

July 22, 1958

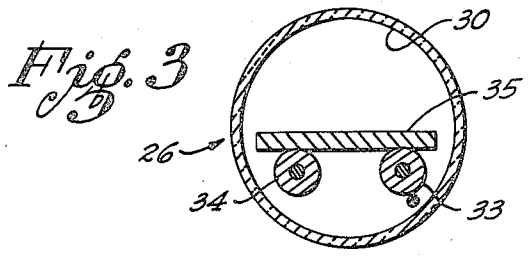
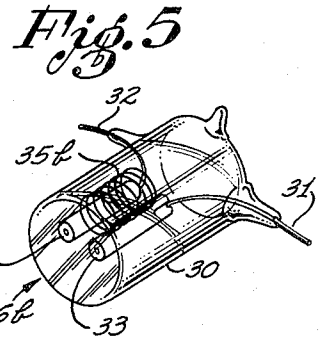
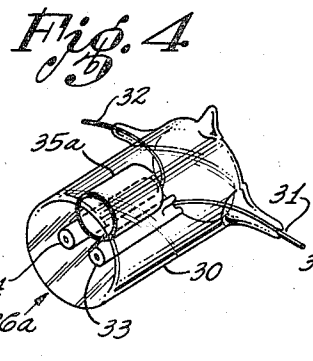
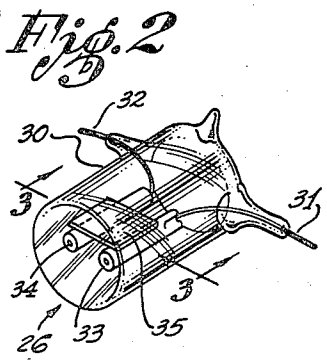
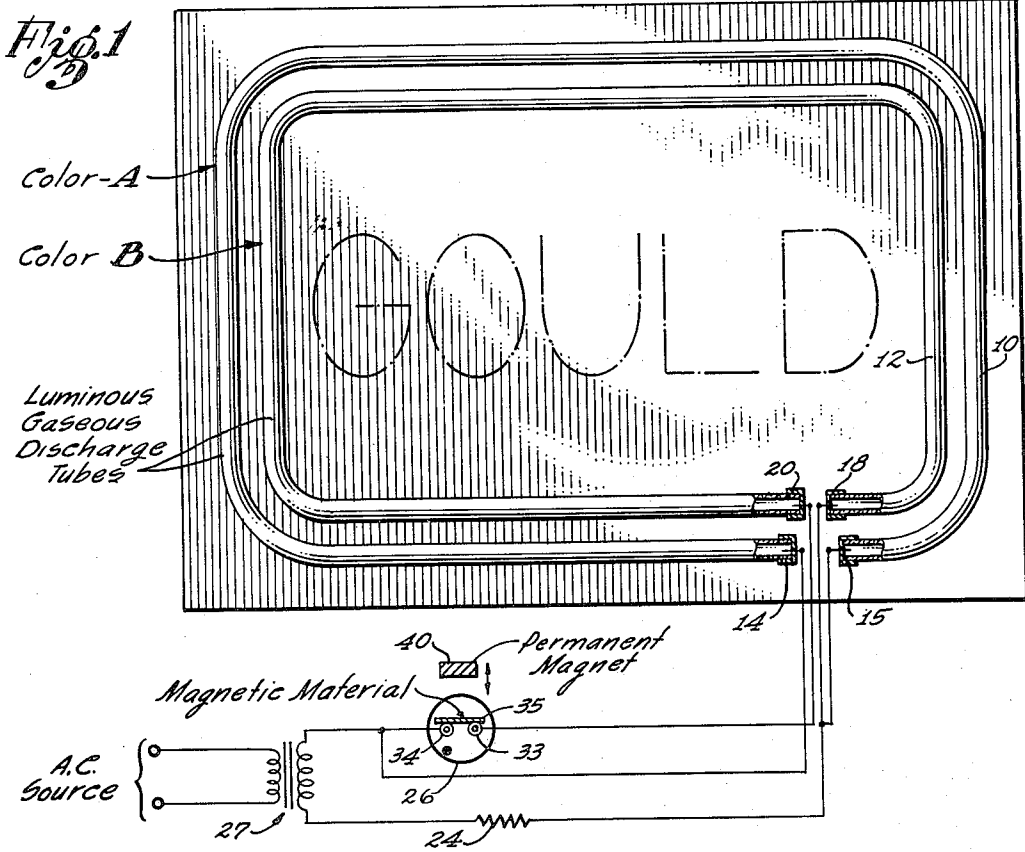
S. GOULD

