

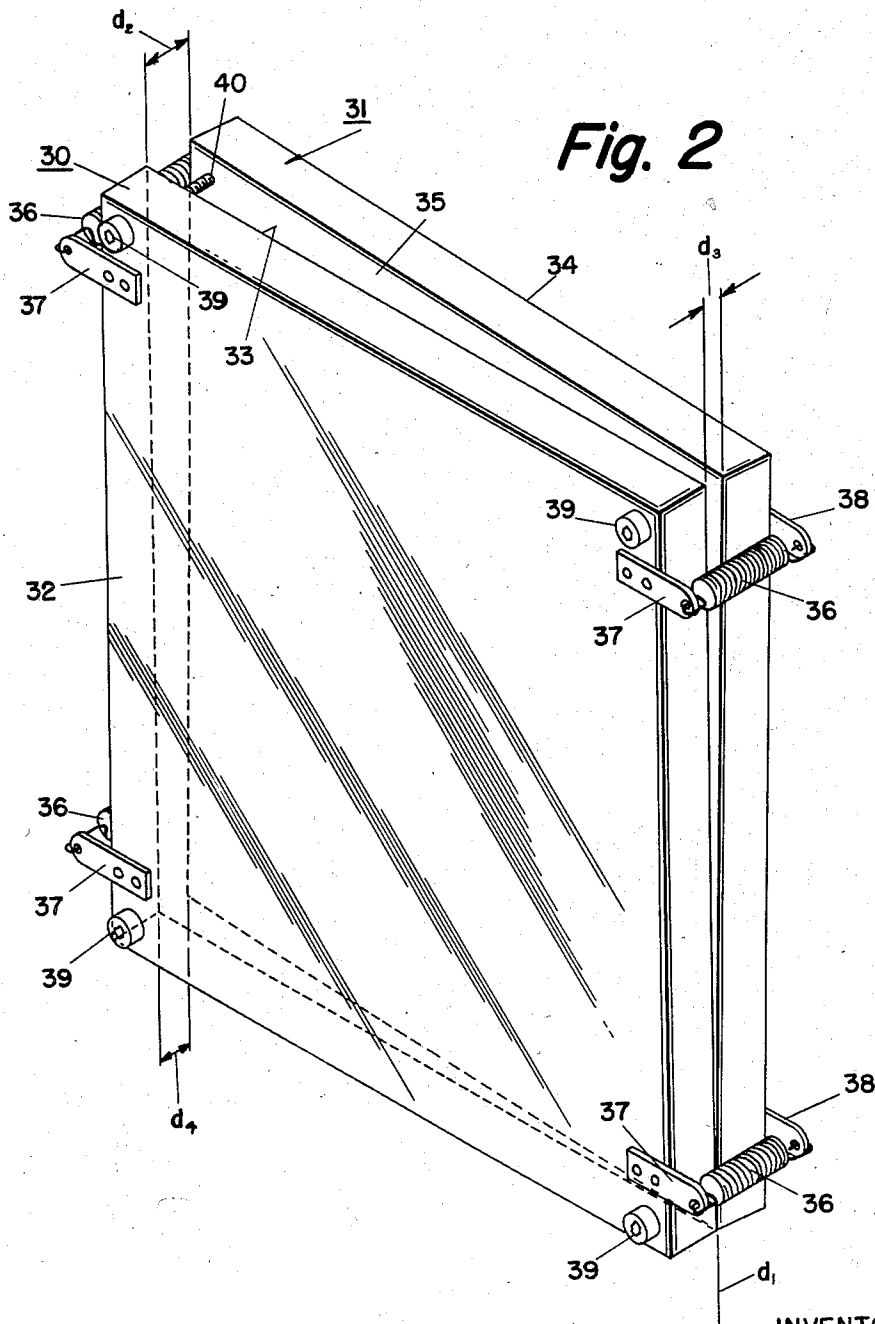
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ELECTRONIC DISPLAY APPARATUS

