

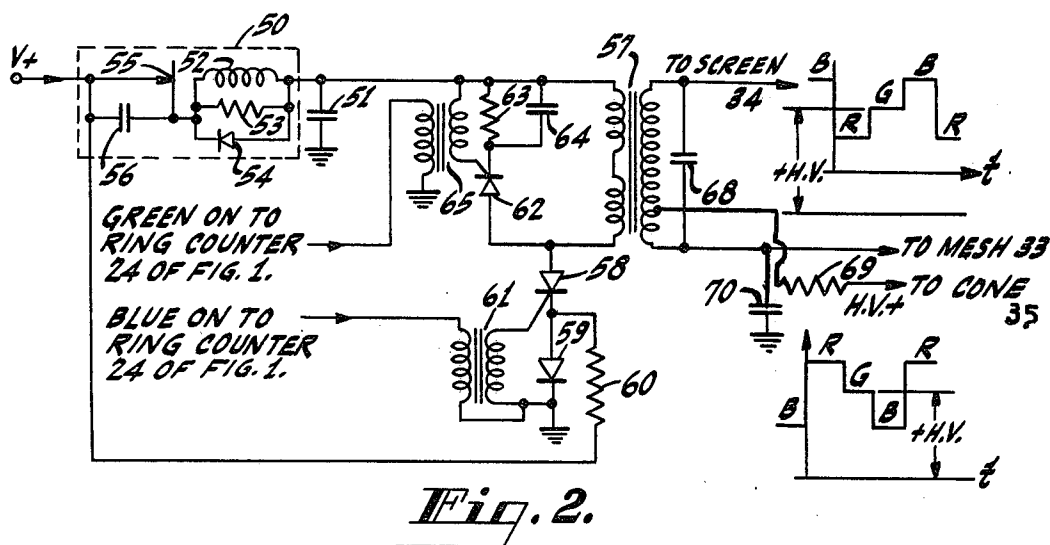
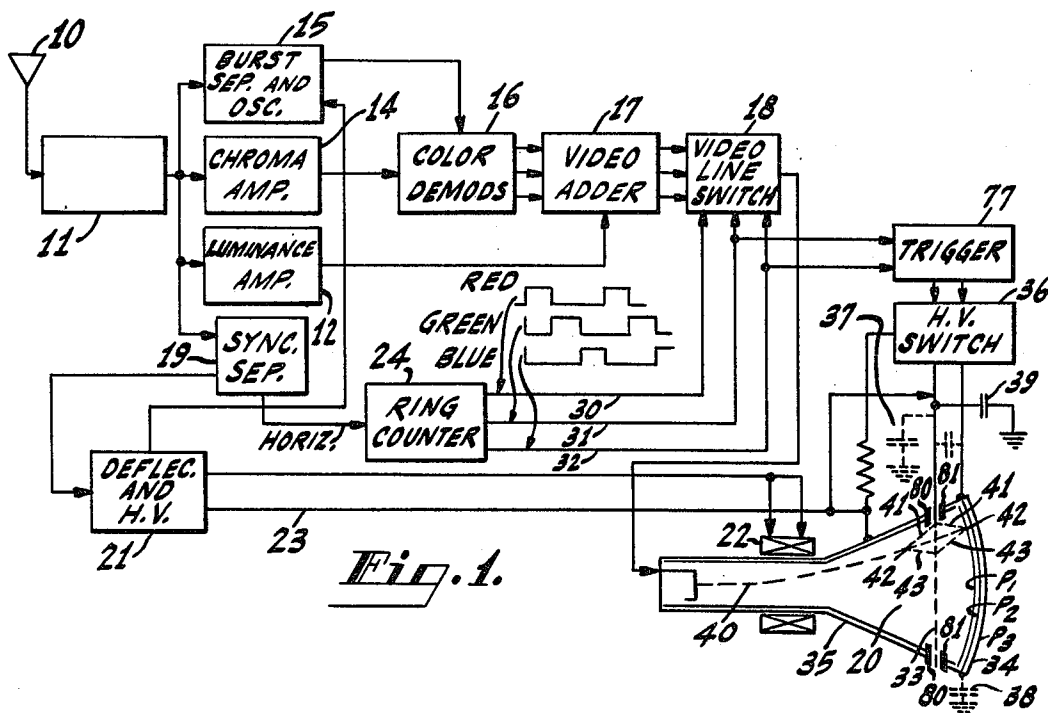
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PENETRATION COLOR DISPLAYS

