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(54) Method of manufacturing a contact stud coating

(57) A stud coating that remains flexible and may be baked out in the normal tube baking cycle includes a colloidal graphite suspension in a base that is a solvent for the lacquer film in the aluminized faceplate of the picture tube.

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Description

Background of the Invention and Prior Art

[0001] This invention relates in general to color television picture tubes, and in particular to an improved stud coating composition and method for providing an electrical path between the color picture tube shadow mask and screened faceplate.

[0002] The color television cathode ray picture tube comprises a glass bulb, consisting of a funnel and a faceplate with the faceplate sealed to the flared end of the funnel. An electron gun is mounted in the neck portion of the funnel to provide one or more electron beams. The faceplate has a nearly flat inner surface upon which is deposited groups of phosphors that are excited by the electron beams. The shadow mask provides color selection by masking groups of the phosphors so that they are excitable by only one of the electron beams. The shadow mask is attached in a precise relationship with the faceplate by means of a plurality of suspension springs which detachably engage metal studs that extend from the faceplate. An electrically conductive coating of colloidal graphite is applied to the internal surface of the funnel and has a high voltage applied thereto through an anode button in the funnel wall.

[0003] It is common practice to aluminize the phosphor screen by applying an electron permeable film of aluminum thereover. The film acts as a mirror and increases the brightness of the display by reflecting the rearwardly directed light produced by the phosphors. A film of organic material, such as lacquer, is applied over the phosphor deposits before application of the aluminum. The organic film fills in uneven areas of the phosphor deposits and provides a smooth surface upon which the aluminum film can be deposited, which takes on the smooth characteristics of the lacquer.

[0004] It is essential that the anode voltage on the funnel coating be applied to the shadow mask and to the aluminum film. The electrical path for accomplishing this comprises one or more springs that extend from the shadow mask into engagement with the funnel coating. The anode potential an the shadow mask is conducted to the aluminum film through the shadow mask suspension springs and the metal support studs. To complete the electrical path to the aluminum film, the metal support studs are painted with a conductive "moustache" that extends to the aluminum film. The material comprising the conductive moustache is commonly referred to as stud coating.

[0005] A prior art conductive material that formerly was in extensive use as a stud coating comprises a water-soluble silicate in a form suitable for application by a brush. The water was driven off in a subsequent tube baking process, leaving a hard, electrically conductive film between the studs and the aluminum film. The water based solutions commonly-contained either potassium silicate or sodium silicate as a binder and did not always "wet" properly nor adhere to components. Consequently, fragments of the coating often flaked off the studs and glass area and blocked one or more apertures in the shadow mask which often resulted in an unacceptable tube. Such particles in the gun area could also result in interelectrode arcing and/or cathode poisoning. The water-soluble coatings required an extra baking cycle after aluminizing and before applying the stud Dag.

[0006] United States Patents Nos. 4,289,800 and 4,301,041, in the name of the inventor and assigned to Zenith Electronics Corporation, solved the above-discussed problems of the prior art and introduced a very significant cost saving in the production process by eliminating the need for the extra baking step after aluminizing. These patents, which are incorporated by reference herein, disclosed a method and a stud coating composition comprising a mixture of glass frit particles and colloidal graphite in an evaporable solvent for the lacquer film (under the aluminum film) and a thickening agent to provide a paintable viscosity. The solvent penetrated the lacquer layer, through the porous aluminum film and was driven off during the tube baking cycle in the Lehr (oven). The method and the stud coating solution described in these patents are in extensive use in the industry and have performed quite well over the years.

[0007] The glass frit type of stud coating described in the above-discussed patents manifests a deficiency during a breakdown or interruption in the production process. Specifically, a problem arises when tubes are subjected to the high Lehr temperatures for an extended time period, such as occurs when the production line stops. The lead oxide in the glass frit reacts with the carbon in the graphite to form carbon dioxide and lead and destroys the conductivity of the stud coating. In many instances close attention to Lehr heat control during line shutdowns can obviate the problem, although during extensive shutdowns, the difficulty may still be present. The problem is often compounded by the fact that a sufficient amount of the stud coating may remain intact to enable the tube to pass final inspection and testing although it may be prone to recurrent arcing and ultimate failure in the field. While the problem is not severe in terms of numbers, it is catastrophic to the picture tube and an obvious expense and inconvenience to the consumer, since it may not show up during routine testing of the picture tube.

Objects of the Invention

[0008] A principal object of the invention is to provide an increase in the performance reliability of color cathode ray tubes.

[0009] Another object of the invention is to provide a reduced manufacturing cost for color cathode ray tubes.

[0010] A further object of the invention is to provide a cathode ray tube with minimal stud coating-related arcing.

Description of the Preferred Embodiment

[0011] As mentioned, color cathode ray tubes have a phosphor bearing imaging faceplate overlaid successively with a lacquer film and an aluminum film. A shadow mask is secured next to the faceplate by a plurality of-metallic studs extending from the faceplate. An electrical bridge is provided between the shadow mask and the aluminum film via the studs and a stud coating to maintain the aluminum film at anode potential. (As is well known, the shadow mask is electrically connected to the anode voltage that exists on the coating inside the funnel by springs that bridge the non-conductive glass frit seal between the picture tube faceplate and the funnel.)

