(No Model.)

E. P. THOMPSON.

PROCESS OF EVACUATING GLOBES FOR INCANDESCENT ELECTRIC LAMPS.

No. 370,994. Patented Oct. 4, 1887.

Fig. 1.

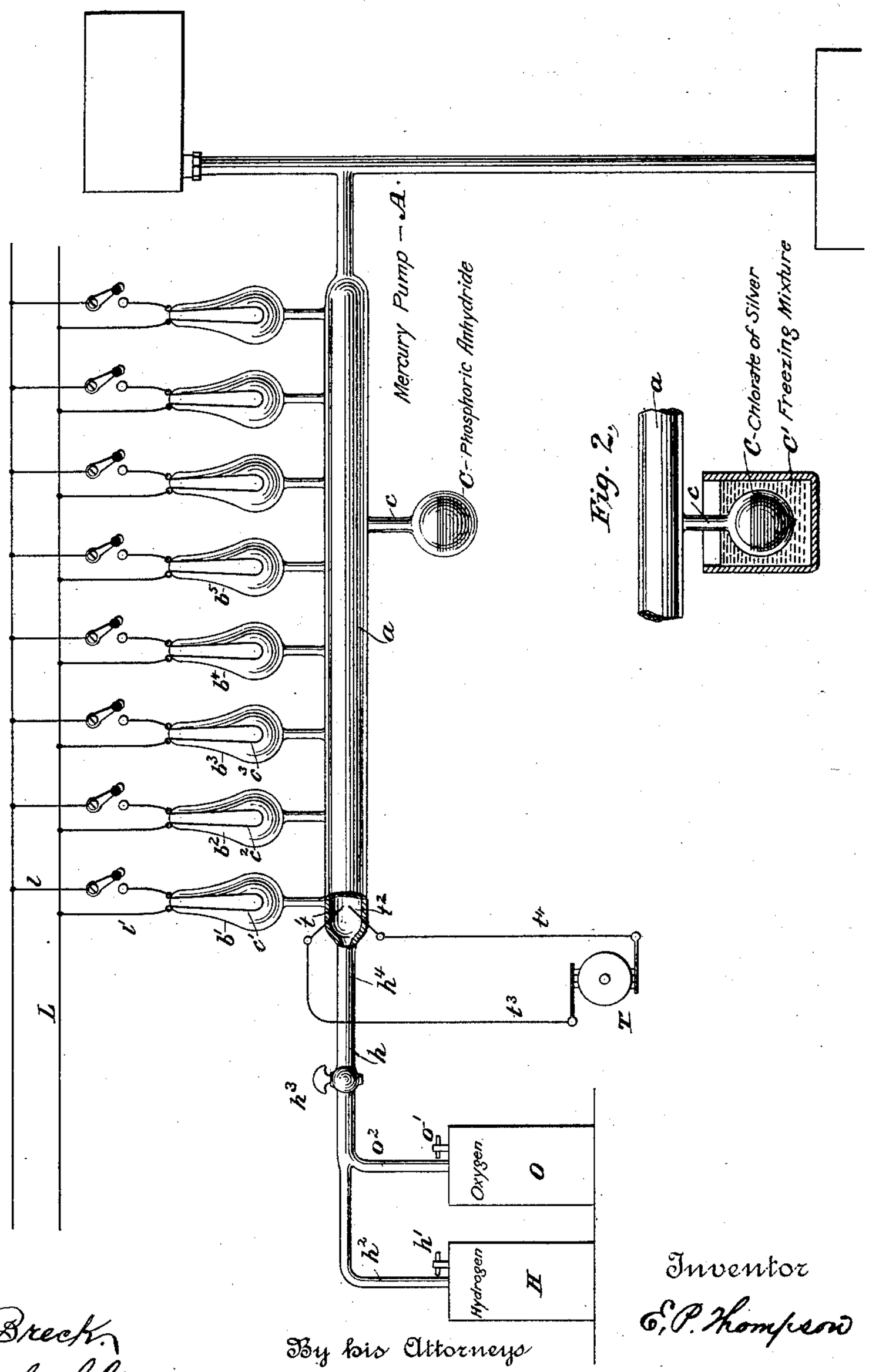

Fig. 2.

Witnesses

Geo. W. Breck.

Carrie E. Ashley

By his Attorneys

Inventor

E. P. Thompson

Poget Edgecomb

UNITED STATES PATENT OFFICE.

EDWARD P. THOMPSON, OF ELIZABETH, NEW JERSEY.

PROCESS OF EVACUATING GLOBES FOR INCANDESCENT ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 370,994, dated October 4, 1887.

Application filed January 22, 1887. Serial No. 225,113. (No model.)

