United States Patent Office 2,702,250 Patented Feb. 15, 1955

2,702,250

COATING COMPOSITION FOR ELECTRONIC TUBES

John Clifford Miller, Toledo, Ohio, assignor to The AP Parts Corporation, Toledo, Ohio, a corporation of Ohio

No Drawing. Application February 16, 1951, Serial No. 211,439

10 Claims. (Cl. 106—189)

This invention relates to coatings for vacuum or gas filled tubes for electronic and allied uses and purposes and more particularly to improvements in coatings for cathode-ray tubes of the character utilized as scanning tubes for television purposes.

The provision of an adequate and satisfactory current conducting anode for electronic tubes where the anode is in the form of an interior surface coating has presented many difficulties. Cathode-ray tubes usable for television purposes are usually provided with picture reproducing area or screen of phosphorescent character and the interior frusto-conical areas of the tube provided with a current conducting anode coating. Such tubes are usually shaped with comparatively narrow necks, a structural characteristic which augments the difficulties of satisfactorily coating the interior tapered surfaces. One of the present methods is to apply a graphite coating to the interior of the tube by means of a brush using a viscous coating composition, but such application is laborious and time consuming and the resulting surface coating may be irregular and nonuniform, conditions which impair the fidelity of picture reproduction and in many instances cause apparitions and distortion of the picture image.

Other similar methods have been employed to establish an interior coating in tubes of this character but the compositions heretofore employed contain one or more ingredients or constituents which are difficult of curing as they emit gases. If in the curing process all the volatiles are not driven off, the efficiency of the tube is greatly impaired and longevity of the tube shortened.

In providing coatings for the interior of cathode-ray tubes or other electronic tubes, it is imperative to secure as far as possible a uniform coating of proper thickness and uniform density in order to secure satisfactory results. The materials which have been heretofore used have not been entirely satisfactory especially as they have been of a viscous nature requiring manual application by means of a brush or similar applicator. The application of coatings of this nature to the interior of tubes especially those for television purposes must be reasonably free from undulations or roughness for reasons among others that a nonuniform coating results in excessive heating and inefficient control of the movement and direction of electrons.

The present invention embraces the provision of a coating admixture or composition which may be satisfactorily used in flowable liquid form in a manner which facilitates the attainment of a smooth homogeneous coating of substantially uniform density and of a character which increases the efficiency of tube operation.

Another object of the invention resides in the provision of a coating composition or mixture particularly usable for coating the interior surfaces of electronic tubes which may be applied in a highly liquid form and the volatile constituents of the composition thereafter readily evaporated or driven off so that the noncurrent conducting properties of the coating per se are negated to result in a smooth current conducting coating on the tube surface.

Another object of the invention is the provision of a coating composition especially adapted for use in establishing a film or coating on the interior of cathode-ray tubes in which the current conducting constituent, which remains as the residue coating after the carriers have been volatilized and driven off, is of an extremely fine particle size in the nature of one micron or less, the

fineness of the particles of the current conducting constituent facilitating the homogeneity, uniformity and density of the coating to attain improved electrical characteristics and functioning.

The present invention contemplates the provision of a dispersion embodying a colloidal graphite constituent which is admixed with one or more carriers or vehicles of a highly fluid nature boiling below 100° C., the function of which is to facilitate the flow of the dispersion on the tube surface. For this purpose the carrier or carriers must have desirable characteristics of low surface tension in order to flow the dispersion in a satisfactory manner. The present invention finds particular utility as the interior coating on the lateral or sidewalls of a cathode-ray tube of the frusto-conical or frusto-pyramidal shape especially configurated for television purposes. Electronic tubes of this nature, in order to secure most satisfactory operation should be provided with an interior coating which has excellent current conducting properties in order to properly control the movement of the electrons within the tube. Graphite is a good conductor of electricity and the composition of the present invention includes a dispersion embodying graphite as the base or current conducting ingredient of the composition. Applicant has found that the following dispersion provides a satisfactory composition for the purpose. The dispersion is inclusive of colloidal graphite, which functions as a current conducting medium, a temporary binder to aid in dispersing the graphite coating on the tube such as triethyl cellulose, a material which in effect functions as a dye or pigment such as carbon black, and a liquid carrier or vehicle such as an alcohol. In coatings especially adaptable for television tubes, it is imperative that the coating be absolutely black and hence carbon black or similar material may be utilized in the dispersion especially as graphite in its natural state is of a gray color and by itself is unsuitable because of its natural color.

