March 1, 1960 F. H. HARRIS 2,926,419

METHOD OF FORMING A STORAGE ELECTRODE

Original Filed May 1, 1957 3 Sheets-Sheet 1

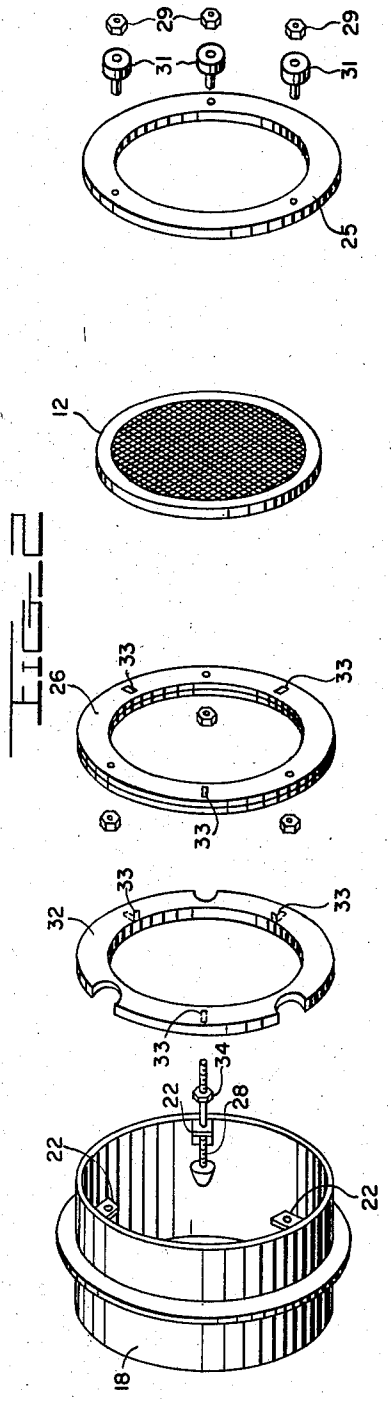

FIG. 2

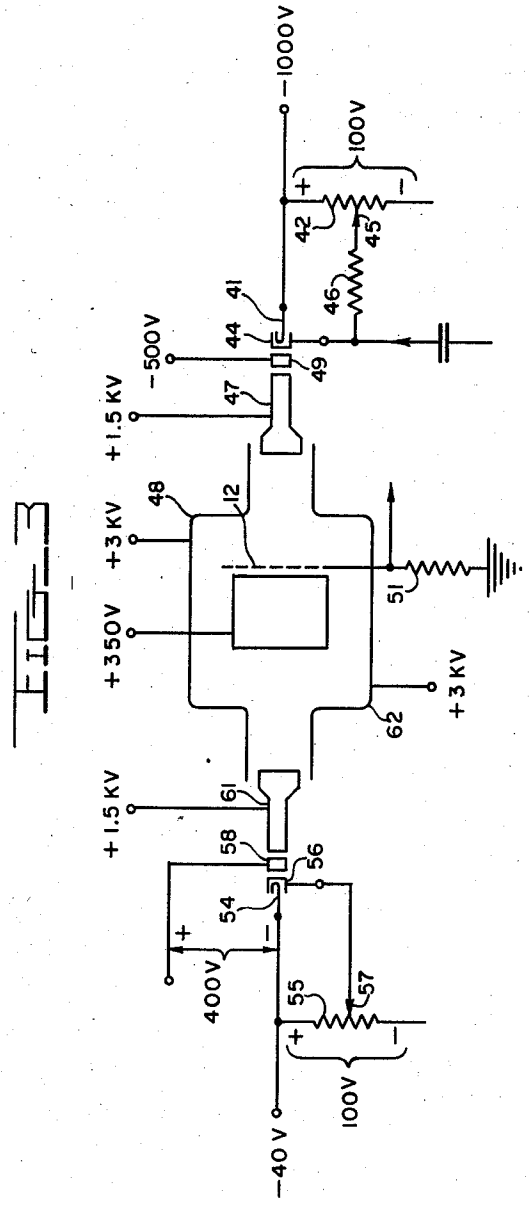

FIG. 3

INVENTOR
FRANKLIN H. HARRIS

BY Richard C. Reed
ATTORNEYS

March 1, 1960 F. H. HARRIS 2,926,419

METHOD OF FORMING A STORAGE ELECTRODE

Original Filed May 1, 1957 3 Sheets-Sheet 2

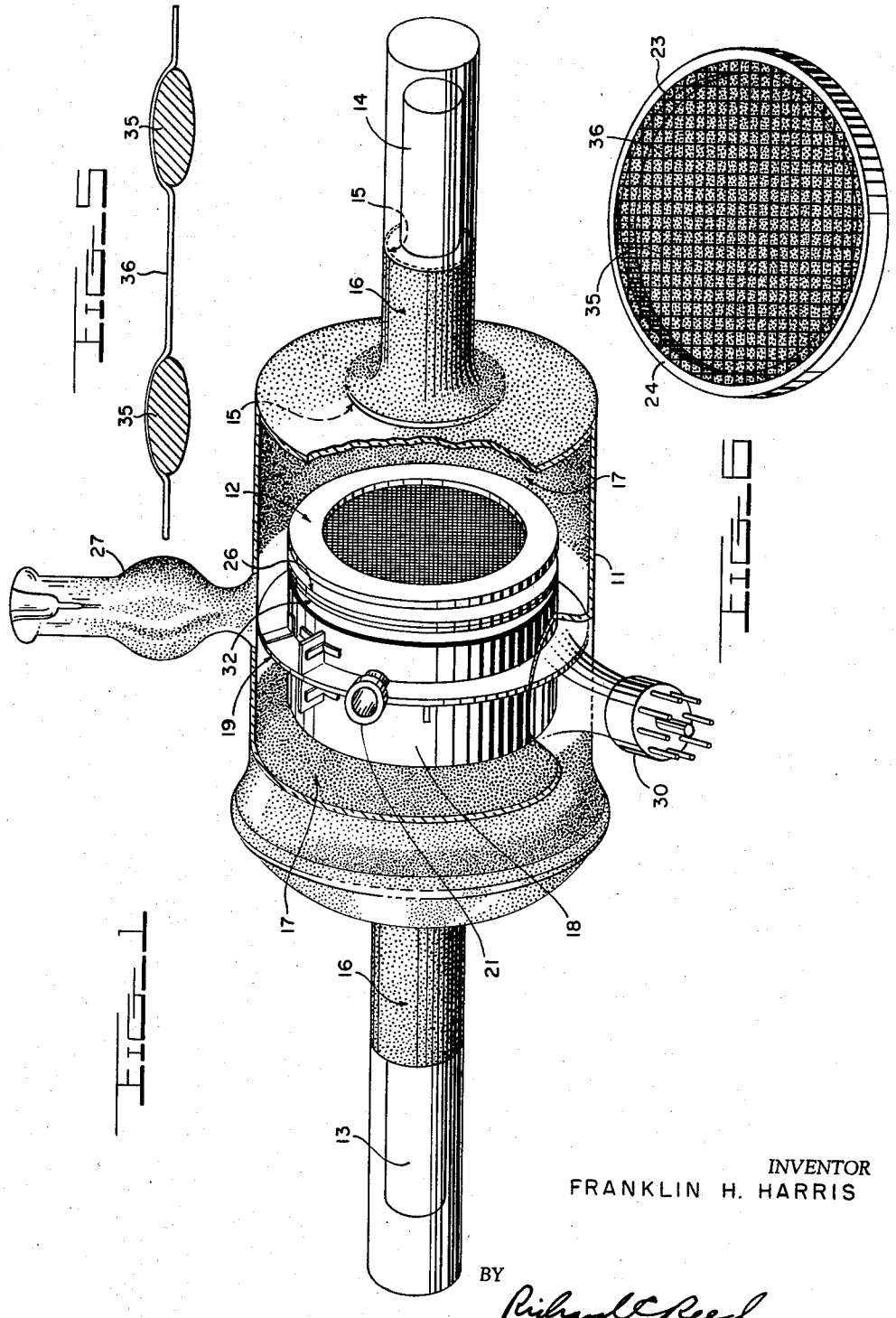

FIG. 1

FIG. 5

FIG. 6

INVENTOR
FRANKLIN H. HARRIS

BY Richard C. Reed ATTORNEYS

March 1, 1960 F. H. HARRIS 2,926,419

METHOD OF FORMING A STORAGE ELECTRODE

Original Filed May 1, 1957 3 Sheets-Sheet 3

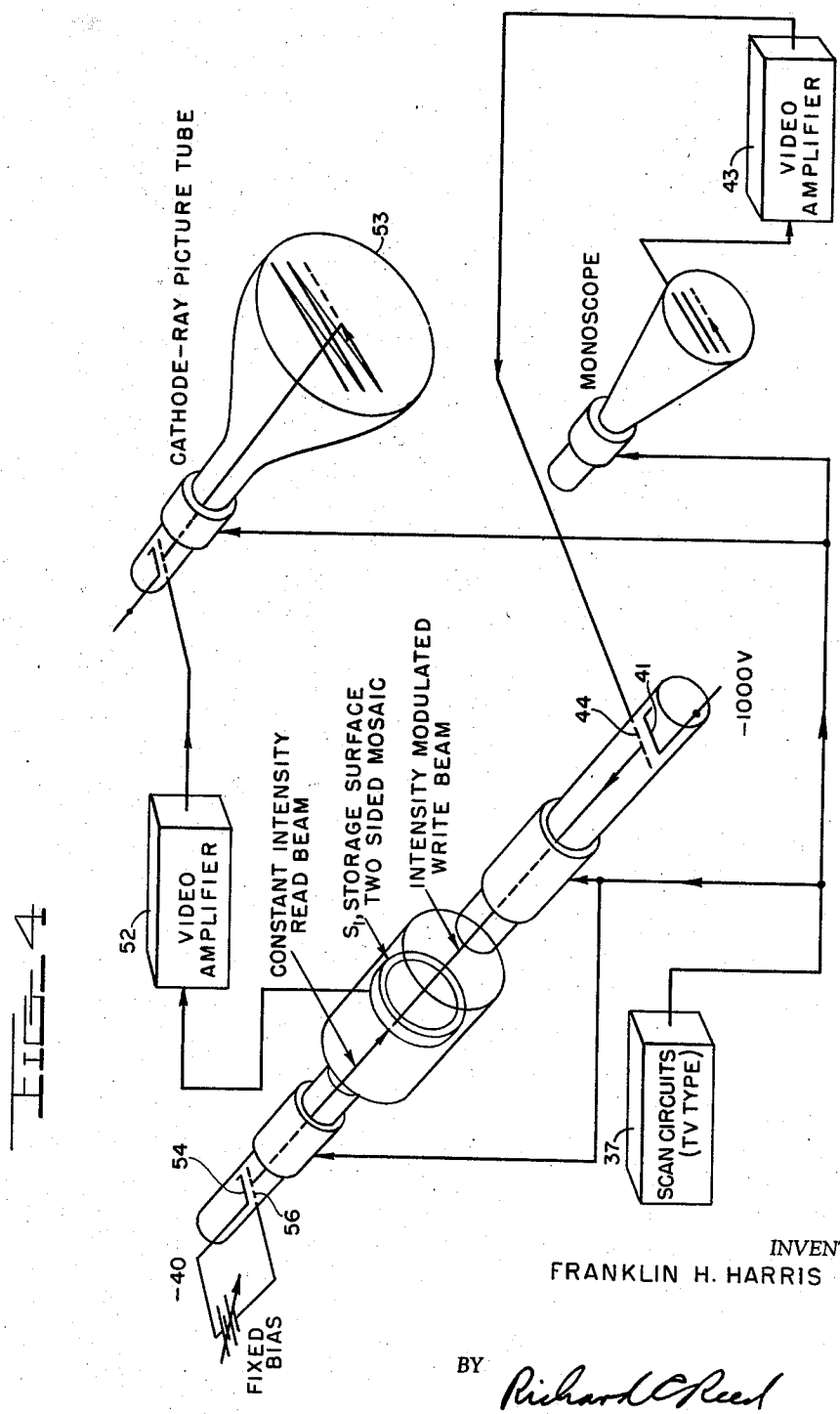

FIG. 4

INVENTOR
FRANKLIN H. HARRIS

BY Richard C. Reed
ATTORNEYS

United States Patent Office 2,926,419
Patented Mar. 1, 1960

2,926,419

METHOD OF FORMING A STORAGE ELECTRODE

Franklin H. Harris, Accokeek, Md., assignor to the United States of America as represented by the Secretary of the Navy

Original application May 1, 1957, Serial No. 656,471. Divided and this application May 26, 1958, Serial No. 737,986

8 Claims. (Cl. 29—25.17)

(Granted under Title 35, U.S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This application is a division of application Serial No. 656,471, filed May 1, 1957, and relates to a cathode ray signal storage device and more specifically to the method of forming or making the storage element or electrode.

