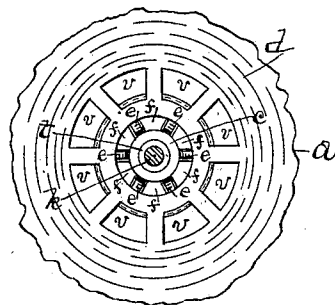
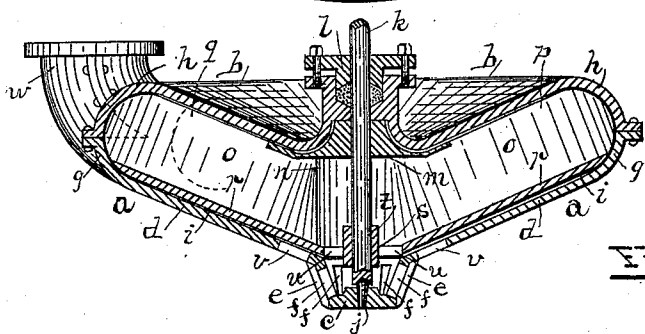
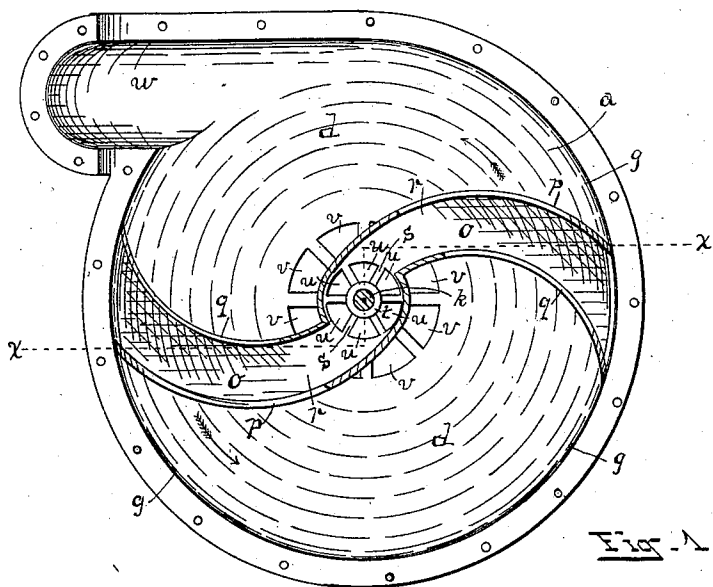


(No Model.)

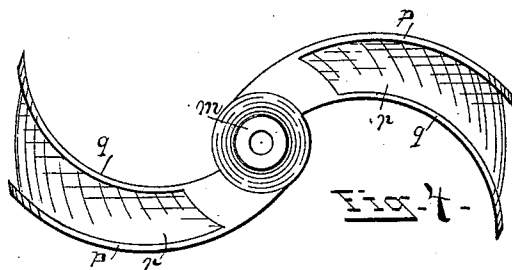
J. J. FORCIER.
CENTRIFUGAL PUMP.

No. 406,394.

Patented July 2, 1889.



ATTEST:
G. P. Thomas
S. C. Hay.



INVENTOR:
Joseph J. Forcier
By
G. P. Thomas
Att'y.

UNITED STATES PATENT OFFICE.

JOSEPH J. FORCIER, OF BAY CITY, MICHIGAN, ASSIGNOR OF ONE-HALF TO CHARLES B. CURTIS, OF SAME PLACE.

CENTRIFUGAL PUMP.

SPECIFICATION forming part of Letters Patent No. 406,394, dated July 2, 1889.

Application filed January 2, 1889. Serial No. 295,118. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH J. FORCIER, a citizen of the United States, residing at Bay City, in the county of Bay and State of Michigan, have invented certain new and useful Improvements in Centrifugal Pumps; 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 and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in rotary pumps of the class in which the water is driven upward by the centrifugal force exerted thereon by rapidly-revolving radial arms, and also of the class in which the centrifugal force is applied to water by means of hollow radial arms, through which the water passes from the center to the periphery of the circle in which the arms move.

The first part of my invention consists in the formation and construction of the hollow radial arms, with the object of obtaining a greater suction and delivery power from the pump.

