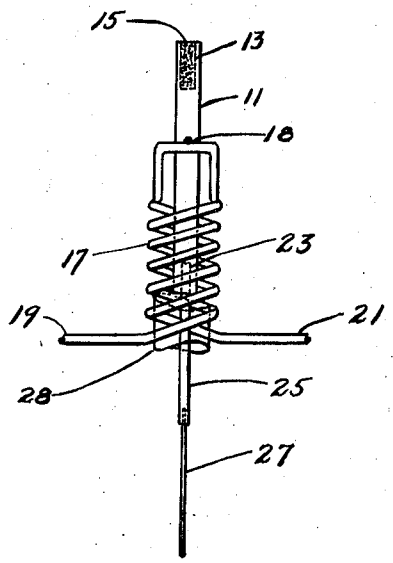
May 17, 1938. R. H. GEORGE 2,117,842

ELECTRODE

Filed Sept. 30, 1935



INVENTOR
Roscoe H. George
BY W. S. Grover.
ATTORNEY

Patented May 17, 1938

2,117,842

UNITED STATES PATENT OFFICE

2,117,842

ELECTRODE

Roscoe H. George, West Lafayette, Ind., assignor to Radio Corporation of America, a corporation of Delaware

Application September 30, 1935, Serial No. 42,820

5 Claims. (Cl. 250—27.5)

The present invention relates to electron tubes and principally to electron tubes of the cathode ray and X-ray type and to the construction of a cathode or electron emitter for such type tubes or for other thermionic tubes where a point source of emission is utilized.

Among the objects of this invention are the following: to provide an electron source which is substantially of point size; to provide an electron emitting element of small size and which is of a diameter less than that of the smallest aperture in any of the grid, anode and/or shielding electrodes so as to permit renewing, where necessary, the emitting material without completely disassembling the tube; to provide an electronic emitter of rigid construction; to provide an electron emitter with heating means which is substantially indestructible by heat under normal operating conditions; to provide a non-inductive heating arrangement for heating the emitting material; to provide an electron emitting arrangement wherein there is a substantial uniformity of emission developed by a heater element having high thermal inertia and capable of operating at low temperatures; as well as to provide a simple, efficient and relatively inexpensive construction of the emitter.

Other objects and advantages will at once suggest themselves and become apparent to those skilled in the art to which this invention is directed by reading the following specification in connection with the accompanying drawing which illustrates schematically one suitable form of cathode construction for use in cathode ray or X-ray tubes.

Referring now to the drawing, the cathode element 11 has drilled into one end thereof a hole 13 into which a mixture of material 15 which copiously emits electrons when heated is pressed. Such material may be, as known in the art, a mixture of barium oxide and strontium oxide or any other suitable material.

In order to heat the emitting material there is provided a non-inductively wound heater element 17, preferably formed of tungsten wire which is spot welded to the cathode at point 18. The end terminals 19 and 21 are attached to any suitable source of heating current, such as an A. C. or D. C. supply source (not shown).

A connection 23 of a conductor element 25, at which point the inductor 25 is preferably spot welded to the cathode 11, provides for connection to an external circuit.

An insulating spacer tube 28 serves the double purpose of maintaining the two spirals of the heater element 17 in alignment, and insulating the conductor 25 from the heater element.

For the purpose of illustrating one suggested form of construction of the cathode and suggested dimensions the cathode element 11 may be formed of nickel or platinum-nickel wire of about #22 B. and S. gauge; the heater wire 17 is preferably of the order of .01" diameter and is spot welded to the cathode at a point approximately $\frac{1}{16}$" from the outer end thereof. Drilled to a depth of the order of approximately $\frac{1}{32}$" with a drill of about a No. 80 size is the recess 13 into which the emitting material 15 is pressed. Satisfactory heating of the emitter material is obtained when the heater element is wound double threaded with approximately 24 single turns per inch. The conducting member 25 formed from .005" tantalum or nickel wire and at its end remote from the cathode attaches to a wire 27 which leads out through the press (not shown) in the tube stem. While the above suggested dimensions and wire sizes have been found satisfactory it is to be understood that such dimensions and sizes of the elements may be widely varied without departing from the spirit and scope of this invention.

Where it is desired to replace the emitter material 15 after extensive use the cathode ray tube into which the complete cathode is placed may be broken either along the conical side thereof or at the end of the cylindrical portion of the tube wall and a tool having a fresh supply of emitter material is then passed through the deflecting and beam developing and control electrodes to press a fresh supply of emitting material into the recess 13. When so arranged it is obvious that the electrode mounting need not be disturbed to renew the emitter and therefore when the emitter material is renewed the tube can be reassembled and again evacuated without changing in any way the operational characteristics.

Having now described the invention what is claimed is:

1. A cathode construction comprising a conductor member having a central recess in one end thereof, a non-inductively wound heater element external to said conductor, said heater element extending over and surrounding said conductor for an appreciable portion of the length thereof and conductively connected therewith at the point nearest the said recess, a packing of electron emitting material within the recess, and a second conductor connecting with the first conductor at the point most remote from said emitting material.

2. A cathode construction comprising a rod-like conducting member having a recess drilled into one end thereof to a depth of the order of 15% of the length thereof, an electron emitting material pressed within said recess, a double spirally wound heating element concentrically and coaxially wound about said conductor and extending lengthwise thereof from the end remote from said emitting material for a distance of the order of 60% of the conductor length, said heating element being conductively connected with said conductor over the area thereof nearest the emitting material and formed from a material having a substantially lower electron emission constant than said electron emitting material, and a second conductor for establishing electrical contact for said first conductor to an external circuit connected with said first conductor a point remote from the emitter.

3. An electrode construction comprising a solid rod member, said rod member having a recess drilled at one end thereof, an electron emitting material packed into said recess, a bifilar wound heater element surrounding said rod member and conductive connection from the midpoint of said bifilar wound heater element and said rod member, and a conductor connected at the end of said rod member opposite said recessed end.

4. A cathode construction comprising a solid rod member having a recess drilled at each end, an electron emitting material packed into the recess at one end, a conductor embedded in the recess at the opposite end, a bifilar wound heater element surrounding said rod member and conductively connected thereto at the midpoint of said bifilar winding.

5. A cathode construction comprising a rod-like conducting member having a recess drilled into one end thereof, an electron emitting material supported within the said recess, a coaxially positioned bifilar heater winding surrounding said rod-like member and extending lengthwise thereof for a substantial portion of its length, an electrical connection between the midpoint of said bifilar winding and said rod-like member, and a conductor connected with said rod-like member at the end thereof opposite said electron emitting material.

ROSCOE H. GEORGE.