Cathode ray tubes are well known in the prior art which will perform the sequential functions of an information device, namely recording, storage, reproduction and erasure of an information signal. These electron discharge tubes operate upon the principle of translating received information into charges and coincident potentials upon the surface of an insulating material and subsequently recovering this information by exploring the surface with a focused electron beam. As a result of the extremely high impedance offered by an insulator to the flow of current to and from a charged area, in the absence of a reproduction operation the charges and coincident potentials initially impressed upon the dielectric will persist without substantial deterioration over a period of time during which the information which they represent may be made available. When elicitation of the information stored is accomplished, however, by scansion of the insulating surface with an electron reading beam, the information being recovered either as a secondary emission current from the dielectric or as capacitively induced current due to a shift in potential of the initially impressed potentials, in the prior art the information bearing charges and potentials are progressively destroyed with successive repetitions of the reading operation. Thus in most of the prior art devices information reproduction can only be effected by destructive reading.

In my copending application Serial No. 288,365, filed May 16, 1952, now Patent No. 2,839,679, issued June 17, 1958, there is disclosed a half-tone memory tube comprising three electron guns namely, a writing, a reading and a holding gun positioned in a triangular mount, and a storage surface or target capable of storing a signal for long periods of time. The storage target has a face consisting of an electrically conducting member and an indefinitely large number of separated dielectric masses dispersed throughout the surface of the conducting member in sufficient concentration so that a considerable number of these dielectric masses appear within an area approximating in dimension the spot of a focused electron beam.

The present invention is an improvement over my copending application and provides a two-sided mosaic consisting of a thin film of dielectric formed on an electroformed nickel screen. The new type of mosaic permits greater writing speeds and also provides a storage surface on which the information is written on one side of the screen and the information is read from the opposite side. This requires a rearrangement of the electron guns such that the read and write guns are directly opposite each other and on opposite sides of the storage surface. The present invention is more specifically related to the method of making the storage surface.

