No. 818,825. PATENTED APR. 24, 1906.

J. A. HICKS.

FEATHERING BLADE PADDLE WHEEL.

APPLICATION FILED SEPT. 22, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

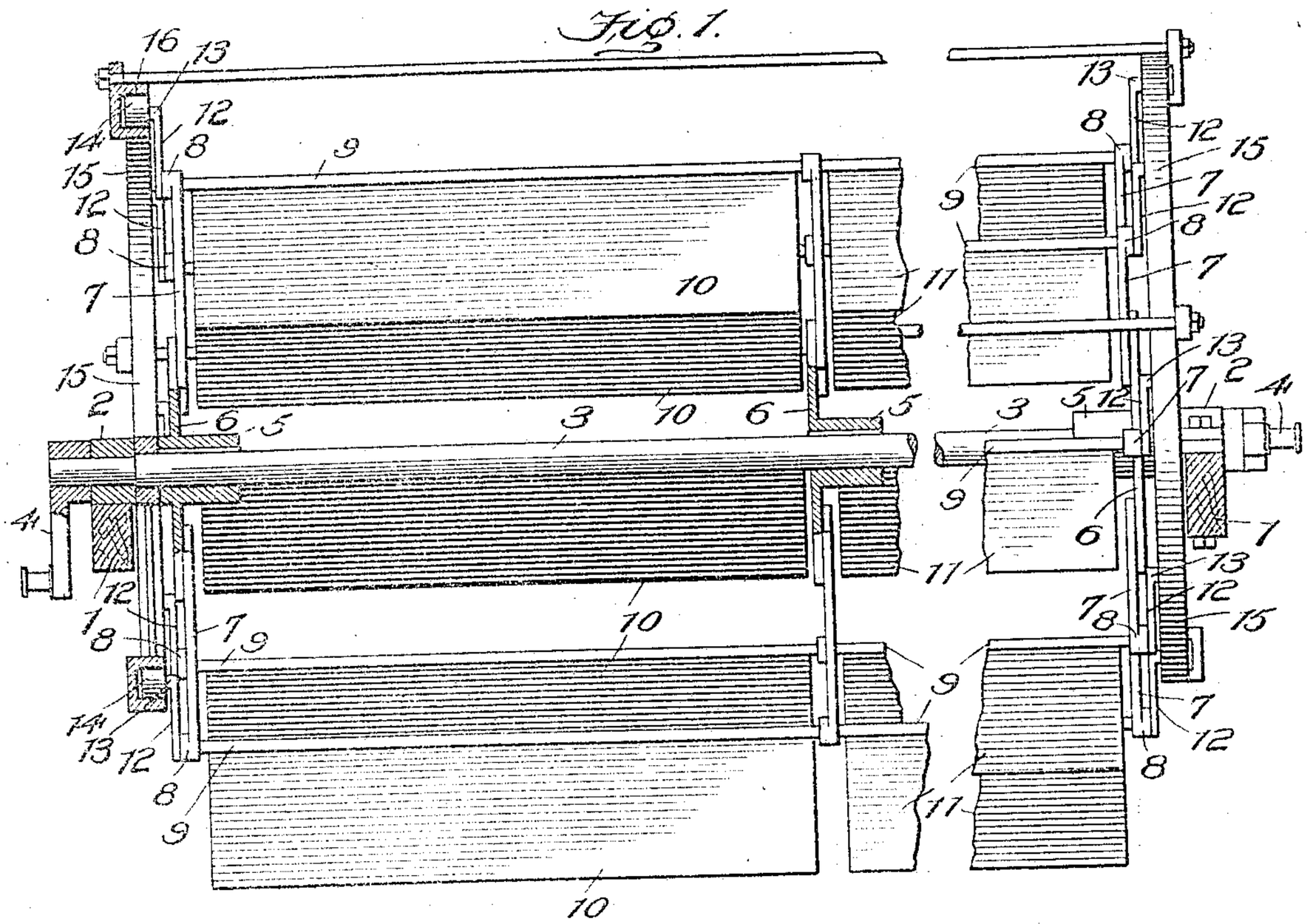
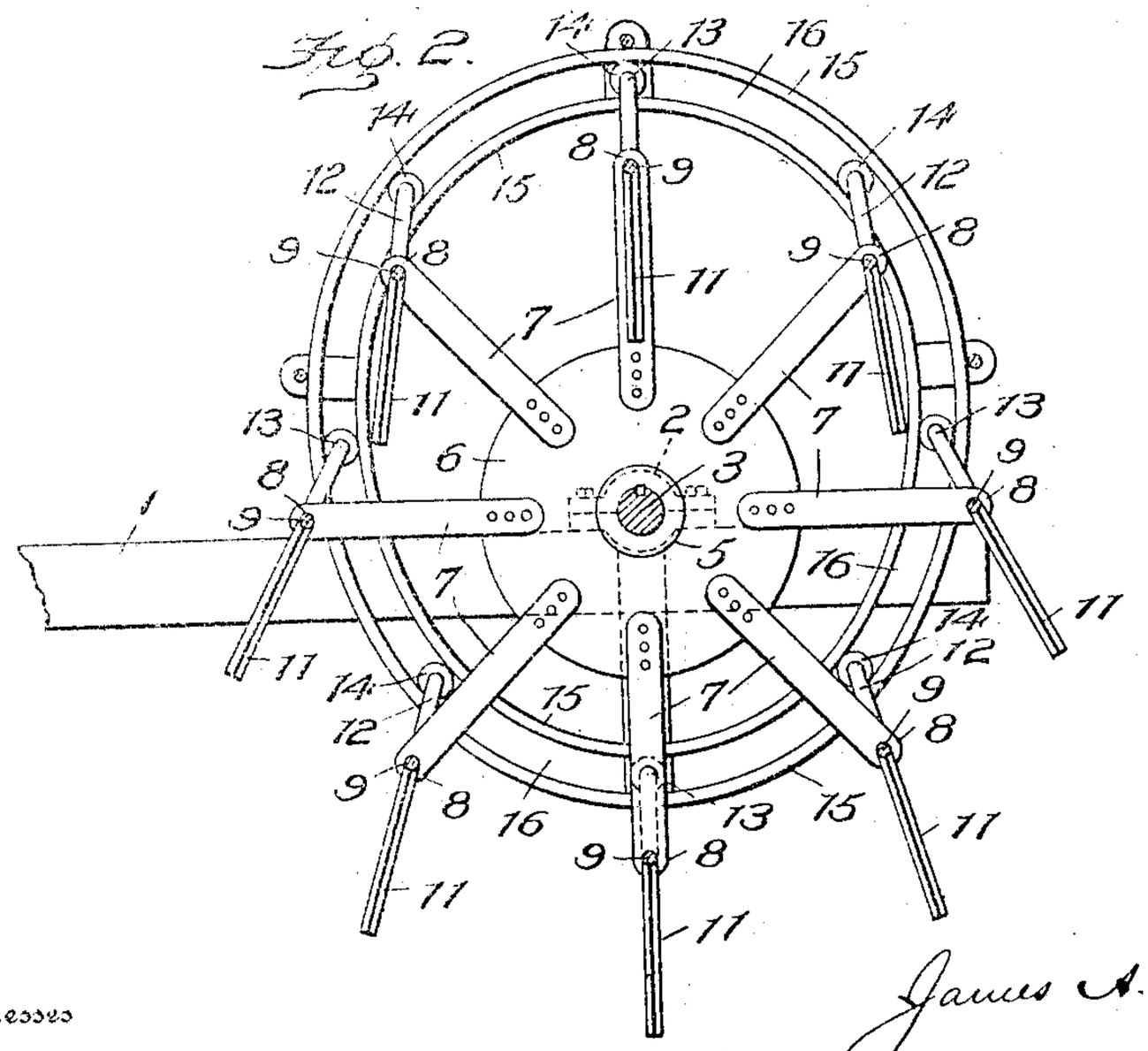


