Nov. 5, 1974 B. W. BYRUM, JR., ET AL 3,846,171

GASEOUS DISCHARGE DEVICE

Filed Oct. 26, 1972 2 Sheets-Sheet 1

FIG. 2

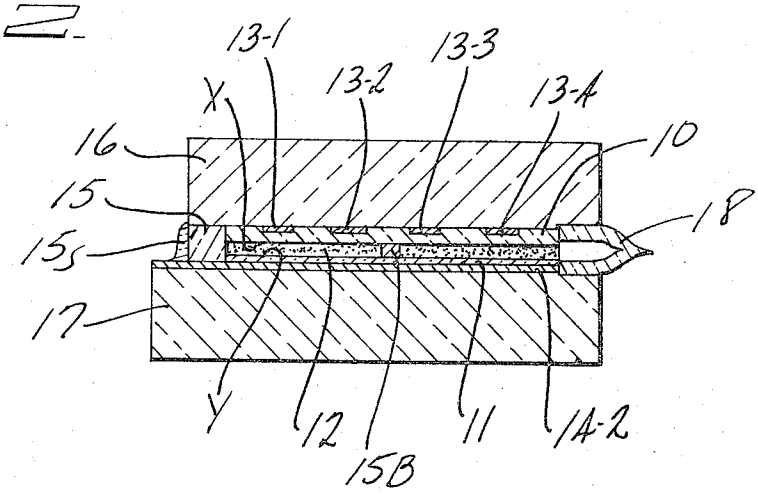
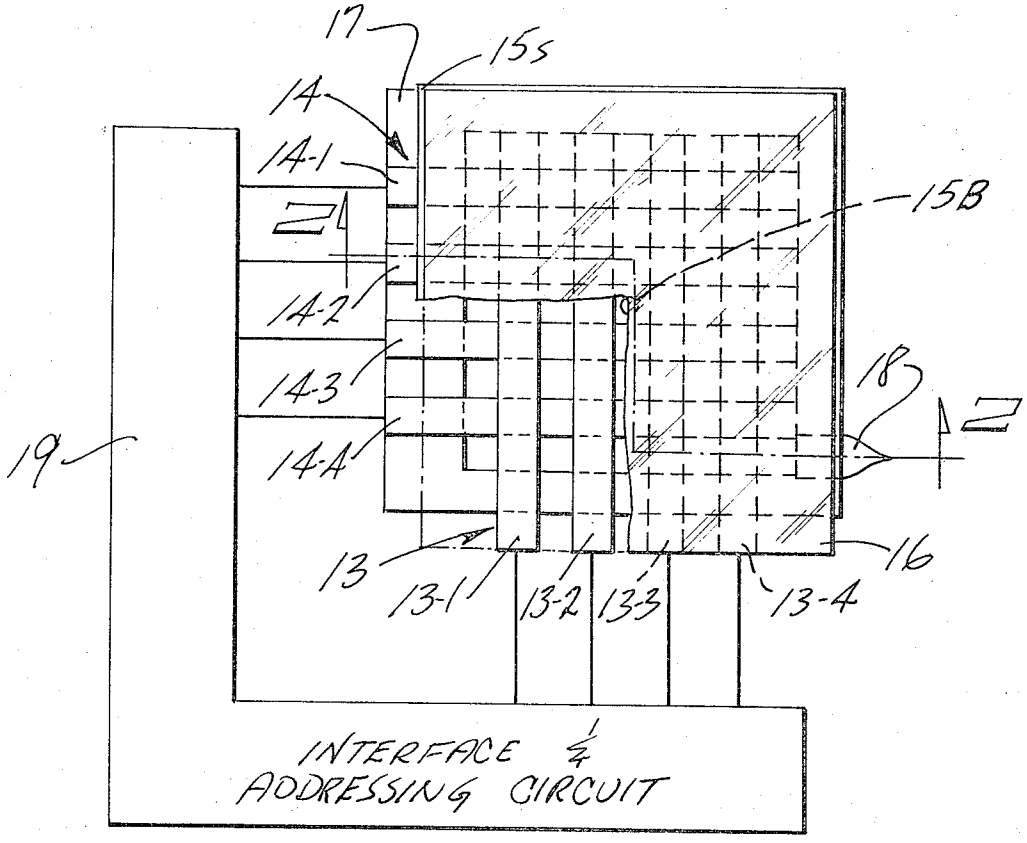