2,844,764

ANIMATED ELECTRIC DISPLAY SYSTEM

Filed May 4, 1956

2 Sheets-Sheet 1



INVENTOR: Samuel Gould

By *Smith & Patton*
Patent Attorneys

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2 Sheets-Sheet 2

Fig. 6

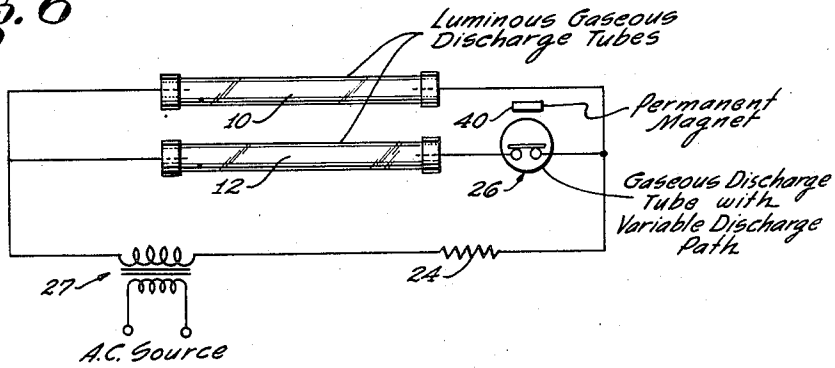


Fig. 7

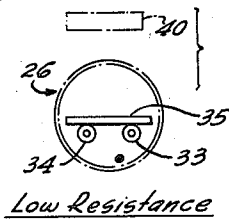


Fig. 8

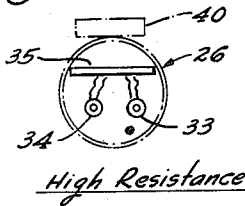


Fig. 9

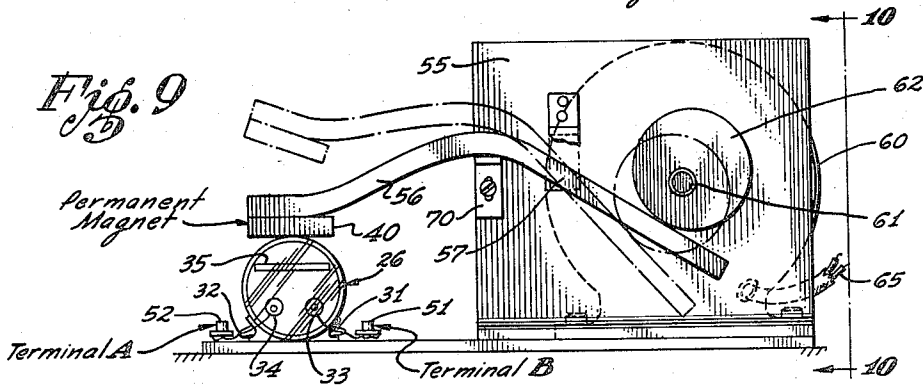
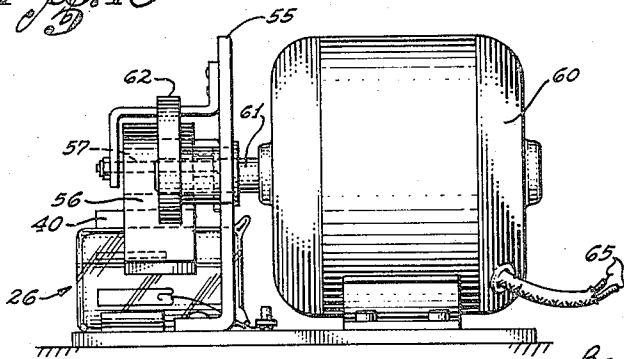


Fig. 10



INVENTOR:
 Samuel Gould
 By *Amey & Boston*
 Patent Attorneys.

