

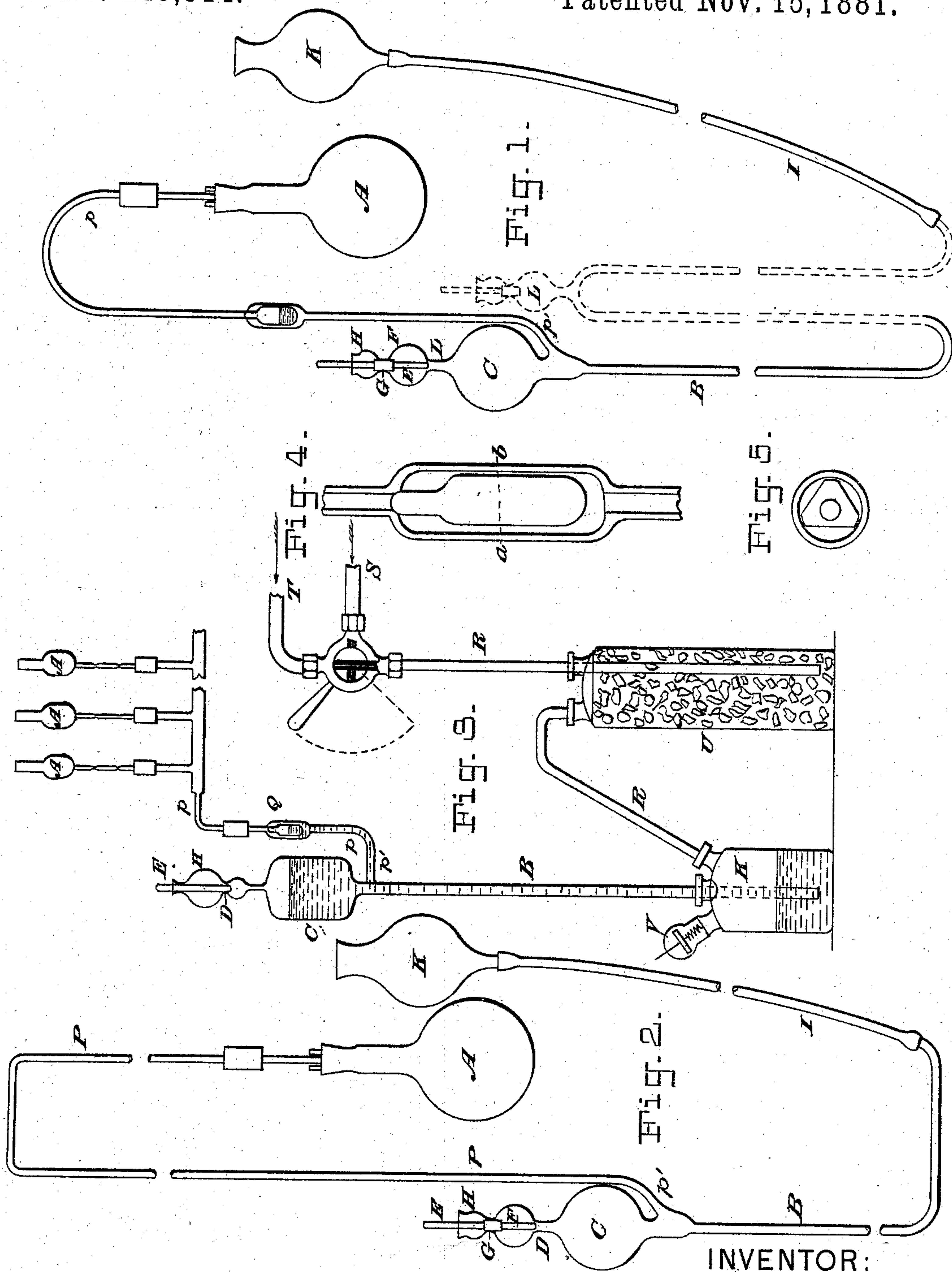
(No Model.)

ST. G. L. FOX.

PUMP OR EXHAUSTING APPARATUS.

No. 249,514.

Patented Nov. 15, 1881.



WITNESSES:

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ST. GEORGE LANE FOX, OF LONDON, ENGLAND.

