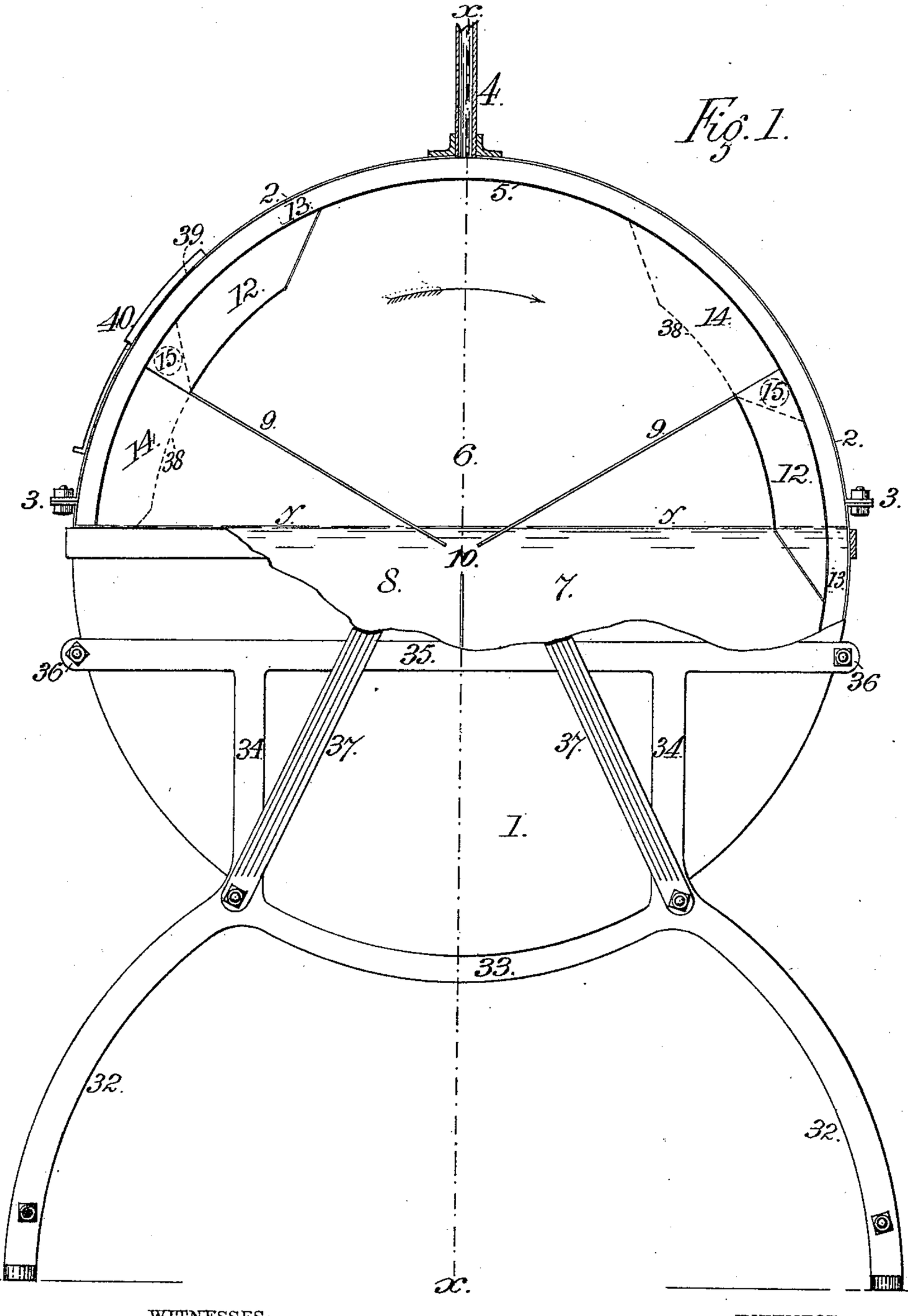
(No Model.) 2 Sheets—Sheet 1.