The present invention also provides an improvement over the prior art tubes which have read and write guns on opposite sides of the storage screen. In the prior art devices a collector is associated with the screen in the form of a coating on the tube surface or a charged screen adjacent to the storage screen surface. The new mosaic tube of the present invention does away with the usual collector through the use of an improved storage screen which serves to carry out proper storage and also acts as the collector.

It is therefore an object of the present invention to provide an improved signal-storage device capable of half-tone storage and reproduction.

Yet another object is to provide an improved two-sided mosaic which is simply and cheaply manufactured and yet provides good control without any deterioration of the original stored pattern.

A still further object is to provide a new and inexpensive method of making a two-sided mosaic.

Other and more specific objects of this invention will become apparent upon a more careful consideration of the following detailed description when taken together with the accompanying drawings, in which:

Fig. 1 illustrates a cathode ray storage tube including the mosaic made according to the method of the present invention and including a write gun on one end and a gun on the opposite end for both holding and reading;

Fig. 2 illustrates the relative parts of the storage screen assembly shown in spaced relationship for simplification;

Fig. 3 is a schematic of the signal storage device illustrated in Fig. 1;

Fig. 4 is a block diagram of the storage tube of Fig. 1 and associated equipment simulating scan converter operation;

Fig. 5 is a greatly enlarged cross section of the storage surface which illustrates the relationship between the metal screen and the dielectric; and

Fig. 6 is an enlarged view of the mosiac screen structure.

In accordance to the present invention a cathode ray storage tube provided with a mosaic made by the method of this invention is capable of capturing a single frame of a television picture which has good tone quality. The storage tube can be used for scan conversion, signal integration, for capturing single transients, and for temporary storage of different patterns such as maps for radar display purposes.

The storage tube device is intended for storing electrical charges and comprises a storage surface including a conductive fine metal screen grid-like structure having a plurality of interstices to which a dielectric material is attached and which bridges the interstices. An electrode system is provided for projecting a recording or write cathode-ray beam onto the storage surface during writing intervals and for projecting a holding and reproducing or reading cathode-ray beam on the opposite side of the storage surface during reading. In writing, the write beam produces electric charges on the write side of the dielectric. The charges are stored as potential energy in an electrostatic field which exists partly within the dielectric, and partly in the space between the dielectric and the metal screen. The mechanisms of holding and reading utilize only the electrostatic field in the space near the screen and the field within the dielectric is of no value and therefore should be minimized. For this reason, the dielectric is formed as thin as possible.

Referring now to the drawings wherein like reference characters represent like parts throughout, the device

shown by illustration in Fig. 1 comprises an evacuated glass envelope **11** which encloses a storage electrode or mosaic **12** and two conventional cathode-ray guns **13** and **14**. The cathode ray guns are positioned respectively in opposite ends of the tube on opposite sides of the storage electrode and are magnetically focused and deflected in the conventional manner as used in television picture tubes. Conductive coatings **15** and **16** of silver paint are respectively provided on the inside and the outside of each end of the envelope to shield the storage mosaic from the electrostatic fields of the deflection coil and yet does not interfere with the magnetic fields. The inner coatings **15** merge with transparent conductive coatings **17**, such as a metallic oxide, which serves as the second anodes and are transparent to facilitate inspection of the inside of the tube if desired. A cylinder **18** positioned within the envelope on the read-beam side of the storage mosaic serves to collimate the read-beam electrons in order to obtain equal values of forward electron velocity over the surface of the mosaic. The collimating cylinder is provided with a ridge **19** about the outer surface thereof for the purpose of securing the cylinder within the envelope; for purpose of illustration, three glass holders **21** are provided for securing the collimating cylinder in position. The inner surface of the collimating cylinder has three equally spaced tabs or lugs **22** attached thereto along one end about the inner circumference to provide means for securing the mosaic surface in position with respect to the electron guns and the collimating cylinder. The tube is provided with a getter **27** to keep the residual gas pressure low during operation.

Fig. 2 illustrates the relationship of the collimating cylinder and the mosaic surface. The mosaic surface is formed between two hoops or rings **23** and **24**, one fitted into the other to hold the mosaic surface therebetween and then assembled between a metal disc **25** through which electrical connections are made to the metal screen of the storage surface and mica disc **26** made of several layers of mica by three bolts **28** and nuts **29**. Any suitable insulators **31** such as glass, are provided to insulate the metal disc from the bolts and also to provide space between the metal disc **25** and mica disc **26** in which space the mosaic is positioned. Mica disc **26** has a metal disc **32** secured thereto by tabs **33** which are bent over along the surfaces of the metal disc **32** and connected to a few of the mica layers of the mica disc **26**. Metal disc **32** is cut away in the vicinity of the bolts **28** and therefore does not have to be insulated therefrom. The ends of bolts **28** are inserted through lugs **22** and connected thereto by nuts **34** and the mica disc and the metal disc **25** is connected to the bolts by nuts **29** screwed on the ends of the bolt, the collimating cylinder and mosaic surface is now ready for assembly in the envelope and connected to the proper lead lines from suitable pins in the connector **30**.