PUMP OR EXHAUSTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 249,514, dated November 15, 1881.

Application filed May 16, 1881. (No model.) Patented in England August 28, 1880.

To all whom it may concern:

Be it known that I, ST. GEORGE LANE FOX, of London, England, have invented certain new and useful Improvements in Pumps or Exhausting Apparatus, of which the following is a specification.

This invention of improvements in pumps or exhausting apparatus forms part of the subject of British Letters Patent granted to me on 28th August, 1880, No. 3,494, and has been specially designed for the purpose of exhausting the air from electric lamps, but it is also applicable to exhausting air or vapor or gas from other objects.

My invention relates to that class of pumps or exhausting apparatus which employs a liquid—usually mercury—as the vacuum-producing medium, the said liquid being caused to alternately fill and empty an exhausting bulb or chamber connected by a pipe with the lamp or other object from which the air is to be exhausted, suitable air outlets and valves being provided to enable the device to work properly. The distinctively novel features will be definitely set forth in the claims.

Figure 1 of the accompanying drawings is an elevation of a pump constructed according to my invention and adapted for the use of mercury. Fig. 2 is an elevation of the same pump without the valve, and with the communicating-pipe carried up to the height of about forty inches. Fig. 3 is an elevation of the pump when constructed for the use of sulphuric acid or other liquid of comparatively light specific gravity. Fig. 4 is an enlarged view of the valve, and Fig. 5 a horizontal section through the line *a b* of Fig. 4.

In Fig. 1, A is the lamp or object to be exhausted. B is a vertical glass tube thirty inches high, or more, and terminating at its upper part in a bulb, C. The neck D of the bulb is ground, and it receives at certain times the ground lower end of a glass rod, E. This neck opens into another bulb, F, above, through the neck G of which the rod E also passes. The part of the rod which passes through the neck G is covered with india-rubber or other suitable material, so that when the rod E is pressed fully down it will close both necks, when partly lifted it will open the neck D while keeping the neck G still hermetically closed, and when lifted still higher, or entirely removed, it will

open both necks. Above the upper bulb is a cup, H. To the lower end of the glass tube B, I connect one end of a strong flexible tube, I, of greater length, to the other end of which an open vessel, K, is fitted. Sometimes I interpose an air-trap, L, as shown in dots, between the tubes B and I, but this air-trap is not essential. To the glass tube B, at P', just below the bulb C, I attach another tube, P, the other end of which is connected to the lamp A. In this tube P, I fit a valve or device, Q, (weighted with mercury,) which, when it rises, closes the communication between B and A.

The action of the apparatus is as follows: The open vessel K having been filled, or partly filled, with mercury when in a lowered position, is raised to such a height that while it becomes nearly empty the mercury rises in the two bulbs C and F, filling the same up to the cup H. The neck G of the upper bulb, F, is then closed by the rod E, the neck D of the lower one being left open. The open vessel K is then lowered until the mercury falls well below the point P'. The consequent fall of the mercury in the bulbs produces a vacuum which will be filled by the air in the lamp A forcing its way through the pipe P and the valve Q into the bulb C and upper part of the tube B. The vessel K is then again raised, the neck G of the upper bulb, F, being opened to allow the air to escape, the valve Q closing to prevent any mercury being forced through the pipe P to the lamp A. The bulbs C and F again become full of mercury, the neck G is again closed, the open vessel again lowered, and the operations are continued until the lamp A is almost exhausted. The pumping action is then somewhat modified, thus: the vessel K is raised and lowered several times while the rod E is out, so as to make the mercury rise and fall in the bulbs, which should now be slightly warmed in order to evaporate any moisture which may be present on their sides. Having got rid in this way of all traces of aqueous or other vapor, the rod E is again inserted (while the vessel K is raised) into the neck G, leaving the neck D open. The vessel K is then again raised and lowered several times, so that the mercury alternately rises and falls in the bulbs, and in this way all traces of air from the surface of the tubes or bulbs will collect in the upper bulb, F. The vessel K is then placed

at such a height that the mercury fills the bulb C and is just above its neck D. The rod E is then forced down so as to close this neck, and the vessel K is lowered until the mercury is
 5 below the point P', again raised, and so on as long as may be found necessary.