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PENETRATION COLOR DISPLAYS

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ABSTRACT OF THE DISCLOSURE

A penetration type kinescope has a screen with a plurality of phosphors, each capable of being excited by a different velocity electron beam. An electron beam, generated by a single gun, is focussed on the screen and the beam velocity is controlled by switching the screen between a plurality of different voltage levels corresponding to the excitation of the different phosphors. Registration is provided, in part, by an electron permeable mesh, insulated from the screen and interposed between the screen and the gun, to which is applied a switching signal of a relative magnitude complementary to that of the screen. A conductive coating or funnel coating, insulated from both the screen and the mesh and located on the inside surface of a vacuum confining envelope surrounding the electron gun assembly, is biased at a fixed high voltage level. The biased coating serves to sharply focus or collimate the beam between the gun and mesh to maintain a desired beam shape irrespective of stray magnetic fields and those electric fields caused by the switching waveshapes and associated transients applied to the mesh and screen.

This invention relates to the production of color television images or pictures using penetration target type kinescopes and more particularly to a color television receiver of the type which uses a viewing screen where the color emitted is dependent upon electron beam velocity excitation of one of a plurality of phosphors deposited upon the screen.

Prior art shows that a color picture may be obtained by the use of a kinescope screen having different phosphors deposited thereon in layers, and by selectively exciting a desired layer by velocity modulating an electron beam which scans the screen. Such techniques are compatible with NTSC standards and produce a color picture by selectively exciting different ones of these phosphor layers to produce different colors. The prior art has shown a three electron gun structure, each gun of which is biased with respect to the screen at a suitable high voltage corresponding to the phosphor layer it is to excite. In such three gun configurations the cathode of each gun is biased with respect to the screen to set up a suitable field for accelerating the electrons emitted by a selected cathode in conjunction with a particular phosphor. An apparent disadvantage of such a system is the requirement of three separate electron beam guns.

The prior art also shows a single gun kinescope wherein the voltage at the screen is switched between different high voltage levels to thereby impart different velocities to the single beam, which different velocities correspond to the phosphor or color to be activated. However, a further difficulty which is associated with most of the penetration type kinescope systems, irrespective of the number of guns, is the production of a different size raster due to the different accelerating potentials necessary for each color. This is so because the deflection sensitivity of a typical kinescope is a function of the accelerating potential. For example, in an electrostatic deflection system the deflection is directly proportional to the electric field or voltage on the screen. In a magnetic deflection system the deflection is inversely proportional to the square root

of the voltage. To compensate for this one may have to vary the deflection waveshape and amplitude to correspond to the velocity of the electron beam that produces the required color. This, of course, is difficult to accomplish due to the rapidity of the scan and the changes in color content during the scanning process. Furthermore a sequential color system would require high switching speeds to prevent color flicker or breakup in the circuitry used to change or alter the scanning waveshape.

One manner in which the misregistration problem can be reduced is to provide an electron permeable grid located between the viewing screen and the electron emitting gun, which grid is positioned as close as possible to the screen. A constant voltage is then impressed upon this grid. The biased grid has the effect of shielding the electrons from the varying voltages on the screen when the electrons are in the region between the gun and grid. In such a system, under different accelerating voltages, the trajectories followed by electrons are such as to excite substantially the same picture element on the screen for small deflection angles.

