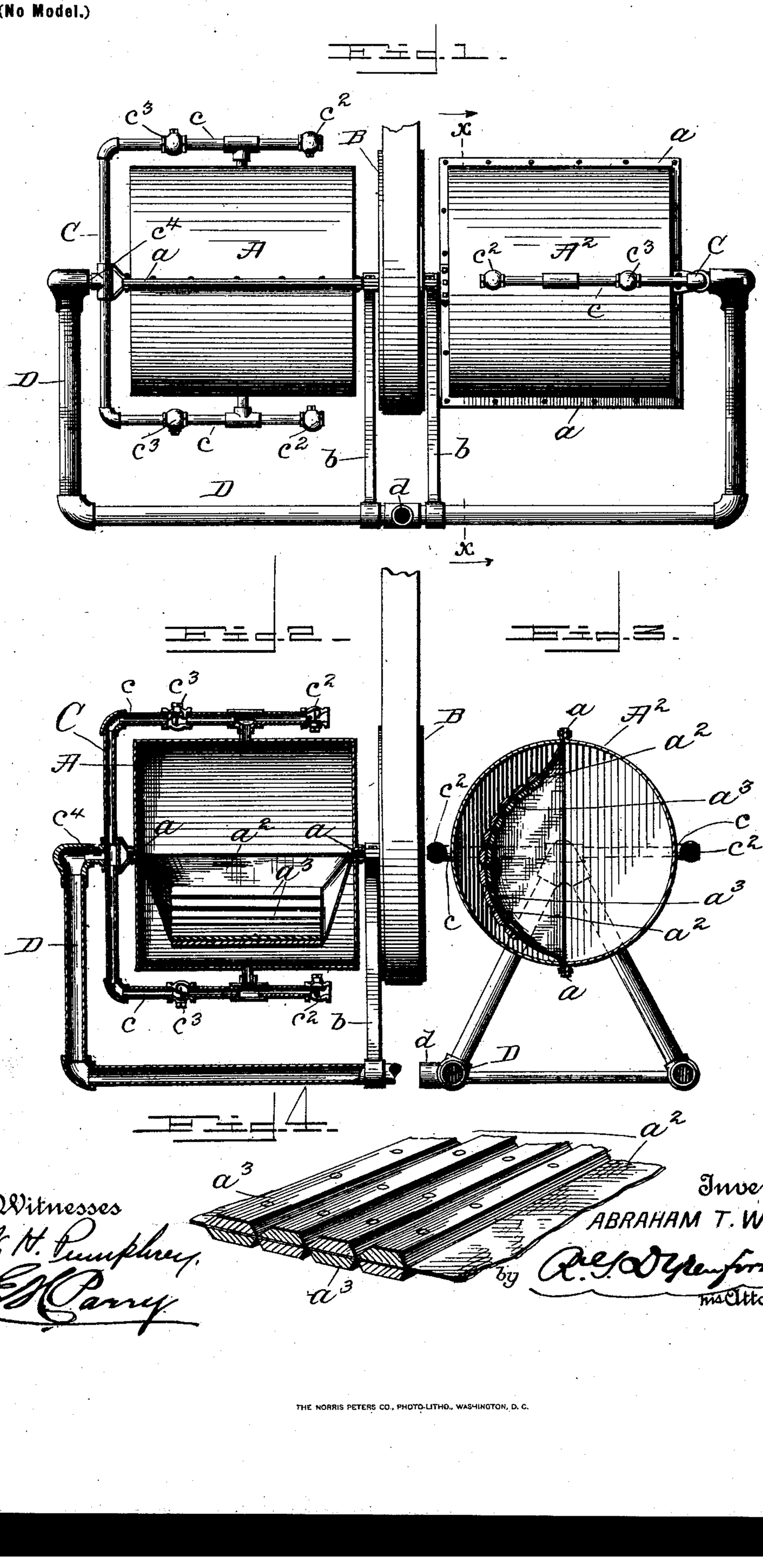
No. 688,453. Patented Dec. 10, 1901.

# A. T. WELCH.

## AIR OR LIQUID FORCING DEVICE.

(Application filed May 28, 1894.)

(No Model.)




Witnesses
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# UNITED STATES PATENT OFFICE.