A. M. SOUTHARD.

AIR PUMP.

No. 438,716. Patented Oct. 21, 1890.

Fig. 1.



WITNESSES:

W. J. Kowalski

L. F. Wilber

INVENTOR

Abraham M. Southard

BY A. J. O'Brien

his ATTORNEY

(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

Fig. 2.

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UNITED STATES PATENT OFFICE.

ABRAHAM M. SOUTHARD, OF DENVER, COLORADO.

AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 438,716, dated October 21, 1890.

Application filed June 6, 1889. Serial No. 313,399. (No model.)

To all whom it may concern:

Be it known that I, ABRAHAM M. SOUTHARD, a citizen of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Rotary Air-Pumps; and I do 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, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to a novel and improved form of rotary air-pump adapted to be used for either the forcing of air to produce a blast or as an exhaust-pump to produce a vacuum or partial vacuum; and its objects are to furnish such a pump adapted to act smoothly and evenly on the air, that the latter may move uniformly and be under a steady and non-variable pressure—a pump of simple construction without pistons or other parts liable to become easily deranged, adapted for easy operation, requiring a minimum of attention, and very reliable and efficient in operation; to which ends the invention consists in the features, constructions, and combinations more particularly hereinafter set forth and claimed.

In the drawings is illustrated an embodiment of the invention, Figure 1 thereof being an end view with a portion of the end torn away to show the interior; Fig. 2, a section on the line *x x*, Fig. 1; and Fig. 3, a detailed view of the pawl and ratchet used.

In the figures the reference-numeral 1 indicates the lower part of the tank, and 2 the upper part thereof, the line of division between the two being somewhat above the horizontal diametrical line of the tank. These parts may be hinged together, and when the machine is to be used as an exhaust a gasket 3 is to be placed at the union in order to make the joint air-tight. A pipe 4 projects from the upper portion of the tank, serving as an inlet or as an outlet for air, as the case may be. This tank is supported by any suitable framing, such a framing being herein shown as composed of legs 32, at either end united by a cross-piece 33, of contour similar to the contour of the tank, arms 34 rising thence and supporting cross framing-piece 35, the cross framing-pieces at the two ends being united by longitudinal bolts or rods 36. Any needed number of diagonal brace-rods 37 may be used to give greater rigidity to the frame and to transfer the strain of the bearings to the parts 32 of the frame. Within this tank is seated a cylinder 5, formed with a series of partitions 9, extending from one head 42 to head 41 within the cylinder, but not quite to the center thereof, there being left at the center of the cylinder a space 10, communicating with each of the chambers or divisions 6 7 8, formed by the partitions 9. The partitions 9 are not as long as the cylinder, so that a free space or chamber 11 is left at one end within the cylinder.

Each of the divisions 6 7 8 has its own inlet-passage 12, formed by securing a bent piece of metal in a corner formed by the head and circumference of the cylinder, such passage extending some distance into the next compartment and having at its extreme end an opening 13 through the case of the cylinder. At the opposite head and from the other partition of a division extends an outlet-conduit 14, covered by a hood 38, closed at one end, but opening into the chamber 11 at its other end. Such outlet-conduits are located in this instance upon the exterior of the head 41, and apertures 15 permit the escape of the air there from the cylinder.

Projecting up into the chamber 11 so that its end is above the water-line of the tank is a vertical pipe 16, opening into the horizontal pipe 17, from which a tube or tubes lead to a point of the apparatus where air is either to be delivered or from which air is to be withdrawn.

