Dec. 5, 1961 A. M. SKELLETT 3,012,095

ELECTROLUMINESCENT DISPLAY PANEL AND ACTUATING MEANS THEREFOR

Filed April 12, 1957 4 Sheets-Sheet 1

Fig. 1.

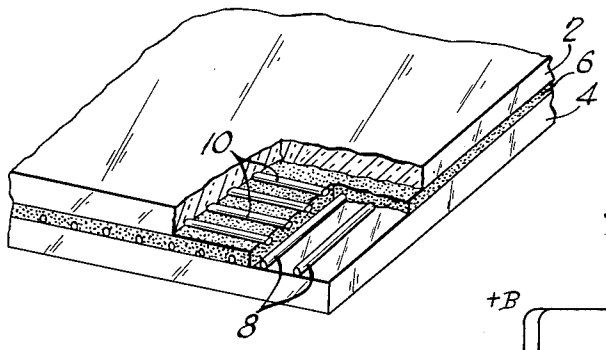


Fig. 2.

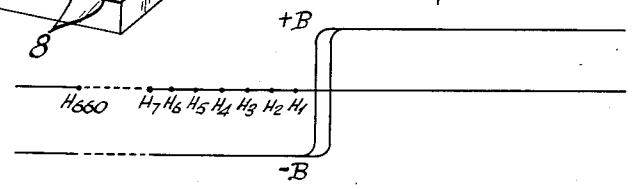


Fig. 3.

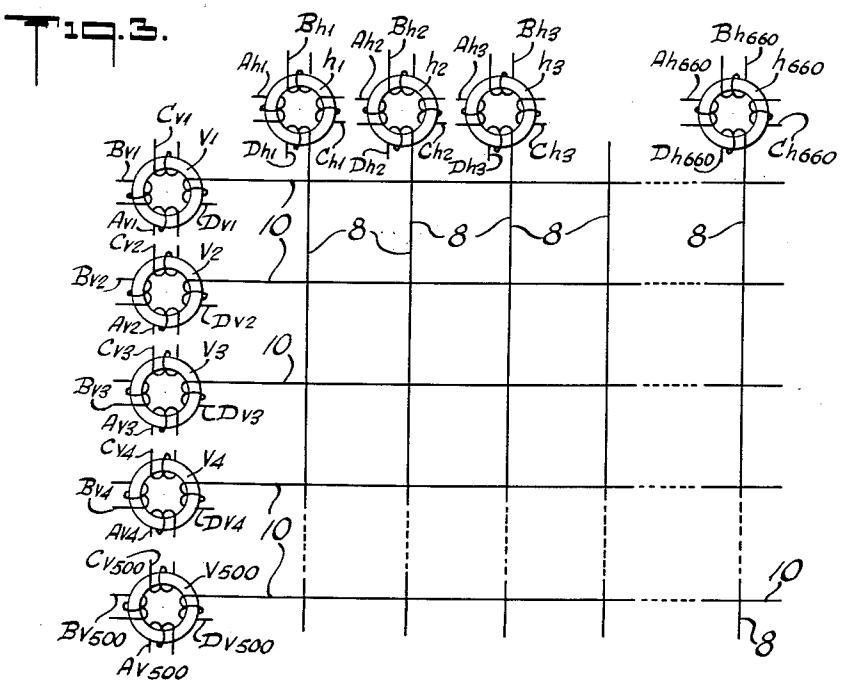
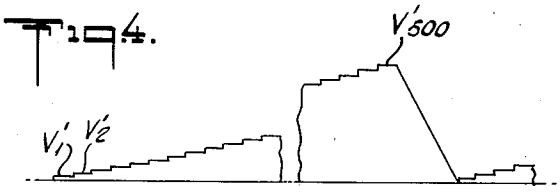


Fig. 4.