The mosaic is made of a very thin metal screen **35** having a thickness from about 0.00005 to 0.0006 inch and with from about 300 to 1000 mesh per inch. The thin metal screen is covered with bentonite clay by a method to be described later to form a very, very thin dielectric surface **36** which fills the openings or interstices of the screens and also covers the screen surfaces, however, that portion of the dielectric which covers the screen surface is much thinner than that which fills the openings and the dielectric effect of that covering the screen is negligible since it is so thin; therefore, in effect, the dielectric film in each of the interstices form individual isolated cells separated by the conducting portions of the screen. The mosaic is secured to the collimating cylinder and preferably positioned to receive the write beam on the dielectric side of the wire screen.

Fig. 3 is a schematic of the tube illustrating the operating voltages for the various elements and in operation of an assembled tube, magnetic focusing and electron acceleration is carried out by conventional television type scan circuits **37** illustrated in block form by Fig. 4 in which the accelerating and focusing assemblies are maintained at a positive potential with respect to ground. The write cathode **41** is maintained at an operating negative voltage of about 1000 volts by any suitable grounded voltage source not shown and has connected thereto a variable write beam current control **42** of 100 volts for controlling the period during which writing proceeds. Electrons emitted by the cathode are resolved in the usual manner by the accelerating and focusing mechanism into a writing beam of small cross sectional diameter and high intensity, the intensity of which may be modulated by information signals originating with an information signal source **43** and impressed upon the write control grid **44** in the form of varying voltages. The bias of the control grid relative to the cathode may be adjusted as desired by a variable tap **45** on the current control **42** and has a decoupling resistor **46** connected between the grid and the tap. The first anode **47** is placed at a relatively high potential such as positive 1.5 kv. with respect to the cathode and a second anode **48** is placed at a potential still higher than the first anode such as a positive 3 kv. with respect to the cathode. The second anode is the same as the inner coating **17** and has an additional purpose of collecting secondary electrons which escape from the mosaic. Between the first anode and the write grid a second grid **49** with a negative voltage of about 500 volts is placed. The electrons from the write gun strike the insulation with sufficient energy to generate secondary electrons in excess of the primary electrons on the insulator. The mosaic is maintained at zero potential and is brought out through an external load resistor **51** to ground. The video output from the mosaic is taken off by a terminal between the resistor and the mosaic and connected to the input circuit of a video amplifier **52** which is then connected to the control grid of a monitoring cathode-ray picture tube **53**.

The read beam and holding electron gun assembly **13** is located on the opposite side of the mosaic from the write gun **14** and focuses the read beam current onto the metallic screen and insulator cells of the storage mesh with a constant beam current. The read cathode **54** has a negative potential of about 40 volts for holding without any decay. The cathode has connected thereto a read beam current control **55** which is connected to a control grid **56** by a variable tap **57**. A second control grid **58** having a positive potential of 400 volts relative to the cathode is positioned about the cathode between control grid **56** and a first anode **61** which has a positive potential of 1.5 kv. with respect to the cathode. A second anode connection **62** connects with the inner coating **15** and the transparent coating which forms the second and has an additional purpose of collecting stray electrons and to help protect the mosaic from electrostatic forces. Collimating cylinder **18** having a positive potential of 350 v. is positioned on the read beam side of the tube adjacent to mosaic **12** and serves to collimate at right angles the read beam electrons with respect to the mosaic surface. Metal disc **32** connected to the mica plate **27** is electrically connected to an outside terminal and adapted to be provided with a positive potential, if additional electron correcting features are required for collimation.

In the preferred operation of the device, the insulator-cells of the mosaic are erased and prepared for writing by priming to the "black" by means of a priming cycle. This is done by scanning the insulator-cells with a read beam whose cathode voltage is nearly at zero, then in a short time about $\frac{1}{10}$ second, the cathode voltage is returned to a holding voltage value, V_h of about -40 volts. During the priming cycle the insulator will accumulate electrons, negative charges and thus its coincident potential will take on a negative value similar to

the instantaneous potential of the read-cathode voltage, and thus maintain a low velocity of arriving read electrons, consequently, very few secondary electrons are released by the surface. The effect of priming the mosaic is to cause negative charges to appear on the write side of the insulator wherein during the writing period, electrons with about 1000 —volts energy strike the insulator with ample velocity to generate secondary electrons in excess of the primary electrons from the write cathode. The escaping secondary electrons in excess of the number of beam electrons striking the insulator results in a net positive charging of the insulator and results in writing on the mosaic. The escaping secondary electrons are collected by the positive coating of the second anode on the surface of the envelope.

