

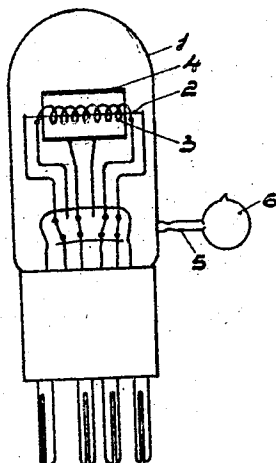
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DISCHARGE TUBE

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UNITED STATES PATENT OFFICE

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DISCHARGE TUBE

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This invention has reference to a process of introducing potassium or caesium or rubidium into an electric discharge tube. The introduction of these metals as such into an electric discharge tube is beset with difficulties as the metals are quite readily oxidized in air so that it is difficult to introduce them in a pure state into the discharge tube.

The object of the invention is to provide for a process that obviates this difficulty and by which it has been found possible to introduce potassium, caesium and rubidium in an entirely pure state into a discharge tube.

According to the invention the process of introducing potassium or caesium or rubidium into an electric discharge tube consists in introducing a mixture of one or more potassium or caesium or rubidium compounds with one or more of the azides of the metals of the second principal group of the periodic system into the discharge tube or into a receptacle united to the discharge tube, after which metallic potassium or caesium or rubidium is formed from the said mixture by the presence of heat.

Preferably barium azide (BaN_3) should be used as the azide of the metals of the second principal group of the periodic system. The mixture of the potassium or caesium or rubidium compounds with an azide may be introduced into the discharge tube or into the receptacle united to it, in a solid state or in the form of a solution. After volatilization of any solvent that may be present, the mixture is gently heated, by reason of which the azide is decomposed and the metal of the second principal group of the periodic system thus liberated reduces the potassium or caesium or rubidium salt into metallic potassium or caesium or rubidium. As these metals are very volatile, even when gently heated, the discharge tube will be filled with potassium or caesium or rubidium vapour of very low pressure.

It is not necessary that the mixture of potassium or caesium or rubidium salts and acids should be arranged in a side tubule of the discharge tube; it may be arranged at other points of the discharge tube if only

it is possible for the said mixture to be so heated at such points that potassium or caesium or rubidium vapour is formed.

The process according to the invention may be carried out in incandescent cathode discharge tubes. In this case the vapour of potassium or caesium or rubidium will deposit on the incandescent cathode as an extremely thin film which need be of the order of thickness of but some molecules. Now, according to Langmuir's researches, such an incandescent cathode may be heated to a temperature that exceeds by many hundreds of degrees the melting point of potassium or caesium or rubidium without the latter volatilizing noticeably and will thus yield an electron emission which in consequence of the extremely low Richardson's constant of potassium, caesium and rubidium is very high.

Potassium or caesium or rubidium introduced by the process according to the invention, into an incandescent cathode discharge tube or into a discharge tube comprising a cold cathode may combine with any gas residues that have remained in the discharge tube in spite of the latter being exhausted as far as possible, the prejudicial effect of such gases being thus neutralized.

The invention will be clearly understood by reference to the accompanying drawing in which 1 is a bulb of the discharge tube in which an incandescent cathode 2 consisting of tungsten, a grid 3 and an anode 4 are concentrically arranged. The bulb of the discharge tube has sealed to it a side tubule 5 with a receptacle 6 into which a mixture of caesium chloride and barium azide in aqueous solution has been introduced beforehand. The discharge tube is then exhausted until the solvent has left the receptacle 6 by volatilization and the mixture of caesium chloride and barium azide remains in a solid state. After the discharge tube has been sealed off the pump, the receptacle 6 is gently heated, the barium azide being thus decomposed. By reason of the heating temperature being slightly increased the caesium chloride is reduced by the liberated barium into metallic caesium which spreads

throughout the interior of the discharge tube. The side tubule 5 with the receptacle 6 may then be sealed off the discharge tube.

The metals potassium and rubidium may
5 be similarly introduced into an electric discharge tube.

What I claim is:

1. The process which comprises introducing into a discharge tube a mixture of an
10 alkali-metal compound with the azide of a metal of the second principal group of the periodic system, and subsequently liberating the alkali-metal from the said mixture by the presence of heat.

15 2. The process of introducing an alkali-metal vapor into a discharge tube which comprises first introducing into a receptacle connected to a discharge tube a mixture of an alkali-metal compound with the azide of
20 a metal of the second principal group of the periodic system and subsequently liberating the alkali-metal from the said mixture by the presence of heat.

In testimony whereof we affix our signatures, at the city of Eindhoven, this 1st of
25 October, 1926.

JAN HENDRIK DE BOER.
PIETER CLAUSING.

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