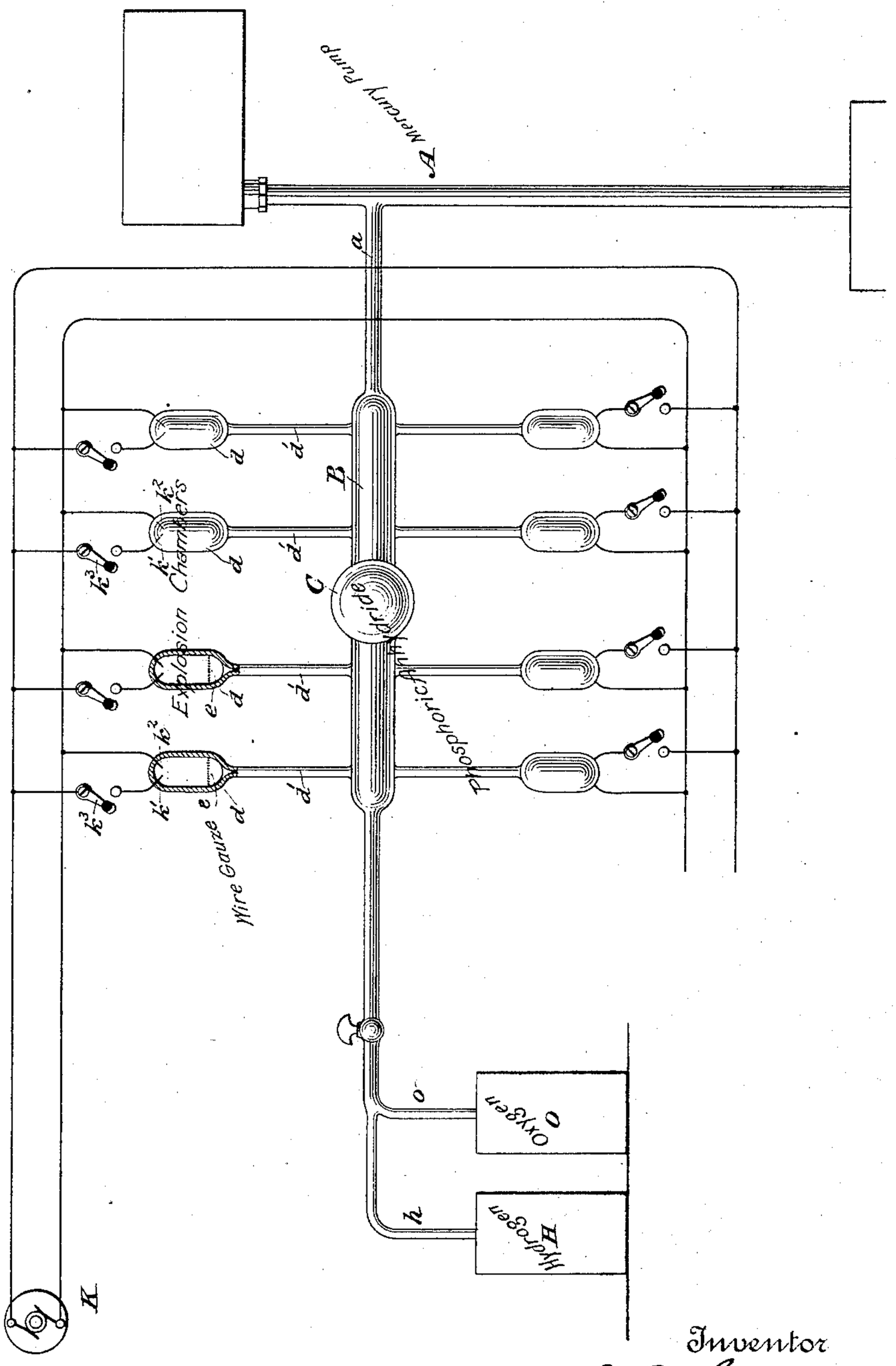
(No Model.) 2 Sheets—Sheet 1.

E. P. THOMPSON.

PROCESS OF EVACUATING GLOBES FOR INCANDESCENT ELECTRIC LAMPS.