2,844,764

ANIMATED ELECTRIC DISPLAY SYSTEM

Samuel Gould, Culver City, Calif., assignor to GHN Neon Sign Company, Culver City, Calif., a partnership

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2 Claims. (Cl. 315—183)

The present invention relates to electric signs or display systems which utilize the luminous electrical discharges between cold electrodes in a rarefied inert gas contained in elongated glass tubes, and which are usually referred to as neon signs. The invention is particularly concerned with an animated or flashing sign or system of this type in which two or more of the gaseous discharge tubes are in alternation recurrently turned on and off to attract attention to the display.

For many years, and from the time when myriads of individual electric light bulbs were generally used in advertising signs and display systems, it was realized that the display was much more appealing and subject to greatly increased attention when the individual light bulbs were cyclically energized and deenergized in accordance with a selected pattern. Likewise, in displays using luminous gaseous discharge tubes, as referred to above, the desirability of providing some means for repeatedly energizing and deenergizing the tubes has long been realized. However, most prior art systems for accomplishing this are unduly complicated and expensive. It is an important object of the present invention to provide an improved, simplified and inexpensive animated or flashing display system using luminous gaseous discharge tubes.

Many problems have been encountered in the construction of flashing display systems using gaseous discharge tubes. One of these problems arises from the relatively high voltage that is usually required to excite the gaseous discharge tubes for the required luminous effect. This voltage, for example, is usually of the order of 15,000 volts, and such high voltage renders usual simple make-and-break switching infeasible. In fact, most safety and fire preventive requirements dictate that no open switching be carried out in the secondary circuit of the transformer producing the high voltage. However, if the switching is to be only in the primary circuit of the transformer, it is evident that a separate transformer will be required for each discharge tube whose illumination is to be independently controlled. This, of course, can prove to be extremely expensive.

Another problem that arises in flashing the luminous gaseous discharge tubes is that of obviating radio and television interference. Any attempt to break a circuit involving appreciable voltage is usually accompanied by arcing of the switch contacts. It is well known that such arcing creates interference with radio and television equipment in the vicinity, and that this interference can be extremely serious.

The present invention provides a simple system for controlling, for example, the illumination of two luminous gaseous discharge tubes in a neon display system. The control is such that the tubes in alternation are repeatedly extinguished and illuminated, and this is accomplished by providing two luminous discharge tubes of different internal resistances and by inserting a variable resistance gaseous discharge control tube in series with the luminous

tube having the lower internal resistance. In a manner to be described, this control is such that one luminous tube discharges when the control tube exhibits a relatively low resistance, and the other luminous tube discharges when the control tube exhibits a relatively high resistance. The luminous tubes may, therefore, be repeatedly and in alternation turned on and off to provide a flashing or animated sign. Since no actual switching is involved, the control may be effectuated in the secondary circuit of the high voltage transformer without any danger of fire or of violating any safety regulations. Therefore, many independently controlled flashing pairs of luminous tubes can be excited from a single transformer. Also, it has been found that when the gas pressure in the control tube is set to lie within a certain range of values, there is no sharp break of the electrical circuit and radio and television interference can be minimized.

The various features and advantages of the invention will be understood from the following detailed description considered with the accompanying drawings.