FIG. 1



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GASEOUS DISCHARGE DEVICE

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FIG. 2

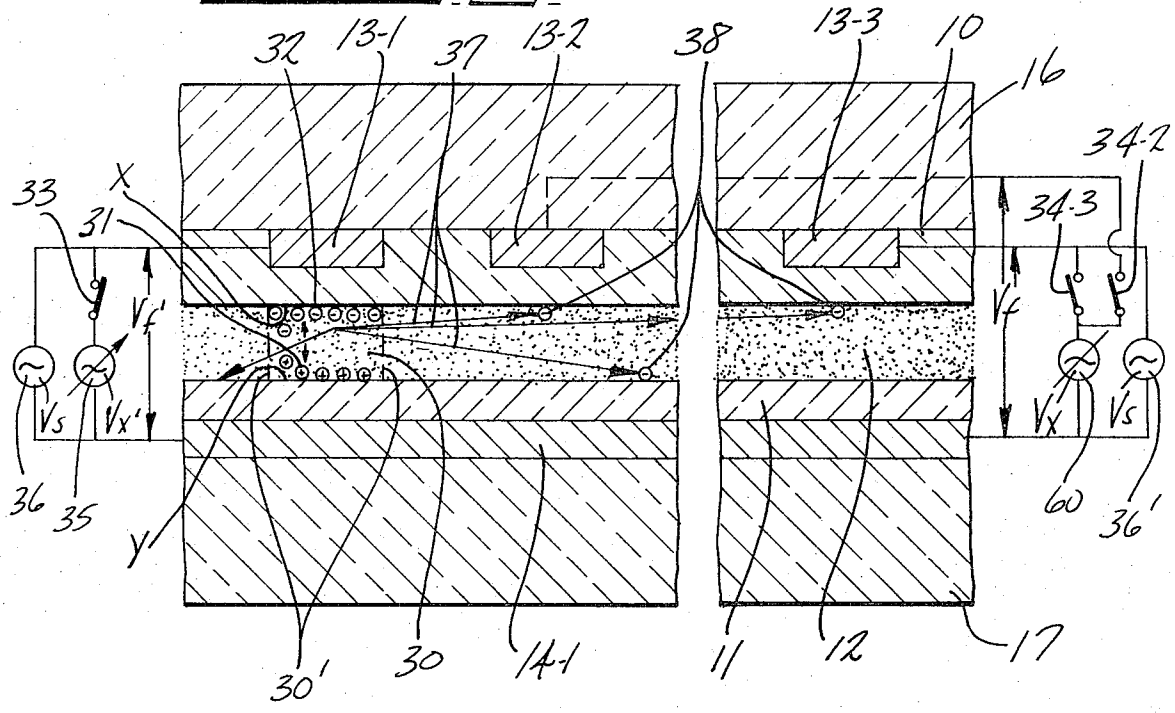
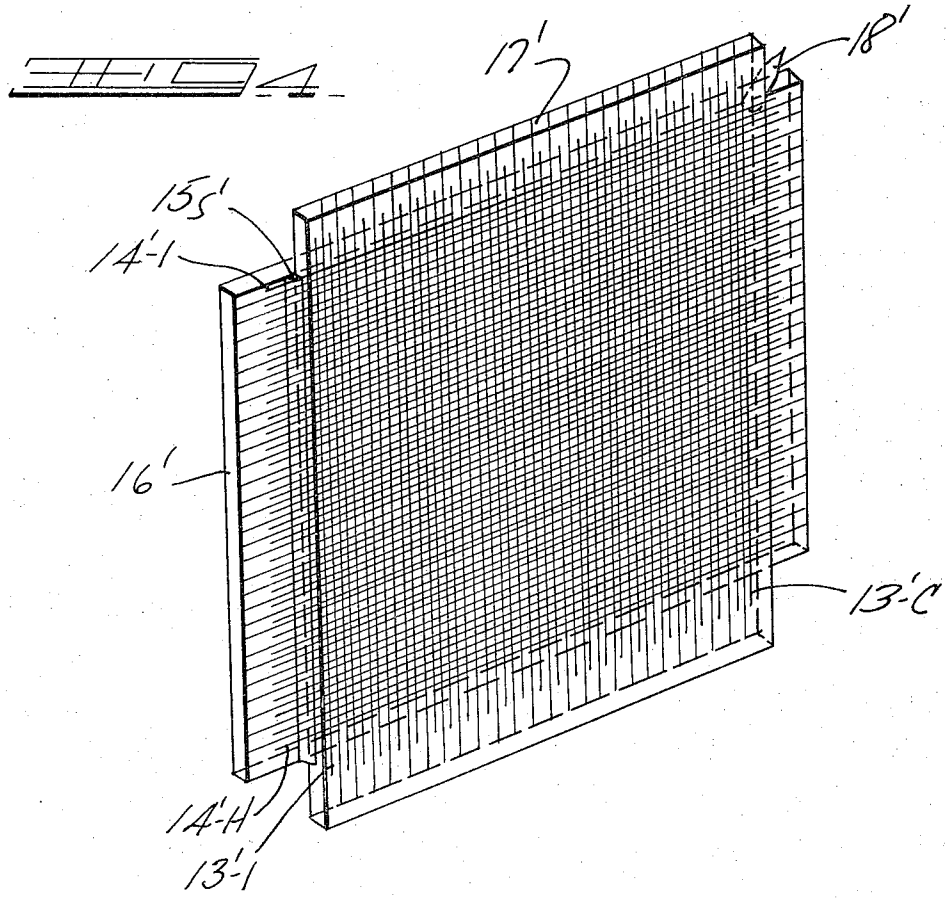


