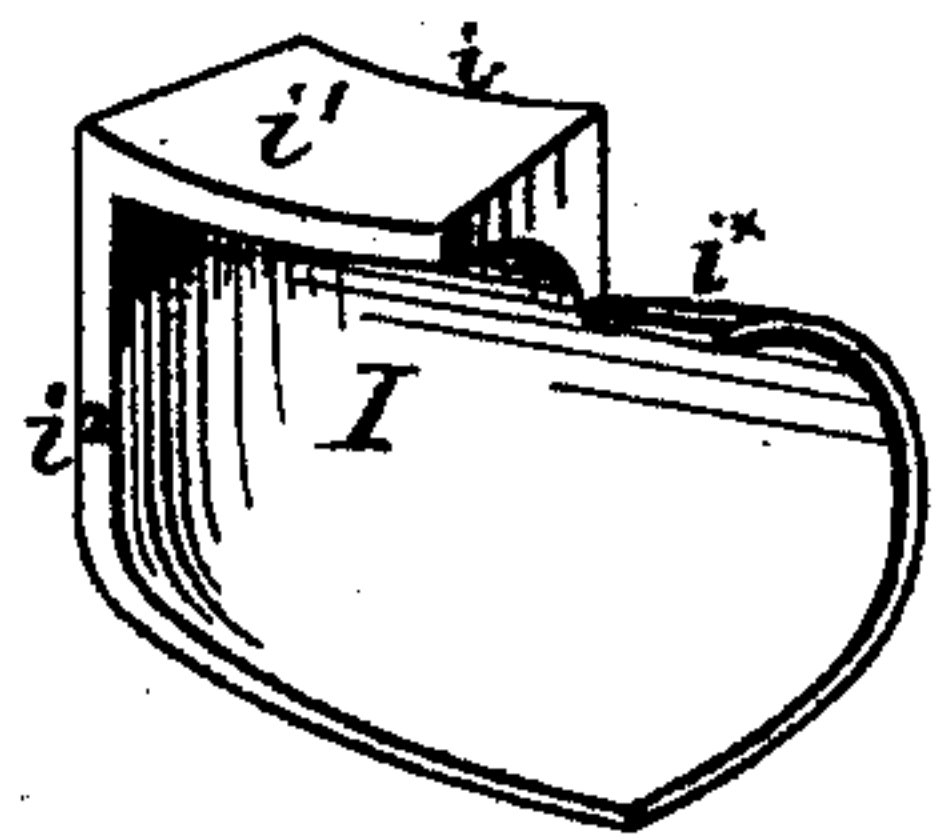


Fig. 3.



Witnesses.

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IMPROVEMENT IN TURBINE-WHEELS.

Specification forming part of Letters Patent No. **156,102**, dated October 20, 1874; application filed September 18, 1874.

To all whom it may concern:

Be it known that I, JAMES L. RODGERS, of Springfield, county of Clarke, State of Ohio, have invented certain new and useful Improvements in Turbine-Wheels, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a side elevation of my improved wheel, partly in section, on the line *x x*, Fig. 2. Fig. 2 is a plan view of the same, partly in section, on the line *y y*, Fig. 1; and Fig. 3 is a perspective view of one of the buckets detached.

Similar letters of reference denote corresponding parts in all the figures.

The invention relates to that class of turbine-wheels employing hinged gates in the casing-cylinder or guide for regulating the flow of water to the buckets, and for determining the angle or direction of approach of the water to said buckets.

These hinged gate-wheels have heretofore been made chiefly in one of two forms of construction—one having the gates pivoted at or near their centers, in such manner that, as the gates were swung upon their pivots, the angle of approach of the water to the wheel was changed, and that, as the opening for the admission of the water was diminished, the distance of the inner ends of the buckets and the width of the passage-way for the water at said end were correspondingly increased, and vice versa; and the other construction having one side or face only of the gate or water-way hinged, the other side forming a fixed stationary guard, toward or away from which the hinged portion or side is moved for opening or closing the gates. This latter construction necessitates the employment of curved or angular wings for covering the outer swinging ends of the hinged portion, and thus presents an obstruction to the free admission of the water to the ways or guides.

