W. C Hibbard,

Centrifugal Pump,

No. 21,756. Patented Oct. 12, 1858.

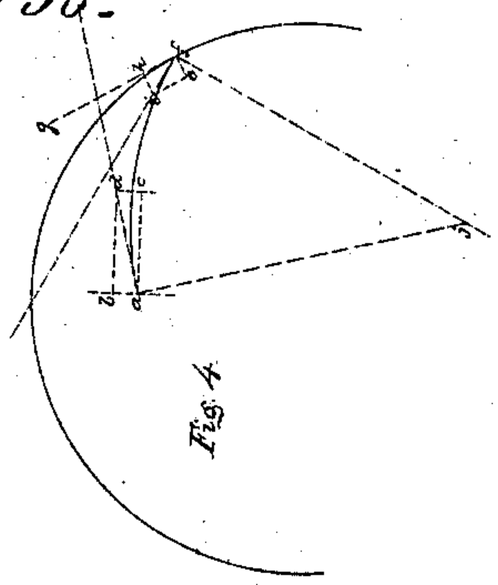

Fig. 4

Fig. 1

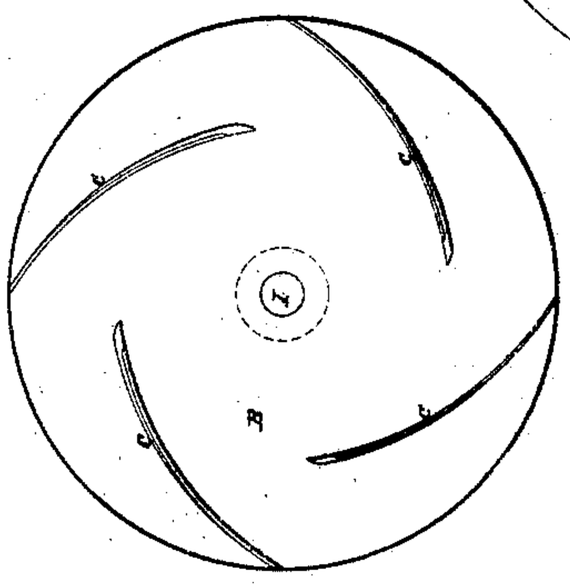

Fig. 3

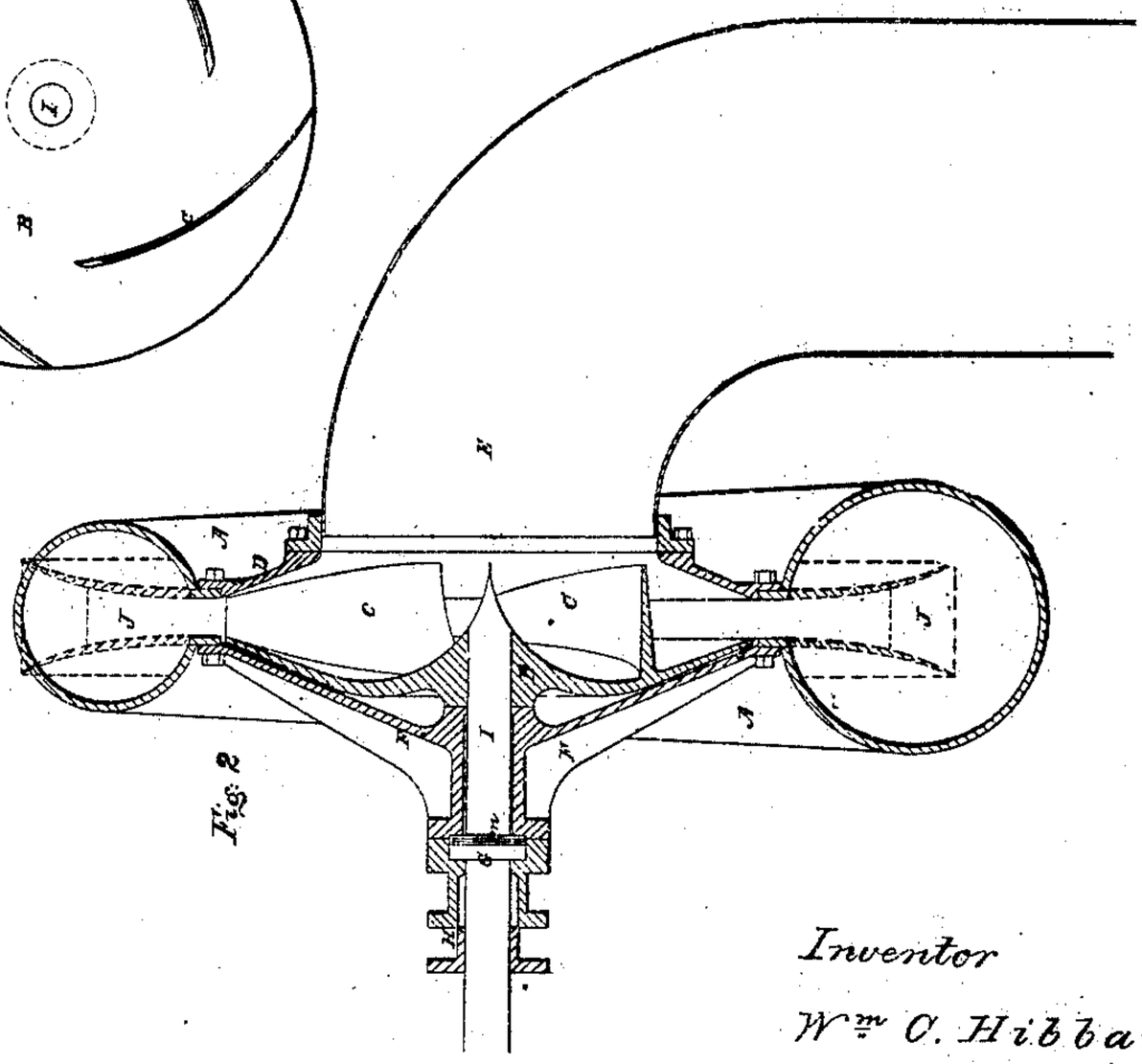

Fig. 2

Inventor

Wm. C. Hibbard.

UNITED STATES PATENT OFFICE.

WILLIAM C. HIBBARD, OF WEST ROXBURY, MASSACHUSETTS.

IMPROVEMENT IN CENTRIFUGAL PUMPS

Specification forming part of Letters Patent No. **21,756**, dated October 12, 1858.

To all whom it may concern:

Be it known that I, WILLIAM C. HIBBARD, of West Roxbury, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Centrifugal Pumps for Raising and Forcing Water and other Fluids; and I do hereby declare that the following is a full, clear, and exact description of the principles and construction of the same, taken in connection with the accompanying drawings, making part of this specification, in which—

Figure 1 is a side elevation; Fig. 2, a transverse section through the center, and Fig. 3 an elevation of the fan-wheel, shown separately to show more clearly the form and arrangement of the vanes.

The subject-matter of my invention consists of certain improvements in the centrifugal pump by means of which the efficiency of its action is much increased as compared with the modes of construction heretofore in use.

My first improvement relates to the manner of forming the fan-wheel and parts with which it immediately co-operates, so as to receive the water at the inlet and deflect it radially on all sides from the center to the inner extremities of the vanes without imparting to it a rotary motion, in connection with such other construction of its parts as will impart to the water in passing through the pump the least rotative movement that will do the work. When the lift of the water is small, a small centrifugal force only is required to be generated to overcome it, while the volume of water thrown should be proportionally large, so as to usefully employ the whole motive power, and when the lift is greater the amount of rotation to be imparted to the water to generate the requisite centrifugal force to overcome it must also be correspondingly greater. To adapt the pump to work with the best effect under these varying conditions