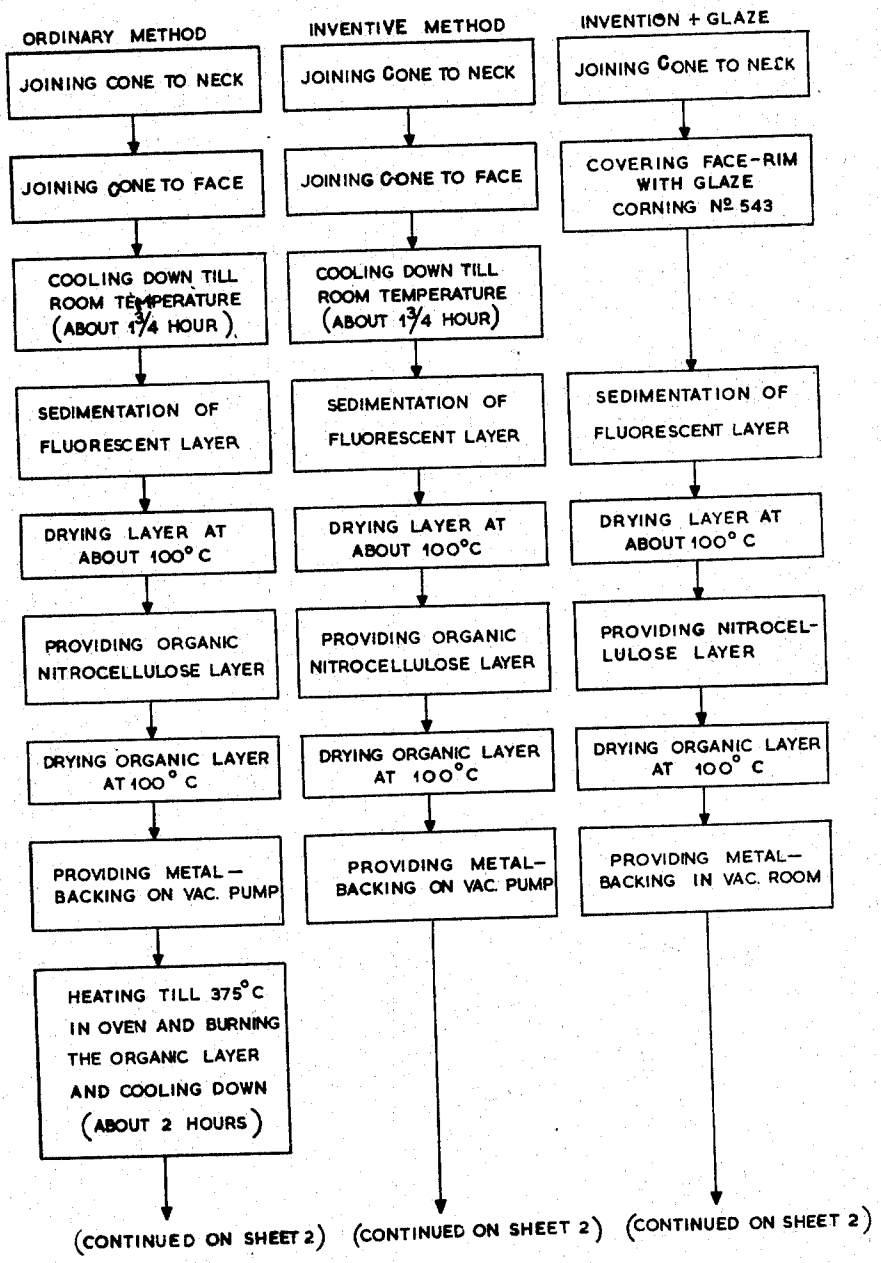
Oct. 6, 1959 T. C. GROOT ET AL 2,907,619

