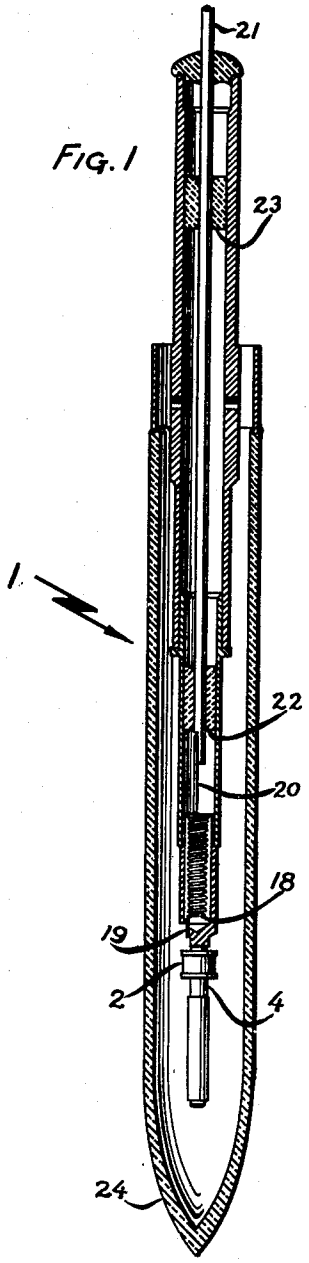
July 27, 1954 R. S. BRIGGS 2,684,886

SELF-BRAZING CATHODE

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FIG. 1



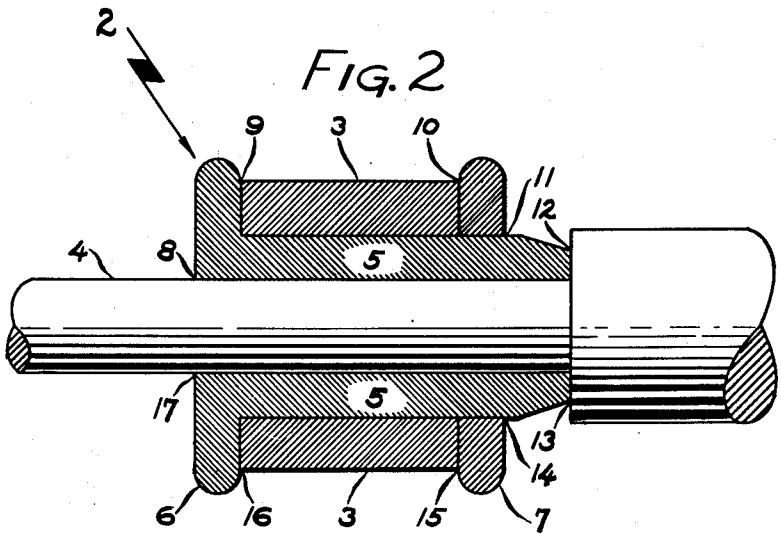
INVENTOR.
Richard S. Briggs

July 27, 1954 R. S. BRIGGS 2,684,886

SELF-BRAZING CATHODE

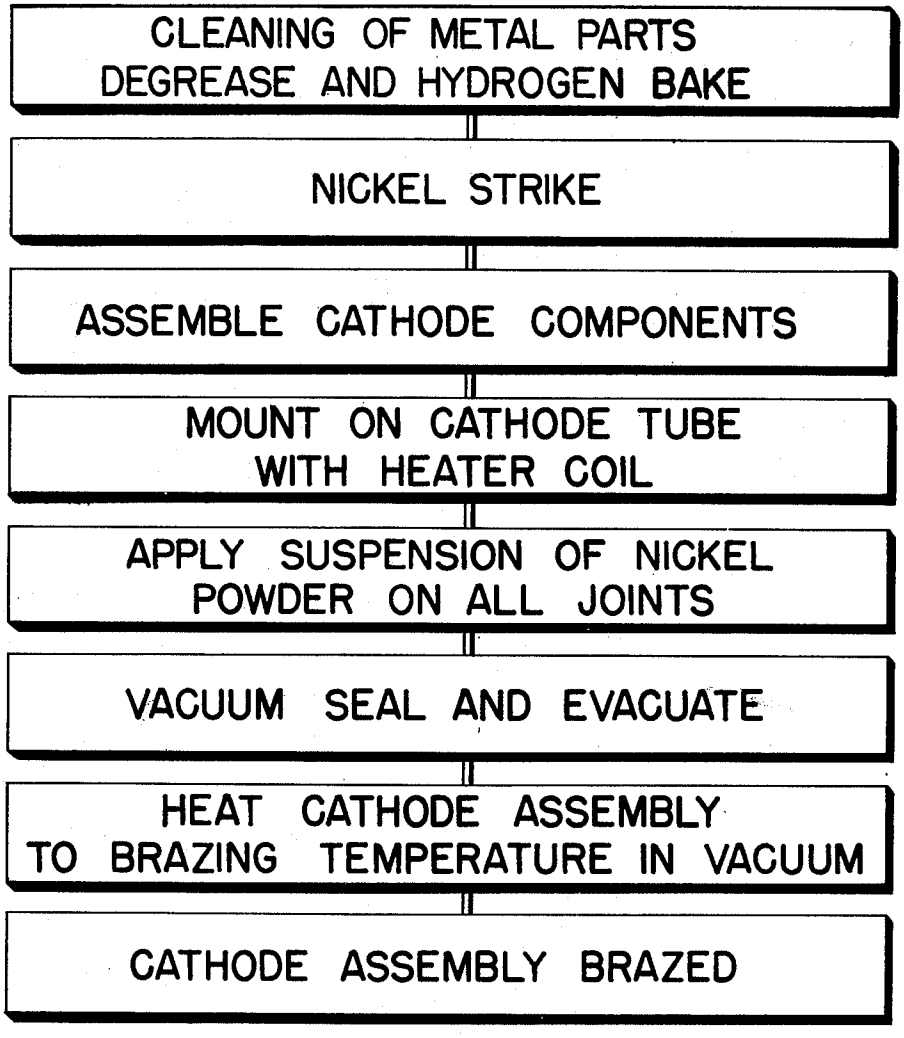
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FIG. 2



INVENTOR.
Richard S. Briggs

Fig. 3



INVENTOR.
Richard S. Briggs

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SELF-BRAZING CATHODE

Richard S. Briggs, Beverly, Mass., assignor to Bomac Laboratories Inc., Beverly, Mass., a corporation of Massachusetts

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3 Claims. (Cl. 316—19)

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This invention relates to the brazing of metals and more particularly to a novel method of brazing the cathode component parts for an ultra high or microwave frequency magnetron.

Ultra high or microwave frequency magnetrons commonly employ oxide coated cathodes as an electron emitting source. The oxide-coated cathode is commonly cantilever-supported and centered within a multivaned anode block. A circular sleeve, coated or impregnated with an electron emissive coating may be supported by a stem and indirectly heated by a heater element communicating with said stem.

In the process of assembling the cathode in accordance with conventional brazing methods, the problem of contamination of parts, as well as sputtering of brazing flux on surrounding parts arises in many cases.

Accordingly, an object of present invention is to provide a novel method of brazing the electron emissive member.

The invention will be more clearly understood from the following detailed description and reference to the accompanying drawings, in which

Figure 1 is a longitudinal cross sectional view of an illustrative embodiment of an assembled magnetron cathode, vacuum sealed.

Figure 2 is an enlarged detail view of the component parts of the cathode in Figure 1.

Figure 3 is a flow diagram of the process of this invention.

Referring now to the drawing, reference numeral 1 indicates an assembled cathode of an ultra high or microwave frequency magnetron, vacuum sealed and in final stage of assembly. The electron emitter 2 consisting of a circular sleeve of a refractory metal, desirably tungsten, coated or impregnated with an emitting material is supported by cathode tube 4.

In detail, as shown in Figure 2, the electron emitter or cathode 3 is retained within cap 5 which is supported on the shank of cathode tube 4. In the illustrative embodiment, I have found molybdenum to be desirable for cap 5 and cathode tube 4.