In order that the cylinder 5 may be supported for rotation at the delivery end and yet the delivery 16 17 be stationary, a flanged collar 18, to be seated upon the pipe 17, is secured thereat, and in order that there may be a water-tight joint one or more washers 19, of rubber, leather, or other suitable material, are held around the pipe 17 and against flange 19 thereof by a jam-nut 21. At the other end of the cylinder a shaft or spindle 22 is secured by means of a flange 23, such spindle

passing through any suitable form of stuffing-box for preventing leakage therearound. Upon this spindle or axle is loosely situated a winding-drum 26, having a ratchet 27 upon its inner end, a pawl 28, secured to a flange or projection on the spindle, being arranged to take in the ratchet-wheel and lock the drum to the axle or spindle. Such pawl is made reversible—that is, it is pivoted and adapted to be swung so that it may lock the drum and axle in either direction when desired. The outer end of the axle 22 is supported in a box 24, secured and held in proper position by any necessary number of struts and braces 25, secured to the frame of the tank.

42 42 indicate the ends or heads of the cylinder, and the partitions 9 are supported at their ends by one of the heads 42 and by diametrical partition 41, which forms, also, one of the boundaries of the chamber 11.

The operation is as follows: The direction of the rotation of the cylinder being as indicated by the arrow in compartment 6 of the cylinder, the tank is filled with liquid up to the line *y y*, permanently sealing the central opening 10 of the compartments 6, 7, and 8. As such compartments continue to descend, the water-level, remaining constant, compresses the air therein, which escapes by its outlet 14 15 into the chamber 11, whence it passes by means of pipe 16 17 to the point where it is to be used. The pressure upon the air increases as the conduit 12, passing through the fluid, becomes more and more filled, and if the air in compartment 7 alone were under tension or pressure and all the air expelled from such compartment there would be a fall of the pressure at the commencement of the operation of the next compartment 6, causing, if the air is to be used for a blast in a carburetor, an unpleasant flicker in the lamps. To remedy this and provide for a uniform pressure is part of the function of the peculiar arrangement of the inlets and outlets before described. As soon as (referring to the compartments as they stand in Fig. 1) the end of the inlet-conduit 12 of compartment 6 passes beneath the fluid-line it is sealed, and such compartment has no communication with any space outside of the cylinder, except through its outlet 14, whose end rises above the water-line in a short time after the end of 12 passes beneath it. Conduit 12 is made a suitable length to produce a required degree of pressure before its outlet 14 begins to discharge its air in chamber 11, the outlets 14 being each made a little shorter than the inlet-conduits 12. As the compartment 7 continues to discharge its air and under its greatest pressure, it has its outlet 14 into the chamber 11, and as compartment 6 is in communication with such chamber through its outlet 14 the pressure in both compartments 6 and 7 is equalized, so that when compartment 6 commences to work it is with its air under the same pressure as was the air in 7 when it ceased to work, and this occurs with each of the compartments in rotation, a steady uniform blast being thus secured without the aid of a governor or regulator. This description of operation relates, of course, to the operation of the pump as a forcing or blast pump. When it is desired to use it as an exhaust-pump, the direction of rotation would be changed, whereupon the compartments would fill with air as they rose out of the liquid, taking such air in through the pipes 16 and 17, the former outlet-conduits 14 becoming in such case the inlet-conduits and the inlets the outlets. Where only a moderate blast is desired the rotation may be accomplished by a weight hung to a rope passing over a suitable pulley, and thence to the drum 26, on which it may be wound up. For a heavy blast or where more rapid action is desired steam or any other suitable prime motor-power may be used.

This air-pump forms one exceedingly well adapted for use with carburetors, in that it may deliver a steady uniform blast of air, so that the action of the carburetor itself is rendered more uniform and there is no variation in the lights, due to unequal action of air in the pump.

