

# UNITED STATES PATENT OFFICE.

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## VAPOR ELECTRIC LAMP.

No. 886,706.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, RICHARD KÜCH, a subject of the German Emperor, and a resident of Hanau-on-the-Main, Germany, have invented certain new and useful Improvements in Vapor Electric Lamps, of which the following is a specification.

Gas or vapor electric lamps are already known. They consist of vacuum glass vessels with metals as electrodes and work in the manner that the metals are heated by the electric current up to such a temperature, that a gas or vapor is developed from the metal in the vacuum and forms an arc light. Heretofore mercury has been the metal most commonly employed for this purpose as it has given so far the best results. Endeavors have been made to utilize the gas or vapor developed from alloys (such as for example Wood's metal) or from other metals for producing the arc light both for scientific purposes and for illuminating purposes, but the trials have proved unsatisfactory. Also amalgams of various metals have been tested and found to give somewhat better results, but they were equally unsatisfactory, even if the proportion of the metal was increased to equal 14% of the amalgam, the spectrum of the metal showing a comparatively smaller intensity than the spectrum of the mercury. The reason of this failure resides in the fact, that the point of vaporization of the mercury is far below that of the metal. As the mercury exceeds the metal, it follows, that the gas or vapor developed contains essentially mercury with but a few traces of the metal.

My invention relates to improvements in gas or vapor electric lamps with electrodes other than mercury, whereby a better arc light is obtained than hitherto, the spectra of the two or more metals employed having intensities in the desired proportion irrespectively of the points of vaporization of the said metals.

The chief improvement is to employ the metal having a higher point of vaporization in a far greater quantity than the metal having a lower point of vaporization and to such an extent, that the former may be considered to be a diluter of the latter. The consequence of this will be, that at every moment only a small part of the more vaporizable metal is permitted to appear on

the surface of the melted alloy and to vaporize, while a large quantity of the less vaporizable metal is at the same time vaporized. Only after this quantity has vaporized will other particles of the more vaporizable metal be permitted to appear on the surface. For instance a mixture of 98 parts of cadmium with 2 parts of mercury has been found to give an excellent result. Such a mixture, however, cannot be called an amalgam in the common sense, i. e. it is quite different from the amalgams mentioned above. It may be said to be a very weak solution of mercury in cadmium. When using this mixture, it will be found, that only a very insignificant quantity of mercury appears at every moment on the surface of the melted alloy and vaporizes while at the same time a larger quantity of cadmium in the said proportion vaporizes.

A further improvement, giving still better results, consists in diluting the two metals to be vaporized in a metal, which cannot vaporize at the respective temperature. When properly proportioning the quantities of the three metals, only very small particles of the two metals to be vaporized will appear on the surface in the determined proportion and vaporize to produce a light of the desired effect.

Now that quartz glass vessels are coming into use for lamps of the kind mentioned above and that they afford the advantage of sustaining a very high temperature, a greater choice of metals is available for such lamps than heretofore.

An improved gas or vapor electric lamp with electrodes of the last mentioned kind may be for instance constructed as follows:

Within a quartz glass tube having bulbs of a similar construction to those used in ordinary gas or vapor electric lamps with mercury electrodes is placed a suitable quantity of tin to which about 5% of cadmium and 2% of mercury have been added. This lamp can be started by means of sparks produced by induction and produces a light, of which the spectra of the cadmium and of the mercury show an approximately equal intensity. The tin does not boil at a temperature of 1200° centigrade in the vacuum, while the cadmium boils at 450° centigrade and the mercury at 150°. In consequence of this no spectrum of the tin will appear, since the



mean temperature of the lamp space is far below the boiling point of the tin in vacuum. In such a lamp the tin merely serves as a diluter of the two metals to be vaporized, viz. cadmium and mercury, and the effect of this diluter is, that the two metals vaporize in a constant proportion on the surface of the electrode. It is further to be remarked, that owing to the insignificant quantity of the metals vaporized at any moment the specific weight of the gas or vapor in this lamp is exceedingly small and far less than that in lamps with mercury electrodes of the same size.

Of course the proportion of the several metals may be varied according to the effect desired. Instead of the two metals in the diluter more metals may be used. Also other combinations of metals may be employed in a similar manner as described above. The essential point is, that the boiling point of the metal serving as a diluter be higher than that of the more vaporizable metals, which should be added in small quantities. It is immaterial whether the spectrum of the diluter partakes in the mixture of the several spectra or not. Of course the positive electrode may be made of another solid metal, for example iron, the same as in

ordinary gas or vapor electric lamps with mercury electrodes.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A gas or vapor electric lamp having the electrode material formed of a mixture of metals vaporizable at different temperatures, the metal constituting the greater part of said mixture being vaporizable at a higher temperature than the remainder of the mixture.

2. A gas or vapor electric lamp having the electrode material formed of a mixture of metals vaporizable at different temperatures, and a metal which will not vaporize at the vaporizing temperature of the other metals in the mixture, the metal constituting the greater part of the vaporizable portion of the mixture being vaporizable at a higher temperature than the remainder of said vaporizable portion of the mixture.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RICHARD KÜCH.

Witnesses:

FRANZ HASSLACHER,  
ERWIN DIPPEL.