(No Model.)

G. WESTINGHOUSE, Jr.

EXHAUST PUMP.

No. 550,359. Patented Nov. 26, 1895.

Fig. 2.

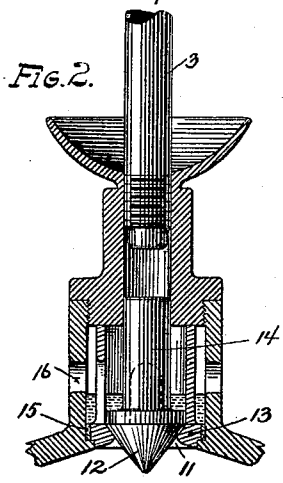
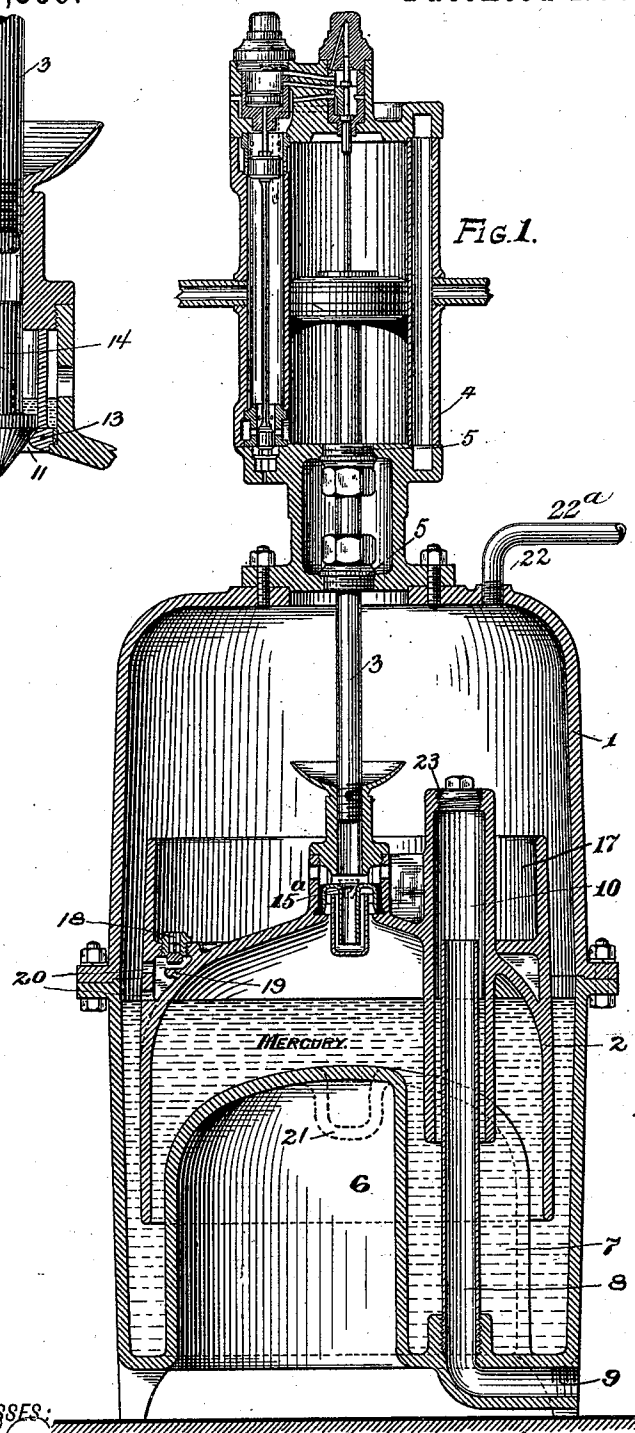


Fig. 1.



WITNESSES:
Chas. F. Scott
W. C. Dener

INVENTOR
Geo. Westinghouse Jr.
BY
Terry & MacKaye
ATTORNEYS

UNITED STATES PATENT OFFICE.

GEORGE WESTINGHOUSE, JR., OF PITTSBURG, PENNSYLVANIA.

EXHAUST-PUMP.

SPECIFICATION forming part of Letters Patent No. 550,359, dated November 26, 1895.

Application filed November 26, 1892. Serial No. 453,198. (No model.)

To all whom it may concern:

Be it known that I, GEORGE WESTINGHOUSE, Jr., a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Exhaust-Pumps, (Case No. 525,) of which the following is a specification.

My invention relates to pumps for air or gas, and particularly to such as are adapted to exhaust the bulbs of incandescent electric lamps.

The object of my invention is to provide a mechanical pump which shall supplant the slow mercury pumps now in ordinary use, combining the advantages of quick action possessed by mechanical pumps with those of thorough exhaustion presented by devices wherein mercury is employed.