2,886,731

Filed June 27, 1957

2 Sheets-Sheet 1



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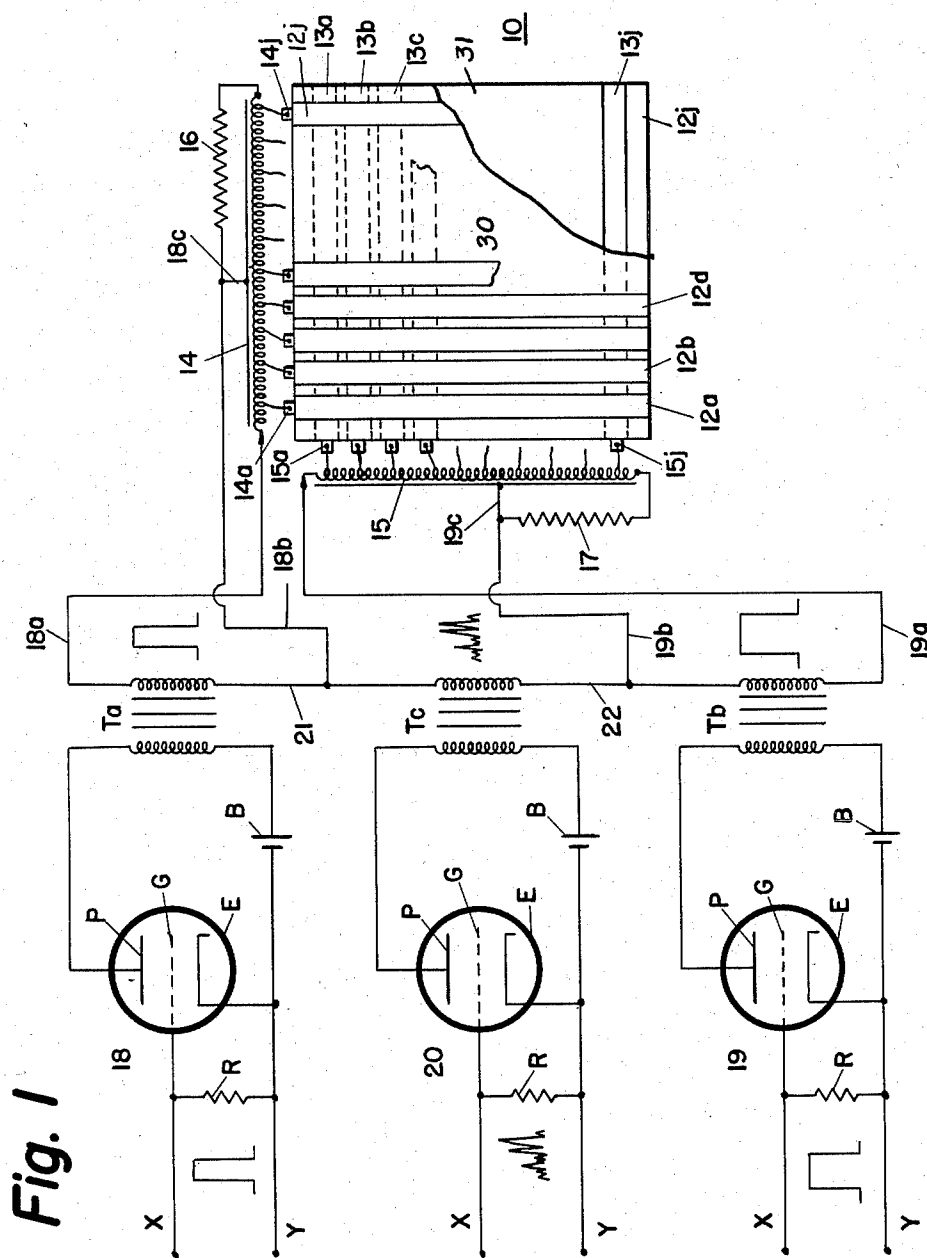
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ELECTRONIC DISPLAY APPARATUS

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Application June 27, 1957, Serial No. 668,584

2 Claims. (Cl. 313-108)

(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 government purposes without the payment of any royalties thereon or therefor.

This invention relates to an electronic display apparatus and is particularly concerned with a display screen which is energized by delay line technique and is adapted for maintaining uniform voltage intensity.