No. 370,996. Patented Oct. 4, 1887.

Fig. 1.



Witnesses
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Fig. 3.

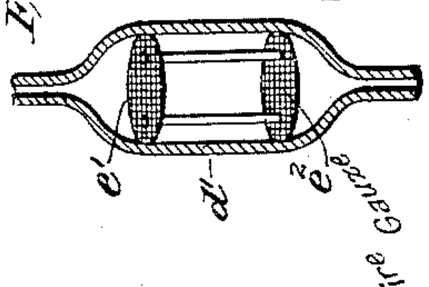

Fig. 2.

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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. 370,996, dated October 4, 1887.

Application filed January 22, 1887. Serial No. 225,115. (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 and State of New Jersey, have invented certain new and useful Improvements in Process of Evacuating Globes for Incandescent Electric Lamps, of which the following is a specification.

The invention relates to a method of producing high vacuums, such as are desired in the manufacture of incandescent electric lamps and in various other classes of apparatus.

The object of the invention is to produce as high a vacuum as practicable by means of mechanical vacuum-pumps as usually employed, and to subsequently increase this vacuum by assisting in expelling the atmosphere by creating a sudden pressure which shall assist in driving out more of the contained gases.

The invention consists, generally, in adding to the usual system of exhausting apparatus a series of chambers in which explosions may be caused one at a time during the operation of the vacuum-pump. These chambers may consist of the lamp-globes themselves, and the explosions may be caused by causing an attenuated atmosphere consisting of a mixture of gases to be present, which gases will combine chemically when subjected to sufficient heat. The heat may be secured either by an electric spark, or, in the case of incandescent electric lamps, by heating the filaments by means of electric currents. The explosion-chambers are cut off from the main exhaust-tube by means of one or more partitions of wire-gauze, which, as is well known, will prevent the ignition of the gases upon the opposite sides. The globes, and the apparatus generally, are prevented from themselves exploding by reason of the presence of mercury in the vacuum-pump, which itself receives the concussion and yields thereto. It is upon this fact that the principle of the invention is based, for the reason that the mercury having yielded, additional mercury flows behind the atmosphere which is displaced, and this is carried off by the pump.

In another application of even date herewith, Serial No. 225,113, there is described an invention having some features in common herewith.

In the accompanying drawings, Figure 1 illustrates a general organization of apparatus adapted to carry out the invention. Fig. 2 illustrates a modification in which a series of electric lamps are represented as being exhausted. Fig. 3 is a detail.

Referring to Fig. 1, A represents a vacuum-pump of any suitable character—such, for instance, as a Sprengle pump. This is connected with an exhaust-chamber, B, by a tube, *a*. The globe or chamber C which is to be exhausted is connected with the chamber B in any suitable manner. Connected with the chamber B′ is a series of chambers, *d d*, &c. These are connected by means of tubes *d′*, and they are each provided with wire-gauze partitions *e*, which prevent the explosions which are designed to take place in the chambers *d* from igniting the gases within the chamber B.

It is designed that the chamber B, and thus the vessel C, shall be exhausted to as great an extent as is practicable by means of the pump, and then a mixture of gases shall be allowed to enter the entire system. This may be conveniently accomplished by connecting a hydrogen-tank, H, and an oxygen-tank, O, through tubes *h* and *o* with the chamber B. The gases are then allowed to flow in the proper proportions to chemically unite when subjected to heat—thus, if hydrogen and oxygen are used, two parts of the former to one of the latter. Other gases than hydrogen and oxygen, it is evident, may be employed. Thus three parts of hydrogen to one of nitrogen may be employed, and other well-known mixtures, the principle of the invention not being dependent upon these special mixtures of gases. These gases are then exhausted to a greater or less extent by means of the pump, and, preferably when the vacuum has been rendered as great as possible by means of the pump, a sudden pressure is created by exploding the gases contained in one of the chambers *d*. This may be conveniently accomplished by providing each chamber with conducting discharge-points k' k^2, respectively connected with the opposite poles of a suitable source of electricity, K. One of each pair of discharge-points is normally disconnected from the generator K, but may be connected therewith by means of a switch, k^3, whereupon a spark will pass from one point to the other and ignite the gas in that chamber. The combination will

