ADHERING COATINGS TO CATHODE BASE METAL

Filed March 24, 1955

INVENTORS
DONALD R. KERSTETTER
ERNEST S. WENNIN

BY Michael Hatz
ATTORNEY
ADHERING COATINGS TO CATHODE BASE METAL

Donald R. Kerstetter and Ernest S. Wennin, Emporium, Pa., assignors to Sylvania Electric Products Inc., a corporation of Massachusetts

Application March 24, 1955, Serial No. 496,608

8 Claims. (Cl. 154—129)

In the prior art, a method of applying alkaline earth metal compositions held in a lacquer binder or metal cathode bases has been evolved in which the leaves are applied to the bases by wetting the bases with a lacquer solvent such as pentacetae and allowing, for each base, a leaf to come into adherence therewith or to wrap itself around the base element after initial contact with the base.

In the process of coating cathodes with emitter coatings of a mixture of barium, strontium and calcium carbonates by the wrap-around method described above, difficulties have been experienced in that the coating peeled or separated from the cathode base metal, usually a nickel alloy with a high percentage of nickel. This separating occurred when the cathode was subjected to heat in a vacuum during the process of reducing the carbonates to oxides. This is not only a problem peculiar to wrap-around coatings but is frequently experienced with coatings applied by spray or cathaporesis coating techniques. A number of changes in processing can be used to correct this problem such as special cleaning of the cathode base metal, firing the base metal, roughening it or changing lacquers or solvents in the coating. However, none of these is completely effective.

It is an object of this invention to provide a simple method of applying the carbonates to the metal base of the cathode so as to almost completely avoid loose coatings.

The figure illustrates in cross-section a cathode made in accordance with the invention.

We have found that the application of a very small amount of barium nitrate between the cathode base metal and the cathode coating has resulted in coatings which adhered so firmly to the cathode base metal as to reduce the loss due to flaking off or peeling of the coating to a negligible amount. This is apparently brought about by one or a combination of two characteristics of the barium nitrate. This compound fuses at the relatively low temperature of 592° C. which is a temperature between the burn-off temperature of the lacquer binders normally used to hold the carbonates together and the sintering or fusing temperature of the oxides. The barium nitrate is held in suspension in a liquid which readily wets the cathode base metal. Such a liquid may be the pentacetae referred to above. As a result, the barium nitrate suspension readily covers the surface of the metal. The fusion of the barium nitrate causes it to act as an adhesive between the coating and the cathode base metal thus insuring good bonding and freedom from peel between the metal oxides and the base metal, after reaching the temperature at which the metal oxides fuse. A second action which takes place is that on heating in a vacuum, the barium nitrate, Ba(NO₃)₂, breaks down, in part, into oxides of nitrogen which have an oxidizing effect on the metallic cathode base. This oxidation of the cathode base metal assists in good bonding between the emissive oxides of the coating and the cathode base metal because of the fact that there is good adhesion between the nickel and nickel-oxide interface of the cathode base and far better adhesion between the nickel oxide and the combination of the earth metal oxides.

It is important that the barium nitrate be applied directly to the cathode base metal. Although adding it to an earth metal carbonate strip as an ingredient of the strip and prior to wetting a leaf from that strip with pentacetae has some beneficial effects, it is most effective when applied in such a manner as to be in direct contact with the base metal and interposed between the metal and the leaf.

This may be accomplished in one of several ways. The cathode base may be sprayed with a suspension of barium nitrate in pentacetae, a concentration of .05 to .15% barium nitrate in the pentacetae working very satisfactorily. After the cathode base has been coated in this manner, it can be further coated by the normal spray or cathaporesis technique or with the wrap-around coating as referred to above. It has been found advisable to fire the cathode square when the barium nitrate is on it so that the barium salt will fuse to the cathode base and will not in, or prior to, subsequent operations be readily washed or blown off. In the case of the wrap-around coating, it has been found that the barium nitrate may be applied to the coating very simply by adding the barium nitrate to the pentacetae that is being used to effect self-wrapping of the coating around the cathode base. Thus the cathode base is wetted with a solution of pentacetae containing the barium nitrate and then the leaf for film of cathode coating is brought into contact with the wetted cathode base to allow the wrapping action to take place.

Still another method may be used to apply the barium nitrate. This can be accomplished during the preparation of coating film by first laying down on a smooth surface a thin film of barium nitrate from a volatile suspension with some lacquer binder and, after the solvent evaporates, laying the carbonate coating in a similar volatile suspension lacquer binder over the nitrate coating. The composite film, when dry, is then stripped off the surface and applied to the cathode base with the barium nitrate side of the film toward the base. This film will wrap itself around the base in the same manner as the carbonate coating alone would, on the wetting of the base with the solvent for the binder in the barium nitrate or in the emitter coating.

The quantity of barium nitrate necessary to produce satisfactory results is extremely small—something in the order of .1 mg. to 1.0 mg. of barium nitrate per square centimeter of coating.

Having thus described the invention, what we claim is:

1. In the manufacture of a cathode for use in electron tubes and which cathode includes a metal base and a preformed layer of alkaline earth metal compounds, the step of interposing barium nitrate between the metal base and the layer of metal compounds.

2. In the manufacture of a cathode for use in electron tubes and which cathode includes a metal base containing a nickel alloy and a preformed layer of alkaline earth metals comprising the carbonates of barium, strontium and calcium, the step of interposing barium nitrate between the metal base and the carbonate layer.

3. In the manufacture of a cathode for use in electron tubes and which cathode includes a base of nickel alloy, the step of applying a coating of barium nitrate to the base and subsequently applying a preformed layer of an electron emissive coating containing the carbonates of barium, strontium and calcium.

4. In the manufacture of a cathode for use in electron tubes and which cathode includes a base of nickel alloy, the steps of applying a coating of barium nitrate to the
3. In the manufacture of a cathode for use in electron tubes and which cathode includes a metal base and a layer of metal compounds, the step of applying to the metal base both barium nitrate and the layer of metal compounds, with the barium nitrate in coexistence with the metal compounds and interposed between the metal base and compounds.

4. In the manufacture of a cathode for use in electron tubes and which cathode includes a metal base and a layer of alkaline earth metal compounds, the step of applying to the metal base both barium nitrate and the layer of carbonates, with the barium nitrate in coexistence with the earth metals and interposed between the metal base and earth metals.

References Cited in the file of this patent

UNITED STATES PATENTS

1,812,103 MacRae 1931 June 30
2,238,595 McNall 1941 Aug. 15
2,650,884 Pakswer et al. 1953 Sept. 1
2,744,838 Newman 1956 May 8

OTHER REFERENCES