In carrying out my invention I employ a reciprocating bell, which is intermittently brought into connection with the vessel to be exhausted and in which the necessary exhausting effect is produced by the displacing action of mercury or other proper liquid. Thus far there is no difference in principle between my invention and the devices now commonly in use. In my method of pumping, however, the bell itself is moved alternately into and out of the body of displacing liquid, which latter is stationary. This action differentiates my invention from those above mentioned, inasmuch as in these latter the body of displacing liquid is raised and lowered or otherwise moved into and out of the exhausting-chamber.

Apparatus embodying my invention is illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal section of my device, and Fig. 2 is a sectional detail view of a preferred form of valve.

In my pump the casing 1 takes the place of the cylinder of an ordinary mechanical exhaust-pump; but the piston is replaced by a reciprocating bell 2, moved by means of the piston-rod 3. This reciprocating movement may be imparted in any desired way; but the agency which I prefer to use is a directly-acting engine 4, which may be driven by air, water, steam, or any desired power. In using this form of motor the piston-rod of the pump is simply an extension of the rod of the engine. Between the two cylinders a tight packing or packings 5 are provided.

Within the casing 1 is placed a body of liquid of a nature proper for use in displacing the gas or air in the bell. The best liquid known to me for this purpose is mercury.

In order to render necessary the smallest possible amount of mercury the bottom of the casing is provided with an inward bulge 6. At one side this bulge is hollowed out or recessed, at 7, to permit the introduction of an air-inlet pipe 8, which preferably extends vertically from the bottom of the casing 1 and communicates with the opening 9, with which the vessel to be exhausted is connected.

As shown in the drawings, the bell 2 is adapted to fit over the bulge 6 and thus to be more or less filled with mercury as it descends or ascends. This bell is provided with a sealing-tube 10, adapted, as the vacuum-chamber descends, to form a mercury seal around the inlet-pipe 8, for the purpose explained hereinafter. This tube is preferably sealed by mercury or cement at 23.

In order to permit of the escape of all gas or air contained in the bell as it descends, I provide an opening 11 at the top thereof. This opening may be provided with any form of valve opening upward only; but I prefer to use the liquid-seal valve illustrated in Fig. 2. As preferably formed, this valve is inserted in the opening 11 and is composed of a movable member having a conical end 12, adapted to fit a correspondingly-coned seat in the valve-cylinder 13. This movable member is guided, as shown, to rise and fall in a vertical path by means of a straight body 14, preferably cylindrical, moving in an appropriate guide. The operation of this form of guide is as follows: When the bell 2 descends, the air or gas therein contained is driven out through the aperture 11, raising the coned member 12 and being followed by the mercury, which fills the entire bell and valve-cylinder and escapes through openings 16 to run back to the main body of mercury below. The holes 16 are situated high enough above the seat 13 so that when the downward movement of the bell ceases and the cone 12 falls

to its seat a sufficient quantity of mercury lies on the cone, as illustrated, to keep it to its seat and to secure a perfectly-tight seal.

Another form of valve, in the form of a cup-trap, is shown in Fig. 1 and has been used by me; but I prefer the form shown in Fig. 2. In Fig. 1 the cone 15^a may be used in connection with the trap, if desired. This form of valve acts simply as a trap. When the bell is sufficiently lowered, the mercury overflows through the valve, and when it ascends the lower cup is left full of mercury, which forms a seal.

When no displacement-ring is used on the bell, the mercury that overflows simply runs down the top of the chamber to rejoin the mass below.

In order to insure a flow of the mercury through the valve and thus effect the removal of any bubbles of air that may adhere to the walls of the bell, I use a displacement-ring 17, the effect of which is to cause the mercury to rise between the shell 1 and the bell considerably above the level of the mercury seal over the valve 12. The space inclosed by the ring 17 acts as a receptacle for the mercury that flows from the inside of the bell. This arrangement admits of a large flow of mercury at each stroke. The mercury that flows through the valve is prevented from running back into the mercury outside of the valve by valves which are held to their seats by the outward pressure of the mercury. So soon, however, as the bell is drawn above the mercury these valves open and the mercury that has passed the valve flows back into the general chamber.

The reverse bulge or central top recess 21 may be employed at the top of the bulge 6 to receive the cone 12 and so permit the bell to be lowered farther than would otherwise be possible.

In using this pump the bell 2 is simply moved up and down within its casing. As the bell is lowered it is entirely filled with the displacing liquid, as above stated, all condensed air or gas being driven out and a seal being formed at the valve 12. The only air or gas left in the bell is that found in the sealing-tube 10; but this is isolated from the remaining portion of the bell by the seal formed by the dipping of said sealing-tube below the surface of the liquid. Of course the inlet-pipe 8 and the vessel to be exhausted are constantly in communication with the sealing-tube. The bell is then lifted, and if the air or gas in the upper portion of the casing were at atmospheric pressure the mercury in the casing would follow the bell to a height of about thirty-one inches, depending on the barometer. In order to insure the falling away of the mercury from the top of the bell, I partly exhaust the air in the main casing. Indeed, I prefer to keep this casing as nearly perfectly exhausted as may be by means of ordinary exhausting means connected to the opening 22. This is indicated by the pipe 22^A, which is understood to lead to an ordinary mechanical air-pump or other exhausting device. In practice I have found it possible to maintain about a twenty-nine-inch vacuum in the upper part of the casing. The bell is thus raised, a practically perfect vacuum being formed as it leaves the mercury behind, until the edge of the sealing-tube 10 comes near enough to the top of the mercury to permit the air in said tube to break its seal and rush out into the main chamber. The bell is then carried to the top of its stroke, when the edge of the tube 10 just clears the mercury, and the air or gas previously confined to the sealing-tube, the inlet-pipe, and the vessel connected therewith for exhaustion expands to fill the bell. The process of lowering and raising is thus continued until the proper degree of exhaustion is reached.