In the drawings, which are to be regarded as merely illustrative:

Figure 1 is a somewhat schematic representation of an animated or flashing electric display sign or system utilizing luminous gaseous discharge tubes whose energization is controlled in accordance with the present invention;

Figure 2 is a perspective view of one embodiment of a gaseous discharge control tube that may be utilized in controlling the alternate energization of the luminous gaseous tubes in the display system of Figure 1;

Figure 3 is a cross-sectional view of the control tube of Figure 2 along the line 3—3 of Figure 2;

Figures 4 and 5 show two other embodiments of the control tube of Figure 2;

Figure 6 is an electrical circuit diagram of the display system of Figure 1 and is useful in explaining the operation of the system;

Figures 7 and 8 are schematic representations of the control tube of Figures 2 and 3 and respectively illustrate the operation of the control tube as its internal resistance is varied between a relatively low value and a relatively high value;

Figure 9 is a side elevational view of a suitable mechanical-electrical apparatus for controlling the position of a floating electrode in the gaseous control tube of the system, thereby to control the internal resistance of the control tube between its relatively low value and its relatively high value; and

Figure 10 is an end view of the apparatus of Figure 9.

The display system of Figure 1 includes a first luminous gaseous discharge tube 10 and a second luminous gaseous discharge tube 12. These tubes in themselves are well known and each takes the form of an elongated glass tube with a cold cathode electrode at each end. The tubes each contain a rarefied atmosphere of an inert gas and a luminous discharge takes place between the electrodes upon the application of a sufficiently high exciting voltage to these electrodes. When neon gas is used, a brilliant reddish orange discharge occurs which is admirably adaptable for electric signs. By the introduction of a small amount of mercury into the tube, the resultant light can be changed to blue. Also by coating the internal surface of the glass tubes with different types of fluorescent powder or the use of colored glass tubing, many other colors can be obtained as is well known to the art.

The tubes 10 and 12 are arranged in the illustrated embodiment in a concentric, nested manner to embrace a rectangular area. It is contemplated that one of the tubes will be luminous in one particular color, and that the other tube will be luminous in a second particular color. These tubes may form an animated, flashing illuminated

border of any desired advertising message, illuminated or otherwise, positioned within the area enclosed by the tubes. Of course, the particular configuration of the tubes 10 and 12 illustrated in Figure 1 is merely by way of example, as the tubes may take on any desired shape or form.

The luminous gaseous discharge tube 10 has a first cold cathode electrode 14 at one end and a second cold cathode electrode 15 at the other end. The tube 12, likewise, has a first cold cathode electrode 18 at one end and a second cold cathode electrode 20 at the other end. The construction and operation of these tubes is extremely well known to the art and a detailed description herein is believed to be unnecessary. As previously pointed out, each of these tubes contains an inert gas; and when a voltage in excess of the particular threshold or "striking" voltage is impressed across the electrodes 18, 20 or 14, 15, that the corresponding tube discharges and glows in a color determined by the color of the tube and the particular gas (or combination of gases) contained therein.

It might be also pointed out, that the threshold or "striking" voltage at which a particular tube will discharge, is dependent upon the internal resistance exhibited by the tube prior to discharge. This resistance increases as the length of the tube increases, assuming the tube diameter remains the same. Therefore, if the illuminating tubes 10 and 12 each have the same diameter, the internal resistance of tube 10 will be greater than that of tube 12, due to the increased length of the former. Therefore, the threshold voltage at which tube 10 discharges and becomes illuminated will be higher than the threshold voltage at which tube 12 discharges and becomes illuminated.

The cathode electrodes 15 and 18 of the respective gaseous discharge tubes 10 and 12 are connected together. A suppressor resistor 24 is connected between these electrodes and one terminal of the secondary winding of a power transformer 27. This resistor aids in suppressing radio interference and can be replaced by a choke coil if so desired. The primary winding of the transformer is connected to any suitable alternating current source, such as the usual 110 volts alternating-current mains. The other terminal of the secondary winding of transformer 27 is connected to the cathode electrode 14 of tube 10, and this terminal is also connected to one of the electrodes of a gaseous discharge control tube 26. The other electrode of the gaseous control tube 26 is connected to the cathode electrode 20 of the tube 12. The control tube 26, therefore, is in series with the tube 12, and tubes 26 and 12 are connected across the secondary winding of transformer 27 in parallel with tube 10.