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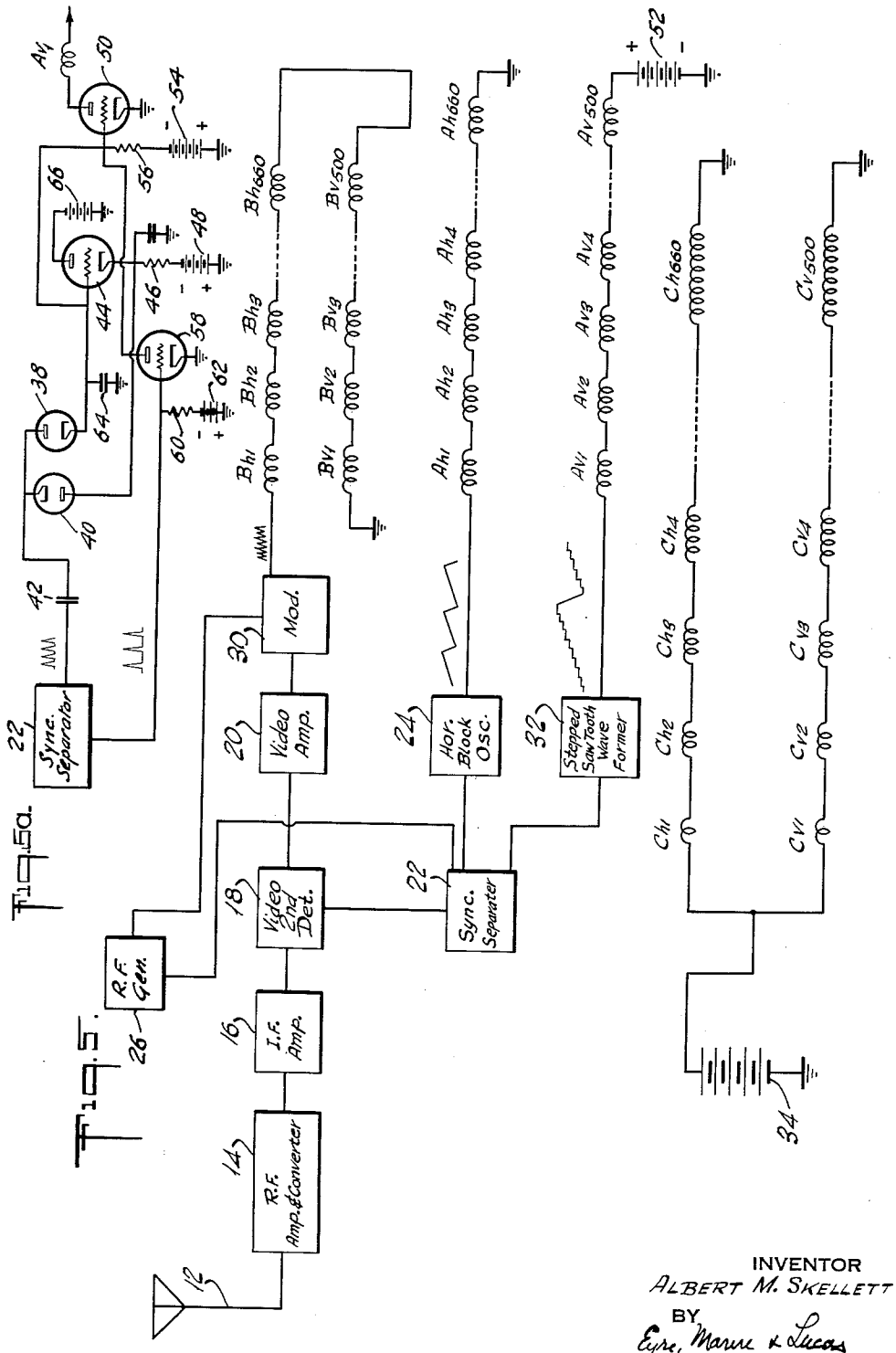


Fig. 5a.

Fig. 5.

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ELECTROLUMINESCENT DISPLAY PANEL AND ACTUATING MEANS THEREFOR

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Fig. 6.

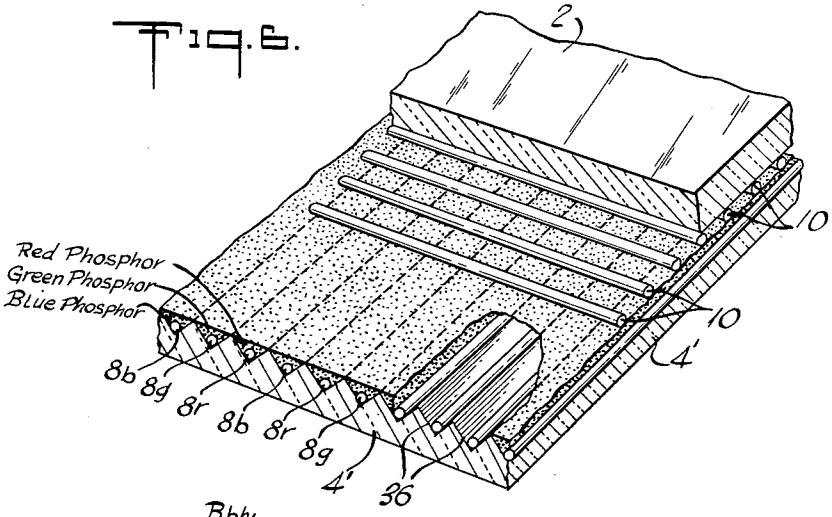
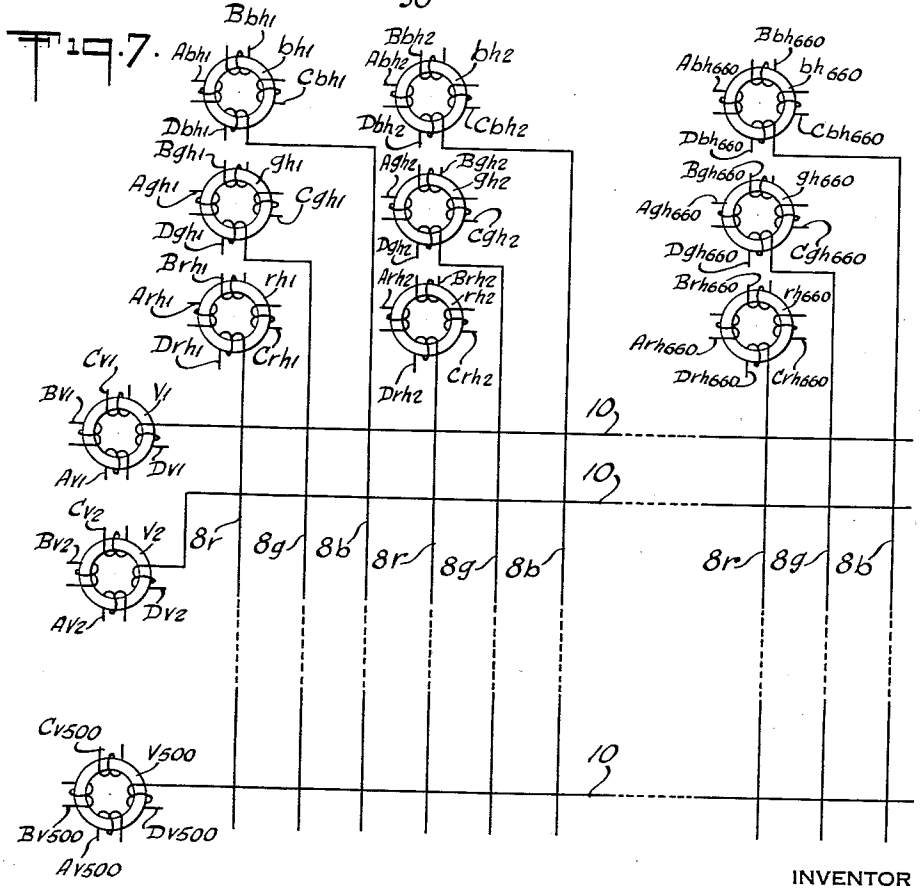


