A. Duvall,

Centrifugal Pump.

No. 45,398. Patented Dec. 13, 1864.

Fig. 3

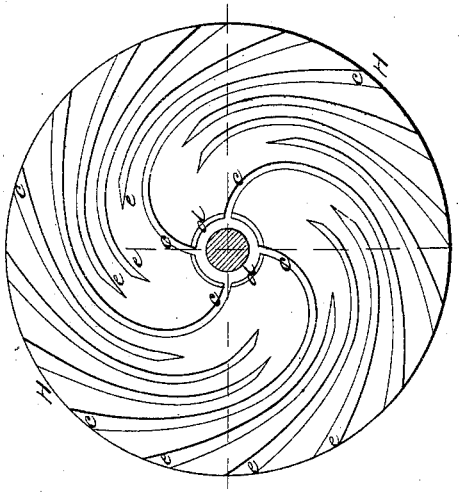


Fig. 4

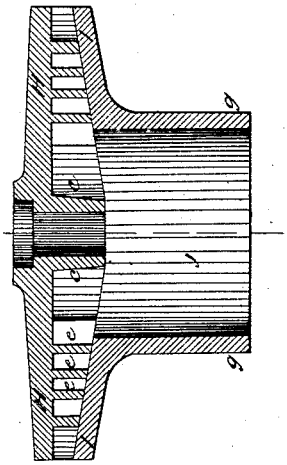


Fig. 1

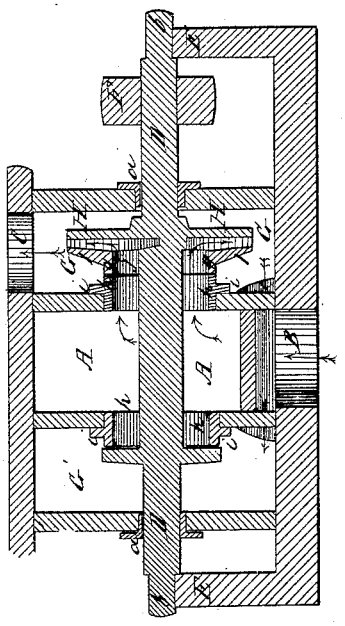
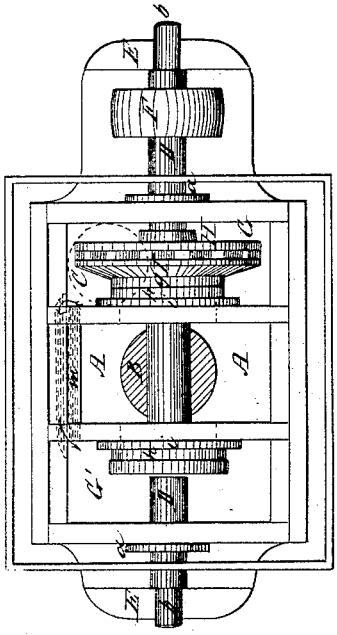


Fig. 2



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UNITED STATES PATENT OFFICE.

ALFRED DUVALL, OF BALTIMORE, MARYLAND.

IMPROVEMENT IN PUMPS.

Specification forming part of Letters Patent No. **45,398**, dated December 13, 1864.

To all whom it may concern:

Be it known that I, ALFRED DUVALL, of Baltimore, in the county of Baltimore and State of Maryland, have invented certain new and useful Improvements in Centrifugal Pumps; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 represents a vertical and longitudinal central section through the pump and its surrounding case. Fig. 2 represents a top plan of the pump and case. Fig. 3 represents, on an enlarged scale, the pump-disk with its buckets and water-ways. Fig. 4 represents a section through the revolving pump-disk and the shield or cover connected with it, and also representing the revolving pipe or water-inlet that leads from the penstock or case to the wheel.

Similar letters of reference, where they occur, denote like parts in all the figures.

My invention consists, first, in dividing up the space on the revolving disk, between the main arms that extend from the center to the periphery of the disk, into one, two, or more ways by means of curved arms or ribs extending from the periphery, but not reaching the hub or center of the disk, so as to form a series of tubes or water-ways from the center, or from near the center, to the periphery of the wheel; and my invention further consists in making the revolving disk of the form of a flat cone, so that the areas of the tubes or water-ways shall be more nearly uniform throughout their length, the increased height near the center compensating for the diminished width at that point; and my invention further consists in combining with the shield or its flange a flanged annular ring, which extends from the inlet water-chamber to said shield, for forming a water-packing between the inlet and the disk and a continuous waterway, as will be hereinafter explained.