Cap 5, in the illustrative embodiment is composed of an eyelet section 6 and ring 7, friction-fitted over the tapered shank of eyelet 6.

The method of this invention resides in the assembly of cathode 3 and retaining cap 5 on supporting member 4.

According to the teachings of the invention as shown in the flow diagram Figure 3, the eyelet 6 and ring 7 are thoroughly cleaned by degreasing solvents and are then baked in an atmosphere of hydrogen in the well-known manner of the electronic art. In the next operation these parts are plated with a nickel strike. For the purposes of this specification, the term strike is defined as a thin layer of electroplating having a thickness of approximately one hundred thousandths to one ten thousandths of an inch (.00001–.0001); said electroplating being applied by immersion for a period of short duration in a bath having low cathode efficiency and a high current. Cathode 3 is then positioned on eyelet section 6 followed by retaining ring 7. This sub-assembly is then friction-fitted over the shank of cathode tube 4 substantially as shown in Figure 2.

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A suspension of nickel powder or any compound of nickel, such as nickel oxide, which can be reduced to finely divided nickel, and a small quantity of nitrocellulose lacquer sufficient to make a pasty mixture is prepared. Other suitable mixing agents may be employed with comparable results. However, I have used nitrocellulose lacquer to provide good adherence. This mixture is next applied to the joints in the cathode sub-assembly indicated by reference numerals 8–17.

The cathode sub-assembly is next provided with a heater element 18 supported by legs 19 and 20 and housed within the cathode tube. An electrode 21 axially spaced and supported by dielectric spacers 22 and 23 is electrically connected to leg 20 of the heater element.

The assembled cathode may then be provided with a glass envelope 24 and be exhausted by conventional methods.

Electrode 21 is connected to a voltage supply sufficient to heat the cathode to approximately 1300° C.–1400° C. Maintaining the cathode at this temperature for approximately two minutes will result in the brazing of the joints of the cathode components to which the nickel powder suspension has been applied.

The brazed cathode assembly will now be ready for further processing in the manufacture of a complete tube.

The self-brazed cathode will be free from contamination, since brazing takes place in an evacuated atmosphere. Further, this method of brazing facilitates assembly of small parts which would present a serious problem under conventional brazing methods.

What I claim and desire to secure by Letters Patent is:

1. A method of assembling a self-brazing

cathode comprising the steps of degreasing and hydrogen baking a metallic retaining member composed of an eyelet section and ring section, depositing a thin layer of nickel plating thereon, assembling an electron emitter over said eyelet section followed by said ring section, mounting said assembled parts on a cathode tube with a substantially hollow section provided with a heater element therein, applying a suspension of nickel powder and a mixing agent to the joints of the electron emitter, eyelet section, ring section and the cathode tube at the point of contact, providing an external connecting source for said heater element, vacuum sealing and evacuating the assembled components, and connecting a voltage source to the heater element sufficient to heat the assembled evacuated and vacuum sealed component parts to a temperature sufficient to cause the nickel powder suspension to flow and braze the assembled components.

2. A method according to claim 1 wherein said electron emitter is composed of a sleeve of a refractory metal and alloys thereof impregnated with a thermionic material and said assembled evacuated and vacuum sealed component parts are heated to a temperature of approximately 1300° C. to 1400° C.

3. A method of assembling and brazing a cathode for an electron device of the magnetron type comprising the steps of plating a metallic retaining member including an eyelet and ring section with a thin layer of nickel, assembling a sleeve of a refractory metal coated with an emissive material over said eyelet section followed by said ring section, mounting said assembled parts on a tubular support member having a hollow section with a heater coil therein, preparing a suspension of a nickel powder and a binding agent, applying said suspension to the point of contact of said sleeve, eyelet section, ring section and the tubular support member, connecting an electrode to one leg of said heater coil, sealing said assembled component parts in a vacuum retaining enclosure, exhausting the atmosphere within said enclosure and connecting the end of said electrode to a voltage source necessary to heat the assembled parts to a temperature of approximately 1300° C. to 1400° C. in the reduced atmosphere.

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