The invention involves improved screen apparatus which may be utilized in the system disclosed in my co-pending application for a System for Electronic Display Serial No. 668,583, filed under even date herewith on June 27, 1957. The screen comprises a first grid or plate having suitably spaced parallel conductors with a second grid of similarly spaced conductors electrically insulated from those of the first grid. The conductors of the screen grids may be wires or strips and form, in effect, a reticulated screen design to provide a scanning area of spaced points. The assembled screen structure may then be provided with an electroluminescent material between the grids in order that the application of a difference in potential between a selected conductor of one grid and a selected conductor of the other grid will result in a visible radiation at a point of intersection or overlap between the conductors which is determined by the shortest paths of travel between the selected conductors.

By electrical delay line technique, voltage is supplied at an input end of the delay line wire and a series of tap-off or branch lines are provided between its input and outlet ends, which are connected to other elements to effect their sequential energization. The use of delay line apparatus with the above-described screen grids results in a progressive decrease in voltage from the input end to the outlet end and consequent areas of low intensity.

The use of electrical delay lines for scanning such a screen however, has various advantages over the presently used mechanical arrangements. One particular advantage resides in the ease and flexibility in applying and synchronizing the scanning pulses impressed on the vertical and horizontal conductors. Another advantage is that the use of electrical delay lines permits a higher speed of scanning than the use of mechanical devices for impressing the voltages on the conductors while a corollary advantage is that the use of electrical delay line apparatus eliminates the need for cumbersome mechanical equipment.

In the use of the present apparatus, one electrical delay line of short time delay is provided for transmitting pulse voltages of short duration to energize the conductors of one grid and another electrical delay line of longer time delay is provided for transmitting pulse voltages of longer duration to energize conductors of the other grid. This arrangement permits the ready application of a modulating voltage of predetermined magnitude to each delay line across any selected intersection of the grids for supplying the intelligence voltage to the screen. Such systems

2

however are defective in that they develop areas of low intensity due to voltage decay.

Accordingly, it is an object of the invention to provide a screen which is usable with delay lines and yet provides uniform screen intensity. Another object of the present invention is to incorporate such a screen structure in a scanning system employing delay lines for energizing the screen conductors.

A detailed object is to provide a screen structure which is arranged to compensate for voltage decay and provide uniform intensity of visual radiation throughout the screen area.

Other objects and advantages of the invention will hereinafter become more fully apparent from the following description of the annexed drawings, wherein:

Fig. 1 is a schematic wiring diagram showing the several circuits associated with the electrical delay lines apparatus for supplying the various voltages to the conductors of a screen; and

Fig. 2 is an enlarged perspective view showing details of the grid plates of the screen of Fig. 1 with the conductors removed and providing one arrangement for spacing the grid plates to provide for uniform intensity.

Referring to Fig. 1, a screen is indicated generally at 10 and has a layer of electroluminescent material which is applied to one of the screen grid plates 30 or 31. A group of ten generally similar vertical and parallel conductors 12a through 12j and another group of ten similar horizontal and parallel strips 13a through 13j are provided and the conductors of one group are disposed generally at right angles to the conductors of the other group. A first or vertical delay line apparatus made up of a coiled wire and copper tube assembly 14 having tap-off branches 14a through 14j between the ends of the delay line 14 is provided for energizing the vertical conductors and a second or horizontal delay line 15 having tap-off branches 15a through 15j is provided for energizing the horizontal conductors. A load impedance 16 is connected to the outlet end of delay line 14 and another load impedance 17 is connected to the outlet end of delay line 15 for absorbing voltages after the respective groups of conductors have been energized.

Circuit 18 is for short time pulse duration voltages, circuit 19 is for long time pulse duration voltages while circuit 20 is for modulating voltages. These circuits are provided for transmitting the various voltages used in the system to the delay lines for activating the conductors and are to be considered as exemplary of means which may be employed for this purpose. Since the circuits are similar, only the elements of circuit 18 will be referred to for a general explanation of their functions. Voltage, from a source or pulse generator, for example, is received by input lines X and Y and a grid resistor R is provided for controlling the bias on grid G of electronic tube E while B represents a battery or power source for the plate P of the tube E. Other sources of voltage will be provided for circuits 19 and 20.

