

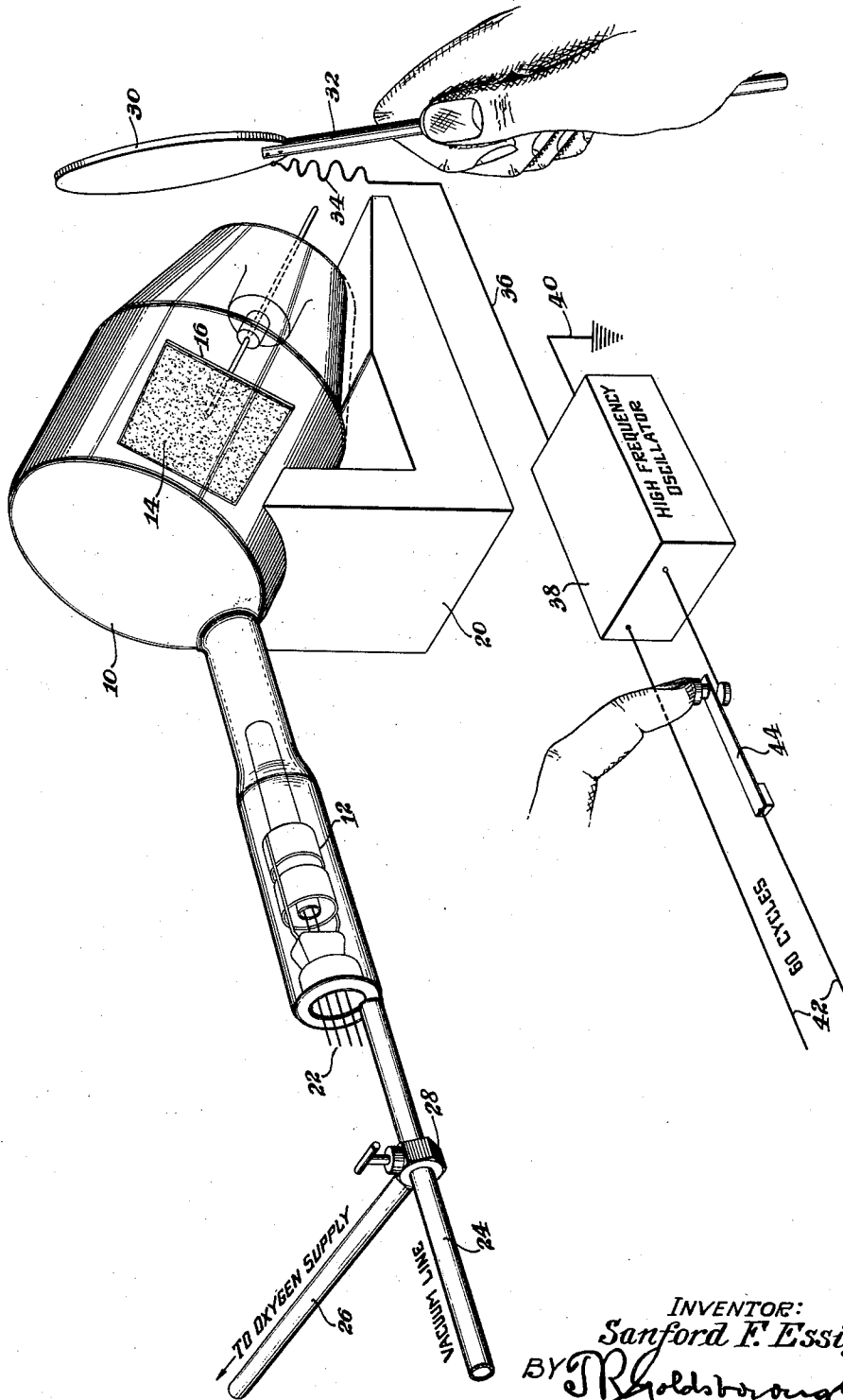
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METHOD OF OXIDIZING ELECTRODE STRUCTURE

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## METHOD OF OXIDIZING ELECTRODE STRUCTURE

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My invention relates to improvements in meth-  
ods and apparatus for oxidizing electrode struc-  
ture and, more particularly, to such structure of  
the mosaic type forming part of a cathode ray  
tube for television transmission purposes.