In reading the stored signal, the electrons from the read electron gun 13 providing the read beam are focused by suitable circuitry to scan the metallic screen mesh and insulator cells of the mosaic with a constant beam current. The read beam causes secondary electrons to escape from the metallic mesh at points where the insulating cells are charged positively while secondaries from the metallic mesh are suppressed by grid action at the points where the insulating cells are charged negatively. The secondaries are emitted with very low velocities (approximately 2 volts or less) and are therefore easily controlled by the nearby electric fields of the insulator cells. The variations in secondary escape current from the conductive metallic mesh, owing to charges in the insulator cells, register as variations in the current through the load resistor 51 connected externally to the conductive mesh and constitute the output reading current. The load resistor 51 has negligible D.C. voltage drop as a consequence of the read or write beam currents. Simultaneous with reading, the read beam regenerates original written charges within each insulator cell by its holding action. The bombarding velocity has the same value of all parts of the mosaic because the deflection angles are cancelled out by the lens produced by the collimating cylinder. At read-beam bombarding energies less than the critical potential V_0 (the potential of the bombarded dielectric portion with respect to the electron source, where the total number of secondary electrons escaping from the surface of the dielectric equals the total number of primary electrons absorbed by it) the insulator cells accumulate electrons and charge negatively to a potential V_h. At read-beam bombarding energies higher than V_0, the insulator cells lose electrons and charge positively to an equilibrium potential V_e where the potential of the insulator cells equals the potential of the conducting member. The holding action of the read-beam overcomes electrical leakage and other deleterious effects, and thus the charge pattern established by the write beam is maintained within each storage cell at either the positive equilibrium potential V_e (white) or the negative equilibrium potential V_h (black).

A more complete and detailed discussion of the electrical operation of the mosaic due to the incident beam from the writing and reading guns is set forth in my copending application Serial No. 288,365, filed May 16, 1952.

It is to be understood that the new mosaic of the present invention can be used with a three gun tube wherein the read and write guns are on opposite sides of the mosaic and the holding gun is set off to one side on the read side of the mosaic. The operation of the holding gun is substantially the same as described in my referred to copending application and the holding beam is properly focused onto the mosaic by the collimating cylinder.

In operation of the two gun storage tube for long time storage the mosaic is primed to charge the insulator cells negatively in order to maintain low velocity of arriving read electrons, during priming negative charges are caused to appear on the write side of the insulator.

Write electrons with 1000 volts energy strikes the insulator with ample velocity to generate secondary electrons in excess of the primary electrons. The excess secondary electrons escape to result in a net positive charge on the insulator which corresponds to writing white. The net positive charge remains on the insulator surface, then the read beam of a negative 40 volts is focused on the read side of the screen. The read beam scans the metallic screen and insulator cells of the storage surface to provide secondary electrons. Due to the charge of the screen and insulator, the secondaries are emitted with very low velocities and are easily controlled by the nearby electric fields of the insulator cells. The variation in secondary escape current from the metallic screen mesh due to the charges in the insulator cells, register as variations in the current through the load resistor connected to the screen mesh and constitute the output signal (reading current) to the cathode ray tube circuitry where the signal is reproduced on the screen of the cathode ray tube.

The mosaic comprises a thin dielectric film having a thickness of from about .02 micron to about 1.3 microns which bridge the openings of a fine mesh nickel screen having a thickness of about 0.00005 to about 0.0006 inch and from 300 to 1000 mesh per inch and formed according to the following method. The screen is placed over a nickel-plated steel ring or hoop 23, stretched taut and then held in position by placing ring 23 into a second like ring 24 of larger diameter. In order to position ring 23 with the fine mesh over it into ring 24, ring 23 is cooled to shrink the ring and ring 24 is heated to expand it. The screen covered ring is then slid into ring 24 and the rings are allowed to return to their normal temperatures whereby the screen and ring is held tightly in ring 24. The assembly is then cleaned by washing it in water with a detergent and then in acetone to remove any foreign solids, salts or oils. Then the assembly is placed on a level surface and water is applied to the screen surface for wetting purposes.

The dielectric film is formed from a preparation of bentonite clay hydrosol made from bentonite clay (montmorillonite) which is a natural mineral classed as an aluminosilicate $Al_2(Si_4O_{10}).xH_2O$. A refined form of bentonite clay hydrosol containing 2.3% solids by weight is diluted with distilled water to form a fluid which contains a much lower concentration of solids about 2.8×10^{-4} parts by weight. In percentage concentrations of 1% or more, the hydrosol has the property of being a thixotropic gel (the property of becoming fluid when agitated and returning to a gel when left undisturbed). The dilute 2.8×10^{-4} parts solid hydrosol appears to have the properties of viscosity and surface tension identical to those of distilled water and can be applied to the screen in liquid form.

The screen is prepared for coating as described above and the surface thereof wet with a pool of distilled water one to two millimeters deep for approximately twenty minutes. The small mesh of the screen and the surface tension of the water serves to prevent the water from going through the screen; however, if the screen is extremely clean the water will run through. In order to obviate this, the screen is purposely contaminated with any suitable solution, for example by immersing the screen momentarily in a solution of amyl acetate and 10^{-3} parts by volume of collodion. This is allowed to dry and then the distilled water is placed on the surface as described above.