Transformers Ta, Tb, and Tc are used conveniently and each has respectively a primary in the circuits 18, 19, and 20. The transformers for transferring or coupling the voltages provide a simple and effective means from circuits 18, 19, and 20 to the conductor energizing circuits and to this end the secondaries of these transformers are connected to the conductor energizing circuits. By using transformers, the secondaries may be readily placed in series by lines, as 21 and 22, and yet the conductor energizing circuits operate generally independently but simultaneously. The conductor energizing circuits include the secondary of transformer Ta, line 18a, vertical delay line 14, and load impedance 16 and line 18b for the short duration pulses from circuit 18; the secondary of trans-

former T_b, line 19a, horizontal delay line 15, load impedance 17 and line 19b for the long duration pulse from 19; the secondary of transformer T_c, line 18b, vertical delay line 14 by way of connecting line 18c, and with horizontal delay line 15, by lines 22, 19b, and 19c.

In Fig. 2, the screen grids or plates are arranged to be relatively adjusted in order to compensate for the voltage decay and provide uniform screen intensity. The screen grid plates are indicated at 30 and 31, in Figs. 1 and 2, and are constructed of a suitable non-conducting material, at least one of which must be transparent. They are shown of substantial thickness and generally square but may take any suitable shape, and, in practice, will be formed of relatively thin sheet material.

Plate 30 is provided with a front face 32 and a rear face 33. Plate 31 has a front face 34 and a rear face 35. Plates 30 and 31 are maintained in opposed face-to-face relationship through spring clamping means comprising spring 36 and spring holding lugs 37 and 38, said spring holding lugs being secured adjacent each corner on the front faces of grids 30 and 31 and extending outwardly therefrom. To the outwardly extended end portion of each of the lugs 37 and 38 is attached one end of spring 36, maintaining the grids in compressive pressure and in the desired opposed face-to-face relationship. Adjusting means is obtained through spacer bolts 39 preferably screw threaded through one of the front faces of the plates 30 or 31 adjacent its corners, the end of said spacer bolt abutting the rear face of one of said plates. Turning spacer bolt 39 in a clockwise direction overcomes the compressive pressure of spring 36 and increases the distance between the rear faces 33 and 35 of plates 30 and 31 resulting in a decrease of intensity of the screen around that corner. The spacer bolts provide adjusting means for varying distances between the rear faces of the plates at any of the corners and are of sufficient length to allow for adjustment of distances at points d_1 , d_2 , d_3 , and d_4 .

By way of explanation of the function of the screen of Fig. 2, assuming the value of the voltages from each circuit 18 and 19 to be 200 and that the voltages drop in travelling from the first to last conductor of each group to be 10 volts then the total voltage applied to the intersection of conductors 12_j and 13_j will be 380 volts. The decay in voltage will be progressive and in a direction from the upper left hand area of the screen toward the lower right hand area as viewed in Fig. 1. By increasing the spacing d_2 in the upper left hand area, the in-

tensity in this area can be made to approach or equal that of the area in the lower right area adjacent the spacing d_1 . The spacings d_3 and d_4 will be adjusted accordingly in order to provide rigidity to the grid plates and to maintain the spacing d_2 at the desired value. It will be apparent that the intensity along a diagonal connecting the spacings d_2 and d_1 will be generally equalized since the linear decay of the scanning voltage in that direction is compensated by the progressive linear decrease in distance between the conductor groups.

What is claimed is:

1. Apparatus for an electronic picture display which comprises a screen formed of a pair of grid plates, one of said plates supporting a first group of spaced conductors on its front face and the other of said plates supporting a second group of spaced conductors on its front face, said plates being relatively disposed with their rear faces in opposed relationship and with the conductors of said first group generally perpendicular to the conductors of said second group, spring clamping means for urging the rear faces of said grid plates toward each other in abutting relationship and other means opposing said spring clamping means for adjusting the spacing between adjacent edges of said grid plates.

2. Apparatus for an electronic picture display which comprises a screen formed of a pair of rectangular grid plates, one of said plates supporting a first group of spaced conductors on its front face and the other of said plates supporting a second group of spaced conductors on its front face, said plates being relatively disposed with their rear faces in opposed relationship and with the conductors of said first group generally perpendicular to the conductors of said second group, independent spring clamping means for adjacent edges of the plates for maintaining the plates in abutting relationship and other means opposing each of said spring clamping means for independently adjusting the spacing between selected edges of the plates.

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