FIG. 4



United States Patent Office 3,846,171 Patented Nov. 5, 1974

3,846,171

GASEOUS DISCHARGE DEVICE

Bernard W. Byrum, Jr., Toledo, and Roger E. Ernsthausen, Luckey, Ohio, assignors to Owens-Illinois, Inc.

Continuation-in-part of abandoned application Ser. No. 76,229, Sept. 28, 1970. This application Oct. 26, 1972, Ser. No. 301,104

Int. Cl. H01j 17/04, 61/06

U.S. Cl. 117—223 21 Claims

ABSTRACT OF THE DISCLOSURE

There is disclosed a gas discharge device containing at least one dielectric charge storage member, the gaseous medium contacting surface portion of the dielectric member consisting of at least one Group IIA oxide selected from oxides of Be, Ca, Sr, Ba, or Ra. The oxide is used in an amount sufficient to increase the operating life span of the device and/or stabilize the operating voltages of the device. The dielectric member can consist of the Group IIA oxide or it can be coated with a continuous or discontinuous layer of Group IIA oxide.

RELATED APPLICATION

This application is a continuation-in-part of United States patent application Ser. No. 76,229, filed Sept. 28, 1970, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to gas discharge devices, especially multiple gas discharge display/memory devices which have an electrical memory and which are capable of producing a visual display or representation of data such as numerals, letters, radar displays, aircraft displays, binary words, educational displays, etc.

Multiple gas discharge display and/or memory panels of one particular type with which the present invention is concerned are characterized by an ionizable gaseous medium, usually a mixture of at least two gases at an appropriate gas pressure, in a thin gas chamber or space between a pair of opposed dielectric charge storage members which are backed by conductor (electrode) members, the conductor members backing each dielectric member typically being appropriately oriented so as to define a plurality of discrete gas discharge units or cells.

In some prior art panels the discharge cells are additionally defined by surrounding or confining physical structure such as apertures in perforated glass plates and the like so as to be physically isolated relative to other cells. In either case, with or without the confining physical structure, charges (electrons, ions) produced upon ionization of the elemental gas volume of a selected discharge cell, when proper alternating operating potentials are applied to selected conductors thereof, are collected upon the surfaces of the dielectric at specifically defined locations and constitute an electrical field opposing the electrical field which created them so as to terminate the discharge for the remainder of the half cycle and aid in the initiation of a discharge on a succeeding opposite half cycle of applied voltage, such charges as are stored constituting an electrical memory.

Thus, the dielectric layers prevent the passage of substantial conductive current from the conductor members to the gaseous medium and also serve as collecting surfaces for ionized gaseous medium charges (electrons, ions) during the alternate half cycles of the A.C. operating potentials, such charges collecting first on one elemental or discrete dielectric surface area on alternate half cycles to constitute an electrical memory.

An example of a panel structure containing non-physically isolated or open discharge cells is disclosed in U.S. Letters Patent 3,499,167 issued to Theodore C. Baker et al.

An example of a panel containing physically isolated cells is disclosed in the article by D. L. Bitzer and H. G. Slottow entitled "The Plasma Display Panel—A Digitally Addressable Display With Inherent Memory," Proceeding of the Fall Joint Computer Conference, IEEE, San Francisco, Calif., November 1966, pages 541–547. Also reference is made to U.S. Letters Patent 3,559,190.

In the construction of the panel, a continuous volume of ionizable gas is confined between a pair of dielectric surfaces backed by conductor arrays typically forming matrix elements. The cross conductor arrays may be orthogonally related (but any other configuration of conductor arrays may be used) to define a plurality of opposed pairs of charge storage areas on the surfaces of the dielectric bounding or confining the gas. Thus, for a conductor matrix having H rows and C columns the number of elemental or discrete areas will be twice the number of such elemental discharge cells.