The use of the upper bulb, F, is not essential, but by its employment the vacuum in the lower bulb, when the mercury falls, is rendered
 10 more perfect.

By using sulphuric acid with the mercury, so as to wet the surface of the bulb C and the ground-joint at the neck D, the bulb F may be altogether dispensed with, but the acid must
 15 be very pure, and the cup H should be almost closed at top, as in Fig. 3, leaving, however, a sufficient opening for the rod E to be moved freely up and down.

It will be understood that the joint or connection at P' forms a liquid-valve which automatically closes and opens the end of the pipe P as the mercury respectively rises and falls.

The modification shown in Fig. 2 is precisely the same as that shown in Fig. 1, except that
 25 the valve or device Q is dispensed with, and in order to prevent the mercury being forced up into the lamp the tube P is made sufficiently high—say forty inches, more or less.

Referring, now, to the modification shown in Fig. 3, which I adopt when sulphuric acid or other liquid of comparatively light specific gravity is employed in lieu of mercury, the same letters of reference as those in Fig. 3 refer to corresponding parts. The pipe B, in this
 30 modification, instead of being connected with a rising and falling vessel, K, Figs. 1 and 2, is connected with a fixed vessel, K, slightly larger than the bulb or vessel C, and which is connected by a tube, R, with a pump worked
 35 by steam-power or otherwise, so as to alternately force air into and exhaust air from the vessel K.

S T are respectively the pressure and vacuum pipes communicating between the tube R
 45 and the pump.

The action of the apparatus is the same as that hereinbefore described with reference to Fig. 1, the alternate pressure and exhaustion produced by the pump having the effect, like
 50 the rise and fall of the vessel K, Fig. 1, of causing the acid to alternately rise in the bulb or vessel C and then fall below the point P', and thereby to alternately force out the air from the vessel C through the neck D and
 55 produce a vacuum in the pipe P.

U is an air-drier interposed in the tube R, and V is a valve weighted so as to open outward at the pressure due to the column of acid when it reaches about the middle of the cup

H. The acid should be pure and kept as cool
 60 as possible.

What I claim, and desire to secure by Letters Patent, is—

1. An air or gas exhausting device consisting of the combination of an exhausting bulb
 65 or vessel, an opening at the top thereof, means for hermetically closing said opening, an inlet-pipe tapping the bulb at the lower part thereof, means for causing mercury or other liquid to ascend said pipe into the bulb, and to descend from the bulb into said pipe at will, a vacuum-pipe leading from the object to be exhausted to and terminating near the bottom of the exhausting-bulb, and a weighted valve arranged in said pipe, adapted to unseat itself
 70 by its own weight, and of such weight as to float on the mercury or other liquid used when the latter ascends to its level, and thereupon to seat itself, substantially as set forth.

2. The combination of a bulb or vessel having an orifice at its top surmounted by a cup, a plug or stopper adapted to work through said cup and close said orifice, a pipe leading from the bottom of said bulb, means for causing mercury or other liquid to ascend said pipe
 85 into said bulb, and to descend from the bulb into the pipe at will, and a pipe communicating with the lower part of said bulb and leading to the object to be exhausted, substantially as set forth.

3. The combination of bulb or vessel C, its neck D, cup H, closing device E, pipe B, a suitable pumping appliance communicating with said pipe, and pipe P, substantially as set forth.

4. An air or gas exhausting device comprising a bulb, C, having a neck, D, at its top, the cup H, the closing device E, ground to fit into the neck D, the fluid-pipe B, arranged to enter the bulb C at its bottom, the flexible pipe
 100 I, connecting the pipe B and vessel K, the said vessel, the pipe P arranged to tap the pipe B just below the bulb C, as shown, and the valve Q, or its substantial equivalent, arranged in the pipe P, substantially as and for the purposes
 105 set forth.

5. The combination of the bulb or vessel C, formed with a neck, D, an upper bulb, F, having a neck, G, and the cup H, with the stopper E, adapted to close both necks D and G,
 110 substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ST. G. LANE FOX.

Witnesses:

JOHN C. MEWBURN,
 HUGH P. HOUGHTON.