To all whom it may concern:

Be it known that I, EDWARD P. THOMPSON, a citizen of the United States, residing in Elizabeth, in the county of Union, in the State of New Jersey, have invented certain new and useful Improvements in the Process of Evacuating Globes for Incandescent Electric Lamps, of which the following is a specification.

The invention relates to a method of evacuating the globes of incandescent electric lamps.

The object of the invention is to provide means for securing as high a vacuum as possible; and it consists, in general terms, in first exhausting, by any of the usual methods, as great a portion of the air as possible; then charging the globes with an attenuated compound of gases which will combine with each other under certain conditions; then exhausting this atmosphere to as great a degree as is practicable by the use of the exhausting apparatus or pump, and, finally, causing the remaining gases to chemically combiue with each other, thereby increasing the vacuum beyond the degree it is possible to secure by means of the pump. The combined gases are then absorbed to as great a degree as possible by means of some chemical substance having the property of absorbing the particular compound thus derived.

It is a fact now well established that when two or more different gases combine with each other their combining volume is always two. Thus, if two parts of hydrogen and two of oxygen are combined to form water, the resultant volume will be two-thirds of that occupied by the gases when uncombined. Again, if three volumes of hydrogen be combined with one of nitrogen the resultant volume would be two—that is to say, one-half the volume of the uncombined gases. If two volumes of oxygen and one of nitrogen are combined, the resultant volume will be two, in place of the original volume of three. From this it will be understood that if the globes are first exhausted and then charged with a combination of gases for the purpose stated, and these gases be exhausted until a very attenuated atmosphere is secured, and finally they are combined, then the rarefaction will be increased by the proportion that the volumes are decreased—that is to say, if the combination be nitrogen and hydrogen the rarefaction will be doubled. By this means a higher vacuum is secured than has ordinarily been practicable.

The invention will be more particularly described in connection with the accompanying drawings, in which Figure 1 illustrates a general organization of apparatus by means of which the invention may be carried out. Fig. 2 illustrates a modification in the method of applying the chemical absorbing compound.

In another application of even date herewith, Serial No. 225,115, there is described a method of evacuating globes containing some features in common with those herein described.

Referring to the figures, A represents a mercury-pump or other form of exhausting apparatus of any well-known construction, the invention not being dependent upon any special form of vacuum-pump. The tube *a*, extending from the vacuum-pump, is designed to be connected with a series of lamps or globes, b' b^2 b^3, &c., which are to be exhausted. The method of connecting these is well known and need not here be particularly described. The filaments c' c^2 c^3, &c., are preferably placed in electrical connection with a conductor, l l', supplied with currents of electricity from a main, L, in any convenient manner.

The natural atmosphere in the lamps is preferably exhausted by means of the pump A in the usual manner to as great a degree as may be desired, and the filaments are raised to incandescence by means of a current traversing the conductors l l', for the purpose of expelling therefrom the occluded gases. After the lamps have thus been exhausted they are charged with an attenuated atmosphere of gases—as, for instance, a mixture of hydrogen and oxygen in the proportion of two to one. This may be accomplished in a convenient manner by connecting two tanks, H and O, through a tube, *h*, with the tube *a*. The tanks H and O are preferably provided with suitable stop-cocks, h' and o'. The tubes h^2 and o^2, leading therefrom to the tube *h*, are of the proper relative sizes to permit the proportionate flow of gases. The stop-cock h^3 serves to control the flow of the combined gases to the tube *a*. For the purpose of securely closing the tube *h* after the required amount of gas has been furnished, the tube is

preferably closed by the stop-cock h^3 and sealed off at a point, h^4, in the manner employed in sealing the lamps themselves after they have been exhausted according to the usual process. The pump is then again placed in operation and the attenuated mixture of gases is exhausted to as great a degree as practicable from the globes. In this manner as high a state of vacuum is secured as is ordinarily accomplished by means of the process usually employed in evacuating lamps. The next step in the present process, however, consists in combining the remnant of gases, thereby still further increasing the vacuum. This may be conveniently accomplished by again raising the filaments to a red heat during the process of evacuating, and after the highest exhaustion is reached raising them to a sufficient heat to cause the gases to combine. In this instance the combined gases form water, which will exist in the vacuum in the form of attenuated vapor; but the volume of the vapor, as already stated, will be but two-thirds that of the uncombined gases, and thus the vacuum will be increased by one-third.

Instead of causing the gases to combine by heating the filaments, an arc may be formed across two discharge-points, t' and t^2, placed within the tube a, or at any other convenient point for the purpose of igniting the gases. This may be conveniently accomplished by leading conductors t^3 and t^4 from a static generator, T, or from an induction-coil.

It should be noticed that the concussion and increase of pressure which will accompany the discharge will be received by the mercury of the exhaust-pump, so that no injury will be done to the globes themselves nor to the exhausting apparatus. A beneficial result also accompanies this—viz., the pump being in operation at the time the explosion occurs, more or less of the attenuated gas will be forced into the pump and withdrawn at the moment of concussion.

