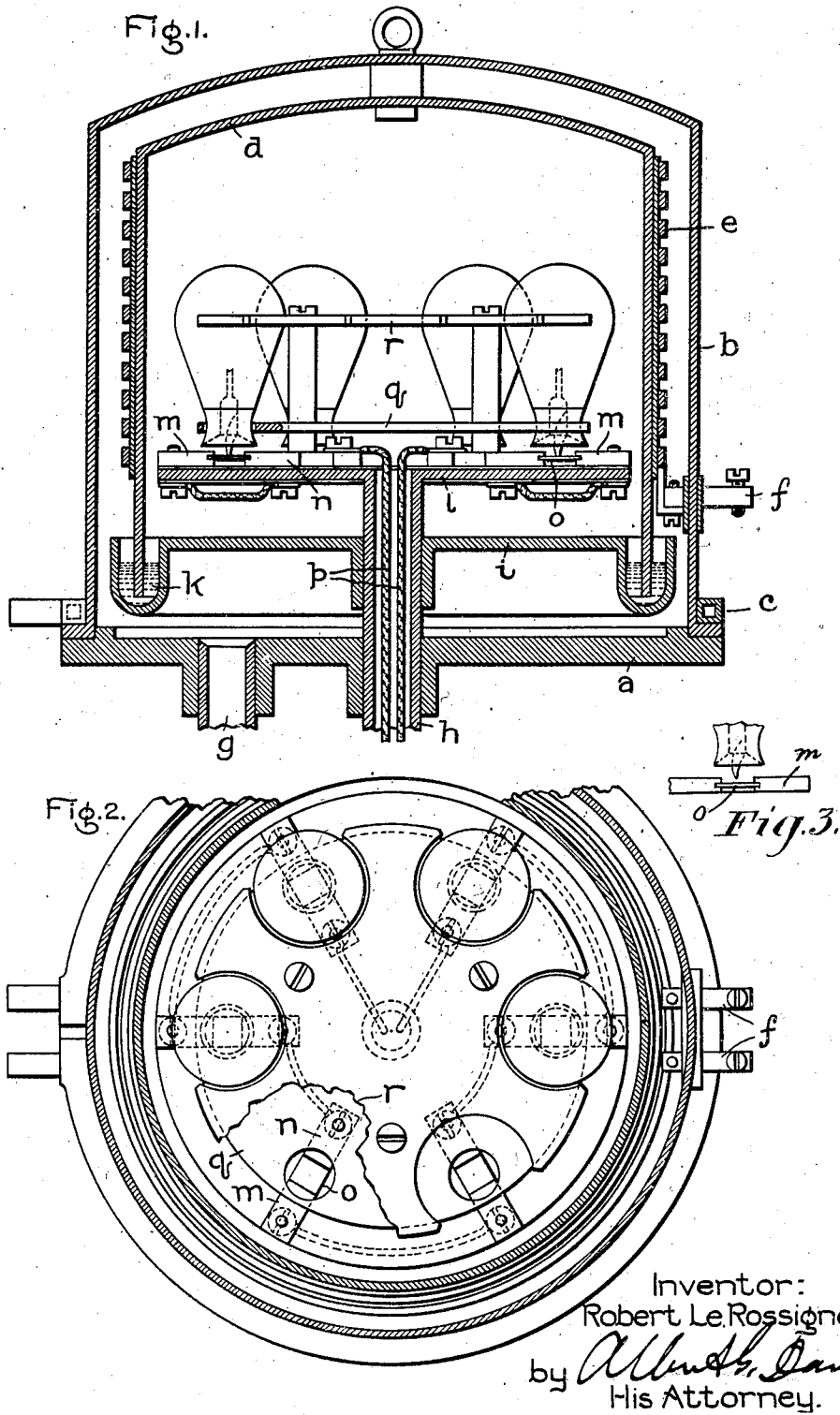


R. LE ROSSIGNOL.
 APPARATUS FOR EXHAUSTING INCANDESCENT LAMPS.
 APPLICATION FILED JAN. 30, 1917.

1,298,569.

Patented Mar. 25, 1919.



UNITED STATES PATENT OFFICE.

ROBERT LE ROSSIGNOL, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

APPARATUS FOR EXHAUSTING INCANDESCENT LAMPS.

1,298,569.

Specification of Letters Patent.

Patented Mar. 25, 1919.

Application filed January 30, 1917. Serial No. 145,563.

To all whom it may concern:

Be it known that I, ROBERT LE ROSSIGNOL, a subject of the King of Great Britain, residing at Berlin, Germany, have invented certain new and useful Improvements in Apparatus for Exhausting Incandescent Lamps, of which the following is a specification.

My invention relates to evacuating incandescent electric lamps and similar glass vessels and more particularly to apparatus for exhausting such vessels.