The second part of my invention consists in the formation and construction of the casing and hollow radial arms and in the combination of the parts, the object being to produce the combined effect of exerting the centrifugal force upon the water through the means of the hollow radial arms, and also by the action of the more common rotary paddles. And a further object of my invention is to apply the centrifugal force to propel the water partially in an upward direction as it passes from the center of the casing to the discharge-pipe, and to provide a more direct and easy lifting action upon the water as it passes through the pump.

The devices I employ to attain these objects are illustrated in the accompanying drawings, in which—

Figure 1 represents a plan view of my improved pump with the upper portion of the casing removed and partly sectional. Fig. 2 is a vertical section of the same, taken across the dotted line at *x x*. Fig. 3 is a plan view of the central part of the lower portion of the

casing. Fig. 4 is a plan view of the radial arms removed from the casing.

Throughout the several views the same letters of reference are used to indicate similar parts of the device.

a is the lower horizontal portion or section of the casing, and *b* is the upper section thereof, each section being provided with suitable outwardly-projecting flanges or lugs for securing the parts together by bolts or rivets. The central portion *c* of the lower section *a* is depressed considerably below the lateral portion *d* thereof, and is supported by and held to the portion *d* by the ribs or bars *e*, which stand nearly vertical, and between the bars are formed the inlet-openings *f*, the size of which can be regulated by their vertical length, so that their radius need not be increased to enlarge their area.

For a purpose hereinafter explained, the disk portion *d*, which surrounds the central portion *e* of the casing, is made funnel-shaped or sloping upwardly from the center to the outer rim *g* thereof at a suitable angle, and the upper portion *b* is provided with a corresponding sloping form, with a rim *h* turned downwardly to meet the upturned rim *g*, to which it is secured by bolts or rivets, as before described, and forming a circular inclined chamber *i* between the sections, with the outer portion of the chamber considerably higher than its central portion.

The depressed portion *c* is provided with a pin *j*, passed through and projecting above the part *c*, and upon the pin *j* rests the lower end of a vertical shaft *k*, which extends upwardly through the packing-box *l*, with which the upper section *b* is provided, and to the upper portion of the shaft is attached suitable means for imparting a rotary movement thereto.

m is a hub mounted upon the shaft within the chamber *i*, the central portion of the section *b* being raised to properly receive the hub, so that the space below the hub will be entirely open for a free flow of the water; and *n* is a central barrel or chamber below the hub and preferably cast integral therewith, and projecting outwardly from the chamber *n* are arranged two or more hollow curved arms *o o*. These arms are formed of the front side

p, starting in a tangent from the circle of the barrel *n* and extending upwardly and rearwardly in a curved line to the outer rim of the chamber *i* and the rear side *q*, which is projected from the barrel *n* at a suitable distance in rear of the side *p* and extends in a curved line to the outer rim of the chamber, the space between the sides *p* and *q* increasing as the outer ends thereof are reached; and *r* is a bottom plate which extends across and closes the space between the lower edges of the sides *p* and *q* from the barrel *n* to the rim of the chamber, and the upper edges of the sides *p* and *q* run close to the upper section *b*, the slope of the sides of course being arranged to conform to the slope of the chamber, and the bottom portion *s* of the barrel is provided with a lower hub *t* and an opening for the shaft *k*, and surrounding the hub are formed a series of induction-openings *u* for the admission of the water to within the arms, and through the bottom *d*, just outside of the periphery of the barrel *n*, is formed a series of induction-openings *v*, for the admission of the water to the chamber *i* outside of the arms.

w is an eduction opening or pipe, which is connected with and opens out of the periphery of the casing-sections *a* and *b*, and is preferably, as shown, so arranged as to cast integral therewith the outer side of the pipe, starting with a tangent of the periphery of the sections, and is turned slightly to a perpendicular line and arranged for connecting in any suitable manner other pipes thereto.

