No. 731,095. PATENTED JUNE 16, 1903.

E. W. BROOKS.

CENTRIFUGAL PUMP.

APPLICATION FILED APR. 17, 1903.

NO MODEL.

Fig. 4.

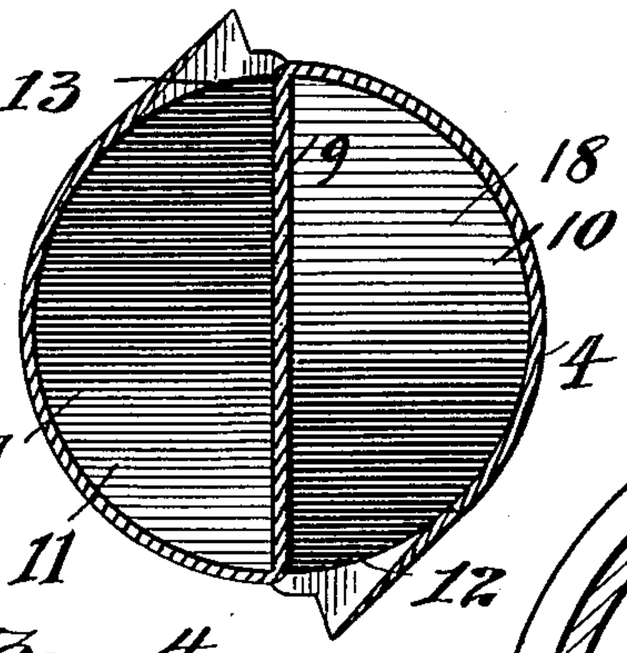


Fig. 2.

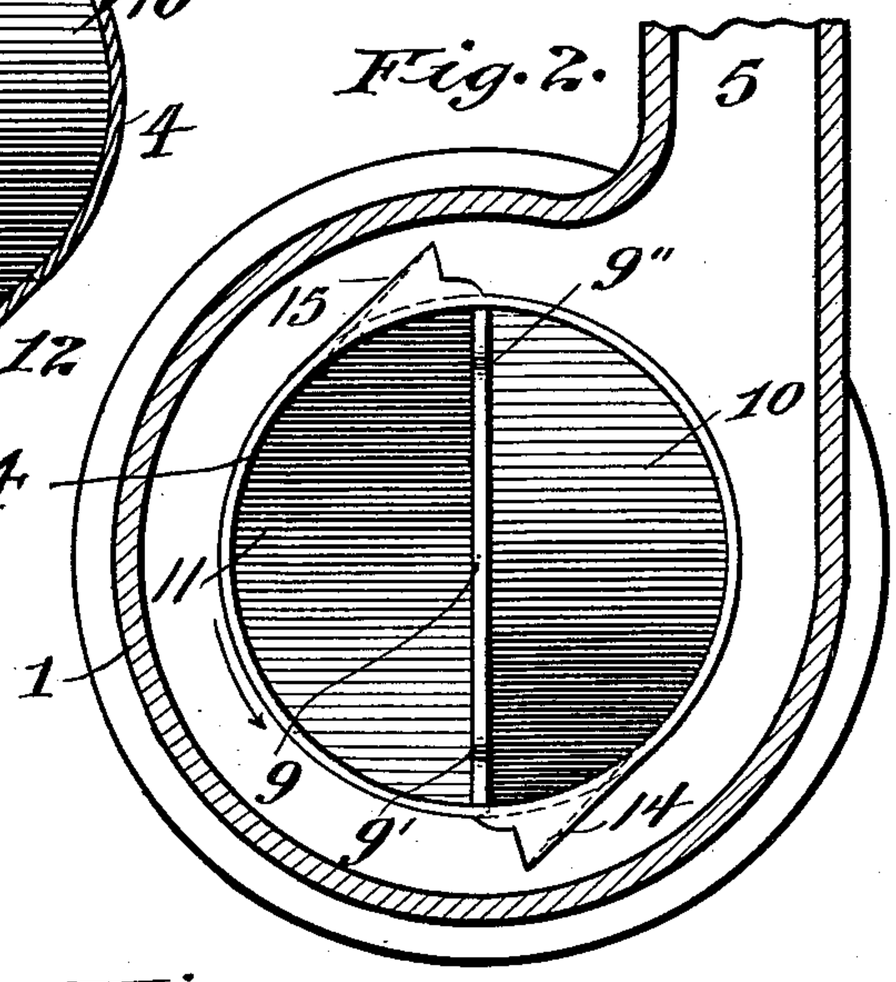


Fig. 3.