The object of my invention is to simplify and shorten the process of exhausting incandescent lamps and similar vessels. Another object is to provide means by which a large number of lamps may be exhausted and sealed at the same time. Still another object is to do away with the special long exhaust tube now commonly used, and also to avoid the use of any special devices, such as check valves or non-return valves, in the apparatus used for exhausting. To this end and in accordance with my invention the operation of exhausting the lamps is carried on in a vacuum chamber containing a large number of lamps, each having a short open ended tubulature, and after the chamber and the lamps in it have been exhausted the free ends of the tubulatures are sealed within the exhausted chamber in some suitable manner, as for example, by means of electricity. As compared with the method of sealing the individual lamps one after another by a gas flame as has heretofore been done, my invention has the advantage that a large number of lamps may be sealed at the same time and while they are inside the exhausted vacuum chamber. In this way the entire process of exhausting and sealing the lamps is simplified and shortened. The sealing of the lamps may be facilitated and accelerated by providing at the open ends of the tubulatures a small amount of glass which is of lower melting point than the glass of the lamp and which when softened or fused by electric heating seals the tubulature. I may also, in accordance with my invention, preheat the lamps to the same or nearly the same temperature as that to which they are raised during exhaust by heating them, for example, in a suitable furnace before putting them into the vacuum chamber. Since by my invention the development of strains or distortion forces in

the lamps during the heating in the receptacle is avoided and the pressure inside and outside the lamps is equalized during the exhaust, the incandescent lamps while being exhausted may be heated almost to the softening temperature of glass without danger of breakage or of the lamp collapsing.

An apparatus which serves well for carrying out my novel method of exhaustion comprises, in accordance with my invention, an electrically heated receptacle which is connected to the air pump, electrically heated surfaces mounted in the receptacle, and one or more frames or supports for holding the lamps in place in the receptacle and in proper relation to the heated surfaces. The arrangement is such that the open ends of the tubulatures which are to be closed by melting are in thermal relation to the heating surfaces and the end of each tubulature may either rest upon a corresponding electrically heated surface even during the operation of exhaustion, or may be held out of contact with the heating surfaces but so close to them that the radiant heat melts down and seals the ends of the tubulatures without actual contact with the heated surfaces.

My invention will best be understood in connection with the accompanying drawing in which, merely for purposes of illustration, I show one form of embodiment of my invention suitable for exhausting incandescent lamps, and in which Figure 1 is a longitudinal section of the apparatus, Fig. 2 a cross section and Fig. 3 a detailed view of a slight modification.

In the particular form of apparatus shown in the drawing, the lamps are exhausted in a double walled vacuum chamber of which the outer wall is formed by a base plate *a* and a bell or open ended receptacle *b* which may be seated on the base to form a closed chamber and which has a flange on the edge with a cooling pipe *c*. An inner bell or globe *d* is mounted within and is affixed to the receptacle *b* to form with it a double walled cup, with a space between the two walls *b* and *d*. The bell *d* is provided with and heated by an electrical heating coil *e*, which receives current through terminals *f* extending out through the walls of the bell *b*. An exhaust pipe *g* extends through the base plate *a* and communicates with the bell *b*. A second exhaust pipe *h*

which may be connected to a separate exhaust pipe if desired extends through the base plate and terminates at its upper end in a plate *l* which goes inside the inner bell *d*. The pipe *h* also carries below the plate *l* a larger plate *i* with an annular groove *k* containing an easily fusible metal of low vapor pressure, such as an alloy of tin and lead. When the double walled cup is in place on the base plate *a*, the lower edge of the inner bell or globe *d* dips into the melted metal in the annular groove and makes a hermetical seal so that the plate *l* is inclosed in an inner vacuum chamber which is formed by the bell *d* and the plate *i* and which may be exhausted at will through the pipe *h*.

For the purpose of sealing the lamps in the vacuum chamber, I provide suitable heating means in the vacuum chamber in proper relation to the open ends of the tubulatures of the lamps which are placed in the chamber. For example, in the particular form of apparatus shown in the drawing, the plate *l* carries a number of pairs of contact blocks *m* and *n* between which heating plates *o* are mounted so that the current flowing from one contact block to the other will pass through the heating plate and raise it to the temperature necessary to melt and close the open ends of the tubulatures of the lamps. Current is supplied to the contact blocks *m* and *n* and to the heating plates *o* through suitable leads *p*. In the particular arrangement shown the various pairs of contact blocks *m* and *n* are connected in series but the connections may be made in any other manner desired. The incandescent lamps which are to be exhausted are provided with short open ended tubulatures and are so placed in the exhaust chamber that the open ends of the tubulatures are near and in thermal relation to the heating devices *o*. In some cases the lamps may be so positioned that the open ends of the tubulatures rest with their uneven or obliquely formed edges directly upon or in contact with the heating plates *o*. The lamps may also be so positioned that as shown in Fig. 3 the open end of the tubulature is close to the heating plate *o* but nevertheless remains perfectly free and unobstructed during the exhaust. This position may be maintained during the sealing of the lamps, since the tubulatures may be heated and sealed by radiation only. The lamps are held in position in the exhaust chamber by any suitable form of holder, but the form which I prefer comprises a frame having two disks *q* and *r* connected to it by bolts and provided with suitable recesses for holding the lamps.