Fig. 2.



Witnesses

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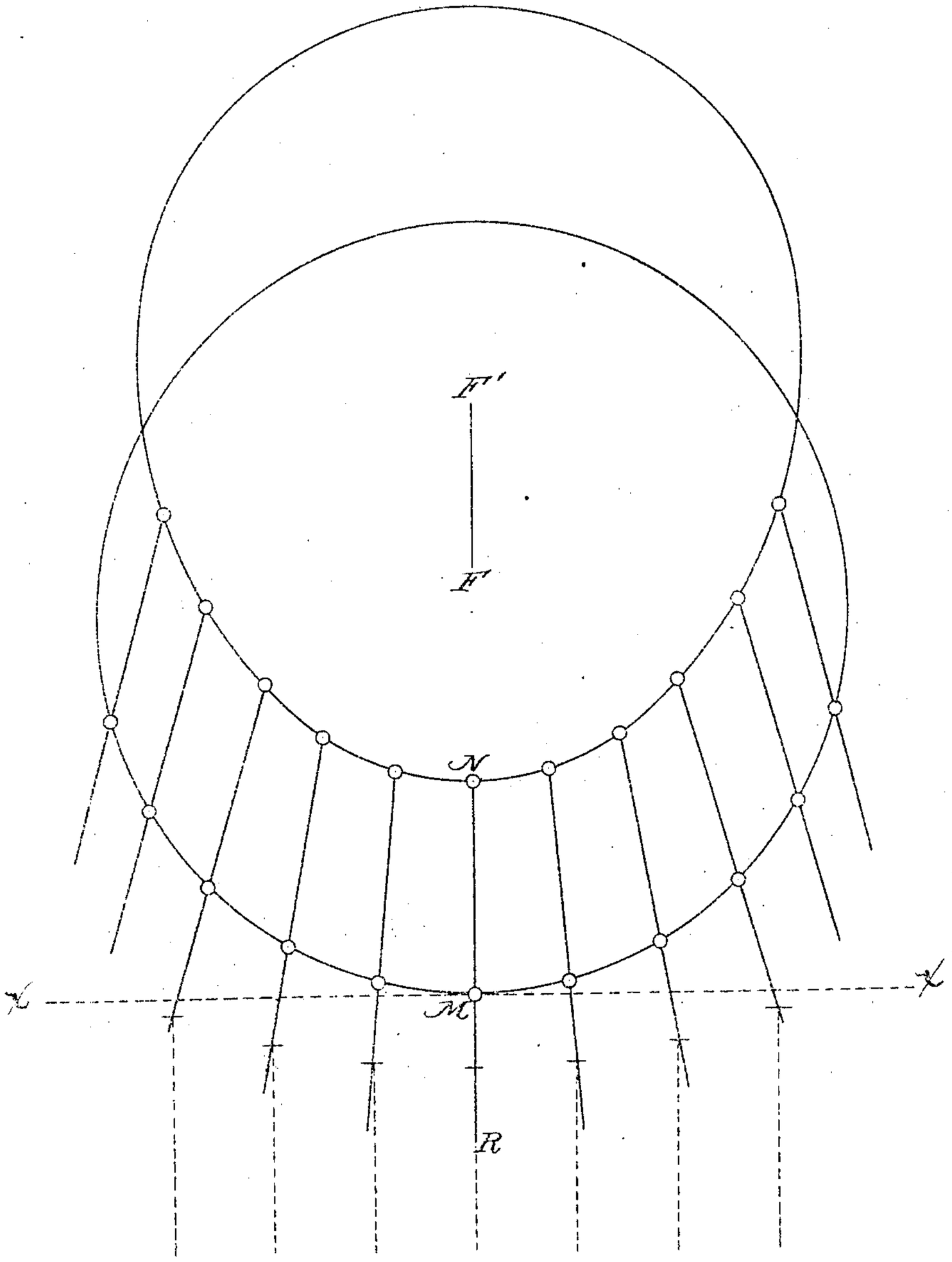
2 SHEETS—SHEET 2.

Fig. 3.



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JAMES AMERS HICKS, OF ATLANTA, GEORGIA.

FEATHERING-BLADE PADDLE-WHEEL.

No. 818,825. Specification of Letters Patent. Patented April 24, 1906.

Application filed September 22, 1904. Serial No. 225,404.

To all whom it may concern:

Be it known that I, JAMES AMERS HICKS, a citizen of the United States, residing at Atlanta, in the county of Fulton and State of Georgia, have invented new and useful Improvements in Feathering-Blade Paddle-Wheels, of which the following is a specification.

My invention has relation to new and useful improvements in paddle-wheels for the propulsion of water-craft, and more especially to paddle-wheels of that character or type in which the paddles or blades are constructed to feather or fold to assume a position of least resistance at such points of their travel as are not effective for the propulsion of the vessel.

