No. 704,756. Patented July 15, 1902.

F. RAY.

CENTRIFUGAL PUMP RUNNER.

(Application filed Aug. 3, 1901.)

(No Model.)

Fig. 1.

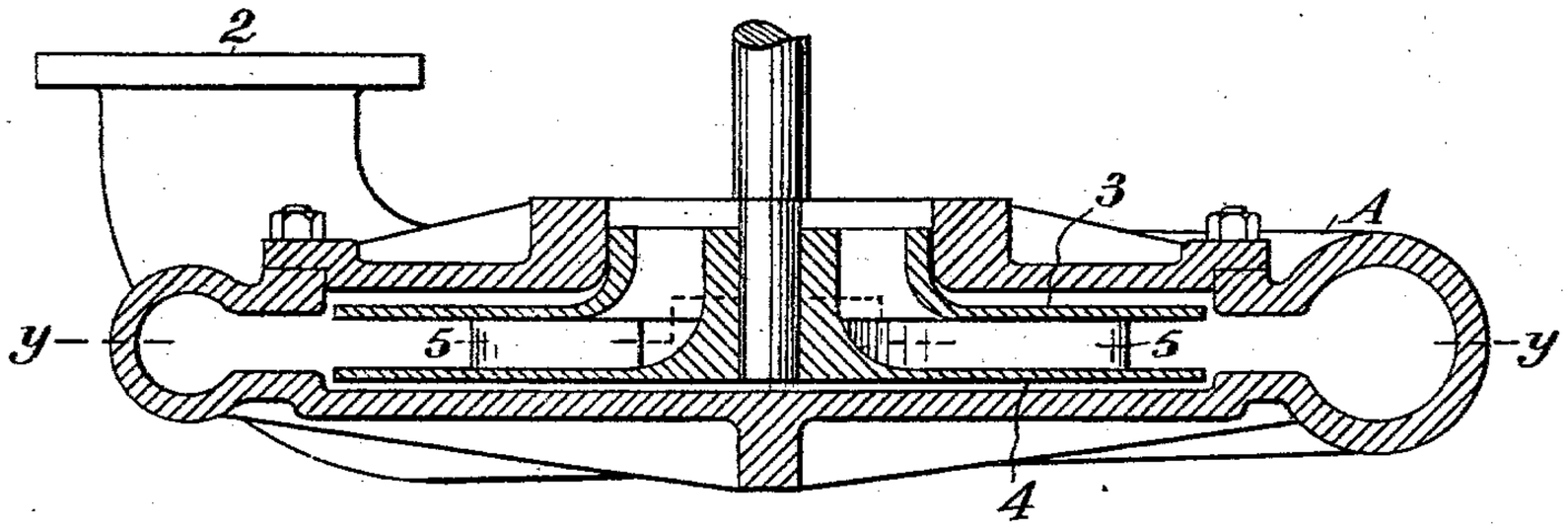
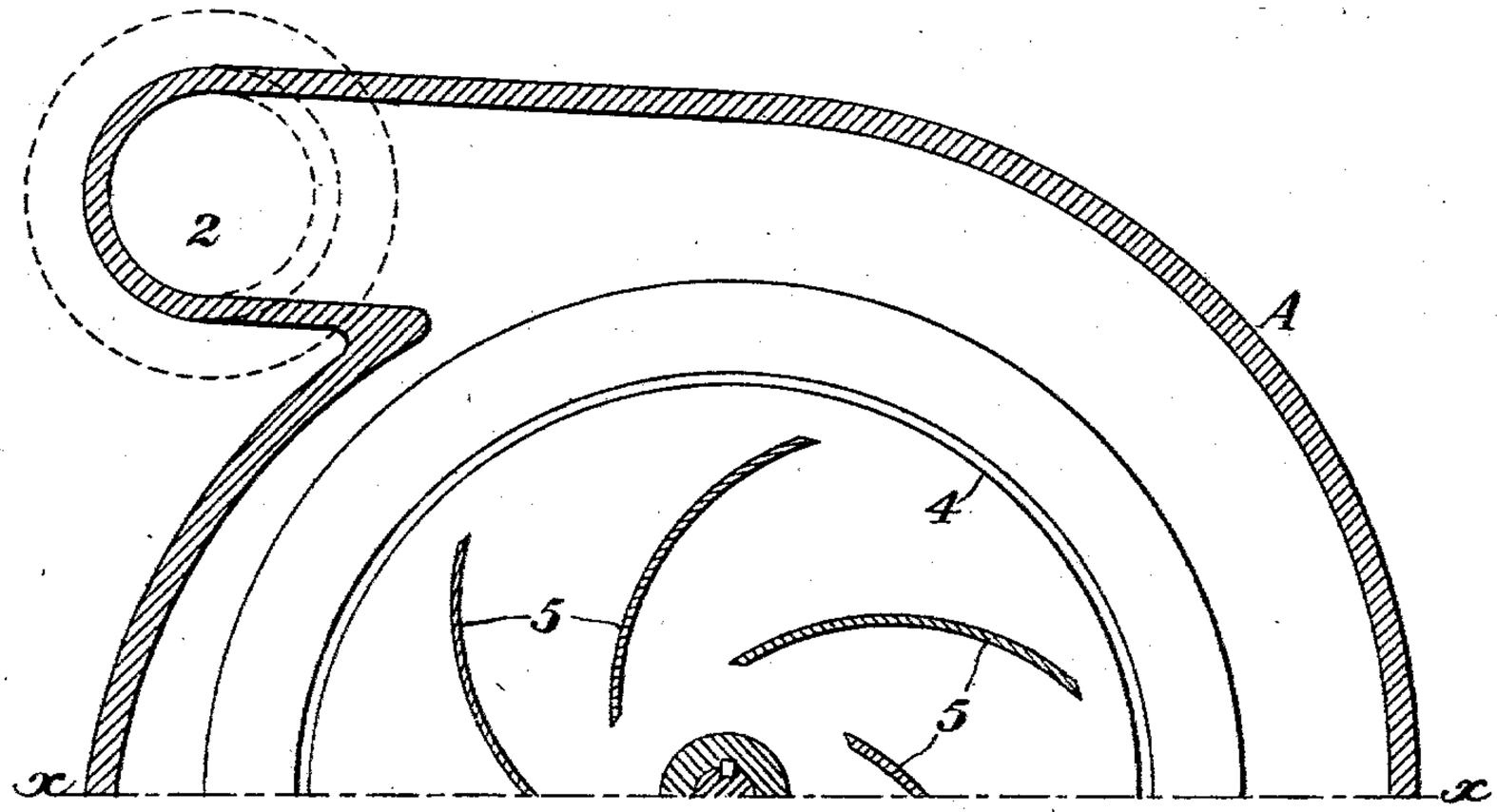