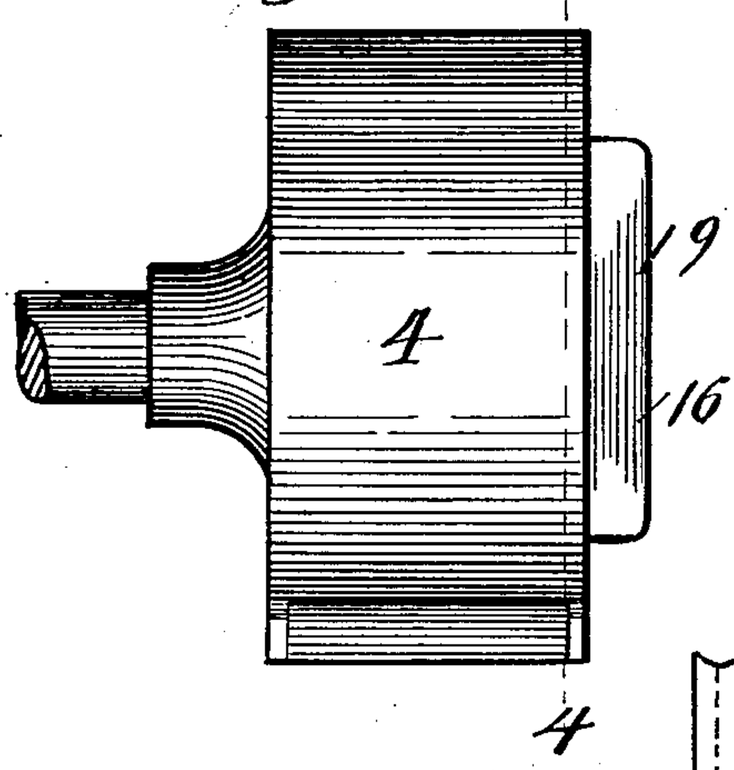
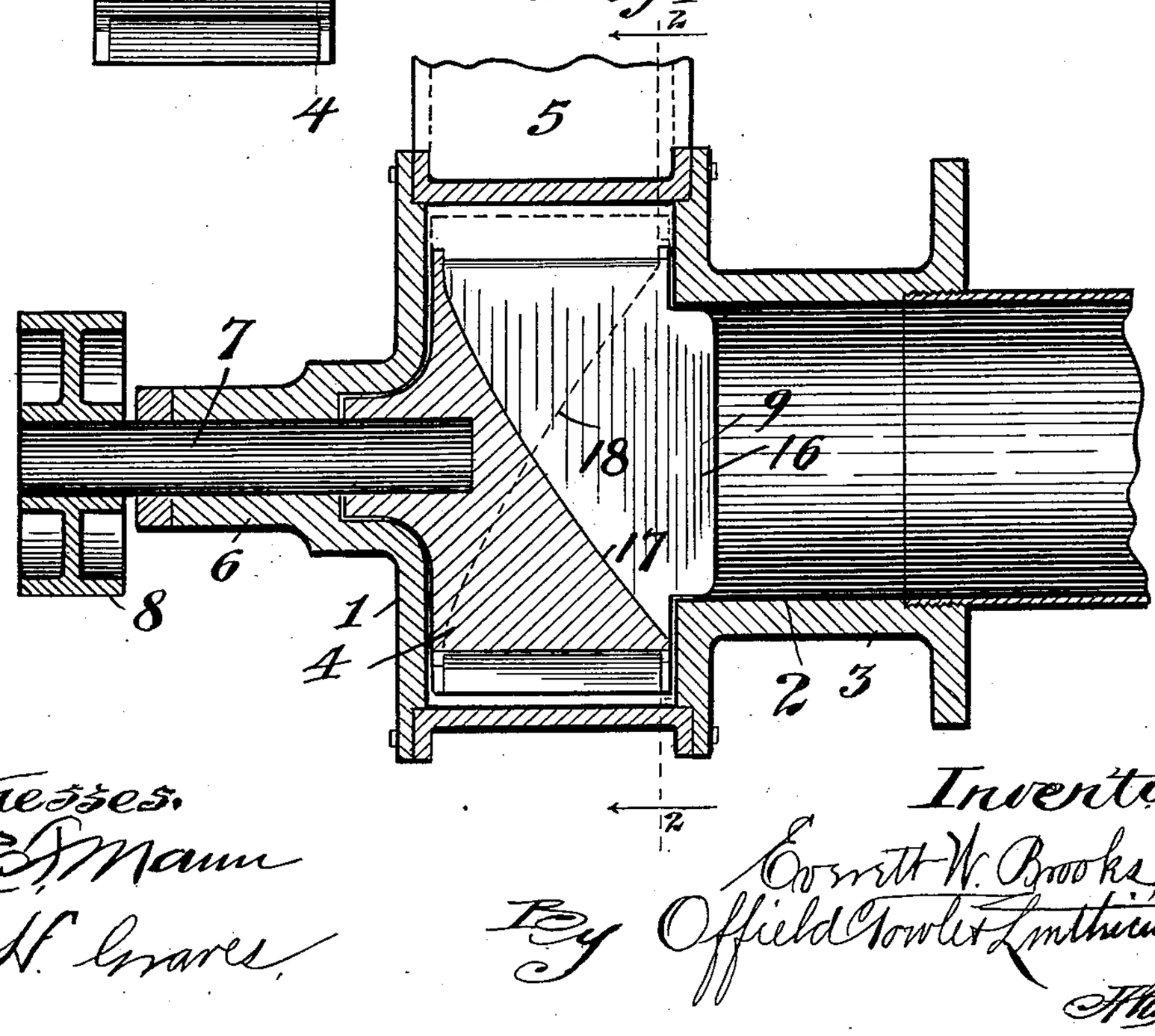