The operation of the device is as follows: The pump is preferably submerged, or at least partly submerged, and power is applied from any suitable source to revolve the shaft *k* and arms *o* in the direction of the arrows shown in Fig. 1; and the revolution of the arms, on account of their backwardly-curved and upwardly-inclined form, causes the water therein to pass, by means of the centrifugal force exerted thereon, outwardly and upwardly and into the eduction-pipe *w*, the water from the outside passing through the induction-openings *f* in the sides of the depressed portions *c* and through the openings *u* into the barrel or chamber *n*, and thence into the arms *o*, to supply the vacuum formed by the displacement or ejection of the water from the arms. In the meantime the water within the chamber *i* is also subjected to a similar action, the rearwardly-curved form of the front sides of the arms *o* operating to move the water within the chamber outwardly and upwardly into the eduction-pipe *w* as the arms pass the pipe-opening, the water outside of the shell passing into the central portion of the chamber through the induction-openings *v*, to supply the vacuum formed by the ejection of the water within the chamber.

It will be seen that by means of the hollow arms a combined or double action is held whereby the water is forced both through the arms and through the angular chamber, the

action of the two systems being to produce a freer and easier flow of water with the same revolutions of the arms, while the incline of the angular chamber and arms obtains a movement of the water in a more direct perpendicular line and at the same time secures the lifting action of the centrifugal force of the revolving arms, so that an easier and freer action of the rotary arms is obtained while the volume of water acted upon is increased.

It will be observed that the distance between the sides *p* and *q* of the arms gradually widens as the outer ends thereof are reached, so that a free and easy exit of the water from the arms is obtained and the suction through the injection-openings is rendered stronger and more efficient, so that a tendency to retain the water within the arms during one or more revolutions of the arms is avoided, the width of opening at the free ends of the arms allowing the centrifugal force to act with its full capacity upon the water until it is forced by the rearward curve of the side *q* into the eduction-pipe.

It will be observed, of course, that the two systems are entirely separate and distinct from each other, although they are contained in one inclosure, the water passing through the central induction-openings without coming in contact or interfering with the water which passes into the outer induction-openings to the chamber *i*, so that a perfect uniformity of action is obtained, producing a combined result of the two systems. Another and great advantage is gained in the construction of the lower casing-section with the depressed portion *c*, as the openings *f* may thereby be made of a sufficient size to admit the required amount of water directly at the center of the section, while a space is provided between the openings in the casing and the openings in the bottom *s* of the barrel, which precludes any possibility of the entrance of the water being shut off by the rapid revolution of the arms should the openings be located near to or directly over each other.

Although I have described and shown, as a preferred form of construction, the barrel *n* as provided with a bottom portion *s*, with openings *u* for the admission of water thereto, and as having a hub *t* to assist in supporting the arms upon the shaft *k*, I do not confine my invention entirely to this form of construction, as the bottom *s* and the hub *t* could be omitted and the arms supported by the hub *l* only, and then a free opening would be left in the bottom portion of the barrel instead of the series of openings *u*, and the operation of the device would be the same.

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

1. In a centrifugal pump, the combination, with the casing having the upper and lower sections inclosing a horizontal circular cham-

ber, having the portions surrounding the center of the said sections inclined upwardly to its peripheries, and provided in the central part of its lower section, as described, with two series of induction-openings and an eduction-pipe leading from the periphery of the casing, of the rearwardly-curved upwardly-inclined arms within the chamber and each provided with a longitudinal opening of greater area at their outer ends than at their inner ends, and projecting outwardly from a central barrel having in its lower portion induction-openings, and mounted upon a shaft passing through the upper section of the casing, substantially as and for the purpose set forth.

2. In a centrifugal pump, the combination, with a casing inclosing a circular chamber and having upper and lower disks inclined from the center upward to their peripheries, and

having the central portion *c* of the lower disk depressed and provided with side openings *f*, and the openings *v* in the lower disk *d*, around the depressed portion *c*, and having the eduction-pipe *w*, the shaft *k* passed downwardly, through the center of the chamber, the barrel *n*, provided with the upper hub *m* and lower hub *t*, mounted upon a shaft, and having the induction-openings *u*, of the upwardly-inclined rearwardly-curved hollow arms *o*, projecting laterally from the sides of the said barrel *n*, substantially as and for the purpose set forth.

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

JOSEPH J. FORCIER.

Witnesses:

JAS. E. THOMAS,
CHAS. B. CURTISS.