An important piece of apparatus for television  
transmission purposes is constituted by a cathode  
ray tube provided with a mosaic screen upon  
which an image of an object is projected and  
which is scanned by a cathode ray. The mosaic  
screen comprises a large number of spaced ele-  
ments, each photosensitive and each capable of  
storing an electrostatic charge. The values of  
the respective charges stored up during any pic-  
ture frame period by the individual elements cor-  
respond to the light intensity on the respective  
elemental areas during that picture frame period.  
As the cathode ray scans the screen, the charges  
are discharged and utilized in a suitable circuit to  
develop the picture signals.

Many problems have been encountered in the  
development of cathode ray transmitting tubes,  
and one of these resided in the construction of a  
satisfactory mosaic screen structure, a number of  
different forms of which have been proposed. One  
form, with which satisfactory results have been  
obtained, comprises a relatively thin sheet of  
mica upon which minute silver globules are  
formed, closely spaced over the surface. The  
exposed surfaces of the globules are then oxidized  
to form a thin insulating coating, it being im-  
portant that this coating be of the proper thick-  
ness to obtain the maximum photosensitivity.  
After the oxidizing step just referred to, caesium  
is deposited upon each globule to photosensitize  
the same.

In the course of making mosaic screen struc-  
ture of the particular type just referred to, sev-  
eral difficulties have been encountered, one of  
which has been in the uniform oxidation of the  
silver globules, with the oxide layer of the proper  
thickness. This difficulty has been more trouble-  
some than it might otherwise have been on ac-  
count of the fact that the individual globules are  
insulated from each other, and the fact that the  
supporting sheet on which the globules are  
formed is of insulating material. It is there-  
fore impossible to make direct electrical con-  
nections with the globules, wherein each con-  
nection would correspond to the single electrical  
connection made, for example, to the silver cath-  
ode of a caesium photocell in oxidizing the same.

For this reason, recourse cannot be had to cer-  
tain of the various oxidizing methods known in  
other arts. In using other methods which seemed

might be satisfactory, it was found that the in-  
dividual globules, at different sections of the  
entire screen area, were oxidized to different de-  
grees. In other words, the important charac-  
teristic of oxidation of each globule to substan-  
tially the same degree was not obtained.

In attempting to solve the problem referred to,  
it was proposed to support within the tube an  
internal electrode in the form of a grid of fine  
wires disposed in close proximity to the mosaic  
screen and in a plane parallel thereto on the side  
thereof containing the silver globules. Oxygen  
was admitted into the tube to a proper pressure,  
and then an ionizing discharge was established  
between the grid of fine wires and some other  
part of the tube such as the electron gun for  
developing the cathode ray. In this method, the  
ions formed by collision of free electrons with  
the oxygen molecules in the space between the  
gun and the grid pass through the grid under  
their own inertia and strike the silver globules,  
forming thereon the oxide layer. It was found,  
however, that it is practically impossible to ob-  
tain the desired uniform oxidation of the individ-  
ual globules by causing an electrostatic charge  
between the internal electrodes. Even assuming  
that the electrostatic field between the internal  
electrodes be uniform over the entire area, the  
mosaic construction operates to distort this field  
to prevent uniform oxidation of the globules.  
Furthermore, after the auxiliary internal elec-  
trode or grid has served its purpose in the oxidiz-  
ing step, it cannot be removed. This grid, it will  
therefore be understood, later serves no useful  
purpose in the normal use of the tube in trans-  
mitting an object, but, on the contrary, appears in  
the reproduced image at the receiving station.

With the foregoing in mind, it is one of the  
objects of my invention to provide an improved  
method wherein mosaic screen structure of the  
character referred to can be provided with a uni-  
form oxide coating over the silver globules, the  
coating being of the required thickness, and  
without incurring the various disadvantages of  
the methods proposed heretofore, such, for ex-  
ample, as the employment of an auxiliary grid  
which interferes later with normal use of the  
tube.