Before entering upon a statement of the objects of my invention and a description of its present mechanical embodiment I would state that in my experience I have noted that it is a common fault among the majority of feathering-blade paddle-wheels which have come under my observation that they cannot be effectively revolved at a high speed owing to the troughing or channeling of the water in the path of the wheel incident to the rapid movement of the paddles, so that an increased speed of revolution beyond a certain point does not result in any increased speed of the vessel. This is due to the fact that in the revolution of the wheel the blades at the deepest point of submergence travel at a higher speed than those just entering the water and form a trough or channel which prevents sufficient density of the water in the path of the advance paddles to afford enough resistance to said paddles to render their initial passage into the water effective to propel the vessel.

It has also been demonstrated that under the existing structures when an ordinary speed is being maintained a propelling force is not obtained commensurate to the power expended to drive the wheel, and this difficulty is due to the fact that the paddles which are just entering and leaving the water travel at less speed than those which are at the deepest point of submergence, resulting in a retarding effect upon the paddles which are in position to most effectively propel the vessel.

The purpose of my invention is therefore to overcome the above-stated objections or defects, and the primary object desired to be attained by the mechanical embodiment of the invention to be described hereinafter is to so construct the wheels and paddles associated therewith as to maintain for all of the paddles submerged a mean horizontal velocity which will be uniform for all of the paddles from the time of entering the water to the time of leaving it.

A further object is to construct a feather-blade paddle-wheel in which all of the paddles have a positive propelling force at all points of submergence.

The invention consists in providing in combination with a feathering-blade paddle-wheel means to regulate the movements and positions of the blades with relation to each other, so that at all points of submergence all of the paddles submerged will have a mean horizontal velocity.

I overcome the defects above stated and accomplish the objects mentioned by the structure to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

I have fully and clearly illustrated my invention in the accompanying drawings, to be taken as part of this specification, and wherein—

Figure 1 is a central transverse vertical section through a paddle-wheel embodying my invention. Fig. 2 is a view in front elevation thereof, and Fig. 3 is a diagrammatic view in elevation for the purpose of clearly demonstrating the operation of the paddle-blades in accomplishing the objects of the invention.

Referring to the drawings, 1 1 designate horizontally-disposed supporting-beams upon which the paddle-wheel is mounted for operation. These beams may be of any preferred construction and are rigidly secured at the inner ends thereof to the stern of the vessel, a space being left between said beams in which the wheel is arranged and revolves.

Located upon each of the beams 1 1 is a bearing 2, said bearings being arranged in alinement with each other and of any suitable construction. Journaled in these bearings 2 is a horizontally-disposed wheel-shaft 3, upon which the paddle-wheel is carried. This wheel-shaft 3 is provided at each of its ends with a crank 4, which is connected in any suitable manner to the engine or other

source of power for driving said shaft and revolving the paddle-wheel.

Mounted upon the wheel-shaft 3 at the opposite ends thereof and also at a point approximating its center are hubs or sleeves 5, which are keyed to the shaft in order that they may rotate therewith. Carried by each of these hubs or sleeves and concentric therewith and with the shaft 3 is an annular plate 6, upon which are secured a plurality of radial arms 7, the arms on each plate being arranged in longitudinal alinement with the arms carried by the other plates. At a point adjacent their outer or free ends these arms are provided with horizontally-disposed bearings 8, and passing through said bearings in each alining set of arms is a shaft or rod 9, which is loosely mounted for free rotation in said bearings during the revolution of the wheel.

Rigidly secured to each of the shafts or rods 9 are two paddles or blades 10 11, said blades being arranged, respectively, in the spaces between the center and end plates on the shaft 3, as shown in Fig. 2 of the drawings. The blades or paddles referred to, it will be observed, normally depend in a vertical plane and maintain this position during the revolution of the wheel in order to afford the least resistance to the movement of the wheel, except as hereinafter referred to, when the blades are submerged or are just entering or leaving the water, under which circumstances they are made to successively assume positions whereby they enter, pass through, and leave the water with a mean horizontal velocity common to all—that is, each blade at no matter what point of submersion will travel a given distance in a horizontal direction in a constant lapse of time. The means for giving the progressive movements above mentioned to the paddle-blades will now be described.