In addition, the panel may comprise a so-called monolithic structure in which the conductor arrays are created on a single substrate and wherein two or more arrays are separated from each other and from the gaseous medium by at least one insulating member. In such a device the gas discharge takes place not between two opposing electrodes, but between two contiguous or adjacent electrodes on the same substrate; the gas being confined between the substrate and an outer retaining wall.

It is also feasible to have a gas discharge device wherein some of the conductive or electrode members are in direct contact with the gaseous medium and the remaining electrode members are appropriately insulated from such gas, i.e., at least one insulated electrode.

In addition to the matrix configuration, the conductor arrays may be shaped otherwise. Accordingly, while the preferred conductor arrangement is of the crossed grid type as discussed herein, it is likewise apparent that where a maximal variety of two dimensionl display patterns is not necessary, as where specific standardized visual shapes (e.g., numerals, letters, words, etc.) are to be formed and image resolution is not critical, the conductors may be shaped accordingly, i.e., a segmented display.

The gas is one which produces visible light or invisible radiation which stimulates a phosphor (if visual display is an objective) and a copious supply of charges (ions and electrons) during discharge.

In prior art, a wide variety of gases and gas mixtures have been utilized as the gaseous medium in a gas discharge device. Typical of such gases include CO; CO_2; halogens; nitrogen; NH_3; oxygen; water vapor; hydrogen; hydrocarbons; P_2O_5; boron fluoride, acid fumes; $TiCl_4$; Group VIII gases; air; H_2O_2; vapors of sodium, mercury, thallium, cadmium, rubidium, and cesium; carbon disulfide, laughing gas; H_2S; deoxygenated air; phosphorus vapors; C_2H_2; CH_4; naphthalene vapor; anthracene; Freon, ethyl alcohol; methylene bromide; heavy hydrogen; electron attaching gases; sulfur hexafluoride; tritium; radioactive gases; and the rare or inert gases.

In a preferred practice, the gaseous medium comprises at least one rare gas, more preferably at least two, selected from helium, neon, argon, krypton, or xenon.

In an open cell Baker et al. type panel, the gas pressure and the electric field are sufficient to laterally confine charges generated on discharge within elemental or discrete dielectric areas within the perimeter of such areas, especially in a panel containing non-isolated discharge cells. As described in the Baker et al. patent, the space between the dielectric surfaces occupied by the gas is such as to permit photons generated on discharge in a selected discrete or elemental volume of gas to pass freely through

the gas space and strike surface areas of dielectric remote from the selected discrete volumes, such remote, photon struck dielectric surface areas thereby emitting electrons so as to condition at least one elemental volume other than the elemental volume in which the photons originated.

With respect to the memory function of a given discharge panel, the allowable distance or spacing between the dielectric surfaces depends, inter alia, on the frequency of the alternating current supply, the distance typically being greater for lower frequencies.

While the prior art does disclose gaseous discharge devices having externally positioned electrodes for initiating a gaseous discharge, sometimes called "electrodeless discharge," such prior art devices utilized frequencies and spacing or discharge volumes and operating pressures such that although discharges are initiated in the gaseous medium, such discharges are ineffective or not utilized for charge generation and storage at higher frequencies; although charge storage may be realized at lower frequencies, such charge storage has not been utilized in a display/memory device in the manner of the Bitzer-Slottow or Baker et al. invention.

The term "memory margin" is defined herein as

$$\text{M.M.} = \frac{V_f - V_E}{V_f/2}$$

where V_f is the half amplitude of the smallest sustaining voltage signal which results in a discharge every half cycle, but at which the cell is not bi-stable and V_E is the half amplitude of the minimum applied voltage sufficient to sustain discharges once initiated.

It will be understood that the basic electrical phenomenon utilized in this invention is the generation of charges (ions and electrons) alternately storable at pairs of opposed or facing discrete points or areas on a pair of dielectric surfaces backed by conductors connected to a source of operating potential. Such stored charges result in an electrical field opposing the field produced by the applied potential that created them and hence operate to terminate ionization in the elemental gas volume between opposed or facing discrete points or areas of dielectric surface. The term "sustain a discharge" means producing a sequence of momentary discharges, at least one discharge for each half cycle of applied alternating sustaining voltage, once the elemental gas volume has been fired, to maintain alternate storing of charges at pairs of opposed discrete areas on the dielectric surfaces.

As used herein, a cell is in the "on state" when a quantity of charge is stored in the cell such that on each half cycles of the sustaining voltage, a gaseous discharge is produced.