After the distilled water has been on the screen surface approximately 20 minutes, most of the water is drained off with the aid of an aspirator or any other convenient means. The removed distilled water immediately replaced with the 2.8×10^{-4} parts solid bentonite clay hydrosol which has been vigorously stirred to insure a thorough dispersal of the solids. Approximately four

milliliters of the hydrosol fluid will easily spread over an area of about 40 square centimeters (a 2⅞ inch diameter screen) to form a pool one millimeter deep. The water evaporates from the solution and the surface of the screen, to leave a uniform film of bentonite clay which weighs approximately 1.1 milligrams and having a thickness of 0.1 micron (4×10^{-6} inches). The average thickness of the film is determined by the formula

$$d=\frac{(w)(10^4)}{(S.G.)A}$$

where d is the thickness in microns, w is the weight in grams of the formed film, S.G. the specific gravity, and A is the area ($cm.^2$) of the covered screen. The above values for forming the dielectric film are typical values for a preferred dielectric film and other concentration of solids may be used to form films having different thickness. Hydrosols containing 8.25×10^{-5} to 2.0×10^{-3} solids by weight will form suitable dielectric films having a thickness of from about 0.02 micron to about 1.3 microns, the thickness of the dielectric film is limited by the thickness and strength of the screen surface. If the hydrosol placed on the screen is too heavy the screen will tear away and films cannot be formed; therefore, the thickness of the film is limited to the strength of the screen.

It is highly important that dust particles do not settle on the screen during forming and that the film have uniform thickness. For this purpose the screen is placed on a stationary level stand or flat surface and a glass cover is placed over the screen as soon as the hydrosol has been placed on it. Since the screen is covered, drying proceeds slowly wherein the water is forced to evaporate primarily from the underside through the openings in the screen. Since the hydrosol has approximately the properties of viscosity and surface tension of distilled water, the fluid is pulled by gravity into the interstices of the screen wherein the fluid clings to the screen surface due to surface tension, this forms a uniform film within the interstices which is thicker than the film over the screen surface. When the water has evaporated and the film formed onto the screen, the screen is removed from the glass cover. The screen in this state can be used as a storage surface; however, the film does not demonstrate as low an electrical conductivity as mica and has slight electrical leakage, therefore it is necessary to further treat the film to obtain the desired dielectric qualities.

The bentonite clay film can be converted to a low-conductivity material similar to mica by either of the following two methods. In one method, the storage screen is removed from under the glass cover and placed in a container such as a stainless steel vented container and heated at approximately 1000 degrees for 20 minutes in hydrogen. The stainless steel vented container serves to shield the screen from the heating flame of the hydrogen furnace and also provides thermal lag which prevents rupture of the storage surface when the container is removed from the furnace. The screen being thin would shrink more rapidly than the mounting rings and therefore would rupture if allowed to cool too rapidly. The storage surface is removed from the hydrogen atmosphere while it is hot (approximately 400 degrees centigrade) and cooled within the container in air. It has been determined that removal from the hydrogen at a temperature below 400 degrees centigrade makes the bentonite film slightly conductive and when removed at temperatures greater than 400 degrees centigrade, a slight oxidation of the nickel screen occurs. Oxidation is not significantly harmful for operation in the tube of the present invention.

In another method of converting the bentonite clay film to a low-conductivity material, the film is treated with lead. Bentonite clay dispersed in water is necessarily sodium bentonite, therefore the dried film on the screen is sodium bentonite clay. The assembly of the screen with the dried film thereon is immersed in a concentrated lead-nitrate solution. A base exchange reaction occurs in which the sodium of the film is replaced by lead. After about a five minute immersion in the lead-nitrate solution, the assembly is removed from the solution, rinsed with distilled water and then dried. The films are nonconductive and have the properties of mica. Films as thin as 20 millimicrons have been formed by this method, wherein such thin films formed by the first method would disintegrate due to the high heat intensity.

In either method described above, the conductivity of the films is comparable to that of mica, and this, combined with their thinness results in negligible conductance along their plane. Even though the films are very thin, they can withstand the high bake temperature (400° C.) required to outgas the tube. In addition sodium-bentonite films have excellent mechanical adherence to the nickel screens in order to form the thin films in the interstices of the screen and in which that portion of the film covering the conducting portions of the screen are thinner than that within the interstices.

A mosaic formed according to the above method combines a metal screen and a very thin insulator in which the insulator is formed in the interstices such that the cells of the insulator are electrically guarded one from the other by the conductor screen. The read beam bombards both the conductor and insulator to fulfill read and hold functions, and the write beam can charge the insulator and control the field on the read side. The latter is attained by forming the insulator very thin, so that large voltages cannot exist between the write and read surfaces, and the insulator has high resistivity so that the written charges will not leak off.

In some other type cathode ray tubes it may be desirable to make a conductive screen with a thicker insulator surface in which it is essential that one face surface of the screen be in contact with the insulator material. For such tubes, the storage electrode made according to the above method can be used wherein the dielectric film side of the storage electrode is used as a substrate and an insulating material added thereto by any well known method such as the evaporation technique, or the water dispersed colloid suspension method. For example quartz, silicon dioxide or aluminum oxide can be added to the bentonite clay film to increase the thickness of the insulating surface. The application of the additional insulating surface by the colloid suspension method is preferred since the liquid would flow into the interstices fill the interstices and then provide a smooth outer surface. In the evaporation method the insulation would build up over the screen surface as well as in the interstices. The method used depends on the outer surface desired.