One embodiment of the control tube 26 is shown in Figures 2 and 3. This embodiment comprises an evacuated envelope 30 composed, for example, of glass. A pair of connecting leads 31 and 32 extend through the envelope 30 and are sealed therein. Thus leads are respectively connected to and serve to support a pair of rigid cathode electrodes 33 and 34. The control tube also includes a floating electrode 35 of magnetic and electrically conductive material, illustrated in this embodiment in the form of a rectangular plate. The floating electrode 35 normally rests on the electrodes 33 and 34 effectively to short circuit these electrodes.

The control tube 26 is a form of gaseous glow lamp. It contains an atmosphere of inert gas, such as nitrogen at a pressure of the order of 10-22 millimeters of mercury. The discharge in tube 26 takes place between the cathodes 33 and 34 and through the floating electrode 35. It is evident that the internal resistance of control tube 26 during discharge increases as the discharge path increases, that is, as the floating electrode 35 is drawn away from electrodes 33 and 34.

In a constructed embodiment of the invention, the control tube 26 had the following dimensions. These are

listed herein merely by way of an illustrative example and are not intended to be limiting in any way.

Diameter of tube 26	-----	1/2"
Length of tube 26	-----	1"
Length of electrodes 33, 34	-----	1 1/16"
Diameter of electrodes 33, 34	-----	3/8"
Spacing between the longitudinal axes of electrodes 33, 34	-----	5/16"
Floating electrode 35	-----	1/2" x 3/8"

Figure 4 shows a gaseous discharge control tube 26a similar in most respects to the control tube 26 described in conjunction with Figures 2 and 3. The control tube 26a also includes a pair of electrodes 33 and 34 which are supported therein by respective contact leads 31 and 32. In the control tube 26a, the floating electrode 35a, instead of having a rectangular plate-like configuration, is in the form of a cylinder composed of magnetic and electrically conductive material. Likewise, the control tube 26b of Figure 5 differs from the control tubes 26, 26a in the use of a helical coil 35b of magnetic and electrically conductive material for the floating electrode.

The floating electrode 35 of control tube 26 (or the corresponding floating electrodes 35a, 35b of control tubes 26a, 26b) may be drawn away from the electrodes 33 and 34 by moving an external permanent magnet 40 (Figure 1) in the direction of the arrows towards and away from the floating electrode. The movement of the permanent magnet 40 is controlled in a manner to be described.

As previously noted, the system of Figure 1 is shown schematically in the electric circuit of Figure 6. As clearly shown in the latter figure, tube 10 is connected across the secondary winding of transformer 27, and tubes 12 and 26 are connected in series across this winding in parallel with tube 10. The striking voltage of tube 10 is higher than that of tube 12 due to its higher internal resistance. Also the voltage required to sustain discharge in tube 10 is higher than for tube 12 for the same reason. The transformer 27 is essentially a constant current source of electrical energy and its secondary voltage varies with variations in the load on the secondary.

Consider first the situation in which permanent magnet 40 is withdrawn from the vicinity of floating electrode 35. The floating electrode now rests across the electrodes 33 and 34 of control tube 26 (Figure 7) to create essentially a short circuit between these latter electrodes and minimum internal resistance in the control tube 26. When this occurs, the voltage introduced across tube 12 by transformer 27 exceeds the firing or striking threshold of this tube so that it discharges and becomes illuminated. The resulting current flow through the tube 12 reduces the voltage across the secondary to a value below the firing threshold of tube 10, but the resulting voltage is still sufficient to maintain the discharge in tube 12 but is not sufficient to maintain a discharge in tube 10. It should be noted at this point that it is characteristic of gaseous discharge tubes, such as the tubes 10 and 12, that the voltage required to maintain the tube discharging and illuminated is somewhat lower than the original threshold striking or firing voltage. Therefore, only the tube 12 is illuminated under this condition, and tube 10 is extinguished.