In addition to the sustaining voltage, other voltages may be utilized to operate the panel, such as firing, addressing, and writing voltages.

A "firing voltage" is any voltage, regardless of source, required to discharge a cell. Such voltage may be completely external in origin or may be comprised of internal cell wall voltage in combination with externally originated voltages.

An "addressing voltage" is a voltage produced on the panel X–Y electrode coordinates such that at the selected cell or cells, the total voltage applied across the cell is equal to or greater than the firing voltage whereby the cell is discharged.

A "writing voltage" is an addressing voltage of sufficient magnitude to make it probable that on subsequent sustaining voltage half cycles, the cell will be in the "on state."

In the operation of a multiple gaseous discharge device, of the type described hereinbefore, it is necessary to condition the discrete elemental gas volume of each discharge cell by supplying at least one free electron thereto such that a gaseous discharge can be initiated when the cell is addressed with an appropriate voltage signal.

The prior art has disclosed and practiced various means for conditioning gaseous discharge cells.

One such means of panel conditioning comprises a so-called electronic process whereby an electronic conditioning signal or pulse is periodically applied to all of the panel discharge cells, as disclosed for example in British patent specification 1,161,832, page 8, line 56 to 76. Reference is also made to U.S. Letters Patent 3,559,190 and "The Device Characteristics of the Plasma Display Element" by Johnson et al., IEEE Transactions On Electron Devices, September 1971. However, electronic conditioning is self-conditioning and is only effective after a discharge cell has been previously conditioned; that is, electronic conditioning involves periodically discharging a cell and is therefore a way of maintaining the presence of free electrons. Accordingly, one cannot wait too long between the periodically applied conditioning pulses since there must be at least one free electron present in order to discharge and condition a cell.

Another conditioning method comprises the use of external radiation, such as flooding part or all of the gaseous medium of the panel with ultraviolet radiation. This external conditioning method has the obvious disadvantage that it is not always convenient or possible to provide external radiation to a panel, especially if the panel is in a remote position. Likewise, an external UV source requires auxiliary equipment. Accordingly, the use of internal conditioning is generally preferred.

One internal conditioning means comprises using internal radiation, such as by the inclusion of a radioactive material.

Another means of internal conditioning, which we call photon conditioning, comprises using one or more so-called pilot discharge cells in the on-state for the generation of photons. This is particularly effective in a so-called open cell construction (as described in the Baker et al. patent) wherein the space between the dielectric surfaces occupied by the gas is such as to permit photons generated on discharge in a selected discrete or elemental volume of gas (discharge cell) to pass freely through the panel gas space so as to condition other and more remote elemental volumes of other discharge units. In addition to or in lieu of the pilot cells, one may use other sources of photons internal to the panel.

Internal photon conditioning may be unreliable when a given discharge unit to be addressed is remote in distance relative to the conditioning source, e.g., the pilot cell. Accordingly, a multiplicity of pilot cells may be required for the conditioning of a panel having a large geometric area. In one highly convenient arrangement, the panel matrix border (perimeter) is comprised of a plurality of such pilot cells.

Reference is made to the accompanying drawings and the hereinafter discussed figures shown thereon.

FIG. 1 is a partially cut-away plan view of a gaseous discharge display/memory panel as connected to a diagrammatically illustrated source of operating potentials.

FIG. 2 is a cross-sectional view (enlarged, but not to proportional scale since the thickness of the gas volume, dielectric members and conductor arrays have been enlarged for purposes of illustration) taken on lines **2—2** of FIG. 1.

FIG. 3 is an explanatory partial cross-sectional view similar to FIG. 2 (enlarged, but not to proportional scale).

FIG. 4 is an isometric view of a gaseous discharge display/memory panel.

The invention utilizes a pair of dielectric films **10** and **11** separated by a thin layer or volume of a gaseous discharge medium **12**, the medium **12** producing a copious supply of charges (ions and electrons) which are alternately collectable on the surfaces of the dielectric members at opposed or facing elemental or discrete areas X and Y defined by the conductor matrix on non-gas-contacting sides of the dielectric members, each di-

electric member presenting large open surface areas and a plurality of pairs of elemental X and Y areas. While the electrically operative structural members such as the dielectric members **10** and **11** and conductor matrixes **13** and **14** are all relatively thin (being exaggerated in thickness in the drawings) they are formed on and supported by rigid nonconductive support members **16** and **17** respectively.

