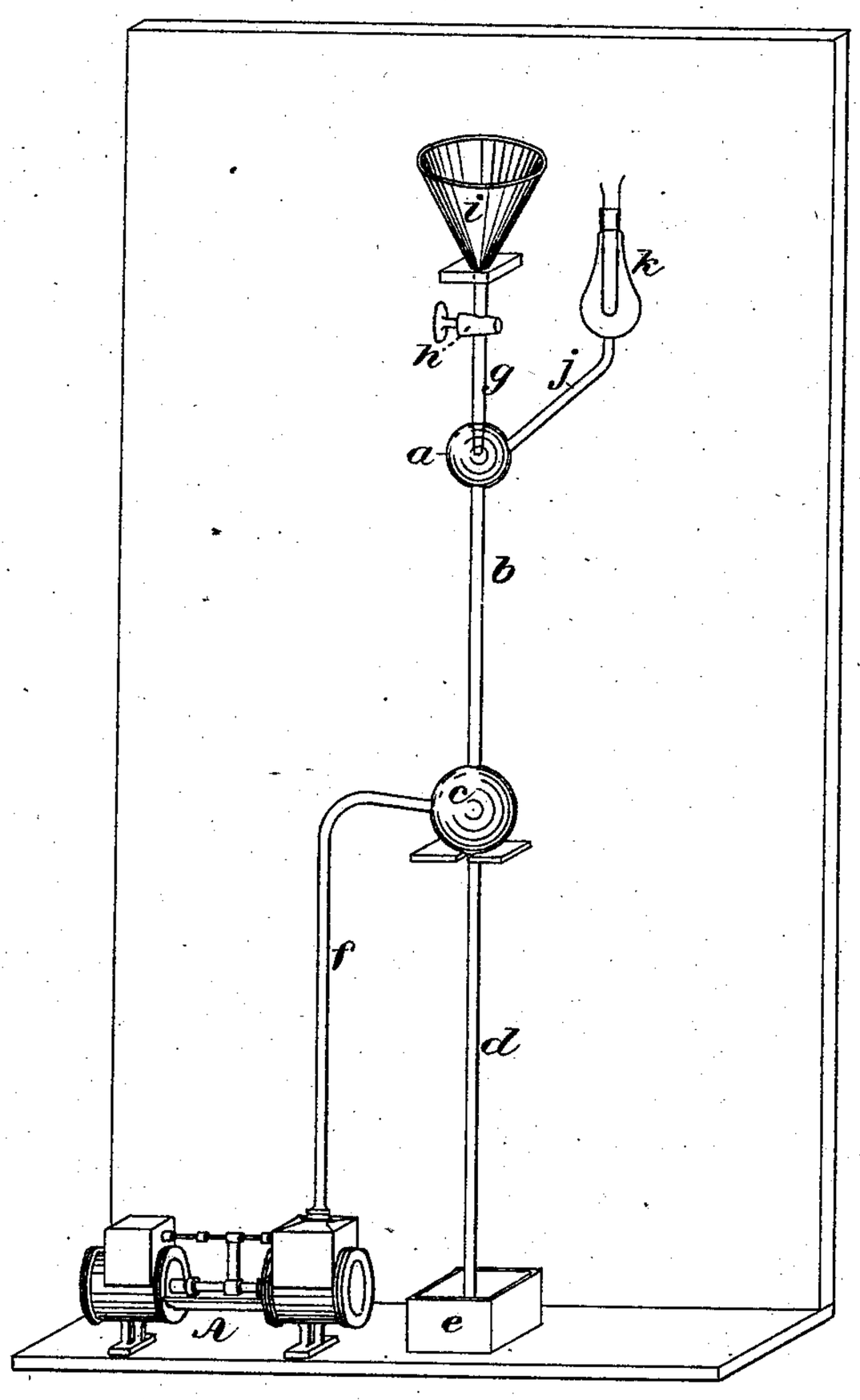
(No Model.)

W. STANLEY, Jr.

AIR PUMP.

No. 294,412. Patented Mar. 4, 1884.



ATTESTS.

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UNITED STATES PATENT OFFICE.

WILLIAM STANLEY, JR., OF ENGLEWOOD, NEW JERSEY.

AIR-PUMP.

SPECIFICATION forming part of Letters Patent No. 294,412, dated March 4, 1884.

Application filed April 27, 1882. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM STANLEY, JR., of Englewood, in the county of Bergen and State of New Jersey, have invented a new and useful Improvement in Air-Pumps, of which the following is a specification.

In the manufacture of electric lamps it is of great importance to produce a substantially perfect vacuum in the globes of such lamps, in order that the carbon or other incandescent material employed to retard the current of electricity and produce the light may be unaffected by the oxygen or other ingredients of the air, the presence of which would cause combustion and the rapid destruction of the incandescent material, as well as the liability of electrolysis between its poles. Many forms of apparatus have been devised, and many ingenious methods suggested and tried; but thus far such methods and apparatus have been lacking in the requisite economy, by reason of the large amount of time required in the operation.