Fig. 7.



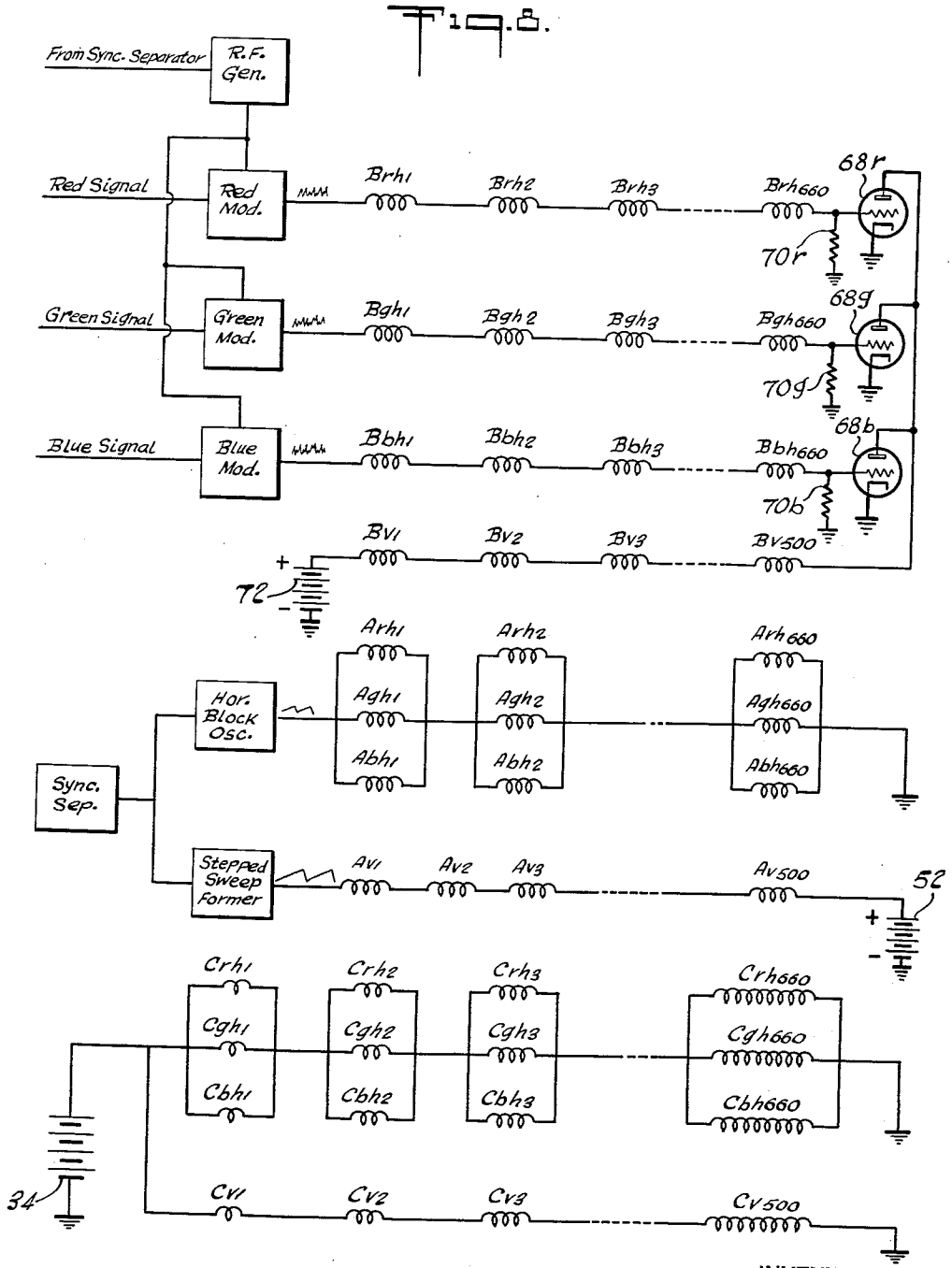
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Fig. 8.



