2 Sheets—Sheet 1.

# J. C. De La VERGNE & W. M. MIXER.

## Compression and Vacuum Pump.

**No. 233,736.** **Patented Oct. 26, 1880.**

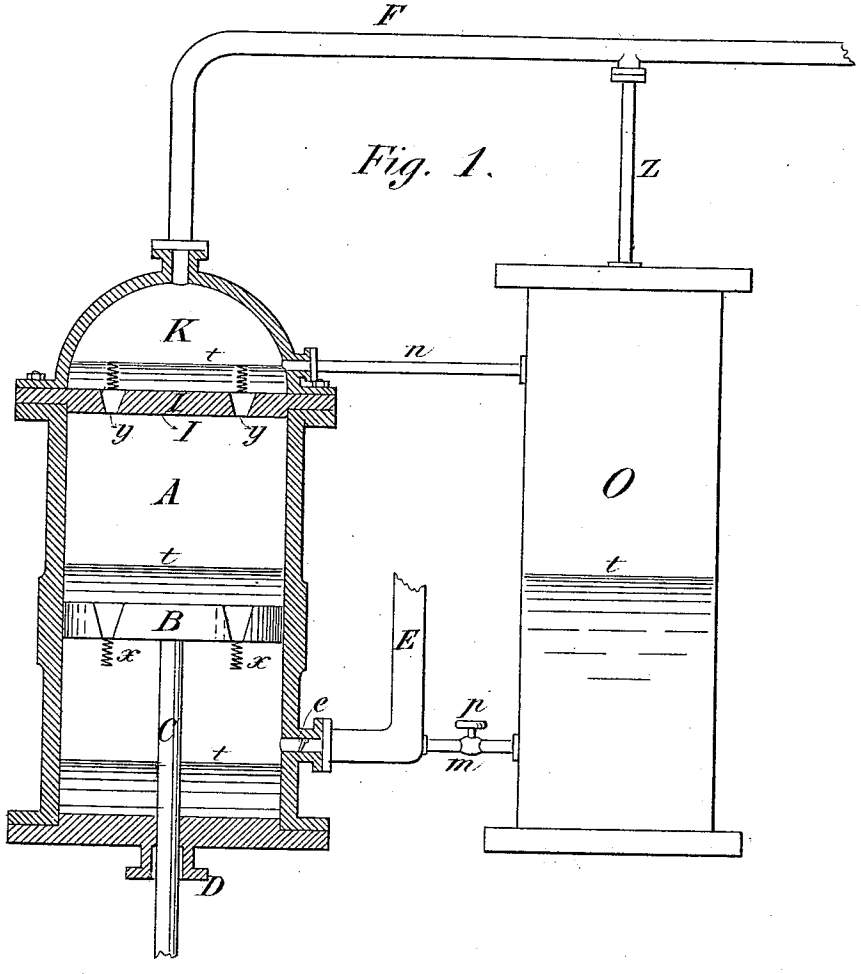



Fig. 1.

*Witnesses:*

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Stephen Byrnes.

*Inventors:*

John C De La Vergne

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N. PETERS PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