METHOD OF MANUFACTURING CATHODE RAY TUBES, MORE PARTICULARLY TELEVISION PICTURE TUBES

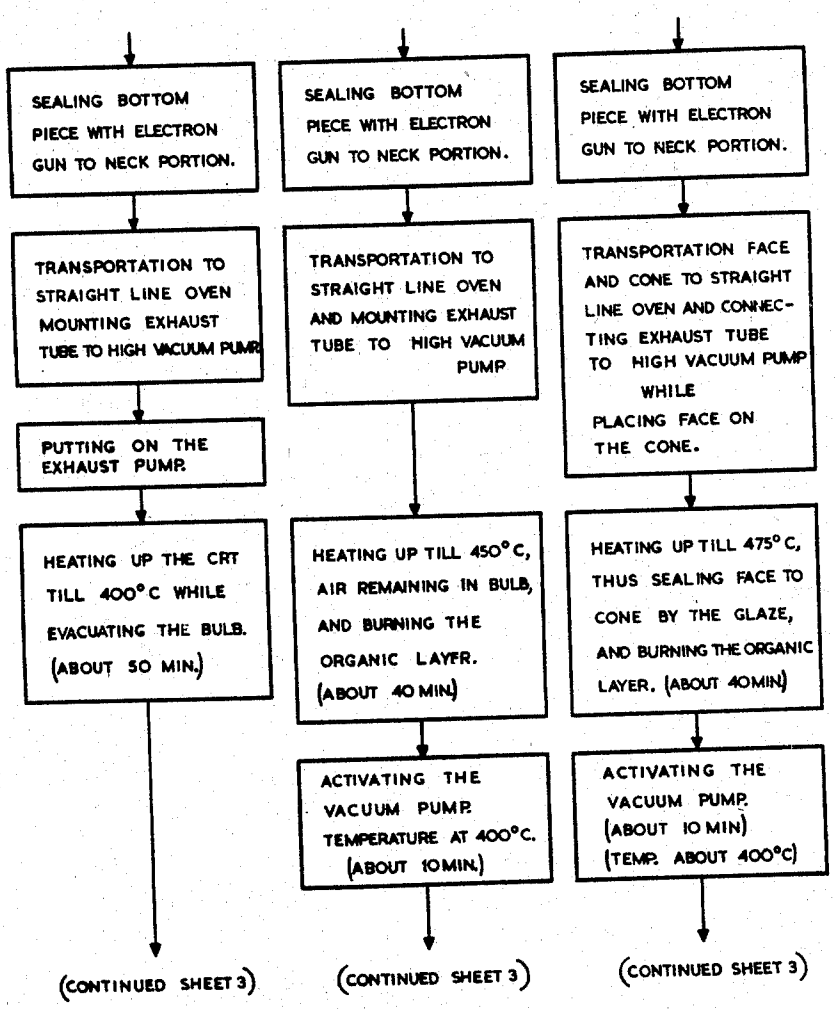
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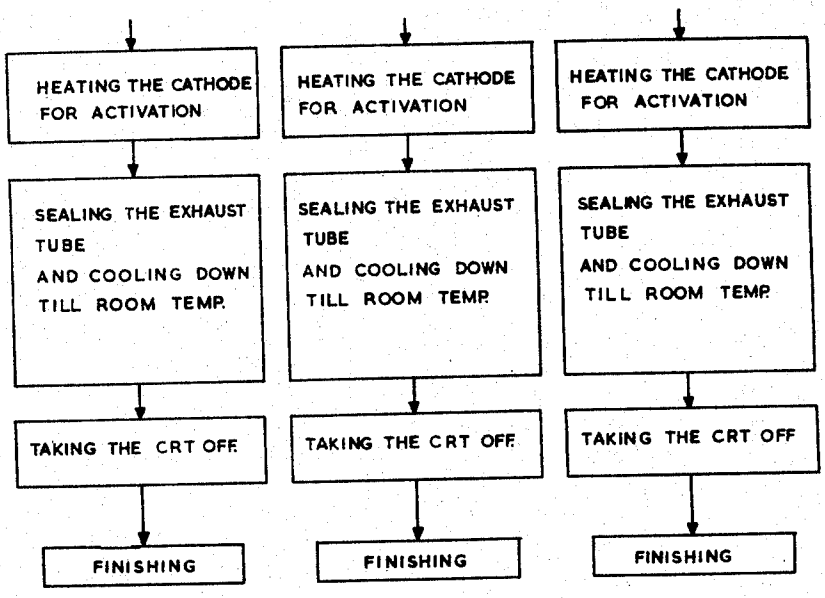
SHEET.2