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United States Patent Office 3,012,095 Patented Dec. 5, 1961

3,012,095

ELECTROLUMINESCENT DISPLAY PANEL AND ACTUATING MEANS THEREFOR

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Filed Apr. 12, 1957, Ser. No. 652,485
7 Claims. (Cl. 178—5.4)

The present invention relates to electroluminescent devices and comprises a novel electroluminescent display panel and actuating means therefor adapted for control by received video signals.

Electroluminescent cells are now well known in the art. One type comprises a phosphor layer interposed between sheet electrodes of which one is transparent. In another type the phosphor layer is interposed between wire grid electrodes oriented at right angles to each other. The panel of the present invention is of the latter type.

When an alternating voltage of sufficient magnitude is applied between one wire of one grid electrode and one wire of the other grid electrode, a strong electric field is produced in the phosphor where the grid wires cross. Consequently a spot of light appears at this point of the panel. If the voltages are in the proper range, only such spot will glow.

The present invention provides means responsive to received video signals for so selectively energizing the wires of the grid electrodes of such an electroluminescent panel as to produce television images thereon. In accordance with the invention a small saturable core transformer is associated with each grid wire. The transformers associated with each set of grid wires are progressively biased so that when a saw toothed voltage wave derived from synch pulses and creating an opposing magnetic field is applied to series connected windings thereon the cores will experience, in sequence, reversal in magnetic flux. During such flux reversal high frequency voltage modulated by the video signal is induced into the associated grid wire. For control of one set of grid wires, those corresponding to horizontal sweep of the television image, a saw tooth wave derived from horizontal synch pulses is applied to windings of the saturable core transformer. For control of the set of grid wires corresponding to the vertical trace of the image, a stepped saw tooth wave derived from both the vertical and horizontal synch pulses is applied to windings of the saturable core transformers.

For a better understanding of the invention and of specific features thereof, reference may be had to the accompanying drawings of which:

FIG. 1 is a perspective view, partly broken away, and on an exaggerated scale, of an electroluminescent panel suitable for use in the invention;

FIG. 2 is a diagram of a hysteresis loop typical of saturable core transformers used in the invention;

FIG. 3 is a diagrammatic layout showing the grid wires of the electrodes of the electroluminescent panel and the saturable core transformers associated therewith;

FIG. 4 is a representation of a saw tooth wave for control of the vertical sweep of the reproduced television image;

FIG. 5 is a diagram showing the energizing circuits for the various windings of the saturable core transformers;

FIG. 5*a* is a diagram of one suitable circuit for the stepped saw tooth wave former of FIG. 5;

FIG. 6 is a view similar to FIG. 1 of an electroluminescent display panel suitable for use in response to color television signals;

FIG. 7 is a diagrammatic layout similar to FIG. 3 but showing the grid wires of the panel of FIG. 6 and the saturable core transformers associated therewith; and

FIG. 8 is a partial circuit diagram showing the energizing circuits for the windings of the transformers of FIG. 7.

The general construction of electroluminescent panel for display of black and white or monochrome television images in accordance with the invention is shown in FIG. 1. The panel comprises outer sheets **2** and **4** of glass or other suitable transparent insulating material and an intermediate layer **6** of phosphor in which are embedded two sets of wires **8** and **10**. The sets of wires **8** and **10** are oriented at right angles to each other and are electrically insulated from each other. The elements of the panel of FIG. 1 of the drawings are shown out of proportion for purposes of clarity. In physical dimensions the whole panel may be about 3 x 4 feet in area, of a thickness of less than an inch and with very small wires forming the grids. For purposes of reproducing television images there would be, for example, 660 wires **8**, corresponding to the horizontal trace of an image and 500 wires **10** for the vertical trace. When the panel is disposed with its layers in vertical planes, the wires **8** are disposed vertically and the wires **10** horizontally as shown in FIG. 3. The wires may be, and preferably are, applied by any known technique directly on the glass sheets **2** and **4**, or as illustrated in FIG. 1, the wires may be separate wires of circular cross section, or they may be transparent ribbons.

Associated with each vertical wire **8** is a small saturable core h_1, h_2, h_3, etc., and associated with each horizontal wire **10** is a similar core v_1, v_2, v_3, etc. The cores are preferably of nickel-iron alloy having a narrow rectangular hysteresis loop of the type shown in FIG. 2. Examples of suitable core material commercially obtainable are Deltamax, 4–79 Mo-Permalloy and Supermalloy. These alloys contain, in addition to nickel and iron, a small percentage of molybdenum and a trace of manganese. Each of the *h* and *v* cores carries four windings. These windings are indicated by the letters A, B, C and D with accompanying symbols to indicate whether the winding is on a core instrumental in forming the horizontal or the vertical sweep of the image and also to indicate which one of the grid wires is associated therewith. For example, coil Dh_1 is connected to the extreme left hand vertical wire; coil Dh_2 is connected with the next vertical wire **8** and so on; coil Dv_1 is connected to the uppermost horizontal wire **10**; coil Dv_2 is connected to the next lower horizontal wire **10**. The C*h* coils provide a progressive bias to the cores associated with the vertical wires **8** and similarly the C*v* coils provide progressive bias starting from the uppermost down to the lowermost for the cores associated with the horizontal wires **10**. The A*h* coils are energized by saw tooth waves synchronized with the horizontal sweep of a television image receiving set and the A*v* coils are energized by a stepped saw tooth wave synchronized with the vertical sweep of the television image. All the B coils are energized by high frequency currents modulated by the video signals.