The present invention relates to an improved apparatus or air-pump especially designed for exhausting the globes of electric lamps, but practical for forming vacuums in many other vessels; and it consists of a mercurial air-pump working, substantially, upon the principle of the Sprengel pump, in combination with a common exhaust-pump worked by any desired power, the two being so connected with the globe or other vessel to be exhausted that they co-operate to remove the air therefrom during the entire operation.

The invention is illustrated in the accompanying drawing, which is a view in perspective of the apparatus with a globe in position to be exhausted, and in which *a* represents a bulb or enlargement connected by a vertical tube, *b*, to a second, *c*, preferably larger than the bulb *a*. The bulb *c* is connected by a vertical tube, *d*, to a reservoir, *e*, and by a tube, *f*, to an exhaust-pump, A. The upper bulb, *a*, is connected by a tube, *g*, provided with a stop-cock, *h*, to a mercury-supply reservoir, *i*, preferably funnel-shaped. The bulb *a* is also provided with a branch tube, *j*, to the upper end of which the globe or other vessel to be exhausted is attached by a short tube or other means, by which an air-tight connection is formed. The tube *g* preferably projects into the bulb *a*, so that its end is slightly above the line of the branch tube *j*, if extended to near the center of the bulb, and the lower half of the bulb *a*, instead of being hemispherical, as shown in the drawing, may be, with advantage, cone-shaped, with its apex forming the upper end of the tube *b*, which construction would better enable the successive drops of mercury to catch successive portions of air, and force them down the tube *b*.

The bulb *c* is not limited to the spherical shape shown in the drawing, inasmuch as its special importance is due to an enlargement of the tubes *b* and *d*, whereby a chamber is formed, in which the air as it is forced from the tube *b* collects; and it should be of sufficient capacity to permit the columns or bubbles of air to become disengaged from the mercury as it falls through this bulb or chamber in its passage from the tube *b* to the tube *d*. The height of the tube *d* should be about thirty or more inches, in order to prevent the mercury from rising into the bulb *c* when a vacuum is formed therein. The height of the tube *b*, or the vertical distance between the bulbs *c* and *a*, will depend largely upon the degree of exhaust produced and maintained by the pump A. This distance should, however, in all cases be sufficient to prevent the air in the bulb *c*, when under the exhaust of the pump, from passing upward through the descending mercury through the tube *b*. If the force of the exhaust in the bulb *c* is represented by twenty-eight inches, a vertical distance of ten or twelve inches between the bulbs will be sufficient for all practical purposes. The bore of the tube *b* should be quite small, so that the successive drops of mercury will completely fill it, to prevent the escape of the air upwardly.

The operation of the apparatus is, briefly, as follows: The parts being in position substantially as shown in the drawing, the reservoir *i* is supplied with mercury, the stop-cock *h* being closed, and, the lower end of the tube *d* being immersed in the cistern of mercury *e*, by a few strokes of the exhaust-pump A, the larger part of the air contained in the globe and in the tubes and bulbs connected there-

with is exhausted through the tube *f*. The stop-cock *h* is then opened sufficiently to allow the mercury to descend through the tube *g* into the bulb *a* in a rapid succession of drops approaching a continuous stream, and thence through the tube *b*, bulb or chamber *c*, and tube *d*, where it displaces a portion of the mercury in said tube, causing it to flow into the reservoir *e*. As the successive drops of mercury descend the tube *b*, the air within such tube is forced downward, and an increased or more perfect vacuum is formed within the tube, into which the air contained in the globe *k* and bulb *a* is constantly drawn, being caught at the mouth of the tube *b* by the successive drops of mercury, and in turn carried down the tube into the bulb *c*. Meanwhile the pump A is in continual operation, to exhaust the air from the bulb *c* as fast as it is delivered from the tube *b*, the ingress of air through the tube *d* being effectually prevented by the column of mercury therein. During the operation, as above described, short columns of air imprisoned between columns of mercury are observed to pass in rapid succession down the tube *b* and into the bulb *c*. These air-columns, during the first stages of the operation, are of frequent occurrence and of considerable size; but as the operation advances they diminish both in frequency and size till only an occasional small bubble of air is seen to descend with the mercury.

Several globes or other vessels can be attached to the tube *j* or to its continuation, and exhausted at the same time by this apparatus, and the supply of mercury can be kept up by emptying the contents of the reservoir *e* into the reservoir *i*. I have, however, invented an apparatus by which several globes attached to separate tubes can be exhausted by means of a single exhaust-pump, and the mercury as it descends the tubes be raised to the desired height by the exhaust of the pump. This invention forms the subject of a separate application filed contemporaneously herewith.

What is claimed as new is—

1. The combination, in an apparatus for exhausting globes for electric lamps and other vessels, of a mercurial air-pump with a common exhaust-pump arranged to operate simultaneously, whereby the mercurial pump will exhaust into the partial vacuum produced by the operation of the common exhaust-pump, substantially as described.

2. The combination, substantially as described, in an apparatus embracing a mercurial air-pump and a common exhaust-pump, of an air-chamber, *c*, connected above with a mercury-supply and a vessel to be exhausted, and with a barometrical tube, *d*, and an exhaust-tube, *f*.

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Witnesses:
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