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## AIR OR LIQUID FORCING DEVICE.

SPECIFICATION forming part of Letters Patent No. 688,453, dated December 10, 1901.

Application filed May 28, 1894. Serial No. 512,785. (No model.)

*To all whom it may concern:*

Be it known that I, ABRAHAM T. WELCH, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Air or Liquid Forcing Devices; and I do hereby 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.

This invention relates to air or liquid forcing devices.

The object is to produce a simple, effective, and inexpensive device which shall deliver air or other fluid in regulated quantities and under requisite pressure with small expenditure of power, with least friction and wear, without waste of air, and without necessity of high speed in operation.

With these objects in view the invention consists in a vessel having a full-bodied, weighted, flexible diaphragm and provided with openings on opposite sides thereof, acting alternately as inlet and discharge, whereby upon rotation or oscillation of the vessel the diaphragm will fall by gravity alternately across the plane of its attachment—that is, flap from side to side—and alternately draw in and expel aeriform or other fluid at the respective sides of the cylinder; furthermore, in various novel details of construction, all as hereinafter fully set forth and claimed.

In the accompanying drawings, forming part of this specification, and in which like letters of reference indicate corresponding parts, Figure 1 is a view in front elevation exhibiting a form of embodiment of my invention with more than one vessel to insure continuity of pressure and the vessel in the form of cylinders capable of rotation, showing the cylinders put together in longitudinal halves for securement of the diaphragms and set with the junction of the halves of one cylinder at right angles to that of the other; showing, furthermore, the cylinders mounted at their ends free to rotate; showing, furthermore, a driving-pulley with a portion of the driving-belt, the pulley being fixed on a power-shaft mounted in standards and engaging an end of each cylinder; showing, furthermore, a pipe across the outer end of each cylinder fixed to the sides thereof, the pipe being fixed to and having entrance at opposite sides, being provided with valves and opening into and being journaled in a larger pipe, and showing, finally, a large bent pipe set longitudinally of the cylinders, forming a support therefor, having its upper ends opening from the cylinder-pipes and forming journals for the same and provided with an escape-orifice. Fig. 2 is a view in vertical longitudinal section of a cylinder in the position of that to the left of Fig. 1, showing the position of the diaphragm therein and the valves in the cylinder-pipe, the inlet-valve above being open with the discharge-valve closed and the inlet-valve below being closed with the discharge-valve open. Fig. 3 is a view in vertical cross-section taken on the line $x\ x$ of Fig. 1—that is, in the position of the cylinder to the right of Fig. 1, showing the position of its diaphragm relative to that of the other, with the cylinders set as shown in Fig. 1; and Fig. 4 is a view in detail showing a portion of a diaphragm exhibiting the general construction thereof with one form of weighting.

In the drawings, A and $A^2$ represent air-tight cylinders, preferably of metal, each of which is bisected longitudinally. Each section of the cylinders is provided with a flange $a$ to afford convenient means of connecting them together. The cylinders contain diaphragms $a^2\ a^2$ of suitable impervious flexible material, which are weighted by any suitable substance in any suitable form, preferably metal in the form of bars $a^3$, fastened to and adapted to move with them. These diaphragms are held at their edges between the flanges of the sections when they are fastened together and are full-bodied, so that they will sag under the weights. The weights may be of any suitable form, but are preferably made in equal longitudinal section of such form that when they are bolted together with the diaphragm between they will preserve their flexibility; but the weights may be in the form of linked disks—squares, hexagons, or the like—of metal or other heavy substance. A diaphragm suitable for the purpose may

