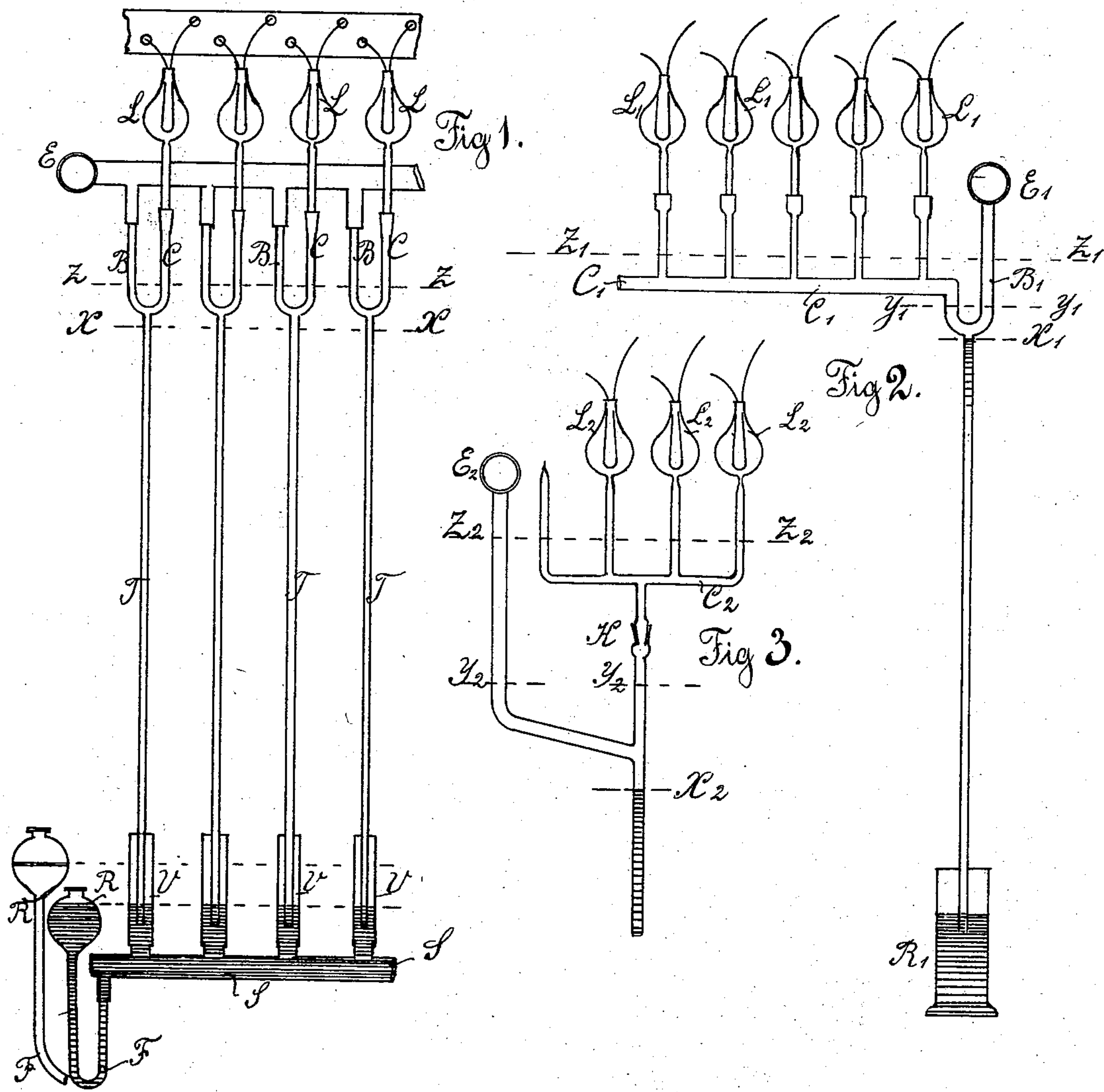


(No Model.)

H. & F. G. A. SCHULZE-BERGE.  
MANUFACTURE OF ELECTRIC LAMPS.

No. 506,733.

Patented Oct. 17, 1893.



WITNESSES:  
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# UNITED STATES PATENT OFFICE.

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## MANUFACTURE OF ELECTRIC LAMPS.

SPECIFICATION forming part of Letters Patent No. 506,733, dated October 17, 1893.

Application filed March 23, 1893. Serial No. 467,365. (No specimens.)

*To all whom it may concern:*

Be it known that we, HERMANN SCHULZE-BERGE and FRANZ GEORG ALEXANDER SCHULZE-BERGE, subjects of the Emperor of Germany, and residents of the city of Brooklyn, county of Kings, State of New York, have invented a new and useful Improvement in the Manufacture of Electric Lamps, of which the following is a specification.

Our invention refers to the manufacture of electric lamps, and its object is a system for detecting leaky lamp bulbs in the process of exhausting the air.

In the drawings accompanying this description Figure 1 shows a number of incandescent lamp bulbs, each of which is connected to the exhaust pipe by a U shaped tube. In Fig. 2 several lamp bulbs are joined to a common tube, the latter one being a branch of the exhaust pipe. Fig. 3 is a modification of the arrangement shown in Fig. 2.

Similar letters refer to similar parts.