is the object of my first improvement. To effect this I construct the fan-wheel with a curved guide-plate of the form shown in section in the drawings, which has a central pointed boss for dividing and deflecting the inflowing current, so as to send it radially outward on all sides, and which also forms one side of the chamber through which the water flows, the outer portion being so formed as in connection with the opposite side of the chamber to give a passage of such circumferential area as will give an equable flow radially to the water in passing through it. To this plate the vanes of a curved and tapering form, as shown, are attached by one edge, their inner extremities being outside of the central inlet, leaving at the center a free open space with nothing to impart any rotative movement to the water. The manner of forming the vanes so as to act upon the water in the manner before mentioned will be hereinafter more fully described.

My second improvement relates to the employing usefully of the power or *vis viva* which remains in the water after it has passed the pump; and it consists in causing the water to pass through what I term an "expanding outlet," or forming the outlet or discharging passage with a gradually-increasing area, which is represented in one form in the drawings as attached to the scroll-pipe, which surrounds the fan-wheel and accumulates the discharged fluid, and in another form by the red lines as surrounding the fan-wheel and immediately receiving the discharge from it, by which means the velocity of the water may be reduced to any required degree, the momentum of the water by such a reduction of velocity having a tendency to produce a vacuum behind, which correspondingly assists the action of the pump.

My third improvement relates to the manner of constructing the casing of the pump, so as to give greater convenience in getting access to the operative parts without disturbing the main body of the casing and disconnecting the pipes; and it consists in making the side of the chamber in which the fan-wheel works with a separate cover a little larger than the fan-wheel, so that by simply removing the cover the entire operative parts of the pump can be removed without difficulty.