Preferably, one or both of nonconductive support members **16** and **17** pass light produced by discharge in the elemental gas volumes. Preferably, they are transparent glass members and these members essentially define the overall thickness and strength of the panel. For example, the thickness of gas layer **12** as determined by spacer **15** is usually under 10 mils and preferably about 4 to 6 mils, dielectric layers **10** and **11** (over the conductors at the elemental or discrete X and Y areas) are usually between 1 and 2 mils thick, and conductors **13** and **14** about 8,000 angstroms thick. However, support members **16** and **17** are much thicker (particularly in larger panels) so as to provide as much ruggedness as may be desired to compensate for stresses in the panel. Support members **16** and **17** also serve as heat sinks for heat generated by discharges and thus minimize the effect of temperature on operation of the device. If it is desired that only the memory function be utilized, then none of the members need be transparent to light.

Except for being nonconductive or good insulators the electrical properties of support members **16** and **17** are not critical. The main function of support members **16** and **17** is to provide mechanical support and strength for the entire panel, particularly with respect to pressure differential acting on the panel and thermal shock. As noted earlier, they should have thermal expansion characteristics substantially matching the thermal expansion characteristics of dielectric layers **10** and **11**. Ordinary ¼" commercial grade soda-lime plate glasses have been used for this purpose. Other glasses such as low expansion glasses or transparent devitrified glasses can be used provided they can withstand processing and have expansion characteristics substantially matching expansion characteristics of the dielectric coatings **10** and **11**. For given pressure differentials and thickness of plates, the stress and deflection of plates may be determined by following standard stress and strain formulas (see R. J. Roark, *Formulas for Stress and Strain,* McGraw-Hill, 1954).

Spacer **15** may be made of the same glass material as dielectric films **10** and **11** and may be an integral rib formed on one of the dielectric members and fused to the other members to form a bakeable hermetic seal enclosing and confining the ionizable gas volume **12**. However, a separate final hermetic seal may be effected by a high strength devitrified glass sealant **15S**. Tubulation **18** is provided for exhausting the space between dielectric members **10** and **11** and filling that space with the volume of ionizable gas. For large panels small bead-like solder glass spacers such as shown at **15B** may be located between conductor intersections and fused to dielectric members **10** and **11** to aid in withstanding stress on the panel and maintain uniformity of thickness of gas volume **12**.

Conductor arrays **13** and **14** may be formed on support members **16** and **17** by a number of well-known processes, such as photoetching, vacuum deposition, stencil screening, etc. In the panel shown in FIG. 4, the center-to-center spacing of conductors in the respective arrays is about 17 mils. Transparent or semi-transparent conductive material such as tin oxide, gold or aluminum can be used to form the conductor arrays and should have a resistance less than 3000 ohms per line. Narrow opaque electrodes may alternately be used so that discharge light passes around the edges of the electrodes to the viewer. It is important to select a conductor material that is not attacked during processing by the dielectric material.

It will be appreciated that conductor arrays **13** and **14** may be wires or filaments of copper, gold, silver or aluminum or any other conductive metal or material. For example 1 mil wire filaments are commercially available and may be used in the invention. However, formed in situ conductor arrays are preferred since they may be more easily and uniformly placed on and adhered to the support plates **16** and **17**.

Dielectric layer members **10** and **11** are formed of an inorganic material and are preferably formed in situ as an adherent film or coating which is not chemically or physically affected during bake-out of the panel. One such material is a solder glass such as Kimble SG–68 manufactured by and commercially available from the assignee of the present invention.

This glass has thermal expansion characteristics substantially matching the thermal expansion characteristics of certain soda-lime glasses, and can be used as the dielectric layer when the support members **16** and **17** are soda-lime glass plates. Dielectric layers **10** and **11** must be smooth and have a dielectric strength of about 1000 v. and be electrically homogeneous on a microscopic scale (e.g., no cracks, bubbles, crystals, dirt, surface films, etc.). In addition, the surfaces of dielectric layers **10** and **11** should be good photoemitters of electrons in a baked out condition. Alternatively, dielectric layers **10** and **11** may be overcoated with materials designed to produce good electron emission, as in U.S. Letters Patent 3,634,719, issued to Roger E. Ernsthausen. Of course, for an optical display at least one of dielectric layers **10** and **11** should pass light generated on discharge and be transparent or translucent and, preferably, both layers are optically transparent.

The preferred spacing between surfaces of the dielectric films is about 3 to 6 mils with conductor arrays **13** and **14** having center-to-center spacing of about 17 mils.

The ends of conductors **14–1** . . . **14–4** and support member **17** extend beyond the enclosed gas volume **12** and are exposed for the purpose of making electrical connection to interface and addressing circuitry **19**. Likewise, the ends of conductors **13–1** . . . **13–4** on support member **16** extend beyond the enclosed gas volume **12** and are exposed for the purpose of making electrical connection to interface and addressing circuitry **19**.

