

(No Model.)

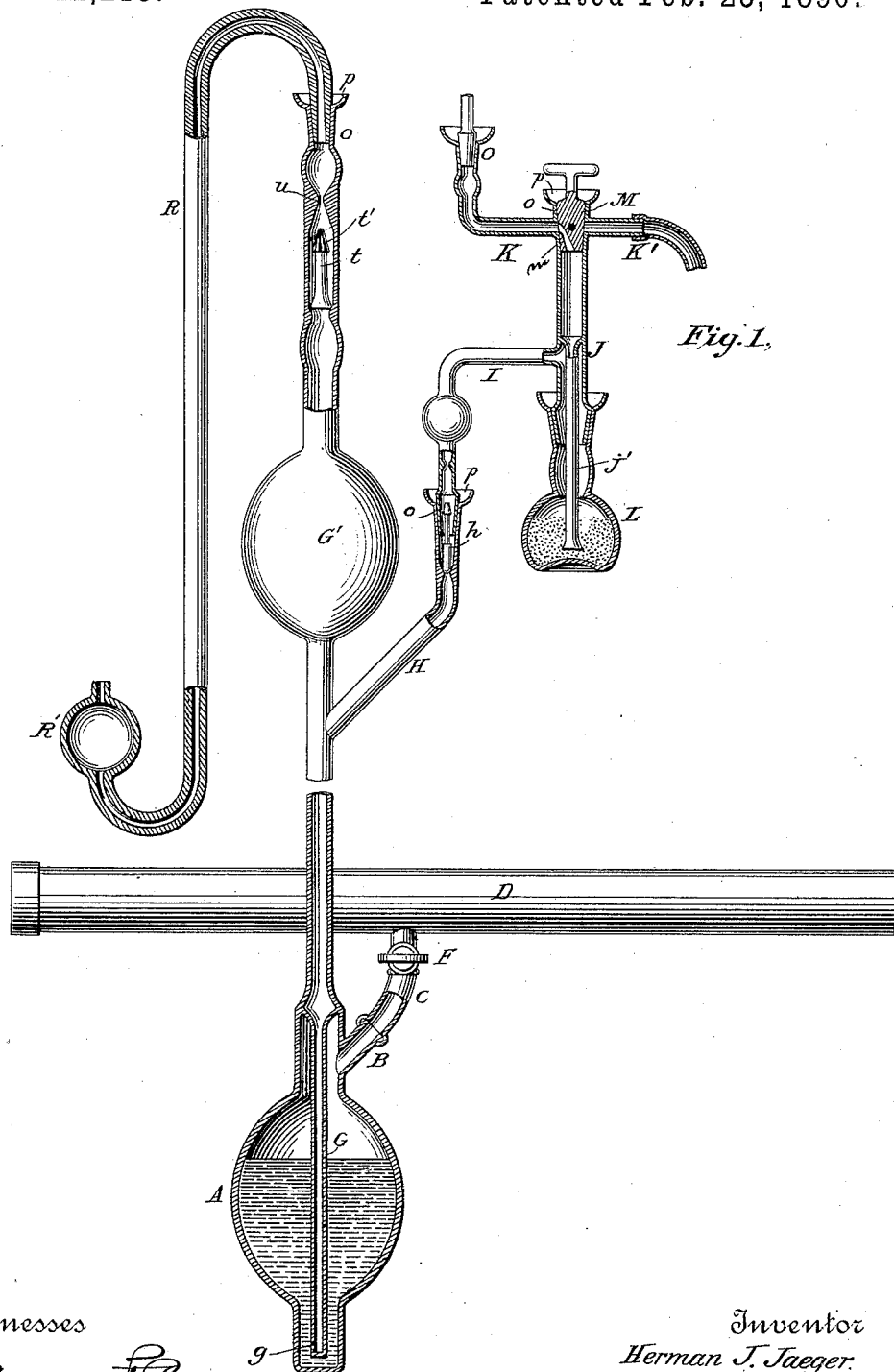
2 Sheets—Sheet 1.

H. J. JAEGER.

EXHAUST APPARATUS FOR INCANDESCENT LAMP GLOBES.

No. 422,219.

Patented Feb. 25, 1890.



Witnesses

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Inventor

Herman J. Jaeger.