If the *h* transformers or cores associated with the vertical lines **8** are first considered in connection with the hysteresis loop of FIG. 2 it will be apparent that if the biasing current delivered to winding Ch_1 is such as to provide a magnetic field indicated by H_1 on the graph of FIG. 2 the core will be negatively saturated and no voltages of substantial magnitude will be induced in the winding Dh_1 when the high frequency modulated current is supplied to winding Bh_1. If now a saw tooth wave is applied to the winding Ah_1, as the current builds up, the field H_1 is neutralized and when the magnetic field in the core due to the saw tooth wave equals that due to the bias current in coil Ch_1 the core changes rapidly from negative saturation to positive saturation. During the time interval of this transition the unit acts as a trans-

former and passes the high frequency on to the first vertical wire 8. Upon reaching positive saturation the core becomes again blocked and passes no high frequency current to the vertical wire. The field created by the biasing current to coil Ch_2 is stronger than that created by coil Ch_1 and is indicated in FIG. 2 as H_2. As the scanning saw tooth wave reaches a value sufficient to counteract the field H_2 in core h_2 this transformer in turn changes or "flips" to positive saturation giving a time interval during which a pulse of high frequency energy is transmitted to the second wire 8. Similarly each of the cores h_3, h_4, h_5, etc., flips from negative to positive saturation when the respective biasing fields H_3, H_4, H_5, etc., are overcome by the opposing field set up by the saw tooth wave. Upon completion of each cycle of the saw tooth wave with the successive energization of the wires 8, retrace occurs during which time the cores flip back to negative saturation under the influence of the biasing currents in the Ch coils. During retrace the blanking pulses in the video signal blocks the high frequency voltage thereby avoiding illumination of the entire panel.

During the time each of the vertical wires successively receives a pulse of high frequency modulated voltage as above described, one of the horizontal wires 10 under control of the associated core v_1 or v_2 or v_3 etc., is energized from the high frequency modulated source. The v cores are biased similarly to the cores with the bias increased from the upper to the lower v core. The saw tooth wave which is supplied to the Av coils differs however, from that applied to the Ah coils not only in frequency but in form. Each horizontal wire 10 must be energized throughout an entire horizontal trace and therefore the saw tooth wave applied to the Cv coils is formed with a number of horizontal steps corresponding in number to the number of h cores. In FIG. 4 such type of saw tooth wave is indicated diagrammatically. When the current in coil Cv_1 reaches the first step indicated at V'_1 the biasing field created in core v_1 by coil Cv_1 is neutralized, bringing the core to the operating point on its hysteresis loop. This current level is maintained for a length of time sufficient to maintain core v_1 in operating condition throughout the entire sequence of flipping of the h cores. During retrace of the horizontal scanning the current of the saw tooth wave approaches and reaches the second step V'_2. The field in core v_2 is then neutralized so that this core acts as a transformer to pass high frequency energy to the second line 10. Thus the system operates to maintain the video signal on the upper line 10 during successive applications of the signal to the vertical lines 8, then to apply the signal to the second horizontal line 10 during the next application of the signal to the vertical lines 8 and so on for each horizontal line. When the stepped saw tooth wave passes its peak, vertical retrace occurs during which time the v scores revert to their initial biased condition, the high frequency energy is blanked, and the cores of the panel are in condition for the next scanning of the image.

Thus the entire panel is effectively scanned and a television image is reproduced by the bursts of light arising at the cross over points of the vertical and horizontal wires when subjected to the electrostatic field set up in the conductors. The Dh and Dv windings are so arranged that the high frequency current carrying the video signals are 180° out of phase in order that sufficient voltage will be obtained at the crossover points to insure luminosity of the phosphor. The particular phosphor employed in the panel is preferably one which does not luminesce at applied voltages below a fixed threshold voltage and has a relatively steep increase in light output with increase in voltage above the threshold value. With such type of phosphor the light at points displaced from the actual crossover point of the energized wires will be negligible and luminosity will vary with the video signal. Typical suitable phosphors are zinc sulfide activated with copper, zinc fluoride activated with manganese.