The following proportions have been found to provide a very satisfactory dispersion for the purposes herein mentioned. A dispersion in which the graphite constituent is by weight 33% of the composition, the binder such as triethyl cellulose and carbon black make up 11% by weight of the dispersion and the remainder alcohol to the extent of 56% by weight. The amount of carbon black may be very small, being only sufficient to secure the black color desired for the coating as it performs no other apparent function in the dispersion.

The triethyl cellulose has been found to function in the dispersion as a satisfactory temporary binder to spread the graphite coating on the tube and this material after the tube is coated may be readily volatilized and driven off by heat at a temperature of approximately 600° F. or about 315° C. When this constituent of the dispersion is eliminated by volatilization, the nonconducting characteristics of the composition are substantially eliminated leaving the colloidal graphite and carbon black as the current conducting coating or film. In the volatilization step of the process, the triethyl cellulose constituent is substantially oxidized and any moisture absorbed thereby is evaporated under the curing temperature.

The dispersion above set forth is blended with a suitable carrier or vehicle boiling below 100° C. and including dichloromethane has been found to function satisfactorily and to have the necessary characteristics of low surface tension to facilitate the spreading or flowing of the composition upon the glass surface of the tube. In the composition or admixture of the carrier and dispersion, the dispersion is blended in the ratio of the entire composition of substantially fifteen parts by weight of dispersion to eighty-five parts by weight of dichloromethane (CH_2Cl_2). Dichloromethane is highly satisfactory as a vehicle or carrier as it has a low surface tension which facilitates flowing or dispersing the colloidal graphite dispersion over the tube surfaces.

The alcohol constituent of the dispersion may be of any suitable character and I have found that isopropyl alcohol is of an inexpensive character and is a factor which aids in adjusting the surface tension and coating thickness and hence the coatability of the composition in its appli-

cation. Moreover, the type of alcohol or the alcohol per se may be utilized to adjust the fluidity or dispersibility of the coating, for example, if a thin coating is desired then more alcohol is added, if a more viscous coating is desired then less alcohol is included in the dispersion. Other alcohols may be used in the dispersion, methanol, ethanol and propyl alcohol, but isopropyl alcohol is preferred because of its comparatively low cost and its favorable characteristic of volatilizing at a rapid rate which reduces the time of processing in the curing or heating operation performed on the coated tube.

Esters may also be used in lieu of the alcohol constituent of the dispersion as well as light weight (petroleum) isopropyl ethers and secure satisfactory results. Other materials may be used for such purpose having desirable characteristics of being rendered volatile under a temperature of approximately 600° Fahrenheit.

The method of combining or blending the colloidal graphite, triethyl cellulose and alcohol dispersion, and the carrier or vehicle dichloromethane, to secure a satisfactory composition or admixture is as follows: The dichloromethane is placed in a blending vat and the dispersion divided into several equal parts as for example eight to twelve parts. One part of the dispersion is added to the blending vat and agitation begun by the use of suitable power driven agitators of conventional character. At intervals of from twelve to eighteen minutes another part of the dispersion is added to the vat and agitation continued. The addition of the dispersion parts and agitation of the mixture in the blending vat continues until all parts of the dispersion are delivered to the vat. The agitation is thereafter continued for a period of from forty-five minutes to one and one-half hours to assure thorough blending. The factors of the length of time for carrying out the blending operation is in a measure dependent upon the size of the vat and the speed of operation of the agitators.

While the composition is especially suitable for establishing current conducting coatings upon the interiors of cathode-ray tubes used for television purposes, it is to be understood that the composition may be advantageously employed in forming current conducting coatings of films upon various types of surfaces.