The method of exhausting lamps by means of this apparatus is as follows: The vacuum chamber is opened by lifting the double walled cup formed by the bells *b* and *d* away

from the base plates *a* and *i*. The lamps, provided with short open ended tubulatures, are placed in the recesses of the disks *q* and *r* of the lamp holding frame, with the tubulatures in such a position that their open ends will either rest on the heating plates *o* or else will be in proper thermal relation to the heating plates when the frame is in place in the vacuum chamber. After the frame and the lamps contained in it are in place the vacuum chamber is closed by putting the bells *b* and *d* on the base plates with the edge of the bell *b*, making an air-tight joint with the base plate *a* and the edge of the bell *d* dipping into the molten metal in the annular groove *k* of the plate *i*. The exhaust tubes *g* and *h* are then connected to the rough pump and to the fine vacuum pumps by suitable connections and in this way the vacuum chamber and all the lamps in it are quickly exhausted to the required degree. During the exhaust the heating coil *e* is supplied with current through the terminals *f*. As soon as the proper vacuum is obtained the lamps are sealed while still in the vacuum chamber by passing a current of suitable intensity through the heating plates *o* and thereby heating them to the necessary temperature to soften and hermetically seal the open ends of the tubulatures which either rest upon the heating plates or are so close to them that when the current is supplied to the plates through the lead wires *p* the open ends of the tubulatures soften and are sealed. After the lamps have been sealed air is admitted into the vacuum chamber, the double walled cup formed by the bells *b* and *d* is lifted to open the chamber, and then the exhausted and sealed lamps are removed.

The incandescent lamps which are to be exhausted may be arranged in various ways to get a large number of lamps into the vacuum chamber.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. Apparatus for exhausting incandescent electric lamps having short open ended tubulatures comprising a vacuum chamber, means for holding a plurality of lamps in said chamber with the ends of their tubulatures open to the interior of the said chamber, means for exhausting said chamber, and means in said chamber for melting the open ends of the tubulatures of said lamps to seal them while said chamber is exhausted.

2. Apparatus for exhausting incandescent lamps having short open ended tubulatures comprising a vacuum chamber connected to an exhaust pump, means for heating said chamber, heating devices mounted inside said chamber, means for controlling said devices from the outside of said chamber, and lamp holding frames mounted in said cham-

ber to position the lamps with the open ends of their tubulatures in thermal relation to said heating bodies.

3. In an apparatus for exhausting incandescent lamps, a vacuum chamber comprising a bottom having an annular groove containing metal of low melting point and low vapor pressure, two bells mounted concentrically and spaced apart to form a double walled cup and movable away from said bottom at will the edge of the inner bell submerged in the metal in said annular groove when the bell is in place and the edge of the outer bell making a substantially airtight joint with said bottom when said cup is in place, means for exhausting the space between said bells, and means for exhausting the inner bell.

4. In an apparatus for exhausting incandescent lamps having short open ended tubulatures, the combination of a vacuum chamber, a supporting plate inside said chamber, electric heating units mounted on said plate, current supply wires for said heating units leading to the outside of said exhaustion chamber, and means for holding the lamps with the open ends of the tubulatures of the lamps in thermal relation to said heating units.

5. In an apparatus for exhausting incandescent lamps having short open ended tubulatures, the combination of a bottom plate provided with heating plates for at will melting and sealing the open ends of the tubulatures of said lamps, a bell cooperating with said bottom plate to form a vacuum chamber, an exhaust pump for exhausting said chamber, and lamp holding frames for securing the lamps in position

with the open ends of their tubulatures in thermal relation to said heating plates.

6. Apparatus for exhausting incandescent lamps having short open ended tubulatures, comprising a normally closed vacuum chamber connected to an exhaust pump, heating bodies mounted in said chamber, and means for holding the lamps with the ends of their tubulatures open to said chamber and in thermal relation to said heating bodies whereby said bodies melt the ends of said tubulatures and seal them while said ends are in said chamber.

7. Apparatus for exhausting incandescent lamps comprising a vacuum chamber, means for exhausting said chamber, means for holding in said chamber an incandescent lamp having an exhaust aperture open to the interior of said chamber, and heating means in said chamber for sealing said exhaust aperture while said chamber is exhausted.

8. Apparatus for exhausting incandescent lamps comprising a vacuum chamber, means for holding in said chamber a plurality of incandescent lamps each having an exhaust aperture open to the interior of said chamber, means for exhausting said chamber, and means in said chamber for simultaneously heating and sealing the exhaust apertures of said lamps while the chamber is exhausted.

In witness whereof, I have hereunto set my hand this 24th day of October, 1916.

ROBERT LE ROSSIGNOL.

Witnesses:

HENRY HASPER,
ALLEN F. JENNINGS.