The pump may be connected with a series of pipes running through a house or building and be used during the day as an exhaust, drawing air through such pipes from any apartment desired to be ventilated. Thence, in Fig. 2, a pipe 29 may lead, for instance, to the carburetor and a pipe 30 to the ventilating-pipes, suitable valves 31 being arranged in each pipe. Then during the day the valve 31 in pipe 29 would be closed and the valve in pipe 30 opened and the cylinder run in the direction to make an exhaust, thus ventilating, as before stated, any desired apartment. In the evening the valve 31 in the pipe 30 would be closed and the corresponding valve in the pipe 29 opened and the direction of rotation reversed, so that air would now be forced through the carburetor for the illumination of the same apartment or house. This capacity or double function is a feature of great value. The cylinder and the tank should preferably be made of galvanized sheet-iron, brass, or copper, and to prevent same from rusting and to keep the journals and bearings lubricated I prefer to put an inch or two of oil in the case of moderate-size machines upon the top of the water in the tank, while if there is a greater strain or larger-sized machine I should prefer in some cases five or six inches of oil upon the top of the water, the oil being of advantage also in that it is a somewhat more unyielding material to act against the air than is the water. At some point in the upper portion of the tank is an opening 39, covered by a sliding door 40. When, now, it is desired to wind up the weight without stopping rotation, the door is opened,

permitting a finger or the hand to reach the cylinder and manually rotate the same while the winding up is going on.

Having thus described my invention, what I claim is—

1. A rotary air-pump having an inclosing-tank partially filled with liquid, a cylinder rotatably seated therein and having radial partitions 9, extending nearly to the center of the cylinder and dividing it into compartments 6, 7, and 8, and a diametrical partition 41, located near one end of the cylinder and separating compartments 6, 7, and 8 from a chamber 11, located between partition 41 and the adjacent end of the cylinder, each compartment being provided with an inlet-conduit 12 of suitable length, extending from a partition 9 into the adjacent compartment and provided with an opening 13, communicating with the inclosing-tank, an outlet-conduit 14, formed on the outside of the opposite head 41 and within chamber 11, said conduit being closed at one end and open at the opposite end, an aperture 15, leading from the compartment to conduit 14, aperture 15 being located across the compartment diagonally opposite from the inner opening of conduit 12, conduit 12 being longer than conduit 14, so that as the cylinder revolves the extremity of conduit 12 shall enter the liquid in the tank and the liquid enter the conduit and compress the air in the corresponding compartment to any desired extent before the outlet extremity of conduit 14 rises from the liquid and permits the escape of the air from the compartment to chamber 11, substantially as described.

2. In a rotary air-pump, the combination of the inclosing-tank for holding liquid, a cylinder rotatably seated therein and having interior partitions projecting radially not quite to the center of the cylinder and dividing the cylinder into compartments 6, 7, and 8, and a diametrical partition 41, located near one end of the cylinder and separating said compartments from the chamber 11, located between partition 41 and the adjacent end of the cylinder, each compartment 6, 7, &c., being provided with an inlet-conduit 12 and an outlet-conduit 14, the outlet-conduits of two contiguous compartments being so located relatively to each other that the compressed air begins to escape through the outlet-conduit of the one compartment before it ceases to discharge from the compartment immediately in advance considered with reference to the direction of rotation of the cylinder, substantially as described.

3. In a rotary air-pump, the combination of the inclosing-tank for holding liquids, a cylinder rotatably seated therein and having interior partitions projecting radially not quite to the center of the cylinder and dividing it into compartments 6, 7, and 8, and a diametrical partition 41, located near one end of the cylinder and separating said compartments from the chamber 11, located between partitions 41 and the adjacent end of the cylinder, each compartment 6, 7, &c., being provided with an inlet-conduit 12 and an outlet-conduit 14, the outlet-conduits of two contiguous compartments being so located relatively to each other that the compressed air begins to escape through the outlet-conduit of the one compartment before it ceases to discharge from the compartment immediately in advance considered with reference to the direction of rotation of the cylinder, the inlet and outlet conduits of any compartment being of such relative length that the entrance of the liquid to the inlet-conduit shall compress the air within the compartment to any desired extent before the air begins to escape from the outlet-conduit into chamber 11, substantially as described.

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

ABRAHAM M. SOUTHARD.

Witnesses:
Z. F. WILBER,
ISHAM R. HOWZE.