I claim:

1. A composition for establishing a current conducting film upon a surface including a dispersion embodying colloidal graphite of fine particle size, an oxidizable binder volatilizable below 315° C. comprising an ethyl cellulose, and a volatilizable liquid boiling below 100° C. comprising an alcohol of 1 to 3 carbon atoms per molecule and dichloromethane.

2. A coating composition for forming current conducting coating on electronic tubes comprising a liquid carrier boiling below 100° C. comprising dichloromethane and isopropyl alcohol, and dispersed in said carrier: colloidal graphite, triethyl cellulose, and a color pigment.

3. A coating composition for forming current conducting coating on electronic tubes comprising a liquid carrier boiling below 100° C. comprising dichloromethane and isopropyl alcohol, and dispersed in said carrier: colloidal graphite, triethyl cellulose, and a color pigment, the alcohol dispersion being in the ratio of substantially fifteen parts by weight to eighty-five parts by weight of dichloromethane.

4. A coating composition for forming current conducting coating on electronic tubes including a dispersion embodying colloidal graphite, a binder volatilizable below 315° C. comprising an ethyl cellulose and a volatilizable carrier boiling below 100° C. comprising an alcohol of 1 to 3 carbon atoms per molecule and dichloromethane in the ratio of substantially fifteen parts by weight of the alcohol dispersion to eighty-five parts by weight of dichloromethane.

5. A coating composition for forming current conducting coating on electronic tube surfaces including a dispersion embodying colloidal graphite of fine particle size in amount of about 33% by weight; a binder comprising an ethyl cellulose and a color pigment in amount of about 11% by weight, and an alcohol of 1 to 3 carbon atoms per molecule in amount of about 56% by weight; said dispersion being blended with dichloromethane.

6. A coating composition for forming current conducting coating on electronic tube surfaces including a dispersion embodying colloidal graphite of fine particle size in amount of about 33% by weight; triethyl cellulose and carbon black in amount of about 11% by weight, and an alcohol of 1 to 3 carbon atoms per molecule in amount of about 56% by weight; said dispersion being blended with dichloromethane in the ratio of substantially 15% by weight of the dispersion to 85% by weight of dichloromethane.

7. A coating composition of material for forming a current conducting film on a cathode-ray tube; said composition including a dispersion in a volatilizable liquid carrier boiling below 100° C. embodying colloidal graphite of fine particle size; a binder of triethyl cellulose, and isopropyl alcohol, and dichloromethane.

8. A coating composition for forming a current conducting film on electronic tube surfaces including a dispersion in a volatilizable liquid carrier boiling below 100° C. embodying colloidal graphite of fine particle size, a binder comprising an ethyl cellulose which is oxidizable at less than about 315° C., a color pigment, an alcohol of 1 to 3 carbon atoms per molecule; and a liquid comprising dichloromethane.

9. A coating composition comprising: a dispersion embodying colloidal graphite, a binder comprising an ethyl cellulose volatilizable below 315° C., and a fluidity adjusting liquid boiling below 100° C., and a low surface tension organic liquid carrier boiling below 100° C. containing dichloromethane.

10. A composition according to claim 9 wherein said fluidity adjusting liquid comprises a lower aliphatic alcohol.

References Cited in the file of this patent

UNITED STATES PATENTS

1,981,652	Long	Nov. 20, 1934
2,039,708	Crouch et al.	May 5, 1936
2,094,146	Elliot et al.	Sept. 28, 1937
2,223,924	Stephan	Dec. 3, 1940
2,252,552	Calbick et al.	Aug. 12, 1941
2,282,832	Spooner	May 12, 1942
2,318,803	Schneider et al.	May 11, 1943
2,337,524	Michael	Dec. 21, 1943
2,448,090	Fuhrman	Aug. 31, 1948
2,496,901	Van Hoorn	Feb. 7, 1950
2,524,733	Payne	Oct. 3, 1950
2,544,363	Siemons	Mar. 6, 1951