Now, should the permanent magnet 40 be brought adjacent the control tube 26, the floating electrode 35 is attracted thereto and moves away from the electrodes 33 and 34 (Figure 8). This increases the discharge path between the electrodes 33 and 34 through the floating electrode 35, and a gradual increase of the internal resistance of tube 26 may be realized as the discharge path is increased. As the internal resistance of control tube 26 is increased in this manner, the voltage across the series-connected tubes 26 and 12 increases due to the lightening of the load on the secondary of transformer 27, and this voltage increase is continued until the firing or striking

threshold of the tube 10 is reached. This causes tube 10 to discharge and become illuminated. The resulting discharge through tube 10 causes the voltage of the secondary winding of transformer 27 to drop, and the resulting low voltage across the secondary together with the high resistance of tube 26 causes the voltage introduced to tube 12 to fall below the threshold required to maintain a discharge in the tube 12. Therefore, in this latter condition, tube 10 is illuminated and tube 12 is extinguished.

By cyclically causing the permanent magnet 40 to be gradually brought adjacent the external surface of the envelope of control tube 26, the floating electrode 35 can be periodically withdrawn from the electrodes 33 and 34 to provide a gradual increase and decrease of the discharge path in the tube 26 to increase resistance within the control tube until the tube 10 is illuminated and tube 12 is extinguished, and vice versa.

When the internal pressure within control tube 26 is of the order of 10-22 millimeters of mercury, it has been found that the resulting discharge of tube 26 as its discharge path is lengthened creates negligible television interference and only a small amount of radio interference. Any residual radio interference can be eliminated for all practical purposes by the suppressor resistor 24 which may have a value of 25,000 ohms.

Should the luminous discharge tube 10 be broken there is no opening of the secondary circuit with resulting dangerous high voltages. The only result is that tube 12 remains continually illuminated. Likewise, should the discharge tube 12 become broken, the secondary circuit is not opened and the only result is that tube 10 remains illuminated. Therefore, the fracture of either of the luminous tubes has no adverse or dangerous effect on the system.

The control tube 26, therefore, functions essentially as a variable resistance in series with the luminous discharge tube 12. This variable resistance has a first relatively low value at which the tube 12 is illuminated and the tube 10 is extinguished, and it has a relatively high resistance at which the tube 10 is illuminated and the tube 12 is extinguished.

A simple control apparatus for cyclically bringing the magnet 40 towards and away from the external surface of tube 26 is shown in Figures 9 and 10. This apparatus includes a horizontal base 50, and a pair of terminals 51 and 52 are mounted on the base in any appropriate manner. The leads 31 and 32 of the control tube 26 are connected, respectively, to the terminals. The terminals not only provide electrical connectors for the tube 26, but they also serve to support and mount the tube on the base 50. A mounting panel 55 is supported in a vertical plane on the base 50, and a rigid lever arm 56 is pivotally mounted on the panel 55 at a fulcrum point 57. The permanent magnet 40 is mounted at one end of the lever arm 56 and in its lower position rests on the upper surface of the envelope of tube 26. An electric motor 60 is mounted on the other side of the panel 55 to the lever 56, and the motor has a drive shaft 61 extending through the panel. A cam wheel 62 is eccentrically mounted on the free end of shaft 61. The periphery of the cam wheel 62 engages the end of lever 56 remote from magnet 40. The motor 60 is connected to a usual power source by a pair of energizing leads 65.