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SHEET.3



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METHOD OF MANUFACTURING CATHODE RAY TUBES, MORE PARTICULARLY TELEVISION PICTURE TUBES

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Claims priority, application Netherlands October 1, 1956

5 Claims. (Cl. 316—21)

The invention relates to a method of manufacturing cathode ray tubes, more particularly television picture tubes, which are provided with a phosphor screen, to the cathode side of which is applied a thin metal layer or backing (aluminizing).

Such tubes are manufactured as follows:

In a sealing machine the window or faceplate and the cone portions of the bulb are sealed to one another. The cone has already been provided with a neck portion. Then the bulb is annealed in a furnace and cooled down to room temperature in about 1¾ hours. The phosphor screen is then applied by settling and dried, which may be carried out for example, in a moderately heated furnace (about 100° C.). After cooling an organic intermediate (lacquer) layer consisting of a 2.5% solution of nitrocellulose in butylacetate is applied to the screen and dried at about 100° C. The neck is then connected to an auxiliary vacuum pump after a metal body has been introduced into the bulb in a manner such that the metal can be evaporated and precipitated on the organic intermediate layer.

Then the intermediate layer is burnt out or combusted in a furnace in an oxygen-containing atmosphere, to this end the bulb is heated to 350° C. to 400° C. and again cooled to room temperature. This operation lasts about 2 hours.

The assembly is then introduced into a large straight-line furnace after a bottom part or stem tube, which is provided with an exhaust tube and to which the electron gun is secured, has been sealed in the open end of the neck. The tube is then placed on an exhaust pump and moved into the straight-line furnace, after the exhaust pump has been made operative.

In the straight-line furnace the tube is heated in about 50 minutes to a temperature of 400° C., so that the bulb, the electrodes and the screen are degasified. Beyond the centre of the furnace the cathode is heated and activated after which the exhaust tube is sealed off and the tube is slowly cooled down to room temperature. After a few external operations the tube is then ready.

In accordance with the invention it has been found that this method can be materially shortened and rendered much cheaper by burning the organic intermediate layer during the heating period in the straight-line furnace and by starting the exhaust of the tube not until the intermediate layer is burnt. The tube is then connected with its exhaust tube to the pump, it is true, but the pump is actuated not until the intermediate layer is burnt, i.e. near the centre of the furnace. It has been found that the reduction of the degasification period of the tube does not bring about disadvantages since most of the gas is set free when the tube reaches the highest temperature during the degasification period. The quantity of oxygen of the air contained in the tube is found to be sufficient for the intermediate layer to be burnt. The combustion

of the intermediate layer may be furthered by raising the temperature during the heating period till 450° C. instead of 400° C. Damage to the cathode and oxidizing of the metal part of the electron gun during the combustion of the intermediate layer are avoided by surrounding the neck with a heat insulating screen, so that the electron gun and the cathode remain comparatively cold. After the air has been evacuated from the tube, this heat-screen is removed, so that the operations to be carried out in the second half of the furnace can take place in the conventional manner. The invention provides the great advantage that the furnace for combusting the intermediate layer is completely omitted, as well as the heating and cooling in this furnace, which would take much time.

