

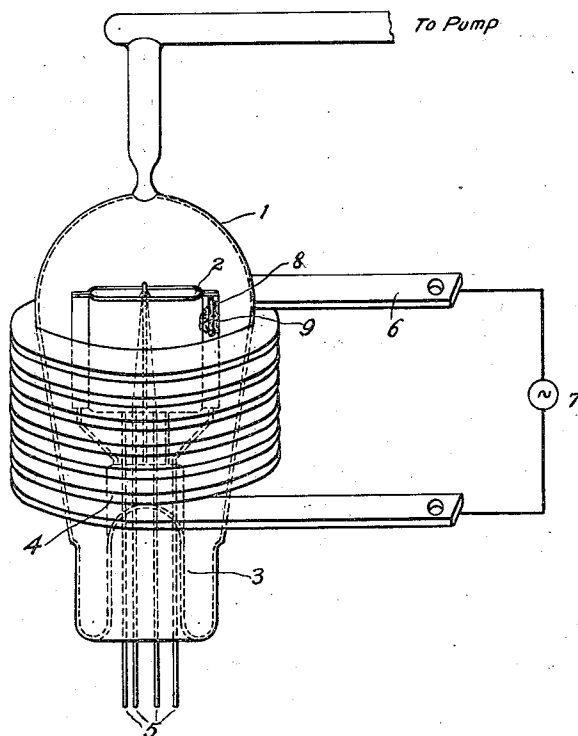
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SPACE CHARGE DEVICE

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WITNESSES:

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SPACE CHARGE DEVICE

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My invention relates to space-current devices and particularly to space-current devices containing vapors.

An object of my invention is to provide a convenient means for introducing a vapor within an evacuated device.

Another object of my invention is to provide a convenient means for introducing an alkali metal vapor into an evacuated container.

Another object of my invention is to provide a convenient method of producing an alkali metal vapor in situ within an evacuated container.

Another object of my invention is to provide a thermionic discharge device containing a reducing substance and a vapor of cesium metal.

In the construction of vacuum tubes, it has been found that the addition of certain of the alkali metals within the evacuated space improves the performance of the device. It appears that small quantities of the metals volatilize and produce an atmosphere of the metal within the container. This metallic vapor atmosphere appears to aid the functioning of the device in several ways, such as increasing the electron emission of the cathode.

Several ways of introducing the necessary metal have been employed. For instance, the metal has been introduced directly in the free state, but this is difficult to do because of the difficulty of obtaining some of the metals, particularly cesium, in the free or elemental form. Another method of introducing the metal vapor is to free it from the glass walls of the container by electrolysis. This method, however, is objectionable and is applicable only to sodium or potassium which are contained in the ordinary glass.

My invention provides means whereby the free alkali metal is liberated from its compounds in situ within the tube after the evacuation of undesired gases and vapors has taken place.

Other objects and structural details of my invention will be apparent from the following description when read in connection with the accompanying drawing, wherein:

The single figure is a view in vertical elevation, partially in section, of an evacuated device embodying a preferred form of my invention.

Referring to the drawing, a container 1 has within it a plurality of metallic electrodes 2 mounted upon a re-entrant portion 3 and a press 4. Lead wires 5 through the press 4 serve to make proper connections to the electrodes 2. Surrounding the device is an inductor 6 connected to a source 7 of high-frequency heating energy. Upon a convenient spot on the surface of the electrode which may preferably be the anode, is welded a bit of "misch-metal" 8. Upon the "misch-metal" and the surrounding electrode surface is placed a portion of alkali metal compound which may preferably be chloride, and if a vapor of cesium is desired in the device, it may be cesium-chloride.

The "misch-metal" 8 may be affixed to the electrode 2 by welding, and the cesium chloride may be applied by painting thereon a solution in alcohol of cesium chloride. The alcohol is then allowed to evaporate, leaving the solid cesium chloride behind. The operation of affixing the "misch-metal" and applying the cesium chloride solution is preferably performed after the "mount", comprising re-entrant portion 3 and press 4, lead wires 5 and electrodes 2, have been assembled. When the alcohol has evaporated, the mount may be sealed within the container 1 and the assembly connected to an exhaust pump as indicated. The customary exhaust process may then be applied to the device and the major portion of the undesired gases and vapors therein removed.

The high-frequency inductor means 6 may then be slipped over the device and energized, causing thereby the development of proper heat within the electrodes 2 and the "misch-metal" 8. When the temperature of the electrodes and "misch-metal" reaches a point which may be well below a dull-red heat, reactions begins between the alkali metal chloride and the "misch-metal". This reaction consists in a displacement of the alkali metal, which may be cesium, from its chloride to form the free metal and a chloride

of the "misch-metal". The chloride of the "misch-metal" is non-volatile and remains inert within the device. Any surplus of "misch-metal" above that required to combine with the alkali metal chloride present, remains available to combine with oxygen and other objectionable residual gases which may remain within the container. The residue of the "misch-metal" may function as a getter in a manner analogous to the action which has been found to occur with the use of other reducing substances.

The device may then be sealed off from the pump. When caesium chloride is used, the device then contains a quantity of free metallic caesium and a vapor of the metal is present in the container. This vapor is at an exceedingly low pressure and is exceedingly attenuated, whereby it does not produce troublesome or objectionable phenomena within the tube, but does produce the desired effects, among which is a marked increase in the electron emission of the cathode electrode.

The reducing agent 8 may be the "misch-metal" as mentioned which is a mixture of rare earth metals such as lanthanum, cerium, yttrium, indium and gallium. Metallic magnesium may be substituted for the "misch-metal" as may also metallic calcium, provided the tube electrodes are not permitted to reach as high a temperature during the evacuation process as may be permitted when employing misch metal.

While I have shown but a single embodiment of my invention in the accompanying drawing, it is capable of various changes and modifications therefrom without departing from the spirit thereof, and it is desired, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or indicated in the appended claim.

I claim as my invention:

The method of introducing a vapor of metallic caesium into a space charge device which comprises attaching to a metallic electrode therein a portion of "misch-metal", depositing thereon caesium chloride from alcoholic solution, evacuating undesired vapors therefrom, and heating to initiate a chemical reaction between the "misch-metal" and the caesium chloride, whereby free caesium metal is liberated and volatilized, and a compound of the "misch-metal" and chlorine is formed.

In testimony whereof, I have hereunto subscribed my name this 20th day of February, 1925.

DAYTON ULREY.