In FIG. 5 one circuit arrangement for the various windings of the h and v transformers is indicated. Conventional parts of a television receiver are indicated as a receiving antenna 12, radio frequency amplifier and converter 14, intermediate frequency amplifier 16, video second detector 18, video amplifier 20, synch separator 22 and horizontal blocking oscillator 24. A high frequency generator, indicated at 26, is intermittently blocked by synch pulses. The output of generator 26 is modulated at 30 with signals from the video amplifier 20 and the output of the modulator is impressed across the series connected Bh and Bv windings of the saturable core transformers. The output of the blocking oscillator 24, being a saw tooth wave of horizontal sweep frequency, is applied to the Ah coils all of which are serially connected. Connected between the serially connected Av coils and the synch separator 22 is a circuit indicated in box form at 32 for converting the synch pulses to a stepped saw tooth wave of the vertical frequency and of the shape indicated in FIG. 4. The unit indicated at 32 may be any one of a number of known circuits. One such circuit is shown in FIG. 5*a*.

The anode of one diode 38 and the cathode of a second diode 40 are connected together for reception through a capacitor 42 of horizontal pulses from the synch separator 22. The cathode of diode 38 is connected to the grid of a triode 44 the cathode of which is negatively biased through a resistor 46 by a battery 48. The anode of diode 40 is connected to the cathode of triode 44. The cathode of diode 38 is also connected to this grid of a second triode 50 in the anode circuit of which are the series connected to Av coils and voltage source 52 (see FIG. 5). The grid of triode 50 is negatively biased by a battery 54 the negative terminal of which is connected to the grid of that triode through a resistor 56. A third triode 58 has its anode tied to the grid of triode 50, its cathode grounded and its control grid negatively biased through a resistor 60 by a battery 62. The control grid of triode 58 is also connected to the synch separator 22 for reception of vertical pulses therefrom. A capacitor 64 which is incrementally positively charged through diode 38 by the horizontal pulses and discharged through triode 58 upon application of a vertical pulse to the grid of that normally blocked triode, is connected between the cathode of diode 38 and ground. A battery 66 provides energizing potential for the anode of triode 44. Thus, in the intervals between vertical pulses the current through triode 50 and the Av coils increases with each horizontal pulse and falls off abruptly upon occurrence of a vertical pulse in accordance with the wave form diagrammatically indicated in FIGS. 4 and 5.

The stepped bias of the coils Ch_1, Ch_2, etc., and Cv_1, Cv_2, etc., may be provided by progressive increase in the number of turns of the respective windings or by progressive increase in the voltage applied to the successive windings. In the circuit of FIG. 5 the first alternative arrangement is employed. The Ch coils have increasing number of turns and are connected across a source 34 of direct current. Similarly the Cv coils have increasing numbers of turns and are connected across the source 34.

When the new television image reproducing device of the invention comprises the single panel of FIG. 1 monochrome or black and white images are reproduced. For reproduction in color three similar panels may be provided each with a different colored phosphor and controlled by the color separation signals of a color television receiver. Preferably, however, for color reproduction, the system now to be described in connection with FIGS. 6, 7 and 8 is employed.

FIG. 6 represents a panel suitable for use for color television display. The panel of FIG. 6 differs from that of FIG. 1 in that one of the outer sheets of glass or other suitable transparent insulating material, specifically

sheet 4' in FIG. 6, is provided with a plurality of grooves or serrations **36** within which are the vertically disposed wires or electrodes for the horizontal sweep. These are identified as **8***r*, **8***g* and **8***b*. Wires **8***r* are energized in response to a red video signal, wire **8***g* in response to a green video signal and wire **8***b* in response to a blue video signal. In the grooves within which are disposed the wires **8***r* is a red phosphor, such as zinc sulfide activated with manganese. In the grooves occupied by the wires **8***g* is a green phosphor, for example, zinc sulfide activated with copper and manganese and in the grooves occupied by the wires **8***b* is a blue phosphor, for example, zinc sulfide activated with copper. Horizontally disposed wires **10** are positioned over the grooves **36** and extend, as in the panel of FIG. 1, at right angles to the wires **8***r*, **8***g* and **8***b*. The outer plate of transparent insulating material **2** is disposed over the wires **10**.

The circuit connections for the two sets of wires of the panel of FIG. 6 are shown in FIG. 7 and the energizing circuits for the windings of the saturable core transformers are shown in FIG. 8. The horizontally disposed wires **10** are coupled to the D*v* coils of the saturable core transformers v_1, v_2 etc. controlled by the vertical sweep of the image as in the system of FIG. 3. The vertical wires **8***r*, **8***g*, and **8***b*, responsive to the horizontal sweep, are connected to D windings on saturable transformers h_1, h_2, h_3, etc., as in the system of FIG. 3 except that there are three times as many *h* cores to accommodate the three different colors. The cores associated with the red video signal are identified as *rh* cores, those associated with the green video signal and controlling energization of the **8***g* wires are identified as *gh* cores and the cores controlled by the blue video signal are identified as *bh* cores. Thus wire **8***r* at the left side of the diagram of FIG. 7 is connected to winding Drh_1 on core rh_1, wire **8***g* is connected to winding Dgh_1 on core gh_1 and wire **8***b* is connected to winding Dbh_1 on core bh_1. Similarly the second group of vertical wires is connected to the D windings of cores bh_2, gh_2, and rh_2. As in the system of FIG. 3 the B*h* windings are energized by radio frequency energy modulated by the video signal, the B*rh* coils being energized by the radio frequency energy modulated with the red video signal, the B*gh* coils being energized by radio frequency energy modulated with the green video signal and the B*bh* coils being energized with radio frequency energy modulated by the blue video signal. Isolating triodes **68***r*, **68***g*, and **68***b* confine the color signals to the appropriate B*h* coils. The grid of triode **68***r* is connected to the junction of a terminating resistor **70***r* with the end of the line containing the series connected B*rh* coils, the grid of triode **68***g* is connected to the junction of a terminating resistor **70***g* with the end of the line containing the series connected B*gh* coils and the grid of triode **68***b* is connected to the junction of a terminating resistor **70***b* with the end of the line containing the series connected B*bh* coils. The cathodes of triodes **68***r*, **68***g* and **68***b* are grounded and the anodes thereof are connected together and to the positive terminal of a source **72** of operating energy through the series connected B*v* coils. The A*h* coils, as in the case of the circuit of FIG. 3, are energized by the saw tooth wave from the horizontal blocking oscillator, the three A*h* coils at each location being simultaneously energized as shown in the circuit of FIG. 8. The circuit of the A*v* coils is the same as in FIG. 3. The C*h* coils as in the circuit of FIG. 3 are progressively biased, except that the C*h* coils of each location are subjected to equal bias current.