At the respective ends of the shafts 9 is rigidly secured an arm or lever 12, which is arranged in longitudinal alinement with the vertical plane of the paddles carried by the shaft. These arms or levers are each provided at their outer ends with an outwardly-projected lateral extension formed to constitute a spindle 13, which has rotatably mounted thereon a roller, which roller travels in a cam-guide during the rotation of the paddle-wheel. The relative movement of the wheel to the guide through the rollers and levers 12 swing said levers to rotate the shafts 9 and move the paddles so that they are feathered or made to assume a position of least resistance when not in effective propelling position. The peculiar construction or form of this cam-guide is the means employed for regulating the positions of the blades to give to them a mean horizontal velocity at all points of submersion. As shown in the drawings, this cam-guide 15 comprises a vertically-arranged curved continuous track, one being preferably arranged at each end of the wheel, disposed eccentrically to the axis of the shaft 9 and paddle-wheel, the center of the guide being located above the center of the wheel, and said guides being formed on their inner faces with a groove 16 to receive the rollers 14, and in which said blocks travel during the rotation of the wheel. These guides at their upper part are formed on the arc of a circle and at its lower portion is approximately an ellipse, the elliptical portion being merged with the arc by an irregular curve to avoid abrupt curvature. The essential feature of this cam-guide resides in that part of the guide formed as an ellipse which controls the blade when submerged. This elliptical portion is the part of an ellipse described as follows, especial reference being had to Fig. 3 of the drawings. The foci are on a vertical line passing through the center of the wheel-shaft, one focus being at a distance from the lowest point of the wheel equal to twice the length of the lever-arm, the other focus vertically distant a length which varies inversely with the mean depth of submergence of the paddle-blades, the radii vectores shall in sum be equal to the above-stated focal distance increased by twice the difference of distance between the radius of the wheel and the length of the lever-arm.

Illustrating the above statement, with particular reference to Fig. 3, F is the lower focus and F′ the upper focus, F F′ being the focal distance. M is the lowest point of the wheel. M N is the lever-arm, and M R is the paddle width. F F′ − 1 − mean submergence, the latter being about .7 inch in an ordinary wheel of this construction. Hence F F′ = $\frac{1}{7}$ = 1.4 + and the radii, vectores distance from F′ and F to N = F, N + F N. It will therefore be seen that as the paddles are swung on their pivots by the lever-arms engaging the elliptical portion of the cam-guide that the lever-arms will be swung such a distance that the mean point of submergence of each paddle (the mean point being midway between the surface of the water and the lower edge of the blade) will be so positioned that said mean points of all paddles will be equidistant from each other, and as the mean points travel the same distance in a horizontal direction in the same period of time it of course follows that all of the paddles at their mean point of submergence travel in a horizontal line at the same velocity.

In Fig. 3 I have indicated by dotted line *x* the mean progressive movement of the paddles as M moves from point to point in the revolution of the wheel.

The paddle-wheel constructed as above described will be found to effectively attain the objects in view and which can be run in shallow water at a greater degree of speed than

any now known to me, without any loss of power incident to the troughing, splashing, and lift of the water.

What I claim is—

1. The combination with a wheel, pivotally-mounted blades carried thereby, each blade having a member connected thereto, and means engaging the members during the rotation of the wheel to move said members to progressively swing said blades on their pivots in such a manner that all of the blades submerged travel at the same mean velocity at all points of submergence.

2. The combination of a wheel, pivotally-mounted blades carried thereby, a lever-arm connected to each blade and means for actuating said arms to swing the blades on their pivots so that all of the blades submerged travel at the same mean velocity at all points of submergence, said means consisting of a cam engaging said lever-arms, said cam having an elliptical portion the foci of which are on a vertical line passing centrally through the wheel-shaft, one focus being distant from the lowest point of the wheel twice the length of one of the lever-arms, the other focus being vertically distant a length varying inversely with the mean depth of submergence of the paddle-blades, the radii vectores being in sum equal to the focal distance increased by twice the difference of the distance between the radius of the wheel and the length of the lever-arm.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES AMERS HICKS.

Witnesses:

M. L. CLIFTON,

F. H. HILL.