Fig. 1.



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No. 731,095. Patented June 16, 1903.

UNITED STATES PATENT OFFICE.

EVERETT W. BROOKS, OF CHICAGO, ILLINOIS.

CENTRIFUGAL PUMP.

SPECIFICATION forming part of Letters Patent No. 731,095, dated June 16, 1903.

Application filed April 17, 1903. Serial No. 153,086. (No model.)

To all whom it may concern:

Be it known that I, EVERETT W. BROOKS, a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Centrifugal Pumps, of which the following is a specification.

This invention relates to improvements in centrifugal pumps, and refers more specifically to that type of centrifugal pumps in which the rotary piston is in the form of a hollow shell provided with internal pallet-blades.

The salient object of the invention is to provide a construction having a greater lifting or suction efficiency and also more economical of power, this object being attained by making the interior of the piston conform more exactly to the natural shape of the streams of liquid flowing through the piston under the influence of the impelling forces. Secondary objects of the invention are to provide improved details of construction contributing to the cheapness of manufacture, strength, and durability of the pump.

To the above ends the invention consists in the matters hereinafter described, and more particularly pointed out in the appended claims.

The invention will be readily understood by reference to the accompanying drawings, in which—

Figure 1 is an axial sectional view of the pump embodying the invention. Fig. 2 is a transverse sectional view taken on line 2 2 of Fig. 1 and looking in the direction of the arrows. Fig. 3 is a side elevation of the piston. Fig. 4 is a transverse sectional view thereof, taken on line 4 4 of Fig. 3.

Referring to the drawings, 1 designates a suitable and generally cylindric casing provided at one end with an axially-disposed inlet 2, formed through a tubular extension 3. The axial length of the casing substantially corresponds to the length of the main body of a piston 4, and at one side said casing is provided with an outlet 5, which is preferably tangentially disposed and is of an axial length equal or approximately equal to the axial length of the main body of the piston.

The piston 4 is a hollow substantially cylindric shell mounted concentrically within the casing 1 and in axial alinement with the inlet 2 of the casing, the casing to this end being provided with a journal extension 6, through which extends a shaft 7, upon the inner end of which is supported the piston. At its outer end the shaft is provided with a drive-pulley 8. The piston is provided internally with one or more pallet members, in the present instance a single pallet member 9 being provided, which extends diametrically across and longitudinally of the piston and completely partitions the latter into two compartments 10 and 11. The single pallet member 9 forms, functionally, two pallet-blades 9′ and 9″, united at their inner edges at the axis of the piston. The piston is provided with peripheral outlets 12 and 13, respectively located coincident with the advance or impelling surfaces of the two pallet-blades and being in the form of slots, which extend throughout substantially the full peripheral length of the piston. Preferably the cylindrical walls of the piston are deflected outwardly at the advance sides of the outlets 12 and 13, as indicated at 14 and 15, respectively, thus forming lips which extend toward the inner cylindric wall of the casing and impart to the outlets a rearward and tangential direction. The combined outlet area of the two piston-outlets 12 and 13 is made substantially less than the area of the inlet-passage 2. In order that the fluid entering the piston may more quickly pass within the influence of the pallet member, the latter is provided with an extension 16, which extends within the inlet-passage 2 and is of a diametrical width approximately equal to the diameter of said inlet-passage.

The liquid entering the axis of the piston to the two compartments 10 and 11 is deflected radially outwardly and at the same time pursues a helical or spiral path as it progresses through the piston. It follows that certain portions of the inner end of the piston (if made cylindric) will not be occupied by the body of water passing through the piston, and accordingly such place is filled or partitioned off from the main interior of the piston, so that the rear end of the piston conforms in shape approximately to the surface configuration of the rear or advancing sides of the two streams passing through the piston.