The operation of the system of FIGS. 6, 7 and 8, being substantially identical with that heretofore described in connection with FIGS. 3 and 5 will be apparent. Assume that only the red video signal is present at the beginning of a scanning operation. A voltage will be applied to wire **8***r* when the current through winding Arh_1 overcomes the bias imposed by winding Crh_1 and to the upper wire **10** when the current through coil Av_1 is sufficient to overcome the bias imposed by coil Cv_1. Accordingly a spot of red light will appear at the crossover of wire **8***r* with the upper horizontal wire **10**. Neither of the wires **8***g* or **8***b* associated with the h_1 cores will be energized because of the absence of the green and blue video signals. If the red video signal alone persists a further red dot will appear at the crossover of the next **8***r* wire with the horizontal wire **10** when the biases introduced by coils Crh_2 and Cv_1 are overcome by the currents through Arh_2 and Av_1 respectively. After the first horizontal line is thus scanned, scanning of the succeeding lines will be effected as heretofore described in connection with the embodiment of the invention illustrated in FIGS. 1 to 5.

The invention has now been described with reference to two embodiments thereof. It will be apparent that the saturable core transformers together with the controlling circuits therefor which cause sequential flipping of the cores from saturation in one direction to saturation in the other direction make possible conversion of received television signals to an image on an electroluminescent screen without the intermediary of a cathode ray tube. Various changes in the particular circuits will be apparent to those skilled in the art.

The following is claimed:

1. The combination with an electroluminescent panel having two sets of mutually perpendicular wires as electrodes thereof, of a plurality of saturable core transformers, one coupled to each wire, means for magnetically saturating each transformer core, means for selectively reversing the direction of saturation of the cores associated with the wires of one set, means for selectively reversing the direction of saturation of the cores associated with the wires of the other set, a source of signal voltage coupled to each core, each transformer, during reversal of saturation of its core and only during such reversal, inducing signal voltage into the wire coupled to the core thereof whereby during reversal of saturation of the core associated with a wire of one set and of a core associated with a wire of the other set, the panel will be illuminated at a crossover point of said last mentioned wires with an intensity dependent upon the signal voltage, each core having four windings thereon, a first winding connected to a wire electrode, a second winding for carrying bias direct current to saturate the core in one direction, a third winding for carrying high frequency signal modulated current and a fourth winding for carrying a saw tooth direct current for creating a magnetic field in opposition to that created by current in the second winding, said fourth windings of the cores associated with each set of wire electrodes being connected in series whereby when bias current in the second windings of the cores of each set subjects cores to progresively higher magnetic fields, a saw tooth current in said fourth windings successively equalizes and overcomes the biasing fields to cause sequential reversal of direction of saturation thereof, each core, during reversal of saturation, acting as a transformer to induce signal modulated high frequency voltage into the associated wire electrode when the third winding carries signal modulated high frequency current.

2. The combination with an electroluminescent panel having two sets of mutually perpendicular wires as electrodes thereof, of a plurality of saturable core transformers, one coupled to each wire, means for magnetically saturating each transformer core, means for selectively reversing the direction of saturation of the cores associated with the wires of one set, means for selectively reversing the direction of saturation of the cores associated with the wires of the other set, a source of signal voltage coupled to each core, each transformer, during reversal of saturation of its core and only during such reversal, inducing signal voltage into the wire coupled to the core thereof whereby during reversal of saturation of the core associated with a wire of one set and of a

core associated with a wire of the other set, the panel will be illuminated at a cross-over point of said last mentioned wires with an intensity dependent upon the signal voltage, each core having four windings thereon, a first winding connected to a wire electrode, a second winding for carrying bias current to saturate the core in one direction, a third winding for carrying high frequency signal modulated current and a fourth winding for carrying a saw tooth direct current for creating a magnetic field in opposition to that created by current in the second winding, said fourth winding of the cores associated with one set of wire electrodes being connected in series and groups of the fourth windings of the cores associated with the other set of wire electrodes being connected in series whereby when bias current in the second windings of the cores subjects successive cores, the fourth windings of which are connected in series, to progressively higher magnetic fields, and subjects successive groups of the other cores to progressively higher magnetic fields, saw tooth current in said fourth windings successively equalizes and overcomes the biasing fields to cause sequential reversal of direction of saturation of the groups of cores associated with one set of wire electrodes and sequential reversal of direction of saturation of the cores associated with the other set of wire electrodes, each core, during reversal of direction of saturation acting as a transformer to induce signal modulated high frequency voltage into the associated wire electrode when the third winding carries signal modulated high frequency current.