readily be made by treating canvas with ordinary heavy axle-grease. Between the cylinders and fixed to their ends is a short shaft having keyed or otherwise secured to it a driving-pulley B, and this shaft is mounted in standards *b*. The cylinders are set with the planes of junction of their sections at an angle with each other, here shown as a right angle, whereby the weight will be balanced, and whereby as the cylinders rotate the diaphragms within them will move successively to the opposite sides, each diaphragm sinking or falling alternately or successively and the two or more diaphragms moving in succession to get a constant blast. Across the outer end of each cylinder and extending along opposite sides to near the inner ends thereof are pipes C, which have branches *c* entering the sides of the cylinders on opposite sides of the diaphragm and have valves $c^2$ $c^3$ set to open and close in opposite directions, as by gravity, whereby the valves $c^2$ will be inlet-valves for air and the valves $c^3$ outlet-valves, the operation being such that as the cylinder rotates and the diaphragm sinks to the lower side the inlet-valve in the part of the pipe at the top will open, while the outlet at the part of the pipe at the top will close, whereby air will be drawn into the cylinder and the inlet-valve at the part of the pipe at the bottom will open, whereby air forced from the cylinder by the sinking of the diaphragm will be forced through the outlet-valve at the bottom. Centrally at the outer end of each cylinder this valve-pipe is fixed to the cylinder, and directly opposite the center of the end of the cylinder the valve-pipe has a short tube $c^4$, which enters and is journaled in the end of a large pipe D. This pipe D has an escape *d*, which is the blast-orifice for connection with any suitable place for application of blast. As the escape-valve of each cylinder opens upon the sinking of the diaphragm in that cylinder air is delivered through this valve and the other portion of its valve-pipe through the hollow journal into the large pipe and thence through the blast-orifice, the respective escape and inlet valves of the two cylinders opening and closing alternately. The cylinders may be coupled up in any desired number and all have their diaphragms arranged to act in sequence or have two of them arranged to act together to give increase of pressure. The air-pressure being obtained by the action of gravity on the diaphragm, it will be apparent that the diaphragms may be weighted to any desired pressure, and it will further appear that the best results will be obtained by a slow revolution of the cylinders. It is further apparent that instead of employing two cylinders rotated simultaneously I may substitute a single cylinder having a central transverse partition to divide it into separate chambers and set a diaphragm in each chamber at an angle to the other diaphragm, whereby I may attain results similar to those accomplished by the use of two cylinders, as to balancing-weight and continuous pressure, and therefore I do not desire to be limited to the use of one cylinder with one diaphragm or to the use of two or more cylinders each with one diaphragm.

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

1. A fluid-forcing device, comprising a rotatable or oscillatory vessel, a flexible diaphragm secured within the vessel, openings in the sides of said vessel upon opposite sides of the diaphragm, each opening being provided with means for causing it to act alternately as an inlet and as a discharge, upon the turning of the vessel, substantially as described.

2. In a fluid-forcing device, the combination of rotatable or oscillatory vessels, each containing a full-bodied, weighted, diaphragm having its edges fixed within the vessel, and each having openings on opposite sides of its diaphragm and provided with means for causing the opening to act alternately as an inlet and discharge upon the turning of the vessel, substantially as and for the purpose set forth.

3. In a fluid-forcing device, the combination with a vessel containing a full-bodied, weighted, flexible, diaphragm having its edges fixed within the vessel, and having openings on opposite sides of the diaphragm, of a pipe communicating with the openings and provided with two valves to each opening, arranged to open and close alternately, substantially as described.

4. In a fluid-forcing device, the combination with a vessel containing a full-bodied, weighted, flexible, diaphragm having its edges fixed within the vessel, and having openings on opposite sides of the diaphragm, of a pipe communicating with the openings and provided with two valves to each opening, arranged to open and close alternately, and a blast-pipe with which the valved pipe communicates, substantially as described.

5. In a fluid-forcing device, the combination with a vessel containing a full-bodied, weighted, flexible diaphragm, having its edges fixed within the vessel, and having openings on opposite sides of the diaphragm, of a pipe communicating with the openings, valves on the pipe on each side of the opening, and adapted to open and to close alternately, a blast-pipe with which the valved pipe communicates and from which the vessel is supported, and means for imparting a rotary motion to the vessel, substantially as described.

6. In a fluid-forcing device, the combination with a vessel containing a flexible diaphragm, having its edges fixed within the vessel, the diaphragm being constructed of a

sheet of flexible material, to which are secured transverse bars or weights, the said diaphragm having openings on opposite sides, of a pipe communicating with the openings, valves on the pipe on each side of the opening, adapted to open and close alternately, a blast-pipe with which the valve-pipe communicates and from which the vessel is supported, and means for imparting a rotary motion to the vessel, substantially as described.

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

ABRAHAM T. WELCH.

Witnesses:
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