[0012] An improved bake-hard enable solution according to the invention for providing the stud coating electrical bridge or moustache comprises essentially a mixture of graphite particles in the micron-sized range. The particles are in suspension in an evaporable solvent for the lacquer film. The suspension includes a thickening agent in an amount sufficient to produce a paintable viscosity for application by a brush. Upon application of this solution between the suspension studs and the aluminum film, the solution penetrates the lacquer film, when the tube is baked, the solution hardens to provide a permanent electrically conductive bridge between the mask and the aluminum film.

[0013] The solution may have a viscosity in the range of 200800 centripoises; and preferably about 550 centripoises. After baking, the solution may have an electrical resistance in the range of 100 to 500 ohms per square. The electrically conductive stud coating of the invention may be compounded as follows (produces one gallon). Equivalent materials supplied by other suppliers may be used.

[0014] Dissolve 225 grams of acrylic resin (Elvacite 2044-Source ICI Acrylics) in 2025 grams of purified grade butyl cellosolve (E179 from Fisher Scientific Co.) for the acrylic resin stock solution.

[0015] Weigh in a suitable container (2000 ml beaker) 225 grams butyl cellosolve. Add to it 675 grams of N-butyl acetate (B-396 from Fisher Scientific Co.) and 630 grams of the resin binder and stir until the solution is homogenous to make a resin binder solution.

[0016] Add the following into a ball mill containing approximately 8000 grams of griding media:

INGREDIENT	QUANTITY	WT. %	RANGE
Graphite HPN-2	630 grams	14	36144
Graphite LN 1052 (Source Grapfo Colloids)	90 grams	2	35797
Acrylic Resin Stock Solution	2250 grams	50	45-55
Resin Binder Solution	1530 grams	34	30-38

[0017] Roll the ball jar for 22-24 hours and pour milled coating suspension into a one gallon container.

[0018] The coating preparation should be performed in an area of adequate ventilation with suitable precautionary procedures, such as wearing rubber gloves, respirator masks, lab coats, hair nets and shoe covers being followed by involved personnel. Care must also be taken because of the flammability of the N-butyl acetate and the resin binder solution.

[0019] The stud coating prepared and used according to the invention eliminates the problem identified above in connection with the use of a glass frit based stud coating. A major feature of the new stud coating is its flexibility (after processing) which enhances its resistance to flaking. Additionally, the inventive stud coating is less costly and still enables the benefit of not requiring an extra bake cycle for the picture tube.

[0020] In a test, the prior art frit-based stud coating was applied to the stud and aluminum film and subjected to a temperature of 450 degrees Centigrade for a period of two hours. The resistivity of the coating rose from 300 ohms to 73,000 ohms. With the new stud coating, under the same conditions, the resistivity remained at 300 ohms.

[0021] In a production line run of color picture tubes, rejects due to stud arcing amounted to 0.3% for the frit-based stud coating of the prior art, whereas with the inventive stud coating, there were no stud arcing rejects.

[0022] What has been described is a novel stud coating composition and method that solves the problem of stud to aluminum film conductivity in color picture tubes. It is recognized that numerous modifications in the described embodiment of the invention will occur to those skilled in the art without departing from its true spirit and scope. The invention is to be limited only as defined in the claims.

Claims

1. A method of manufacturing a stud coating comprising:

providing a colloidal graphite mixture;
preparing an acrylic resin solution capable of penetrating the lacquer film of an aluminized picture tube faceplate;
preparing a resin binder solution; and
milling the solutions and the graphite mixture.

2. The method of claim 1, wherein the acrylic resin solution is prepared by dissolving an acrylic resin in butyl cellosolve.

3. The method of claim 2, wherein the resin binder solution is prepared by making a homogeneous mixture of butyl cellosolve, N-butyl acetate and resin binder.

4. The method of claim 3, wherein the weight percentage of the stud coating solution is approximately:

16% colloidal graphite;
14% resin (binder);
5% acrylic resin;
15% N-butyl acetate; and
50% butyl cellosolve.

5. A stud coating for making an electrical connection between the studs and the aluminum film in a color picture tube faceplate comprising:

colloidal graphite dispersed in an acrylic resin solution that is capable of penetrating the lacquer layer under said aluminum film;
the solvents in said coating being baked out with said lacquer layer during a tube baking operation and said conductive connection remaining flexible to resist flaking.

6. The coating of claim 5, wherein said coating comprises:

an acrylic resin solution; and
a resin binder solution.

7. The coating of claim 6, wherein said acrylic resin solution comprises an acrylic resin dissolved in a solution of butyl cellosolve.

8. The coating of claim 7, wherein said resin binder solution comprises a resin binder, N-butyl acetate and butyl cellosolve.

9. The coating of claim 8, wherein the weight percentages of said coating are approximately:

16% colloidal graphite;
14% resin (binder);
5% acrylic resin;
15% N-butyl acetate; and
50% butyl cellosolve.

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EUROPEAN SEARCH REPORT

Application Number
EP 98 40 2061

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE 15 14 828 A (TELEFUNKEN PATENTVERWALTUNGSGESELLSCHAFT) 8 January 1970 * page 3; claim 1 * ---	1	H01J29/88
D,A	US 4 301 041 A (SHAH RICKY H) 17 November 1981 * claim 1 * ---	1	
A	US 5 156 770 A (WETZEL CHARLES M ET AL) 20 October 1992 * column 5 * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 November 1998	Colvin, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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E : earlier patent document, but published on, or after the filing date
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