As in known display systems, the interface and addressing circuitry or system **19** may be relatively inexpensive line scan systems or the somewhat more expensive high speed random access systems. In either case, it is to be noted that a lower amplitude of operating potentials helps to reduce problems associated with the interface circuitry between the addressing system and the display/memory panel, per se. Thus, by providing a panel having greater uniformity in the discharge characteristics throughout the panel, tolerances and operating characteristics of the panel with which the interfacing circuitry cooperate, are made less rigid.

In accordance with this invention, it has been surprisingly discovered that the operating characteristics uniformity and operating life span of a gaseous discharge device can be increased by utilizing a charge storage member with a gas medium contact surface consisting of at least one member selected from oxides of Be, Ca, Sr, Ba, or Ra.

As used herein the gas medium contacting surface is that portion of the dielectric charge storage member which is in direct contact with the ionizable gas medium. Although it is not known whether the charges are stored on the gas contacting surface or sub-surface of the dielectric, the charges at least originate at such surface.

In one embodiment the entire dielectric body consists of Group IIA oxide.

In another embodiment a continuous or discontinuous layer or film of Group IIA oxide is applied to the gaseous medium contacting surface portion of the dielectric body.

In such latter embodiment, the oxide layer may be formed in situ on the dielectric surface, e.g., by applying the elemental Group IIA element (or a source thereof) to the dielectric surface followed by oxidation. One such in situ process comprises applying a melt to the dielectric followed by oxidation of the melt during the cooling thereof so as to form the oxide layer. Another in situ process comprises applying an oxidizable source of the Group IIA element to the surface. Typical of such oxidizable sources include minerals and/or compounds containing the appropriate Group IIA element, especially organic compounds which are readily heat decomposed or pyrolyzed.

Typically, the Group IIA oxide layer (or a source thereof) is applied directly to the dielectric surface by any convenient means including not by way of limitation vapor deposition; vacuum deposition; chemical vapor deposition; wet spraying upon the surface a mixture or solution of the oxide suspended or dissolved in a liquid followed by evaporation of the liquid; dry spraying of the oxide upon the surface; electron beam evaporation; plasma flame and/or arc spraying and/or deposition; and sputtering target techniques.

The Group IIA oxide is applied to (or formed in situ on) the dielectric surface as a very thin continuous or discontinuous film or layer, the thickness and amount of the oxide layer being sufficient to increase the operating characteristics uniformity (such as stabilization of operating voltages) and/or operating life span of the device. In the usual practice hereof, the oxide layer is applied to or formed on the dielectric material surface to a thickness of at least about 200 angstrom units with a range of about 200 angstrom units up to about 1 micron (10,000 angstrom units). When the entire dielectric consists of Group IIA oxide, the dielectric Group IIA oxide thickness may range up to 25 microns or more.

As used herein, the terms "film" or "layer" are intended to be all inclusive of other similar terms such as deposit, coating, finish, spread, covering, etc.

In the fabrication of a gaseous discharge panel, the dielectric material is typically applied to and cured on the surface of a supporting glass substrate or base to which the electrode or conductor elements have been previously applied. The glass substrate may be of any suitable composition such as a soda lime glass composition. In a Baker et al. device two glass substrate containing electrodes and cured dielectric are then appropriately heat sealed together so as to form a panel.

In the preferred practice of this invention, the Group IIA oxide layer is applied to the surface of the cured dielectric before the panel heat sealing cycle.

The practice of this invention may be especially beneficial after appropriate aging of the device. Device aging is defined as the accumulated total operating time for the device. In a typical panel, 50 to 100 hours of panel aging is about standard.

In order to achieve maximum results, the Group IIA oxide layer is continuously or discontinuously applied to the gaseous medium contacting surface of the dielectric. In other words, the applied Group IIA oxide layer must be directly exposed to the gaseous medium in order to achieve the desired results.

Other metal or metalloid oxide layers may exist below that of the Group IIA oxide layer. Such sub-layers may be of any suitable oxide of the periodic table, especially aluminum oxide, silicon oxide and the rare earth oxides. Also as already noted hereinbefore, another embodiment of this invention comprises using a dielectric which consists of Group IIA oxide.

We claim:

1. In a gaseous discharge display/memory device comprising an ionizable gaseous medium and at least one dielectric charge storage member in contact with the gaseous medium and at least one electrode insulated from the gaseous medium by a dielectric member, the improvement wherein the portion of the dielectric member contacting the gaseous medium consists of at least one oxide of Be, Ca, Sr, Ba, or Ra, in an amount sufficient to increase the uniformity of the operating voltages of the device.