The description of the machine is as follows, the letters referring to the same parts in all the figures.

A is the main casing of the pump, made with a spiral pipe surrounding the fan-wheel, which has a constantly-increasing transverse area from the small end toward the outlet corresponding to the accumulating volume of water received from the fan-wheel, so that its circumferential velocity shall be the same in

all parts when the pump is discharging a quantity as small as a maximum in calculating the capacity of the pump.

B is the fan-wheel. It is made with a guiding-plate of the form shown in section in Fig. 2, the part at its center in connection with the shaft I forming a pointed boss which divides and deflects the water outward on all sides to the vanes C, and is continued beyond, forming one side of the passage to the outer extremity of the vanes, as is shown in the drawings. To this plate the vanes C are attached by one edge, which forms their support without any other connection with the shaft. The vanes are made tapering to fit the form of the chamber, and are also curved in the direction of their length and set on the plate in a manner to be described. In practice I make the curve of the vane at its inner extremity a tangent to the diagonal of a rectangle one side of which represents the radial velocity of the water and the other side the circumferential velocity of the vane, and at the outer extremity a tangent to the diagonal of a rectangle one side of which represents the radial velocity of the water and the other side the circumferential velocity of the vane less the circumferential velocity of the water at that place when the discharge is what is assumed in the calculation as a maximum. This is shown by the paralellograms and diagonals shown in red lines in Fig. 4 where *a b* represent the radial velocity of the water, *a c* the circumferential velocity of the vane at its inner end, and *a d* the diagonal of same, and *e f* the radial velocity of the water; *f g*, the circumferential velocity of the vane at its outer extremity, and *g h* the circumferential velocity of the water, and *f i* the diagonal of the rectangle *e f h i*.

a j f j are radii, to which the diagonals are tangents, and which are also radii of the curve of the vane *a f*. The inner ends of the vanes are placed just exterior to the inlet-passage through the cover D, so that it leaves a central space for the water entirely unobstructed. The cover D is fitted to receive the suction-pipe E at its central orifice, and at its circumference is bolted to the casing A, as shown. F is the other cover bolted in the same manner to the casing, and at its center is provided with a suitable boss to receive the bearing for the shaft and also the stuffing-box H.

The openings at each side of the casing, to which the covers are bolted, are a little larger than the fan-wheel, as is shown, so that it can be removed from the chamber with the cover, and the covers can also be used on either side of the casing, so that the pump can be fitted up to receive the water on either side, as desired. Upon the shaft I and exterior to the boss of the cover F, a collar G is fixed to resist the tendency of the fan-wheel to move toward the inlet when the lift is considerable. The thrust is taken upon a series of washers *m*, interposed between the collar and cover, which washers are made of steel and composition alternately. These are inclosed in an oil-casing, as shown, which insures their perfect lubrication at all times and also that of the main bearing.

J is a conical pipe attached to the outlet of the casing, having its larger end outward by means of the constantly-enlarging area of which the water is retarded in velocity to any required degree, by which means the *vis viva* of the water given up is made to assist in moving the column of water behind it and is thus usefully employed instead of being allowed to go to waste, as in the usual manner. The increase of area in the outlet should be so gradual as to prevent the formation of eddies, and to cause all parts of the column at any given cross-section to move with sensibly the same velocity.

When the axis of the pump is placed vertical, as might be the case in drawing with a low lift, and the discharge is made into a free surrounding space, I propose to make the expanding outlet of the form shown in Fig. 2 in red lines, in which case the scroll-pipe is not used.

In the operation of the pump the before-described improvements are intended to produce three particular results, namely: first, to present the water to the vanes without rotation, and consequently with its maximum of inertia; second, to impart to the water the least amount of power that will do the work; and, third, to abstract from the water after it passes the pump the power that remains in it and which otherwise would be wasted, and make it assist in the operation.

What I claim as my invention is as follows:

1. In the construction of the fan-wheel, the combination of the curved guide-plate B with the vanes C, arranged around a central open space, substantially as described, and working in connection with the covers D and F, and casing A, or such other equivalent devices as will co-operate with it upon the same principle.

2. I do not claim the spiral passage of discharge constantly enlarging toward its exit to receive the accumulated discharge from the fan-wheel, as that has before been used, but in combination with the centrifugal pump I claim the expanding outlet, constructed upon the principle described, whether employed in combination with the spiral passage of discharge or applied directly to the fan-wheel, substantially as described.

3. Constructing the casing of a centrifugal pump with a detached cover F, in combination with the fan-wheel and fixed casing, substantially as described.

Boston, July 1, 1858.

WM. C. HIBBARD

Witnesses:

JOHN H. TOMLINSON,
H. A. PEELER.