Other objects and advantages will hereinafter  
appear.

In accordance with my invention, oxidation  
of the globules is accomplished while keeping  
the cathode ray tube electrically isolated. That  
is, there are no metallic connections or current

conductive paths between any part of the tube structure and ground.

When my invention is practiced in the making of the tube, the same is mechanically complete except for the oxidation and photosensitizing of the silver globules on the screen structure but the tube is still connected to the vacuum pump line. After evacuation, the connection between the tube and the vacuum system is cut off by a suitable valve device, and oxygen is admitted into the tube until the desired pressure is reached. Suitable means are provided for developing a high frequency, electrostatic field, and by manual manipulation of an electrode forming part of said means and which is exterior of and structurally independent of the tube, the oxygen molecules in the tube are ionized, whereby a uniform oxide layer is caused to form over each of the silver globules. The action, in one sense, might be compared to the application of a uniform coat of paint over a surface by the use of a brush or spray.

My invention resides in the improved method and apparatus of the character hereinafter described and claimed.

For the purpose of illustrating my invention, an embodiment thereof is shown in the drawing, wherein the figure is a diagrammatic view of a system embodying my invention and by which my improved method can be carried out.

In the drawing, the reference numeral 10 designates a cathode ray transmitting tube comprising a gun 12 at the small end for developing and directing a ray of electrons at mosaic screen structure 14 set in a metallic frame 16. The tube 10 is electrically isolated, and is supported on a suitable insulating block 20. The usual wires 22, for making connections with the various parts comprising the gun 12, are shown as being free, to better illustrate and emphasize the fact that the tube 10 has no conductive connections at any point with ground. The tube 10 is shown at that stage in the making thereof whereat the same has been evacuated to a high degree and is still connected with the glass tubular connection 24 from the vacuum pump or system (not shown). A glass tubular connection 26 leads from a suitable oxygen supply (not shown) and is placed in communication with the interior of the tube 10 by turning a suitable three-way valve 28, subsequent to the time the tube is disconnected from the vacuum line 24.

The screen structure 14 is of the type comprising an insulating base member, such as a sheet of mica, on one side of which are minute silver globules uniformly spaced over the surface, each globule to be provided with a silver oxide layer over which there is to be later applied a layer of caesium or other photosensitive material.

In the drawing, the tube is complete except for the fact that it is still connected to the vacuum system, and the fact that the oxidizing and photosensitizing steps have not been performed.

In carrying out my improved method, the valve 28 is first turned to disconnect the tube from the vacuum line 24, and to admit oxygen into the tube by way of the connection 26 until the desired pressure is reached. Satisfactory results have been obtained by admitting oxygen into the tube until the pressure of this gas is substantially 1500 microns. This pressure is not critical in any strict sense of the word, but should be within such range that the mean free path of the electrons in the gas is long enough

to insure that the individual electrons can accelerate to a velocity sufficiently high to give the electrons the required energy to ionize the oxygen molecules with which they collide. When the oxygen in the tube has reached the desired pressure, the valve 28 is turned to cut off communication with the line 26, at which time the valve still disconnects the tube from the vacuum line 24.

For the purpose of subjecting the screen structure 14 to the influence of a high frequency electrostatic field, as heretofore mentioned, I employ a metallic disc 30 provided with a suitable insulating handle 32 for manual manipulation, and connect this disc, by a flexible coupling 34, to the output line 36 from a suitable high frequency oscillator 38. The other output line 40 from the oscillator is connected to ground, as shown. The input to the oscillator 38 is supplied from an alternating current, 60 cycle line 42, in which a key 44 is inserted. Satisfactory results have been obtained with the voltage across lines 36 and 40 from 1000 to 5000 volts, at a frequency of 3000 to 5000 kilocycles.