It is desirable that the combined gas be absorbed and withdrawn to as great an extent as possible from the globes, and for this reason there is preferably provided in each instance some chemical having the property of absorbing the particular new compound formed. Thus, when hydrogen and oxygen are employed phosphoric anhydride is preferably used. This is contained in a suitable vessel, C, connected by a tube, c, with the exhaust-tube a. This serves to absorb the vapor of water formed by the combining of the hydrogen and oxygen.

Instead of employing hydrogen and oxygen, it is evident that other gases—such, for instance, as nitrogen and hydrogen—may be employed. In this case it is preferable to use three parts of hydrogen to one of nitrogen, the gas being supplied in their proper proportions after the manner described with reference to hydrogen and oxygen, and the entire process is parallel therewith. It is preferable to use, however, for absorbing the ammonia formed by the combining of the gases the chlorate of silver, which, however, must be maintained in a solid state. The method of accomplishing this is illustrated in Fig. 2, wherein the vessel C is contained within a vessel, C′, containing the freezing-mixture. When the ammonia is absorbed by the chlorate of silver, the new compound which is formed must be held in a solid state; otherwise the new compound formed by the combination of the ammonia with the chlorate of silver would pass into a vapor, thus defeating the object. Other combinations of gases—such, for instance, as one part nitrogen to two of oxygen—may be employed with equivalent results. In the latter the increase in the vacuum is in the same proportion as when hydrogen and oxygen are employed, while in the instance where hydrogen and nitrogen are employed the vacuum is double.

It may be observed that it is not always necessary to exhaust the natural atmosphere by means of a pump, but this may be expelled directly by charging the globes with hydrogen and oxygen, or with the other gases to be employed; but as a matter of economy it is usually preferred to first exhaust that in the manner described.

The invention is of course applicable to securing high vacuums in other vessels than the globes of incandescent electric lamps, and it is not desired to restrict it thereto.

I claim as my invention—

1. The hereinbefore-described process of evacuating globes, which consists in first exhausting the natural atmosphere, charging the globes with a mixture of gases, exhausting such mixture to a greater or less extent, and then causing the remnant of such mixture to form a chemical combination, substantially as described.

2. The hereinbefore-described process of creating high vacuum, which consists in charging a vessel with a mixture of gases, rendering such mixture rarefied, and in causing a chemical combination of the gases constituting such rarefied mixture.

3. The hereinbefore-described process of evacuating electric-lamp globes, which consists in charging the globes with a mixture of gases bearing a predetermined proportion to each other, mechanically exhausting such gases to such an extent as is practicable, causing the remaining mixture to form a chemical combination, and in absorbing more or less of such chemical combination.

4. The hereinbefore-described process of producing a high vacuum, which consists in mechanically procuring a rarefaction of a mixture of gases and in securing the chemical combination of such rarefied gases.

5. The hereinbefore-described process of evacuating globes, which consists in creating within the same a rarefied atmosphere consisting of a mixture of gases adapted to combine with each other chemically and in igniting such mixture by means of an electric current.

6. The hereinbefore-described process of

evacuating electric-lamp globes, which consists in charging the same with an atmosphere consisting of two parts hydrogen to one part nitrogen, rendering the same attenuated, and igniting the attenuated mixture, thereby causing a chemical combination.

7. The hereinbefore-described process of evacuating electric-lamp globes, which consists in charging the same with an atmosphere consisting of two parts hydrogen to one part nitrogen, rendering the same attenuated, igniting the attenuated mixture, thereby causing a chemical combination, and in absorbing the vapor of water formed by such combination.

8. The hereinbefore-described process of increasing a vacuum, which consists in first rarefying the atmosphere, thereupon increasing the pressure of the rarefied atmosphere, reducing the pressure, and subsequently withdrawing the increased pressure, substantially as described.

9. The hereinbefore-described process of increasing the rarefaction within a vessel, which consists in mechanically exhausting the same to as great a degree as is practicable, creating a sudden pressure upon the rarefied atmosphere within the vessel, and during the same time continuing the process of evacuation.

10. The hereinbefore-described process of evacuating globes, which consists in momentarily increasing the pressure of the contained atmosphere without increasing its density, and in withdrawing a portion of such atmosphere when the pressure is so increased.

11. The hereinbefore-described process of producing pressure in the attenuated atmosphere of incandescent electric lamps, which consists in heating the atmosphere to incandescence.

In testimony whereof I have hereunto subscribed my name this 19th day of January, A. D. 1887.

EDWARD P. THOMPSON.

Witnesses:
DANL. W. EDGECOMB,
CHARLES A. TERRY.