be confined to that particular chamber by reason of the wire-gauze partition *e*, but the pressure will extend throughout the entire system. The only yielding point, however, is the mercury within the pump, and this will be pressed downward by the sudden impact, and other mercury from the supply-chamber of the pump will follow, thus inclosing a quantity of the attenuated atmosphere and withdrawing it. Explosions may be thus caused through the several chambers in succession, and the successive sudden pressures will cause the vacuum to be gradually increased, and in this manner a very high vacuum may be secured. Another effect is also due to the union of the gases—namely, that the combined gases always occupy a less space than the mixture of gases. This is especially apparent in the case of ammonia, resulting from the combination of one part of nitrogen with three parts of hydrogen. These have in their uncombined state four volumes, but when combined they have merely two volumes.

Instead of employing separate and distinct chambers, the explosion may be made within the chambers which it is desired to evacuate—as, for instance, when incandescent-electric-lamp globes are to be evacuated the organization illustrated in Fig. 2 may be employed, and in this instance the chambers *d d* are the lamps and the discharge-points k' k^2 are replaced by the filaments *k* of the lamps. The heat required is obtained by passing a current through the individual filament of sufficient strength to cause incandescence, which will ignite the gases. Discharge-points k' k^2 may with advantage be applied to the main exhaust-tube B. These are of service in creating a final explosion after the explosions have occurred in the several lamps. In this instance there are shown two gauze partitions as applied to each lamp at e' e^2, these being contained in the necks or tubes d', to which the lamps are attached.

A suitable chamber, N, is connected with the chamber B in each instance, and this contains, when hydrogen and oxygen are employed, a quantity of phosphoric anhydride. This will absorb the moisture or vapor of water formed by the union of the hydrogen and oxygen, but will not absorb the individual gases. Instead of causing explosions in the several chambers or lamps in succession, it is evident that the several explosions may be made in a single chamber, for after each explosion the remaining atmosphere diffuses itself through the entire system.

For the purpose of exploding all the remaining gases which have diffused throughout the system after the explosions have taken place in the several globes or chambers, the circuit may be connected with all the chambers at the same time, and thus a general explosion throughout the entire system will be produced, thus causing a chemical union of all the remaining gases.

I claim as my invention—

1. The hereinbefore-described process of creating high vacuum, which consists in mechanically producing an attenuated atmosphere consisting of a mixture of gases capable of chemical union, and in causing successive explosions of portions of such gases, and in simultaneously exhausting portions of the atmosphere thus momentarily placed under pressure.

2. The hereinbefore-described process of evacuating globes, which consists in successively 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.

3. The hereinbefore-described process of creating vacuums, which consists in establishing an attenuated atmosphere of gases susceptible of chemical union, successively causing a chemical union of portions of such gases, and driving off a portion of such gases by the pressure incident to the chemical union.

4. The hereinbefore-described process of creating high vacuums, which consists in establishing an attenuated atmosphere of gases, causing portions of such gases to be chemically combined, exhausting portions of such gases by reason of the pressure thus momentarily produced, and ultimately causing a chemical union of the remaining gases.

5. An evacuating apparatus consisting of a vacuum-pump, an exhausting-chamber connected therewith, one or more chambers connected with said exhausting-chamber, division-walls of wire-gauze intervening between the same, and means for creating a high temperature in said chamber.

6. In an apparatus for exhausting electric-lamp globes, the combination, with a vacuum-chamber and means for exhausting the atmosphere therefrom, of one or more tubes leading therefrom, each containing one or more partitions of wire-gauze, means for attaching the lamp globes thereto, and conductors for connecting the filaments of the lamps in an electric circuit.

7. In an apparatus for exhausting electric-lamp globes, the combination, with a vacuum-chamber and means for exhausting the atmosphere therefrom, of one or more tubes leading therefrom, each containing one or more partitions of wire-gauze, means for attaching the lamp-globes to said tubes, conductors for connecting the filaments of the lamps into an electric circuit, and discharge-points or other means for creating a high temperature in the said exhausting-chamber, substantially as described.

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.