By his Attorney

W. J. Johnston

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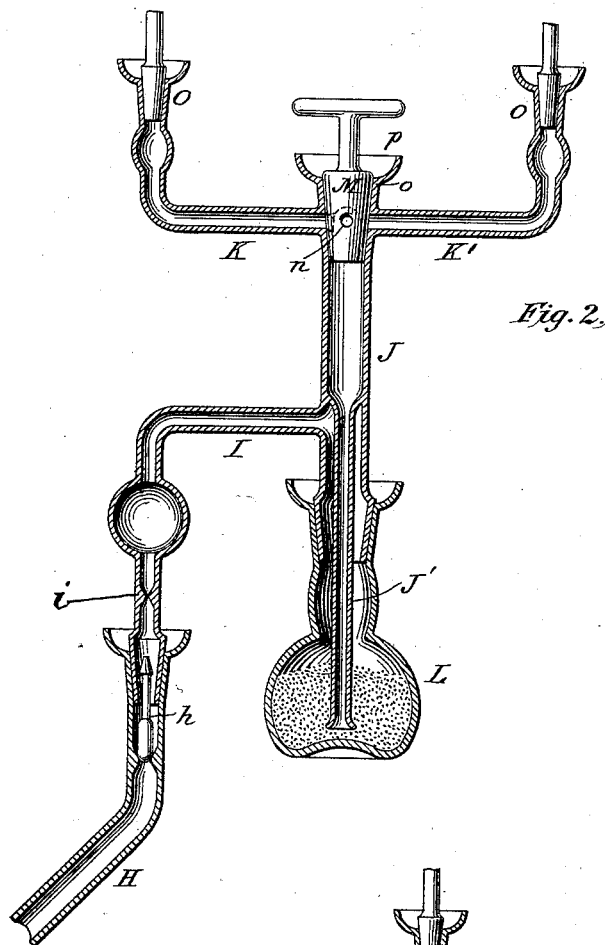


Fig. 2.

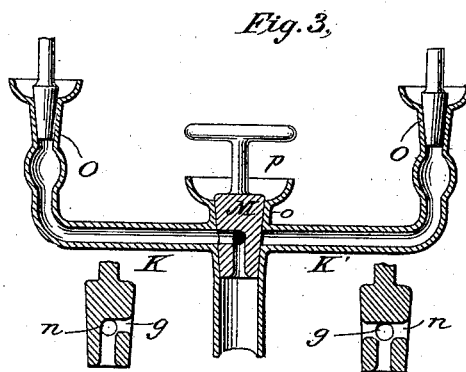


Fig. 3.

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EXHAUST APPARATUS FOR INCANDESCENT-LAMP GLOBES.

SPECIFICATION forming part of Letters Patent No. 422,219, dated February 25, 1890.

Application filed November 17, 1886, Serial No. 219,133. (No model.)

To all whom it may concern:

Be it known that I, HERMAN J. JAEGER, a citizen of the United States, residing in Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Exhaust Apparatus for Incandescent-Lamp Globes; and I do hereby declare that the following is a full, clear, and exact description of my invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Heretofore it has been customary to operate the mercury-pumps commonly employed in exhaust apparatus of this class through the medium of mechanical exhaust-pumps, the latter being applied first in such a manner as to raise the mercury by suction and at the same time partially exhaust the globes, and afterward in such a manner as to draw the mercury back to its original level. By frequent repetitions of this process the globes are exhausted to the degree desired.

My invention contemplates the substitution of mechanical force-pumps for the mechanical exhaust-pumps hitherto employed. I connect force-pumps with the mercury-pumps in such a manner that the pressure exerted by the pump will force the mercury up through a system of tubing, and I depend upon the weight of the mercury itself to bring it back to its original level when the pressure is cut off. In my apparatus the pumping is effected by the movements of mercury back and forth in a system of tubing, just as it is in the apparatus now in use; but the reciprocations of the mercury are produced in my pump by the action of pressure upon the one hand and gravity upon the other, and not by suction in both instances.

Referring to the drawings in which I have illustrated my invention and which form a part of this specification, Figure 1 is an elevation of pumping apparatus constructed in accordance with the principles of my invention. Fig. 2 illustrates a modification, and Fig. 3 shows details.

A is a glass bulb containing mercury, the said bulb being joined by a tube B and a rubber connection C with a metallic pipe or tube D, which is connected to a mechanical pressure-pump. (Not shown.) The tube D has similar connections with a series of mercury-bulbs similar to A, so that the exhaust-pump may be made to operate a large system. Between

the bulb and the pipe D is located a stop-cock F, which serves to connect or disconnect the pipe and the bulb. The same relation exists between the pipe D and every mercury-bulb in the system, so that an operator can at will put the pump into operative connection with as few or as many of the mercury-pumps as he wishes.

A glass tube G extends down into the mercury-bulb A nearly to the bottom, and is provided near its lower end with a hole or perforation *g*. The purpose of the hole *g* is to admit mercury into the tube G, so that when pressure is applied to the mercury through the pipe B the mercury will be forced into the pipe G and up through the system of tubing connected with it. It will be observed that the bulb A has no outlet at the top, the tube G being sealed into it, so as to close the opening at the upper end. It is evident that the mercury will be forced more rapidly into the tube G when the opening *g* is larger. It thus happens that the size of that aperture serves as a very convenient regulator for the action of the pump. The tube G extends upward and at a height of a little more than thirty inches above the top of the bulb A branches into a smaller tube H. A short distance above the branching point—say about thirty-six inches above the bulb A—the tube G is formed into a large bulb G', and above that still it is united by a grinding-joint *o* with a bent and narrowed tube R, which is curved over and extends down vertically for about thirty inches, where it begins to curve up again and is formed into a bulb R', containing mercury. A valve *t* is located between the bulb G' and the joint *o*. This valve as the mercury is forced up is lifted into a passage *u* in the pipe G, but has several slits *t'* made in its face, so as to allow some of the mercury to pass through. Where the tube G is united with the smaller tube R it is formed into a cup *p*, in which I place mercury for sealing purposes.