When the motor 60 is energized, the cam wheel 62 rotates pivoting the lever arm 56 about its fulcrum point 57, and this causes the permanent magnet 40 to move down and up, towards and away from the external surface of the tube 26. When the permanent magnet 40 is in its lower position adjacent the envelope of the tube 26, the lever 56 rests against a bracket 70 on the panel 55 and the floating electrode 45 is drawn upwardly away from the electrode 33 and 34 to its illustrated position in Figure 9, at which the discharge path of the control tube has its maximum length and the tube exhibits its maximum internal resistance. At the upper position of the perma-

nent magnet 40 (shown by the dashed lines in Figure 9), the floating electrode 35 rests on the electrodes 33 and 34 and the length of the discharge path is a minimum and the control tube exhibits minimum internal resistance.

It should be pointed out that the permanent magnet 40 may be replaced by an electro-magnet when so desired. This electro-magnet would be placed in a stationary position with respect to the control tube 26, and the current through the element could be controlled by a commutator driven by a motor such as motor 60. This would achieve the same result as with the permanent magnet but without the need to displace the magnet periodically from the control tube.

The control tube 26 could be mounted in a vertical position with the electrode 35 resting on the top of the electrodes 33, 34. This would permit a multiple electrode construction in which a plurality of individually movable electrodes such as the electrode 35 are supported respectively on a plurality of pairs of electrodes such as the electrodes 33, 34, and all within a single envelope or individual envelopes and conveniently grouped for producing a multiple control effect. Such a multiple control effect would find particular application in a system in which both the low resistance and the high resistance illuminating tubes have electrodes disposed at intervals along their respective lengths with control tubes respectively interconnecting corresponding pairs of these electrodes from one of the illuminating tubes to the other. Thus by successively closing these latter control tubes, a discharge through the high resistance tube can be directed through successive sections of the low resistance tube. Of course, many other systems, too numerous to mention, can be devised to utilize the present invention.

The invention provides, therefore, a simple and convenient neon sign display system in which a pair of luminous gaseous discharge tubes are repeatedly illuminated and extinguished in alternation. The control of these tubes may be safely effected in the secondary circuit of the energizing transformer so that a plurality of independently controlled display systems of the type described may be fed from a single transformer. Moreover, the control of the illuminating tubes is such that interference to radios and television receivers is obviated for all practical purposes.

My description in specific detail of selected embodiments of the invention will suggest to those skilled in the art various changes, substitutions and other departures from my disclosure that properly lie within the spirit and scope of the appended claims.

1. In an animated electric display system, a first luminous discharge tube including an elongated transparent tubular element having a pair of cathodes at the respective ends thereof and containing a rarefied atmosphere of an inert gas, a second luminous discharge tube including an elongated transparent tubular element having a pair of cathodes at the respective ends thereof and likewise containing a rarefied atmosphere of an inert gas, said first luminous discharge tube having a discharge voltage threshold higher than the discharge voltage threshold of the second luminous discharge tube, a transformer having a primary winding and a secondary winding, means for connecting the primary winding of the transformer to a source of alternating current energy, a common electrical connection of essentially zero inductance extending from one of the cathodes of each of the discharge tubes to one side of the secondary winding, a second electrical connection of essentially zero inductance extending from the other cathode of the first discharge tube to the other side of the secondary winding, a variable resistance gaseous discharge control tube having an enclosing envelope containing a gaseous atmosphere within a predetermined pressure range and the control tube having a first electrode connected to the other cathode of the second luminous discharge tube and having a second electrode connected to the other side

7

of the secondary winding, and magnetic means externally of the enclosing envelope of the control tube and independent of current flow through the first and second luminous discharge tubes for varying the internal resistance of the control tube between a relatively low value at which the second luminous discharge tube discharges and reduces the voltage across the secondary winding below the discharge voltage threshold of the first luminous discharge tube and a relatively high value at which the second luminous discharge tube is effectively deactivated and the voltage across the secondary winding raises the value sufficient to cause the first luminous discharge tube to be discharged.

2. The combination defined in claim 1 in which a sup-

8

pressor impedance means is included in series between the secondary winding of the transformer and the cathodes of the first and second luminous discharge tubes effectively to eliminate the production of interfering signals by the display system.

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