The object of the invention is to preserve the angle of direction or approach of the water to the buckets, by making the inner portion of the guideways stationary, and thereby keeping them at all times in the same relation to the buckets, so that no increased width

of space is afforded for the water as the amount admitted is diminished, while at the same time the entire outer end or portion of the gates is made adjustable for increasing or diminishing the volume of water admitted to the buckets, thus dispensing with guards at the outer ends, and making both sides of the guides or gates to form movable sides to the guideways, through which water is admitted to the wheel.

The construction of the wheel for effecting the above-named objects will be best understood by reference to the accompanying drawing, in which *A A' B* represent the guide-wheel, composed of an upper horizontal annular plate or rim, *A*, a lower annular plate, *A'*, and the vertical flange, rim, or curb, *B*. The vertical rim *B*, which, by preference, is cast in one piece with and upon the inner edge of the ring *A'*, is provided at its lower end with a spider, *C*, in the center of which a step or bearing is placed for the wheel-shaft, in any usual way, said spider being cast with, or formed separately and bolted to the rim *B*, as preferred. The annular plates *A A'* may also be cast together, if desired, intermediate upright triangular or wedge-shaped bars *a a* serving to unite them; or they may be formed separately, provided with suitable sockets for the reception of the ends of the bars *a*, and the whole firmly secured by through-bolts, if desired. The bars or uprights *a* are made in the form, in horizontal section, (see Fig. 2,) of an acute triangle, and are set obliquely with the apex or acute angle adjacent to the inclosed wheel, and with the inner side or face of the triangle arranged tangentially, or thereabout, to the periphery of said inclosed wheel, and about at right angles to the outer ends of the buckets of said wheel. The sides *a¹ a²* of the bars *a*, converging toward the wheel in right lines, form fixed sides to the inner ends of the ways, through which the water is conducted to the wheel of about one-third, more or less, the length of said ways, and the base or outer side of these triangular bars *a* is hollowed out to form a socket for the reception of each of the inner convex ends of a hinged gate, *b*, the curvature of the sockets, and also of the convex inner ends of said gates, being in the arcs of circles, of which the pivotal bolts *c* (which

unite the hinged gates b at their inner ends with the rings $A A'$ are the centers, in such manner as to maintain at all times, and under all adjustments of the gates, a close joint between said gates and the bars a . The gates b are made of a width at their inner ends conforming to width of the base or outer ends of the bars a , so as to entirely cover the same; and the face b^1 of each gate is made in a right line, forming an extension of the side a^1 of the bar a . The opposite faces b^2 of the hinged gates, at their inner ends, also form extensions of the lines of sides a^2 of the bars a to a point at or near midway the length of the gates, whence, by curved or angular lines, said sides b^2 are deflected toward, and unite in, an acute angle with the sides b^1 , at or near the periphery of the rings $A A'$, as shown in the plan and sectional view, Fig. 2.

By this arrangement of the gates, which may be made hollow, for lightness, as shown, the bars a , together with the inner portion of the hinged gates b , forming the guide or sluice ways, are made to maintain a fixed and uniform relation to the inclosed wheel, such as is found best adapted to direct the water thereto under all circumstances, while the outer portions of said gates, swinging upon the pivots at their inner ends, are adapted to be moved in or out, as required, for adapting them to receive and direct more or less water to the wheel.

By this construction, also, both sides of the gates, throughout their entire extent, form the outer swinging end at the angle formed by the converging sides $b^1 b^2$ to the inner angle of the fixed bar a , are made to direct the water inward toward the wheel, the sides $a^1 b^1$ in right lines, or nearly so, and the sides $a^2 b^2$ partly in curved, but for the greater portion of their length also in right, lines, as explained, and the entire volume of water surrounding the guide-case $A A'$ is thus directed inward toward the inclosed wheel.

For opening and closing the gates, each gate is provided on its outer curved face, near its upper edge, with perforated lugs or ears d , between which one end of a link, D , is pivoted, the other ends of the links being pivoted to the lower face of an annular plate, E , which may either rest in a rabbet formed in the periphery of the ring A , or it may be provided with a lip, e , overhanging and resting upon the outer edge of said plate A , as shown, the upper face of the ring E in either case being brought into substantially the same horizontal plane with the upper face of plate A . Upon this ring E is secured a short curved rack, F , and a pinion, f , mounted upon and turning with a vertical shaft, G , which has its lower bearings in a U-shaped standard, g , secured to a plate, and its upper in the flume, or at any convenient point outside thereof, serves to impart a partial rotation to the ring E for simultaneously and uniformly vibrating the gates b upon their pivots, in a manner that will be readily understood.