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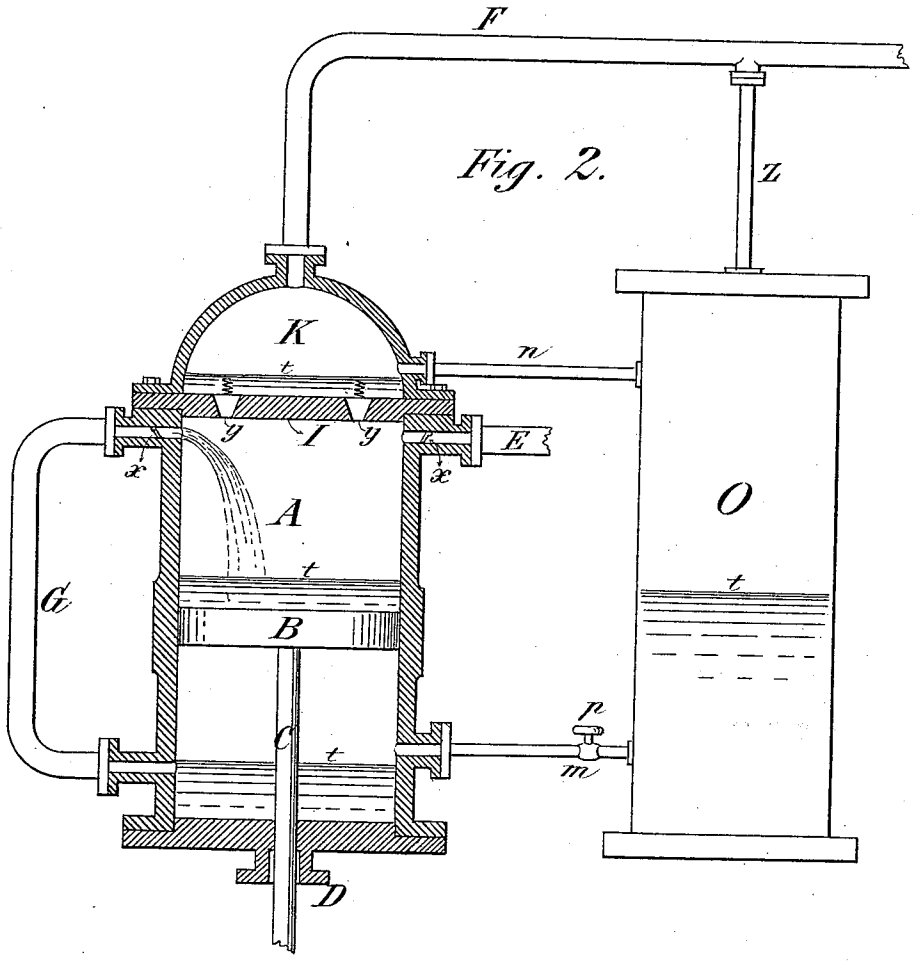



Fig. 2.

*Witnesses:*

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# UNITED STATES PATENT OFFICE.

JOHN C. DE LA VERGNE AND WILLIAM M. MIXER, OF NEW YORK, N. Y.

## COMPRESSION AND VACUUM PUMP.

SPECIFICATION forming part of Letters Patent No. 233,736, dated October 26, 1880.

Application filed October 6, 1879.

*To all whom it may concern:*

Be it known that we, JOHN C. DE LA VERGNE and WILLIAM M. MIXER, of the city, county, and State of New York, have invented certain new and useful Improvements in Compression and Vacuum Pumps, of which the following is a specification.

The invention relates to compressing and vacuum pumps for the compression or exhaustion of air as well as all simple and compound gases.

Heretofore in such pumps, where air or gases were to be compressed to great pressures, there was a loss of power and execution through the leaking or slipping of the compressing air or gas through the valves past or around the piston and piston-rod, through the stuffing-box and joints; also, from a want of proper lubrication, there was great friction in the working of the pump.

The object of our invention is to provide means by which all the air or gas taken into the pump may be forced through and retained by the eduction-valves, and to properly lubricate all the frictional parts of the pump.

The invention consists in certain constructions, which will be distinctly pointed out in the claims.

In the accompanying drawings, in which similar letters of reference indicate like parts, Figure 1 is a vertical transverse section of the pump. Fig. 2 represents a modification of the same.

A is the pump-cylinder having a chamber formed by the valve-diaphragm I and the upper dome-shaped cylinder-head, K. B is the piston; C, the piston-rod, and D the stuffing-box. E is the induction-pipe having a check-valve, *e*. F is the eduction-pipe leading to a main reservoir when it is desired to use one. *x x* are valves in the piston B. *y y* are eduction-valves in the diaphragm I. *t t t t* represent the liquid. O is a reservoir or tank connected with the pump-cylinder by the pipes *m n*. These pipes may connect directly with the cylinder or may connect with the pipes E F. In the drawings one connection, *m*, is shown as made with the induction-pipe E, the other pipe, *n*, connected directly with the dome-shaped cylinder-head K.

*p* is a stop-cock or valve for regulating the flow of liquid to the pump from the tank O. Z is a pipe connecting the tank O with the pipe F. This flow of liquid may also be regulated by a small pump, automatic cut-off, or other suitable mechanism, not shown in the drawings, but connected with the working part of the pump in such a manner that with each revolution of the pump a sufficient quantity of liquid to form a liquid seal or piston will be admitted to the pump-cylinder, which liquid will also thoroughly lubricate the working parts of the machine.

The tank or reservoir O is partly filled with liquid, such as mineral oil or other liquid, which will not saponify, gum, or combine with the gas to be compressed, and is used to furnish the pumping-cylinder with a fresh supply of liquid (which may be cooled by suitable agencies before entering the pump) upon each return-stroke of the piston, and receives the excess of liquid which is above the valved diaphragm when the piston reaches the end of its upstroke.