A further simplification and economy may be obtained in that the faceplate and the cone are not sealed directly to one another, but with the intermediary of a glaze. A suitable glaze is known under the registered trade name "Corning 543." Then first the fluorescent screen, the nitrocellulose intermediate layer and the metal backing may be applied to the faceplate and the edges of the screen and/or the cone may be painted with a suspension of the above-mentioned glaze-powder in water, to which, if desired, a small quantity of waterglass is added, the faceplate and cone being placed one on the other loosely but centered, on the exhaust device, after the bottom part with the electron gun and the exhaust tube has been sealed in the opening of the neck, the glaze melting during the aforesaid heating and combustion of the intermediate layer or immediately thereafter, the faceplate being thus secured to the cone. To this end it is desirable when using the above-mentioned glaze, to raise locally the temperature of the furnace for example to 475°, and to reduce the temperature to 420° at the exhaust area. The glaze which is still slightly soft, is then reduced to a very thin layer between faceplate and cone owing to the pressure of the air on the faceplate. When using glaze or, if desired, an enamelled metal ring between faceplate and cone, the aforesaid sealing machine may also be omitted. However, in this case the metal coating must be applied in a vacuum furnace to the open, dish-like faceplates; which however does not involve any appreciable complication because a large number of faceplates may be treated simultaneously.

It is evident that with respect to the temperatures and the order of succession of the various treatments small variations are permitted within the scope of the invention.

In order to point out the differences between the inventive method and the prior art, a flow chart has been shown in the accompanying drawing. In the flow chart are arranged alongside one another, reading from left to right, the succession of steps required to manufacture a cathode-ray tube in accordance with the prior art, in accordance with the invention, and in accordance with the invention including the feature of the glaze for joining together the faceplate and cone. The identical steps in the three processes are arranged next to one another, so that the absence of a block indicates elimination of a step. For example, note that the precombustion step of the prior art, which consumed about two hours of time, has been eliminated in the inventive processes.

What is claimed is:

1. A method of manufacturing a cathode-ray tube with a metal-backed, phosphor screen, comprising the steps of providing an organic intermediate layer on the phosphor screen and a metal-backing layer on the organic layer, thereafter assembling the tube with an electron gun in position therein while the organic layer remains on the screen, thereafter heating the tube in an oxygen-containing atmosphere and at a temperature at which the

organic layer is combusted and eliminated, immediately thereafter evacuating the tube while the heating is continued to outgas its elements, and thereafter activating the cathode.

2. A method of manufacturing a cathode-ray tube with a metal-backed, phosphor screen, comprising the steps of providing an organic intermediate layer on the phosphor screen and a metal-backing layer on the organic layer, thereafter assembling an electron gun in position within the tube and sealing off the tube with an air atmosphere while the organic layer remains on the screen, thereafter heating the tube with its air atmosphere and at a temperature at which the organic layer is combusted and eliminated, immediately thereafter evacuating the tube while the heating is continued to outgas the electrodes of the electron gun and the other parts of the tube, and thereafter activating the cathode.

3. A method of manufacturing a cathode-ray tube with a metal-backed, phosphor screen, comprising the steps of providing an organic intermediate layer on the phosphor screen and a metal-backing layer on the organic layer, thereafter sealing an electron gun including a cathode in position within the tube while the organic layer remains on the screen and in such manner that the tube contains an air atmosphere, thereafter placing the tube within a furnace and heating the tube at a temperature and for a time interval at which the organic layer is combusted and eliminated, immediately thereafter evacuating the tube for a time interval shorter than that of the previous

step while the heating is continued and the tube remains at the high temperature of the previous step to outgas all of the tube elements, and thereafter activating the cathode.

4. A method as set forth in claim 3 wherein the temperature of the combustion is slightly higher than that of the outgassing step.

5. A method of manufacturing a cathode-ray tube with a metal-backed, phosphor screen, comprising the steps of providing an organic intermediate layer on a phosphor screen on the faceplate of the tube and a metal-backing layer on the organic layer, assembling an electron gun into the cone portion of the tube, applying to the edges of the faceplate and the cone portion of the tube a glazing material, thereafter assembling the tube by juxtaposing the faceplate and cone portions so that the glaze-covered edges abut while the organic layer remains on the screen, thereafter heating the tube in an oxygen-containing atmopshere and at a temperature at which the organic layer is combusted and eliminated and the glazing material softened to seal together the faceplate and cone portions of the tube, immediately thereafter evacuating the tube while the heating is continued to outgas its elements, and thereafter activating the cathode.

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