Within the guide-case constructed as above is inclosed the wheel, constructed as follows, viz: H represents the vertical shaft, stepped at c in the spider C , as above explained. Upon this shaft, at a point at about the same height, or about in the same plane with the annular plate A , is secured a horizontal disk, H' , of an external diameter (either with the buckets applied, or overhanging said buckets, as preferred) conforming to the internal diameter of the said annular plate A , and upon the lower face of said disk, at a distance from its periphery equal to the depth of the buckets at their upper ends, is formed a vertical annular flange, to which and to the outwardly-projecting disk H' the buckets are firmly secured, by bolting or otherwise, as preferred.

The buckets I are made in the form represented in the detached perspective view, Fig. 3—that is to say, with a curved vertical rear face at i , conforming to the vertical flange or disk H' , and a horizontal plane or face at i^1 , extending outward to the periphery of disk H' , or forming an extension thereof, and adapting the bucket to be secured to said flange and disk; a vertical forward face, i^2 , in the same vertical plane with the periphery of disk H' , and a concavo-convex portion extending from and uniting said planes, and forming the bucket proper, which, at its rear end, i^x , extends underneath and in rear of the succeeding bucket, the lower portion of the outer vertical face or edge being curved or inclined downward, either or both, as shown in Figs. 1 and 3, and forming an inclined plane, over which the water passes to its point of discharge. The portion of the outer face i^2 which is curved or inclined, as described, is covered by a thin vertical rim or ring, J , of a diameter on its outer face conforming to the internal diameter of the vertical curb B , so as to fit and turn closely, but easily, therein, in such manner that, by the action of this ring J , to which the lower outer faces of the buckets are closely united, the entire weight of the descending volume of water rests upon the rotating wheel, thereby increasing its power, instead of resting with a frictional resistance against the stationary guide-casing, such as would tend to retard the movement of the wheel and diminish its power. Above the disk H' is a crown-plate or disk, K , made convex on its upper face, and provided at its outer edge with a rabbet, the horizontal lip k of which overhangs the inner edge of the plate A , and, resting snugly thereon, serves to prevent the access of water to the wheel, except through the gates, as explained. This crown-plate, with its central sleeve, however, together with other parts of the wheel, its flume, and connections not hereinbefore particularly described, may be constructed and arranged in any usual or preferred manner.

From the above description it will be seen that the inner portions of the water-ways, for about one-third, more or less, of the length of said ways through the guide-case, remain

always unchanged in their relation to the inclosed wheel, maintaining that angle of direction or approach to the buckets which experience has demonstrated to be the most effective, while the entire outer portions of the ways or gates upon both sides are made adjustable for increasing or diminishing the amount of water admitted to the wheel, said outer movable portion being at the same time made to determine the direction of the water in right lines to the inner fixed portions of said guideways.

It will further be seen that the volume of water, after expending its direct force upon the buckets, and as it begins to descend over the inclined portion of the bucket toward its point of discharge, is withheld from contact with the stationary casing by the moving rim or guard J, secured to the outer face of the lower inclined or curved ends of the buckets, by means of which the entire weight of the descending volume is thrown upon the wheel; and, finally, that the construction and arrangement of this rim, which is located within the pit-rim or curb B, permits the vertical adjustment of the wheel, if required, to give it the full force of a diminished volume of water.

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

1. The hinged adjustable gate *b*, having the straight and curved faces, as described, and against or upon both of which the water impinges in its passage to the wheel, said gate being pivoted at its extreme inner end, in such manner that said hinged end shall maintain a fixed or uniform relation to, or distance from, the inclosed wheel, substantially as described.

2. The inner fixed portions *a* of the ways or gates, in combination with the outer hinged portions *b*, made in form and operating substantially as described.

3. The fixed and hinged portions *a b* of the gates, provided with the faces *a¹ b¹*, formed in right lines, as described.

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Witnesses:

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