In exhausting electric lamp bulbs two different methods are used. Either every individual lamp is exhausted by a separate pump, or several lamp bulbs are jointly exhausted by a common pump. In the latter case a difficulty arises if there is among the lamp bulbs connected to one pump a leaky bulb, because it is generally difficult to decide, which is the leaky one. The usual way of finding it out is often connected with considerable loss of time and with expense for the manufacturer. It is the purpose of our invention to remove this difficulty and to furnish simple means for detecting leaky lamps in a group connected to a common pump or vacuum chamber. For this purpose we interpose adjustable manometers between the lamps to be exhausted and the vacuum chamber into which their air is discharged.

In Fig. 1 a manometer is interposed between every individual lamp bulb L and the exhaust pipe E. To one arm C of the manometer the incandescent lamp bulb L is airtightly connected, while the other arm B leads to the exhaust pipe E. The tube T dips into mercury which is supplied to the tube V from reservoir R by tube S. The reservoir R is connected to S by a flexible tube F. When a vacuum is created in the exhaust pipe, mer-

cury rises up in tube T, and the length of this tube is such, that even when a perfect vacuum is produced, still the mercury column does not obstruct the passage ways between the lamp bulbs and the exhaust pipe, but only rises, for instance, to the level marked X. If then it is desired to test the air-tightness of the lamp bulbs, vessel R is raised so as to make the mercury rise up into the shanks B and C of the manometers to the level marked Z and to close the passageways between the lamp bulbs and the exhaust pipe. If all bulbs are airtight the level of the mercury will remain the same in the shanks C connected to the bulbs. In case however a lamp bulb is leaky, the alteration of air pressure occurring in the same will be indicated by the depression of the mercury level in the shank C to which that lamp bulb is connected. Thus the leaky lamp is manifested and can easily be sealed off and removed. By this arrangement all the manometers are supplied with mercury simultaneously by simply raising the vessel R, and by lowering this vessel the manometers are emptied again.

If the tubes T are connected airtightly to tubes V, the raising or lowering of the liquid column contained in the same can be effected by increasing or decreasing the air pressure acting upon the mercury in R by an air pump or other suitable means. In fact if this air pressure is properly regulated, the tubes T need not be of barometric height, but may be considerably shortened.

It hardly is necessary to mention that instead of mercury other liquids which are not objectionable to the nature of the lamp can be used.

The principle illustrated by Fig. 2 is essentially the same as that of Fig. 1, but here a manometer is shown, one arm C' of which is connected to a plurality of lamp bulbs, while the other arm B' leads to the exhaust pipe E'. If the vacuum is produced and then the mercury raised to mark Y', the manometer will indicate whether the whole group of lamp bulbs connected to it, considered as a unit, contains a leak. Raising the mercury to the level marked Z' will allow to eventually detect any single leaky bulb.

In Fig. 3 a number of lamp bulbs are con-



nected to the arm C<sup>2</sup> of the manometer by an airtight joint K. Also here the manometer may be used to test the airtightness as well of the whole group as of a single lamp bulb 5 by raising the mercury level from X<sup>2</sup> to Y<sup>2</sup> or Z<sup>2</sup>.

The arrangement of the adjustable manometers for examining the airtightness of the lamp bulbs may be varied in many ways. 10 Separate manometers can be inserted on the one hand between the main exhaust pipe and pipes branching off from the same, and on the other hand between the branch pipes and the lamps which they carry. The manometers may all be supplied with mercury from 15 a common reservoir or from different reservoirs. We do not limit ourselves to the special construction or arrangement of the manometers described nor to any special way 20 for raising or lowering the mercury; but we wish it understood that by the term "adjustable manometer" as used in this specification and in the claims we designate a manometer the liquid of which may be introduced or 25 withdrawn at will or adjusted to any suitable height.

What we claim is—

1. A system for detecting any leaky lamp bulb in a plurality of electric lamp bulbs connected to a common vacuum chamber, consisting in the combination of every lamp bulb 30 to be tested with an adjustable manometer interposed between said lamp bulb and the vacuum chamber, substantially as and for the purpose described.

2. A system for detecting any leaky lamp bulb in a plurality of electric lamp bulbs connected to a common vacuum chamber, con-

sisting in the combination of every lamp bulb to be tested with an adjustable manometer 40 interposed between said lamp bulb and the vacuum chamber, and a common reservoir adapted to supply the mercury to the manometers simultaneously, substantially as and for the purpose described.

3. In a system for exhausting electric lamp bulbs adjustable manometers interposed between the vacuum chamber and the pipes carrying the lamp bulbs or groups of lamp bulbs to be exhausted, substantially as and for the 50 purpose described.

4. In a system for exhausting electric lamp bulbs adjustable manometers interposed between the vacuum chamber and the pipes carrying the lamp bulbs, said adjustable manometers being adapted as well to control the 55 passageways between the vacuum chamber and said pipes, as the passageways leading from said pipes to the single lamp bulbs to be tested, substantially as and for the purpose described. 60

5. In a system for exhausting electric lamp bulbs a plurality of lamp bulbs connected to the vacuum chamber by adjustable manometers adapted to indicate any alteration of 65 air pressure occurring in any of the bulbs, substantially as and for the purpose described.

In testimony that we claim the foregoing as our invention we have signed our names, in presence of two witnesses, this 18th day of 70 March, 1893.

HERMANN SCHULZE-BERGE.

FRANZ GEORG ALEXANDER SCHULZE-BERGE.

Witnesses:

FREDERICK CHARLES NIBLO,  
WM. SWANSBORO.