

# PATENT SPECIFICATION

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Convention Date (United States): May 16, 1928.

311,768

Application Date (in United Kingdom): May 13, 1929. No. 14,842/29.

Complete Accepted: Aug. 13, 1930.

## COMPLETE SPECIFICATION.

### Emission Element in an Electrical Discharge Device.

We, ARCTURUS RADIO TUBE COMPANY, of 260, Sherman Avenue, Newark, New Jersey, United States of America, a corporation organised under the laws of the State of Delaware, United States of America (Assignees of SAMUEL RUBEN, of 801, Riverside Drive, New York, State of New York, United States of America, a citizen of the United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an emission element in an electrical discharge device, and more particularly it relates to an indirectly heated cathode element in a vacuum tube, having a potential difference along its axis caused by a thermo-electric action. Such a cathode constitutes an improvement upon those of the prior art in thermionic and electronic discharge devices, all of which have the property of equal potential throughout their lengths.

By the terms of this invention the cathode element in a vacuum tube is in two or more parts or sections, preferably cylinders of different diameters, closely fitted together at one end, and composed of dissimilar materials so that when heated a thermo-electric potential is generated therein. The difference in potential has various advantages such, for example, as maintaining a slight bias potential on the grid or control element of the tube. The cathode is preferably coated with high emission materials, such as a mixture of barium and strontium oxides, and is so designed that in operation there is a temperature gradient along its axis, the temperature difference being most positive at the area of contact between the two sections.

A difference of potential would also be obtained by connecting the different sections or parts of a cathode of like materials, such as tungsten or nickel, etc., with a closely fitted interposed band of a different material such as copper, connecting the sections.

For a better understanding of the

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invention, reference is made to the accompanying drawings of an embodiment thereof, namely, a two part cathode in which in

Fig. 1 is diagrammatically shown a vacuum tube containing only the heater and cathode elements, the usual accompanying elements, the grid and anode, being omitted, and

Fig. 2 showing a section of the device at 2-2.

Referring to the drawings, at 1 is represented an evacuated glass tube containing a silica coated resistance wire 3 supported on conductor rods 3<sub>a</sub> and 3<sub>b</sub>, and having terminals at 3<sub>c</sub>. The cylindrical cathode element is in two parts, 4 and 4<sub>x</sub>, composed respectively of nickel and chrome-iron alloy and fitted together at 5, both cylinders being externally coated with a mixture of strontium and barium monoxides. The lower cylinder has a slightly larger diameter than the other, that a better juncture at the ends may be formed and to maintain a temperature difference from the same heater element. The heater element is composed of a resistance wire having a coating of silica, as described in my copending application No. 306,832. A satisfactory heating element may also be made up of tungsten wire coated with fused aluminum oxide, and the cathode element may be arranged with other elements for use in a rectifier or electron relay.

In operation, as the cathode is heated by conduction or radiation from the heater element, due to the difference in materials and diametric dimensions, a thermo-electric potential is generated at the junction.

The potential difference available at the terminals 4<sub>t</sub> is useful when the cathode is employed in a grid control type of tube.

In the three or four element type of tubes employing a grid or control element this potential is useful in many ways, for example, as a slight positive grid bias.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we

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claim is:—

- 5 1. An electrical discharge device having an indirectly heated cathode element having a direct current potential difference along its length, caused by a thermo-electric action.
- 10 2. An electrical discharge device as claimed in the preceding claim in which the cathode is composed of a plurality of sections or parts of different materials which are heated by conduction or radiation by the discharge of current through an adjacent body.
- 15 3. An electrical discharge device as claimed in the preceding claims in which one of the cathode parts is made of nickel.

4. An electrical discharge device as claimed in the preceding claims in which one of the cathode parts is made of nickel and another is made of a chrome-iron alloy.

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5. An electrical device as in any of the preceding claims in which the cathode surface is coated with an electron emitting substance such as the oxides of strontium and barium.

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Dated this 13th day of May, 1929.

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and  
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Agents for the Applicants.

[This Drawing is a full-size reproduction of the Original]

Fig. 1.

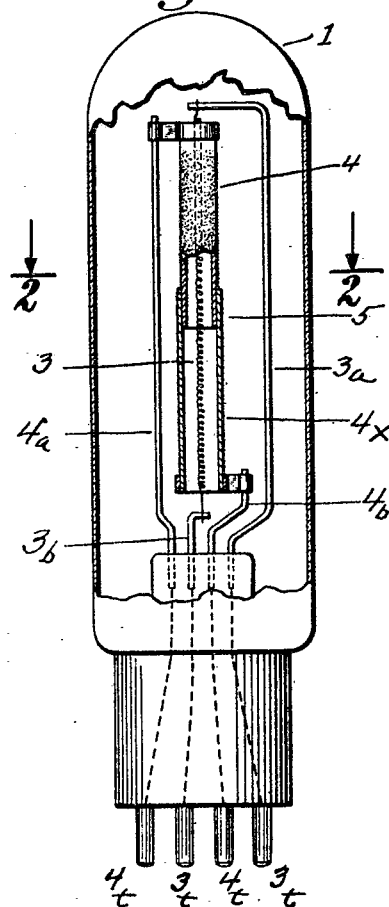


Fig. 2.