17 and 18 respectively designate such rear

end walls, each of which, as best seen in Fig. 1, extends from a point where the rear side of the pallet-blade meets the peripheral wall of the piston at the forward or receiving end of the latter obliquely across to the rear end of the piston at the end of the peripheral outlet of that compartment, the faces of said walls being curved rearwardly or concavely, as shown clearly in the drawings. The interior of the piston in rear of the respective walls 17 and 18 may be either solid or hollow, as preferred, but when made solid, as shown, forms additional support for the shaft 7.

The operation is as follows: Liquid entering the pump is subject to two impelling forces—namely, atmospheric pressure induced by the exhaust action of the pump, which would alone tend to cause the liquid to flow in direct lines axially through the pump, and centrifugal force, which deflects the liquid and tends to cause it to flow out in a direction at right angles to the axis of rotation. These two forces acting together, it follows that the resultant lines of force will be curved lines, which extend parallel with the axis at a point of no rotation and diverge more and more from the axis as they approach the periphery of the piston. It follows that the liquid if unguided mechanically will pursue these lines of force; but it will be of course understood that the flow of liquid is not directly through the pump, but in spiral paths, since it is rotating with the piston during its flow therethrough. Those portions of the incoming liquid which enter at and near the axis of rotation will take up the action of the piston relatively slowly and will therefore travel through the piston axially along a relatively long distance or pursue a relatively flat curve. This curved path or resultant will also be a curve of constantly-increasing angle, since the liquid will constantly be accelerated. Such portions of the liquid as enter the piston most remote radially from the axis will obviously acquire a high speed of rotation much more rapidly than that entering at the axis and will therefore be deflected upon a much more abrupt or sharper curve, so that the two extreme resultants will be divergent from each other. It follows that the piston to be most effective must have a zone of discharge wide enough, measured axially of the piston, to substantially include these two extreme resultants. Nevertheless, while the zone of delivery should be wide the total area of the outlet of the piston should be restricted to correspond to the difference in velocities of the liquid obtaining at the point of entrance to the piston and the point of discharge therefrom.

The general construction and arrangement of the pump herein described are similar to that shown and described in a prior pending application filed by me September 25, 1901, Serial No. 76,517; but in said prior application the piston, as shown, is substantially cylindric internally and is not provided with the inclined end walls 17 and 18, described herein. I have found in practice that the improved construction shown herein possesses a higher efficiency as measured by units of power expended in lifting a given quantity of liquid to a given height, and I have further found that the present construction is capable of sucking up or lifting the liquid to a higher level as regards the suction side of the pump. While I am unable to determine precisely why these improved results are secured, I attribute the greater economy, in part at least, to the avoidance of eddying currents and molecular friction within the piston by providing the curved rear end walls, which conform substantially to the shape of the stream flowing through the piston, and I attribute the great suction or lifting efficiency to the fact that with this construction of piston the streams of liquid flowing through the piston more perfectly occupy and seal the piston against backflow of air.

It will be obvious that the features of improvement constituting the present invention may be embodied in other modifications of the pump, and I do not, therefore, limit myself to the details shown and described herein, except to the extent that they are made the subject of specific claims.

I claim as my invention—

1. In a centrifugal pump, the combination with a suitable casing, of a hollow rotary piston having an axial inlet, one or more internal pallet members and peripheral outlets distributed or extending over an axial length of the piston substantially comprehending the divergent angles of delivery of the liquid induced by the impelling forces, the end wall portions of said piston opposite the axial inlet being curved to substantially conform to the resultant lines of delivery at that end of the piston.

2. In a centrifugal pump, the combination with a suitable casing, of a hollow rotary piston having an axial inlet, one or more internal pallet members whereby the interior of said piston is divided into compartments, and slot-shaped peripheral outlets extending axially of the piston and each of a length to substantially comprehend the resultant divergent angles of delivery of the liquid induced by the impelling forces, the end wall portions of the piston opposite the axial inlet thereof being arranged to extend as to each compartment obliquely from a point adjacent to the receiving end of the piston and at the periphery thereof to a point coincident with the end of the slot pertaining to said compartment remote from the receiving end, for the purpose set forth.

3. In a centrifugal pump, the combination with a suitable casing, of a hollow rotary piston, externally of substantially cylindric form and provided with an axial inlet, a pallet member dividing the interior of said piston diametrically and longitudinally into two compartments, slot-shaped peripheral outlets located coincident with the advance surfaces

of the opposite sides of said pallet member and obliquely-disposed concavely-curved internal end walls, one for each of the two compartments of the piston, each said end wall extending from a point approximately coincident with the junction of the pallet member with the periphery of the piston at the receiving end thereof, and diametrically remote from the outlet-slot, to a point coincident with the end of the slot for that compartment remote from the receiving end of the piston substantially as described.

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