The reservoir above the liquid being filled with compressed air or gas, the liquid in the reservoir is subject to the pressure at which this air or gas is being pumped from the cylinder, and is thereby not only fed to the cylinder by gravity, but under pressure.

The liquid in the tank or reservoir is permitted to cool and part with any foreign matter taken up in its circulation which will gravitate to the bottom of the tank, and may be removed through a suitable blow-off cock.

In working the pump the gas enters the pump-cylinder through the induction-pipe E. The stop-cock *p* is open to permit the proper quantity of liquid to flow into the cylinder A, which is so much that on the downward stroke the piston B will be immersed in the liquid, a part of which will pass through the valves *x x* in the piston, and form an auxiliary liquid seal or piston over the piston B, which will prevent the escape of gas past the piston, or through the valves in the piston on the upward stroke of the pump, and at the same time sufficiently lubricate all of the frictional parts.

On the commencement of the downward stroke the check-valve *e* will close, and the gas which has been taken in through the pipe E will pass through the valves *x x* before the piston B is immersed in the liquid.

The liquid which passes through the valves

*x x* is carried up together with the air or gas by the piston, and forced through the valves *y y* in the diaphragm. The liquid being the heavier, it forces all the air or gas out first, thereby entirely emptying the cylinder of the air or gas it contained at the commencement of the upstroke, leaving none to expand at commencement of the downstroke; in consequence of which the pump does work to its full capacity.

The piston B, by reason of the valves *x x* being fitted to work on a plane with its upper surface, will work close to the under surface of the diaphragm and force out nearly all the liquid contained between the piston and diaphragm through the valves *y y* in the diaphragm into the chamber forming the upper end of the pump, to which the discharge-pipe is so connected as to allow a portion of the liquid to remain in the chamber, thus covering the valves in the diaphragm and sealing them. This liquid forming the seal above the diaphragm is changed with each upstroke of the piston. This liquid having had the air or gas forced through it is replaced by the liquid which is carried on top or in front of the piston after the air or gas is forced from between the liquid piston and the diaphragm at the completing of the upstroke of the piston. The air or gas forced through said liquid is thereby cooled on its way to the reservoir in proportion to the extent that the liquid is cooler than this air or gas. The surplus or excess of liquid then passes through the pipe *n* to the tank O, from whence it was supplied, making a complete circulation. The liquid may be used in this way as long as it keeps in good condition. When desired, it can be taken out and replaced through stop-cocks. (Not shown in the drawings.)

The downward stroke of the piston is so adjusted that it does not pass down to the bottom of the cylinders, the lower end thereby constituting a chamber for the retention of the liquid entering the cylinder through the pipe *m*, beneath the point to which the piston comes down. By this construction a portion of the liquid is continually left in the lower portion of the cylinder, which will prevent any air or gas from coming in contact with the passage leading to the stuffing-box, and also prevent any leak of air or gas past the piston-rod; also obviating the use of a frictional or metallic packing. Ordinary packing used for liquids will suffice.

The upper cylinder-head, K, may be of any desired form or shape that will give sufficient space above the diaphragm for the easy working of the pump, but dome-shape is preferred.

Fig. 2 represents a modification of this pump, doing its work substantially in the same manner as the pump represented by Fig. 1, the difference between the two being a variation in form not affecting the principle of operation.

G is a pipe connecting the upper and lower portions of the cylinder.

The induction-pipe E, Fig. 2, will enter at the upper part of the cylinder A. The valves *x x* are placed near the end of the pipe E, where it enters the cylinder, and near the end of the pipe G where it enters the upper part of the cylinder. In this construction the liquid admitted below the piston is, by the downward stroke thereof, forced through the pipe G to the upper part of the cylinder between the diaphragm and the piston.

These pumps work equally as well whether pumping from pressure or vacuum in the induction-pipes.

Having described our invention, what we claim, and desire to secure Letters Patent of the United States, is—

1. A compression or vacuum pump wherein the internal operating mechanism is lubricated and sealed by a liquid, in combination with a liquid-reservoir and intermediate connecting-pipes, whereby the same sealing and lubricating liquid is repeatedly admitted and discharged to and from said pump without exposure to the atmosphere, substantially as described.

2. A compression or vacuum pump wherein the internal operating mechanism is lubricated and sealed by a determined quantity of liquid, in combination with a liquid-reservoir and intermediate connecting-pipes, whereby the same sealing and lubricating liquid is repeatedly admitted and discharged to and from said pump without exposure to the atmosphere, substantially as described.