Fig. 2.



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FREDERICK RAY, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR OF ONE-HALF TO JAMES SPIERS, JR., OF SAN FRANCISCO, CALIFORNIA.

CENTRIFUGAL-PUMP RUNNER.

SPECIFICATION forming part of Letters Patent No. 704,756, dated July 15, 1902.

Application filed August 3, 1901. Serial No. 70,729. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK RAY, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented an Improvement in Centrifugal-Pump Runners; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to improvements in centrifugal-pump runners of the class known as the "closed" type.

It consists in forming the runner with the upper and lower disks having a diameter such as to provide for proper clearance and radial vanes interposed between said disks and having a radial extent less than that of the disks.

The accompanying drawings illustrate the device.

Figure 1 is a vertical section of my invention, taken on the line *x x*, Fig. 2. Fig. 2 is a half horizontal section on the line *y y*, Fig. 1.

In the designing of standard centrifugal pumps it is desirable to use the same patterns for any given size of pumps without reference to the head against which the pump is to be used, and in carrying a stock of pumps it would be impossible to provide for every possible different head. It is therefore desirable to have each size of pump so constructed that it is suitable for any head within reasonable limits with the least possible modification. It is also desirable that its efficiency should be as near the same under all conditions as possible.

The quantity of water which any pump would economically handle is arrived at by considering the first cost of the pump and the subsequent cost of running it per unit of water pumped. This quantity is then the maximum that the pump can handle for the least cost, and for any one pump this is evidently about the same for any head. It can be mathematically proven that the least loss will occur when the velocity of whirl of the water in the outer edge of the vortex-chamber where it joins the volute is double the velocity in the volute. Hence the velocity or the tangential component of the true velocity of the water in the outer edge of the vortex-chamber is fixed. Considering the sides of this vortex-chamber as parallel, the velocity of whirl will vary in it inversely as the distance from the center. Therefore if a certain tangential velocity of the water is desired in order to pump against any head all that is necessary is to cause that certain tangential velocity to occur at the proper distance from the center by making the vanes of the proper length relative to the diameter of the runner and revolving them fast enough to produce the desired result.

If the whole runner were made of a diameter only equal to the length of the vane, there would be a large mass of water occupying the space exterior to the runner, and water would thus be discharged directly into this mass, and its energy would thus be absorbed and lost.

By extending the disks beyond the ends of the vanes, so that they run close to the interior of the casing with sufficient clearance, we avoid this difficulty.

As shown in the drawings, A is the exterior casing of a pump of this description, having a discharge, as shown at 2.

3 and 4 are the upper and lower disks of the runner, having a diameter sufficiently less than the interior of the casing where they run to give the necessary clearance. The vanes 5 radiate from the center toward the periphery between these disks and are here shown as in the form of curved segments. These vanes form a circle of less diameter than that of the periphery of the disks, the object being to enable the manufacturer to so construct the pumps that they are suitable for any given head within reasonable limits without essential change. I extend the sides beyond the ends of the runner to obtain a uniform passage-way. If I cut the whole runner down, the space occupied by the first runner beyond the circumference of the cut-down runner is of different width from the stream, causing first a sudden decrease of velocity and then a sudden increase as the stream enters the vortex-chamber. As I desire to avoid all unnecessary changes of velocity, I extend the sides of the runner until they are in close proximity to the opening into the vortex-chamber, thus obtaining a continuous passage of uniform width; but it is the uniform system of changing the lengths of the vanes in a ratio inverse to the square root of the head against

which the pump works, while leaving the sides of the runner of the same diameter suited to the casing of the pump, that I consider as the essential feature of my invention.

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

1. The combination in a centrifugal pump of a runner composed of separated disks having a diameter approximately that of the interior of the casing within which they revolve and radial vanes fixed between said disks, said vanes being shorter than the distance from the center to the periphery of the disks.

2. The combination in a centrifugal pump of a casing with suction and discharge passages, a closed runner revoluble within said casing, said runner consisting of radial vanes of less peripheral diameter than the interior of the casing, and disks fixed in parallel planes upon each side of the vanes, said disks having a diameter equal to the interior diameter of the casing less clearance.

In witness whereof I have hereunto set my hand.

FREDERICK RAY.

Witnesses:
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