July 2, 1929. H. T. REEVE 1,719,128

ELECTRON. EMITTER

Filed Aug. 26, 1924

Fig. 1

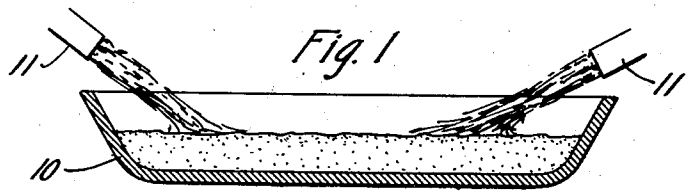


Fig. 2

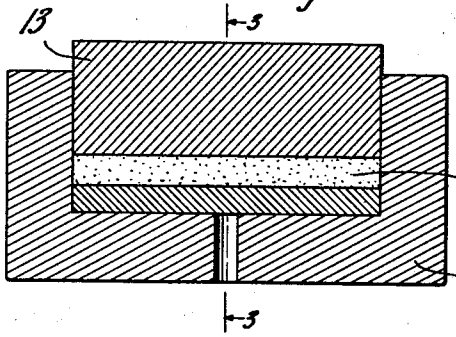


Fig. 3

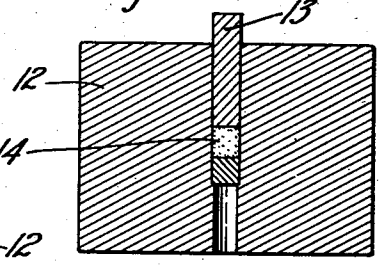


Fig. 4

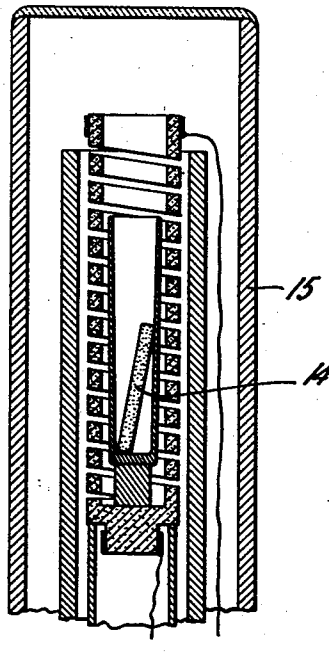


Fig. 5

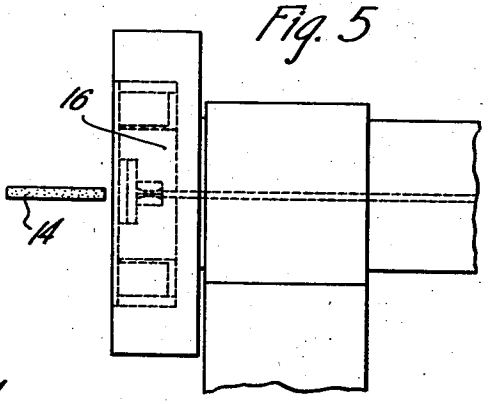


Fig. 6

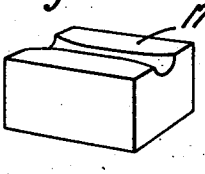
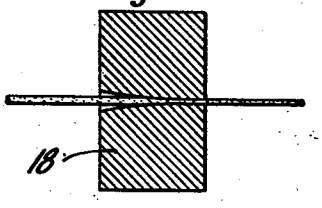


Fig. 7



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Patented July 2, 1929. 1,719,128

UNITED STATES PATENT OFFICE.

HOWARD T. REEVE, OF MILLBURN, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRON EMITTER.

Application filed August 26, 1924. Serial No. 734,217.

This invention relates to electron discharge devices and has for its object an electron emitter and process of making the same.

Most materials of high thermionic activity cannot be made in filament form. It has therefore been the usual practice to coat thermionically active material on a filament having suitable physical and electrical characteristics. The product thus obtained is apt to lack uniformity. This invention contemplates incorporating the thermionically active material in the metal of the filament to secure a uniform homogeneous product.

Referring now to the drawings, the various figures thereof are illustrative of the steps in the process of producing an electron emitter according to this invention.

Fig. 1 is a sectional view of a metal receptacle containing the desired molecular portions of barium and strontium carbonates and atomic portions of nickel being heated to form nickelites of barium and strontium;

Figs. 2 and 3 are sectional views of a suitable die and block to press the powdered nickelite into a rod;

Fig. 4 is a sectional view of a vacuum furnace to break down the nickelites to yield the oxides of the earth metals;

Fig. 5 shows a suitable swaging machine to form the rod into wire;

Fig. 6 is an enlarged view of one of the swaging dies shown in Fig. 5; and

Fig. 7 is a sectional view of one of the succession of dies through which the wire is passed to reduce it to the proper size for use as vacuum tube filaments.

A filament made in accordance with this invention may comprise a high melting point alloy such as platinum-nickel or a metal such as tungsten throughout which is uniformly distributed oxides of the alkaline earth metals. The process of manufacture will be described in detail in connection with a platinum-nickel filament having strontium and barium oxides incorporated therein.

Proper molecular portions of the carbonates of barium and strontium and atomic portions of nickel are mixed in a metal boat 10 and heated by means of oxy-hydrogen flames 11 or the like to about 1200 degrees C. in the presence of air or oxygen. Compounds of barium and strontium with nickel and atmospheric oxygen are formed which might be expressed BaO_2 (NiO_2) and conveniently termed nickelites of barium and strontium.

The product of this operation is crushed to a powder and mixed with a proper proportion of platinum powder. It is then placed in a die 12 and by means of the block 13 is pressed into the form of a rod 14 as shown in Figs. 2 and 3. The rod 14 is then placed in a vacuum furnace 15 of any of the well known types and is heated to a temperature of approximately 1600 degrees C. This heating in vacuum breaks down the nickelites yielding the oxides of the alkaline earth metals which are incorporated in and uniformly distributed throughout the platinum-nickel rod.

The rod 14 is then hammered down by swaging machine 16 until it is formed into a homogeneous ductile wire. Fig. 5 discloses the swaging machine and Fig. 6 shows an enlarged view of one of the swaging dies 17. The rod 14 is then drawn down by being passed through a succession of dies 18 until it is of the proper size to be used as the filament of an electron discharge device.

It is of course understood that this process may be used in the formation of electron emitters having other constituents than those recited in connection with the detailed description of the process without in any way departing from the spirit of the invention as set forth in the appended claims.

What is claimed is:

1. The process of forming a cathode which comprises forming nickelites of alkaline earth metal, combining said nickelites with powdered refractory metal to form a core, reducing said nickelites and working the product into filamentary form.

2. The process of forming a cathode which comprises forming barium and strontium nickelites, combining said nickelites with platinum powder to form a core, heating said core to reduce said nickelites and working the resulting product into filamentary form.

In witness whereof, I hereunto subscribe my name this 22nd day of August A. D., 1924.

HOWARD T. REEVE.