The tube H is connected with the tubes I, J, and K, the last-mentioned being the tube to which the usual lamp-fork is applied. In the pipes H and I a valve *h* is located, which acts automatically when the mercury rises against it to close a passage *i* in the tube I, so as to prevent the mercury from rising beyond that point. The method of uniting the pipes H and I is the same as that described

above of uniting the pipes G and R. The tube J is similarly joined to the bulb L or to a tube extending upward therefrom. The tube I is not connected directly with the upper portion of the tube J, as will be seen by examining Fig. 1. Above the point of union of the two tubes a smaller tube J' is sealed to the tube J and extends down through it and into the bulb L. The latter contains phosphorous anhydride or some other good drying substance. The top of the tube J is closed by a three-way cock M, which may connect it either with the tube K, as shown in Fig. 1, or with the extension K' of the said tube, or with both at once. The cock M has an opening *m*, extending from the bottom to one side, and an opening *n*, extending horizontally all the way through. The cock is united to the tube by a grinding-joint *o*, the tube being provided with a mercury-cup *p*, like the tube H and the bulb L. On the top of the tube K is a similar connection for the lamp-fork O. The tube K' is connected with a vacuum-pump for the purpose that will be explained hereinafter.

The operation of the parts described is as follows: When pressure is applied from the pump to the mercury within the bulb A, the latter is forced through the hole *g* into the tube G and up through the same, passing the branching-joint of the tube H, filling the bulb G', forcing up the valves *t* and *h*, and passing slowly by the former into the smaller tube R. Owing to the tube G being formed into a bulb at G', the shock on the upper part of the tubing is relieved, and through the valve *t* the force of the mercury on the curved, narrowed portion of the tubing is still further broken. Furthermore, the bulb R' being open to the outer air, a vent is furnished, so that there is no danger of the tubing being broken by the pressure of the mercury. The vertical height of the tube R is somewhat more than thirty inches. The mercury which passes by the valve *t* and beyond the curved portion of the tube R fills the vertical portion of the latter tube. Of course during the process above described the air in the tubes G and R is expelled through the opening of the bulb R'. The mercury meanwhile has been prevented from passing up into the tube I by the valve *h*. When this process is continued long enough, (as will be determined by experiment,) the stop-cock F is turned so as to cut off the pressure from the pump. The mercury is then free to fall by its own weight, being resisted by the partial vacuum existing in the system of tubing. The stop-cock M, being turned to the position shown in Fig. 1, the descent of the mercury will increase the rarefaction in the tubes J and K, and as a consequence tend to exhaust the lamp-globes. By a repetition of this process a vacuum of any desired degree may be secured. The function of the phosphorous anhydride in the bulb L is to remove moisture from the air in the tubes L and K. It is ap-

parent that all the air in passing out is forced to come in contact with the anhydride. To insure a thorough exposure of the air to the drying substance, the opening at the bottom of the tube J' is made large, as seen in Fig. 1.

As an antecedent to the operation above detailed, the cock M may be turned so as to connect the tube K with its extension K', and an air or vacuum pump connected with the latter may be operated to produce a partial vacuum in advance of the work of the mercury-pump. This, however, is not necessary, and is merely a suggested arrangement.

In Fig. 2 the tube K' and the tube K are both connected with lamp-forks, the air or vacuum pump being dispensed with. With this arrangement the cock M is solid and the lower passage *m* extends up to the center of the cock and connects with a passage *n*, running all the way through horizontally, and a passage *g*, running half-way through at right angles with the passage *n*. These details are illustrated in Fig. 3. Ordinarily the cock will be turned so as to connect the tube J with both the tubes K and K'. If it is found, however, that either of the latter tubes or its connections are leaking the passage *g* can be turned alternately to one and the other, so as to test which of the two is defective. The cock M thus constitutes a testing device for the two fork-arms.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination, with a bulb containing mercury and a force-pump suitably connected with the bulb by an air-passage, of a tube extending into the bulb below the surface of the mercury, the said tube being connected with a system of tubing and being provided at or near its lower end with an inlet-passage, as and for the purpose set forth.

2. The combination, with a tube containing mercury, of means for applying air-pressure to the mercury, as set forth, the tube being provided near its extremity with a bulb containing mercury, the said bulb being open to the atmosphere, as and for the purpose set forth.

3. In a mercury-pump for electric-lamp globes, the combination, with a tube supporting the usual lamp-forks, a tube leading to the main mercury-tube, and a tube connected with an air or vacuum pump, of a three-way cock, as described, whereby the globes to be exhausted can be connected either with the vacuum-pump or with the mercury-pump at will.

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

HERMAN J. JAEGER.

Witnesses:

GEORGE H. STOCKBRIDGE,
CHARLES A. SAAL.