It is clear that as the bell may be made of very large capacity with relation to the lamps or other vessels to be exhausted, it will need comparatively few reciprocations of the same to complete the process of exhaustion. Thus this process may be carried on by my method with a rapidity unattainable with the Sprengel-pump type of apparatus, owing to the large bulk of mercury required to be moved in this latter, and with a completeness impossible of attainment with the ordinary mechanical pump.

While I have shown a direct-acting engine for the purpose of moving the bell into and out of the mercury, I do not limit myself to that arrangement. The same result may be attained by any of the well-known mechanical means.

I claim as my invention—

1. The combination with a casing, of a reciprocatory bell therein provided at its top with a valved outlet and a body of liquid in said casing which entirely fills said bell when the latter is in its lowest position and an inlet pipe the open end of which is above said body of liquid, substantially as described.

2. The combination with a casing and a body of liquid therein, of a reciprocatory bell movable downwardly into said liquid so as to be entirely filled thereby and having an outlet at its top provided with a submerged cone valve, and an inlet pipe terminating above said body of liquid, substantially as described.

3. In a pump, a stationary body of liquid and a reciprocating bell having an outlet in combination with a sealing valve in said outlet, a displacement ring around said bell and an overflow valve, for permitting the return of overflowing mercury to the main body, substantially as described.

4. In a pump, a stationary body of liquid and a reciprocating bell having an outlet; in combination with a sealing valve in said outlet, a displacement ring around said bell and an overflow puppet valve for permitting the return of overflowing mercury to the main

body and closing upward by flotation, substantially as described.

5. The combination with a casing having a body of liquid therein and a stationary inlet pipe extending above said body of liquid, of a reciprocatory bell having a sealing tube inclosing said inlet pipe and cooperating with the liquid to cut off communication between the inlet pipe and the bell except when the latter is elevated, substantially as described.

6. The combination with a casing having a body of liquid therein and an inlet pipe extending upwardly through and above the liquid, of a reciprocatory bell having a sealing tube closed at its upper end and extending downward over said inlet pipe and cooperating with the liquid to cut off communication between the pipe and chamber except when the latter is elevated, substantially as described.

7. In a pump, a casing having an inwardly bulging imperforate bottom and an inlet above the same, a reciprocating bell fitting over said inward bulge, and a stationary body of liquid submerging said bulge and entirely filling said bell when the latter is at its lowest point, substantially as described.

8. In a pump, a partly exhausted casing having an inwardly bulging imperforate bottom and an inlet above the same, a reciprocating bell having a valved opening in its top and fitting over said inward bulge, and a stationary body of liquid submerging said bulge and entirely filling said bell, when the latter is at its lowest point, substantially as described.

9. In a pump, a casing having an inwardly bulging bottom, said bulge having a recess, an inlet pipe standing in said recess and a stationary body of liquid; in combination with a reciprocating bell moving in said casing, and a sealing tube carried by said bell and fitting over said inlet pipe, substantially as described.

10. In a pump, a partly exhausted casing having an inwardly bulging bottom, said bulge having a recess, an inlet pipe standing in said recess and a stationary body of liquid; in combination with a reciprocating bell having a valved opening in its top and moving in said casing, and a sealing tube carried by said bell and fitting over said inlet pipe, substantially as described.

11. In a pump, a partly exhausted casing having an inwardly bulging bottom, said bulge having a recess, an inlet pipe standing in said recess and a stationary body of liquid; in combination with a reciprocating bell moving in said casing, a displacement ring on said bell, an outlet in the top of said bell and a sealing valve in said outlet, and a sealing tube carried by said bell and fitting over said inlet pipe, substantially as described.

12. In a pump, a partly exhausted casing having an inwardly bulging bottom, said bulge having a central recess and a side recess, an inlet pipe standing in said side recess and a stationary body of liquid; in combination with a reciprocating bell moving in said casing, a displacement ring on said bell, an outlet in the top on said bell, and a sealing valve in said outlet, and a sealing tube carried by said bell and fitting over said inlet pipe, substantially as described.

In testimony whereof I have hereunto subscribed my name this 21st day of November, A. D. 1892.

GEO. WESTINGHOUSE, JR.

Witnesses:
JAMES WM. SMITH,
HAROLD S. MACKAYE.