3. A compression or vacuum pump wherein the internal operating mechanism is lubricated and sealed by a determined quantity of liquid, in combination with a liquid-reservoir which holds the liquid under pressure, and intermediate connecting-pipes, whereby the same sealing and lubricating liquid is repeatedly admitted and discharged to and from said pump without exposure to the atmosphere, substantially as described.

4. A compression or vacuum pump having within the pump-cylinder a liquid-sealed piston-rod and a valved piston, which upon its forward movement is liquid-sealed, and which receives the air or gas in an air-chamber in said pump-cylinder upon one side of the piston while it is discharging its previously-obtained charge of air or gas from an air-chamber on the other side of said piston, substantially as described.

5. A compression or vacuum pump having within said pump a liquid-chamber and liquid for sealing the piston-rod, a valved piston, a valved diaphragm, a chamber for holding liquid to seal the valves of said diaphragm, and an overflow or discharge pipe for the passage of the surplus liquid and gas, substantially as set forth.

6. A compression or vacuum pump in which a body of liquid is admitted below the piston, and having an air-chamber above the piston, and upon the descent of the piston the liquid

is forced to its upper side, and which, upon the return-stroke, is carried to the discharge end of the cylinder, thereby expelling all the gas contained in the cylinder at the beginning of the upward stroke, substantially as described.

7. A compression or vacuum pump having a sealed piston-rod, a valved diaphragm, and valved piston, with an air-chamber interposed between said diaphragm and piston, wherein the air or gas is forced through a body of liquid on its passage to the eduction-pipe, whereby the air or gas is cooled before leaving the pump-cylinder, substantially as described.

8. A compression or vacuum pump in which a new or fresh supply of liquid is admitted to the cylinder upon each upstroke of the piston, and a portion thereof forced through the piston at each downstroke and carried by the piston upon its upstroke through a valved diaphragm, thereby displacing the heated liquid above the diaphragm and renewing the same upon each upstroke of the piston, substantially as described.

9. The combination of a compressed-air or gas reservoir or tank containing a lubricating and sealing agent with an air or gas compressor, connected by suitable means, whereby a predetermined quantity of liquid is introduced into the compressor, passed through the same, lubricating and sealing the working parts thereof, and is returned to the reservoir without exposure to the atmosphere, substantially as herein set forth.

10. A compression or vacuum pump having a chamber holding a liquid which at all times lubricates and seals the piston-rod, a valved piston which is liquid-sealed upon its forward stroke, a valved diaphragm which is liquid-sealed upon the return-stroke of the piston, with an air or gas chamber between said diaphragm and piston, an induction-pipe for the admission of the gas and liquid below the piston, and a discharge-pipe above the diaphragm, substantially as described.

11. A compression or vacuum pump having a liquid-sealed valved diaphragm, which sustains the pressure of the compressed air or gas when the piston begins its return-stroke, and an air or gas chamber between the liquid, which seals the piston-rod and the piston, substantially as described.

12. In a compression or vacuum pump, the combination of a valved piston, a valved diaphragm, with an interposed body of liquid between said piston and diaphragm, and an inclosed chamber below the piston, substantially as described.

13. A compression or vacuum pump having a valved piston which becomes liquid-sealed upon the completion of its return-stroke by being immersed in a liquid, and which, upon the completion of its forward stroke, has received its charge of gas between the piston and the liquid in which the piston was immersed for sealing, substantially as described.

14. A compression or vacuum pump having a chamber for holding the liquid to seal and lubricate the piston-rod, a liquid-sealed piston which, upon its half-stroke, has an air or gas chamber each side of said piston, a valved diaphragm with a chamber for holding a liquid to seal the valves in said diaphragm, an air or gas chamber above the liquid-chamber and liquid which seals the diaphragm-valves, and an eduction-passage leading therefrom, substantially as set forth.

15. A compression or vacuum pump having within the pump-cylinder, between the head-plate or cap of the pump, through which the piston-rod moves, and the piston, an interposed liquid to seal and lubricate said piston-rod, and a chamber for the reception of air or gas, substantially as set forth.

16. A compression or vacuum pump having a chamber holding a liquid which at all times lubricates and seals the piston-rod, a valved piston which is liquid-sealed upon its forward stroke, a valved diaphragm which is liquid-sealed upon the return-stroke of the piston, and an air-chamber between said piston and diaphragm, substantially as described.

In testimony whereof we have hereunto set our hands.

JOHN C. DE LA VERGNE.
W. M. MIXER.

In presence of—
WALTER W. MONTAGUE,
STEPHEN BYRNES.