3. A television display system comprising the combination with a television receiving circuit having means for receiving and separating video signals and horizontal and vertical synch pulses of an electroluminescent panel comprising a set of horizontal wire electrodes, a set of vertical wire electrodes and an intervening layer of phosphors, a saturable core transformer associated with each wire electrode, means coupled to the cores of said transformers for magnetically saturating the cores, means coupled to the cores associated with the vertical wire electrodes and responsive to separated horizontal pulses for reversing the direction of magnetic saturation thereof, means coupled to the cores associated with the horizontal wire electrodes and responsive to separated vertical pulses for reversing the direction of magnetic saturation thereof, and means coupling separated video signals to each core for induction into the associated wire electrode by transformer action during reversal of direction of magnetic saturation of such core.

4. The television display system according to claim 4 wherein said receiving circuit includes means for receiving and separating color video signals and wherein said phosphor layer comprises groups of bands of different colored phosphors, each band overlying one vertical wire electrode, and the number of bands in each group corresponding to the number of separated color video signals, said means, coupling separated video signal to each core inducing into the horizontal wire electrodes during reversal of direction of magnetic saturation of the cores associated therewith a voltage varying with the sum of the separated color video signals and into the vertical wire electrodes, during reversal of direction of magnetic saturation of the cores associated therewith, a voltage varying with the separated color video signal corresponding to the color of the overlying phosphor band.

5. The combination with a television receiving circuit having means for receiving and separating video signals and synch pulses, of an electroluminescent panel having a vertical set of wire electrodes and a horizontal set of wire electrodes separated by a layer of phosphor, a saturable core transformer associated with each wire electrode, each core having a first, second, third and fourth winding thereon, the first winding on each of said cores being connected to the associated wire electrode, energizing means connected to the second windings of the cores for magnetically saturating the cores associated with each set of electrode wires in one direction with progressively higher magnetic fields, means for converting separated horizontal synch pulses into a saw tooth current of horizontal sweep frequency and for energizing the fourth winding of the cores associated with the vertical wire electrodes with such current to cause sequential reversal of the direction of saturation of such cores, means for converting separated synch pulses into a stepped saw tooth current of vertical sweep frequency and for energizing the fourth winding of the cores associated with the horizontal wire electrodes with such current to cause sequential reversal of the direction of saturation of such cores, a source of high frequency energy, and means for modulating current from said source with the separated video signals and for energizing the third winding of all of said cores with such modulated current.

6. The combination according to claim 5 wherein the second windings on the cores associated with each set of electrode wires are of a progressively increasing number of turns and are connected in series and wherein said energizing means comprise a source of direct current across which said windings are connected in series.

7. The combination with a color television receiving circuit having means for receiving and separating synch pulses and color video signals, of an electroluminescent panel, said panel comprising a transparent insulating plate having vertically disposed grooves, a wire electrode disposed in each of said grooves, a colored phosphor in each groove overlying the wire electrode, the number and color of the phosphors corresponding in number and color to the color video signals, and the phosphors in adjacent grooves being of different color, a saturable core transformer associated with each wire electrode, each core having a first, second, third and fourth winding thereon, the first winding on each of said cores being connected to the associated wire electrode, energizing means connected to the second windings on the cores associated with the horizontally disposed electrode wires for magnetically saturating the cores in one direction with progressively higher magnetic fields, the second windings of the other cores being also connected to said source for magnetic saturation in one direction with progressively higher magnetic fields for the cores associated with the wire electrodes in the grooves containing the same color phosphor, means for converting separated horizontal synch pulses into a saw tooth curent of horizontal sweep frequency and for energizing the fourth windings of the cores associated with the wire electrodes disposed in said grooves with such current to cause sequential reversal of the direction of saturation of the cores associated with the wire electrodes in the grooves containing the same color phosphor, means for converting separated synch pulses into a stepped saw tooth current of vertical sweep frequency and for energizing the fourth windings of the cores associated with the horizontal wire electrodes with such current to cause sequential reversal of the direction of saturation thereof, a source of high frequency energy and means for separately modulating energy from said source with each of the separated color video signals, means for energizing the third winding of each core associated with a wire electrode disposed in a groove containing one color phosphor with energy from said source modulated with the same color video signal and means fer energizing the third windings of the cores associated with the horizontal wire electrodes with energy from said source modulated with all the color video signals.

References Cited in the file of this patent

UNITED STATES PATENTS

2,595,617	Toulon	May 6, 1952
2,698,915	Piper	Jan. 4, 1955
2,734,187	Rajchman	Feb. 7, 1956
2,904,626	Rajchman et al	Sept. 15, 1959

OTHER REFERENCES

Ser. No. 108,062, Toulou (A.P.C.), published May 18, 1943.