To enable those skilled in the art to make and use my invention, I will proceed to describe the same by reference to the drawings.

A represents a penstock or water-chamber, having an inlet-passage, B, and an exit-passage, C, united or connected therewith. Through this water chamber or box A passes a shaft, D, which may be packed at the points *a a*, where it passes through the ends of said box or case, to make a close connection. The shaft D may be supported by its journals *b* in bearings E outside of the water case or chamber, and furnished with a pulley, F, by which it may be rotated; or any other gearing may be used to give motion to said shaft.

On the shaft D, and inside of the pump-chamber G, there is affixed a disk, H, (better seen in Figs. 3 and 4,) which has upon its face a series of curved arms, *c*, which extend from its hub or center *d* to the periphery of the disk, and between this series of curved arms or ribs a second series, *e*, which start from the periphery, and, curving inward, terminate at or near the points *f*, which may be at, say, midway, or thereabout, between the rim and center, though these terminations will vary in accordance with the number of vanes, arms, or ribs used, or the height to which the water is to be raised, their object being to make upon the face of the disk a series of tubes or water-ways leading from or near its center to its perimeter. The face of the disk H and its vanes or buckets are in the form of a frustum of a very flat cone, for the purpose of increasing the area of the water ways at or near the center of the wheel, and making them conform more equably with the area of discharge, which makes a more uniform balance and flow of of water, neither throttling it at the inlet nor overbalancing the disk by excessive weight at the perimeter.

It will be perceived by reference to Fig. 3 that the water-ways between the ribs are much wider at the perimeter of the disk than they are at or near the center; but to compensate for this diminished width I have increased the height of the ribs or vanes from the perimeter toward the center, as will be more clearly seen in Fig. 4, so that the areas of inlet and of exit shall be about the same, which keeps the volume of passing water compact from the inlet to the discharge and preserves a uniform momentum throughout. It will also be perceived that the vanes or ribs themselves are thickened as they approach the perimeter of the disk. This aids somewhat to contract the areas of discharge, and makes them somewhat more uniform; but the whole compensation cannot be made here, as it would make too much dead-weight upon the perimeter of the wheel, and loss of effective surface; hence the

compensation at the center by increasing the height or depth of the vanes thereat.

A shield, I, having a water-way, J, through its center, is placed against the face of the disk H, and this incloses all the water-ways between the vanes or ribs, converting them into trunks or tubes, so that each shall carry its own separate volume of water, as will be seen at Fig. 4. This shield I has an annular flange, *g*, which projects from it, and runs in close proximity to an annular ring, *h*, set in the partition K, that divides the water-chamber proper, A, from the pump-chamber G, and makes a water-packing between said chambers, said ring *h* having a flange, *i*, upon it to hold it to its place. The advantage of the water-packing is, that there is so much less liability of its being impaired by use or getting out of order.

The opening through the packing-ring *h* and through the projecting flange *g* forms a continuous water-way from the inlet-chamber A to the center of the pump, the passage of the water through the pump being indicated by the red arrows in Fig. 1.

I have shown but one pump upon the shaft E. Another one may be placed upon the other end of it in the chamber G′, if desired, and when so used, then a water-way, *m*, Fig. 2, should extend from one pump-chamber to the other, to preserve a uniform pressure of the water upon the pumps by allowing it to find its own level through said passage. I have also shown the pump as arranged upon a horizontal shaft. It may be arranged in a vertical position, where the location or object suits, without changing its leading characteristics.

Having thus fully described the nature, object, and purpose of my invention, what I claim therein as new is—

1. Dividing up the face of the pump-disk, between the main arms *c*, into a series of water-ways, arranged as and for the purpose described.

2. The forming of the face, or of the vanes or ribs upon the face of the disk, of the shape of a frustum of a flat cone, for the purpose of enlarging the areas of the water-ways near the center of the disk, and making them of the same or nearly the same areas of that of the discharge issues, substantially as described.

3. The arrangement of the projection *g* upon the shield I, and the flanged ring *h*, for the purpose of forming a water-packing and a continuous water-way between the inlet and the pump chambers, substantially as described.

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