2. The invention of claim **1** wherein the dielectric member consists of the oxide.

3. The invention of claim **1** wherein the dielectric member is coated with a layer of the oxide.

4. The invention of claim **3** wherein the oxide layer is continuous.

5. The invention of claim **3** wherein the oxide layer is discontinuous.

6. In a gaseous discharge display/memory device comprising an ionizable gaseous medium in a gas chamber formed by a pair of opposed dielectric gaseous medium contacting surfaces and at least one electrode insulated from the gaseous medium by each dielectric member, the improvement wherein each dielectric surface consists of at least one oxide of Be, Ca, Sr, Ba, or Ra in an amount sufficient to increase the uniformity of the operating voltages of the device.

7. The invention of claim **6** wherein each dielectric gaseous medium contacting surface consists of the oxide layer applied to the dielectric base material.

8. The invention of claim **7** wherein the thickness of the oxide layer on each dielectric surface is at least about 200 angstrom units.

9. The invention of claim **7** wherein the oxide layer thickness on each dielectric surface ranges from about 200 angstrom units up to about 10,000 angstrom units.

10. In a gaseous discharge display/memory device comprising an ionizable gaseous medium in a gas chamber formed by a pair of opposed dielectric material gaseous medium contacting surfaces backed by electrode members, the electrode members behind each dielectric material surface being oriented with respect to the electrode material members behind the opposing dielectric material surface so as to define a plurality of discharge units, the improvement wherein a layer of at least one oxide of a member selected from Be, Ca, Sr, Ba, or Ra is applied to each opposed dielectric material surface in an amount sufficient to increase the uniformity of the operating voltages of the device.

11. The invention of claim **10** wherein the thickness of the oxide layer on each dielectric surface is at least about 200 angstrom units.

12. The invention of claim **10** wherein the oxide layer thickness on each dielectric surface ranges from about 200 angstrom units up to about 10,000 angstrom units.

13. An article of manufacture comprising a dielectric body having a structural configuration for use in a gaseous discharge display/memory device, said dielectric body having at least one electrode on one side thereof and on the opposite side thereof having a deposit of at least one oxide of Be, Ca, Sr, Ba, or Ra in direct contact with the surface of the body in an amount sufficient to increase the uniformity of operating voltages in the gaseous discharge device.

14. The invention of claim **13** wherein the thickness of the oxide deposit is at least about 200 angstrom units.

15. The invention of claim **13** wherein the thickness of the oxide deposit ranges from about 200 angstrom units to about 10,000 angstrom units.

16. In the method of operating a gaseous discharge display/memory device comprising an ionizable gaseous medium in a gas chamber formed by a pair of dielectric material members having opposed gaseous medium contacting surfaces, which dielectric material members are respectively backed by a series of parallel-like electrode members, the electrode members behind each dielectric material member being transversely oriented with respect to the electrode members behind the opposing dielectric material members so as to define a plurality of discrete discharge volumes, each constituting a discharge unit, and

wherein the gas is selectively ionized within each discharge unit by operating voltages applied to the transversely oriented electrode members, the improvement which comprises increasing the uniformity of the operating voltages of the device by coating the gaseous medium contacting surface of each opposed dielectric material with a layer of at least one oxide of Be, Ca, Sr, Ba, or Ra.

17. The invention of claim **16** wherein the thickness of the oxide layer on the surface of each dielectric material member is at least about 200 angstrom units.

18. The invention of claim **16** wherein the thickness of the oxide layer on the surface of each dielectric material member ranges from about 200 angstrom units to about 10,000 angstrom units.

19. A gas discharge display/memory device comprising, in combination, a pair of spaced-apart non-conductive support members, a pair of conductor arrays arranged one on each of the confronting surfaces of said support member, the arrays being in transverse relative orientation so as to provide a series of cross-points therebetween, and a dielectric material coating on the confronting surfaces of each of the support members and over the conductor arrays for defining therebetween a sealed gas chamber, the surface of each of said dielectric material coating including a further coating of at least one oxide of Be, Ca, Sr, Ba, or Ra in an amount sufficient to increase the uniformity of the device operating voltages.

20. The invention of claim **19** wherein the thickness of the oxide coating on each dielectric surface is at least about 200 angstrom units.

21. The invention of claim **20** wherein the thickness of the oxide coating on each dielectric surface ranges from about 200 angstrom units up to about 10,000 angstrom units.

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