In operation, the disc or electrode 30 is placed in close proximity to the tube 10, in some such manner as is shown in the drawing. The key 44 is then closed. In this way, the region over the surface of the screen 14 is brought under the influence of the high frequency electrostatic field, to cause ionization of the gas molecules and the formation of a silver oxide layer over the minute silver globules. This oxidation action is evidenced to the operator by the change which takes place in the color of the screen 14. By experience, it is comparatively easy to ascertain when the proper amount of oxidation has taken place. With the electrode 30 in the same position, oxidation takes place at different rates over the area of the screen 14. However, by manipulation of the electrode 30, the operator is enabled to so control the intensity of the electrostatic field with respect to the various sections of the screen 14 that the oxidizing action can be made more intense, at any particular section than at other sections of the screen. When it is observed, from the change in color of the screen, that the oxidation of any particular portion thereof has about reached the proper point, the key 44 is released and then tapped to close the circuit intermittently, to bring the oxidizing action slowly up to the proper point.

When there has been a uniform change of color over the surface of the screen 14 to indicate uniform oxidation over the entire surface, the valve 28 is turned to again connect the tube to the vacuum line 24, after which the residual oxygen is pumped out and the tube is evacuated. The oxidized screen is then photosensitized in any well known manner, and the tube 10 is sealed off from the vacuum line.

From the foregoing, it will be seen that I have provided an improved method and apparatus for uniformly oxidizing the silver globules, forming part of a mosaic screen for television transmitting tubes and the like, and that in carrying out my improved method, no metallic connections to any part of the tube are required, the means to the end, which includes the electrode 30, being entirely exterior of the tube 10. It will be seen, therefore, that in carrying out my improved method, no parts are required which would later interfere in any way with the normal operation of the tube in developing picture signals.

While but one embodiment of my invention has

been disclosed, it will be understood that various changes might be made without departing from the spirit of my invention or the scope of the claims.

5 I claim as my invention:

1. The method of oxidizing electrode structure supported in a container therefor to produce over the surface of said structure a uniform oxide layer of a thickness within predetermined limits, which comprises subjecting said structure to an atmosphere of oxygen, developing an electric field between said structure and an electrode exterior of and structurally independent of said container, and moving said electrode to vary the effectiveness of the field with respect to said structure.

2. The invention set forth in claim 1 characterized in that the electric field is oscillatory in character.

3. The method of oxidizing substantially to a definite degree the entire exposed surface of each of a plurality of minute metallic elements spaced from each other and distributed in a generally uniform manner over the surface of electrode structure in a container, which comprises subjecting said structure to an atmosphere of oxygen, developing an electric field between said structure and an electrode exterior of and structurally independent of said container, and moving said electrode to vary the intensity of said field with respect to different sections of said structure to effect the required degree of oxidation of the entire exposed surface of each element.

4. The method of oxidizing substantially to a definite degree the entire exposed surface of each of a plurality of minute metallic elements spaced from each other and distributed over the surface of electrode structure in a container, which comprises subjecting said structure to an atmosphere

of oxygen, developing an electrical field between said structure and an electrode outside of and mechanically independent of the container, and moving said electrode to subject each of said elements to substantially the same degree of influence of said field whereby the entire exposed surface of each of said elements is oxidized to substantially the same degree.

5. The method of oxidizing the surface of each of a plurality of discrete metallic elements insulatingly carried by a backing electrode, the assembly being disposed in a container of insulating material, through the agency of a high potential source having at least one mobile terminal, which comprises providing an oxidizing atmosphere within the container in contact with the surfaces to be oxidized, establishing an electric field between the mobile terminal and the said surfaces, to thereby ionize the gas in contact therewith, and concurrently causing relative movement between said assembly and said terminal whereby the effectiveness of the electric field and the consequent ionization are controlled.

6. The method of oxidizing a surface of an electrode supported within a container of insulating material, through the agency of a high potential source having at least one mobile terminal, which comprises providing an oxidizing atmosphere within said container in contact with the surface to be oxidized, establishing an electric field between the electrode surface and the mobile terminal, and concurrently causing relative movement between said electrode and said terminal to thereby control the effectiveness of the electric field.

7. The method set forth in claim 6 wherein the electric field is oscillatory in character.

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