The present invention is concerned with the use of this dielectric film for the mosaic of a storage tube, however, it would be obvious to anyone skilled in the art to use thin dielectric films for other uses; therefore, it is to be understood, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. The method of making a storage electrode for a signal device comprising a grid-like structure having a plurality of interstices therein mounting said grid-like structure under slight tension between the outer and inner surfaces of two loops, cleansing said structure to remove foreign solids, salts and oils, placing said structure on a level surface, wetting said grid-like structure with a depth of from about one to two millimeters of distilled water, draining the major portion of said distilled water from said surface, replacing said water with sufficient fluid bentonite clay hydrosol to cover said grid-like structure and allowing said liquid to dry slowly to form a film of bentonite clay over the surface of said grid-like structure and across and into said plurality of interstices in a

plane midway between the outer surfaces of said grid-like structure.

2. The method of making a storage electrode for a signal storage device comprising a grid-like structure having a plurality of interstices therein, mounting said grid-like structure under slight tension between the outer surface of one hoop and the inner surface of a second loop, cleansing said structure to remove foreign solids, salts and oils, placing said structure on a level surface, wetting said grid-like structure with a deepness of from about one to two millimeters of distilled water for about 20 minutes, draining the major portion of said distilled water from said surface, replacing said water with sufficient fluid bentonite clay hydrosol to cover said grid-like structure with a pool one millimeter deep, allowing said liquid to dry slowly to form a film of bentonite clay over the surface of said grid-like structure and across and into said plurality of interstices in a plane midway between the outer surfaces of said grid-like structure.

3. The method as claimed in claim 2 wherein a cover is placed over the grid-like structure during drying to prevent dust particles from falling thereon.

4. The method of making a storage electrode for a signal storage device comprising a nickel grid-like structure having a plurality of interstices therein, mounting said grid-like structure under slight tension between the outer surface of one nickel-plated steel hoop and the inner surface of a second nickel-plated steel hoop, cleansing said structure by washing first in water with a detergent, then in acetone, to remove any foreign solids, salts and oils, contaminating said grid-like structure by immersing it momentarily in a suitable solution, placing said structure on a level surface, wetting said grid-like structure by covering the surface with a pool of distilled water one to two millimeters deep for about 20 minutes, draining said distilled water from the surface of said structure, replacing said distilled water with a one millimeter deep pool of liquid bentonite clay hydrosol over the entire surface, covering the structure and allowing the liquid to evaporate to form a film of bentonite clay on one surface of said grid-like structure and into and across said interstices in a plane midway between the outer surfaces of said grid-like structure.

5. The method of making a storage electrode for a signal storage device comprising a nickel grid-like structure having a plurality of interstices therein, mounting said grid-like structure under slight tension between the outer surface of one nickel-plated steel hoop end the inner surface of a second nickel-plated steel hoop, cleansing said structure by washing first in water with a detergent, then in acetone, to remove any foreign solids, salts and oils, contaminating said grid-like structure by immersing it momentarily in a suitable solution of amyl acetate and about 10^{-3} parts by volume of collodion, allowing said contaminated structure to dry, placing said structure on a level surface, wetting said grid-like structure by covering the surface with a pool of distilled water one to two millimeters deep for about 20 minutes, draining said distilled water from the surface of said structure, replacing said distilled water with a one millimeter deep pool of liquid bentonite clay hydrosol over the entire surface, covering the structure and allowing the liquid to evaporate to form a film of bentonite clay on one surface of said grid-like structure and into and across said interstices in a plane midway between the outer surfaces of said grid-like structure.

6. The method as claimed in claim 4 wherein the formed film is further treated to form a low-conductivity insulator material.

7. The method as claimed in claim 4 wherein the formed film is treated to form a low-conductivity insulator material by placing said structure in a container and firing the storage structure at about 1000° C. for about 20 minutes in hydrogen, allowing the surface to cool down to approximately 400° C., removing the container from the hydrogen atmosphere and allowing said structure to cool within said container in air.

8. The method as claimed in claim 4 wherein the film is treated to form a low-conductivity insulator material by immersing the storage structure in a concentrated lead-nitrate solution for approximately five minutes, removing the structure from said lead-nitrate solution, rinsing in distilled water and allowing the storage structure to dry.

References Cited in the file of this patent

UNITED STATES PATENTS

2,047,369	Hickock	July 14, 1936
2,149,977	Morton	Mar. 7, 1939
2,251,992	Flory	Aug. 12, 1941
2,495,042	Wilder	Jan. 17, 1950
2,627,049	Shawfrank	Jan. 27, 1953
2,687,492	Szegho	Aug. 24, 1954
2,731,580	Freeman	Jan. 17, 1956
2,795,840	Saleker	June 18, 1957

FOREIGN PATENTS

475,393	Canada	July 17, 1951
739,081	Great Britain	Oct. 26, 1955