However, even with such approaches there is still a residual amount of misregistration present. Certain improvements may be effected by applying a voltage on the permeable grid which is in synchronism, but 180° out-of-phase with the modulation of the voltage on the screen. As a result electrons in the region between the gun and grid are caused to follow different trajectories in reaching the same picture element on the viewing screen. In this manner the changes in direction of the beam as it passes between the grid and screen and due to the modulation of the screen voltage is compensated for and residual misregistration is further reduced. In a single beam penetration type color kinescope the accelerating potential on the screen is switched between three different high voltage levels typically, from approximately 10 kilovolts for exciting a red phosphor to over 20 kilovolts for exciting a blue phosphor. For such large voltage variations if the beam is not properly focused, between the gun and the permeable grid and if the velocity of the beam in the deflection region is changed the spot size will be poor and therefore the resolution of the picture will decrease. Such effects cause poor picture fidelity and are not corrected any compensating voltages applied to the permeable grid.

It is therefore an object of the present invention to provide an improved penetration type kinescope display with associated circuitry to produce a minimum amount of residual misregistration and good picture fidelity.

A further object is to provide circuitry for reducing residual misregistration in the penetration type kinescope system using a single electron gun.

A further object is to provide an improved circuit for matching the relative deflection of three different velocity electron beams that strike a voltage dependent phosphor screen employed in a penetration type kinescope.

In accordance with an embodiment of the present invention the screen of a penetration type kinescope employs a plurality of superposed phosphors which will produce an associated color under electron bombardment of a suitable velocity electron beam. The kinescope further employs a single gun with a high transmission mesh or electron permeable grid mounted near the phosphor screen. The inside of the glass envelope of the kinescope is coated with a conductive coating referred to as the funnel coating. The funnel coating, mesh, and phosphor screen are electrically separate. The phosphor screen is switched during the horizontal retrace time to the required potential to obtain a desired primary color and in one particular system is maintained at this potential for the entire scan line. The pur-

pose of the mesh and the separate electrical connections to the phosphor screen, mesh and funnel coating is to permit control of the focus, velocity and landing position of the electron beam for the various colors which are being produced. The voltage applied to the screen, as indicated, determines the color of the light emitted. The voltage applied on the funnel coating is held at a relatively high constant voltage to provide a well formed constant velocity electron beam in the deflection region of the kinescope. The funnel coating voltage thereby assures that the focusing action is not influenced when the color is changed while further assuring insensitivity of beam path to stray magnetic fields. The voltage on the mesh is switched according to the voltage on the screen to cause the electron beams corresponding to different colors to achieve coincidence for the plurality of different color rasters on the viewing screen.

Reference is made to the following drawings in which:

FIGURE 1 is a schematic diagram partially in block form of a color television receiver using a single beam penetration type kinescope and associated circuitry according to this invention.

FIGURE 2 is a schematic circuit diagram of a high voltage switching generator for use with this invention.

With reference to FIGURE 1, a receiving antenna 10 for intercepting ratio frequency (R.F.) television signals is coupled to the input section 11 of a television receiver which includes the usual tuner, intermediate frequency (I.F.) amplifier and video detector. The inter-carrier beat between the sound and picture carrier of the television signal are derived from the I.F. amplifier and applied to a sound channel, not shown, for detection of the FM sound signal. The sound signal is applied to a suitable audio amplifier and speaker.

As in a conventional shadow mask type receiver, the composite video signal is applied to an input of a luminance amplifier 12 and a chrominance or chroma amplifier 14. The luminance amplifier which includes a delay line as is known, serves to amplify the relatively wide bandwidth monochrome information contained in the composite signal. The chroma amplifier 14 serves to process a higher frequency but narrower bandwidth signal containing color information in the composite signal pertinent to the production of a color scene.

A burst separator and color oscillator circuit 15 is used to separate and retrieve color bursts which appear on the back porch of a horizontal synchronizing pulse during a color transmission, and which are representative of the phase and frequency of the color reference sub-carrier necessary to retrieve color information. The color bursts are used to synchronize the color oscillator.

One output terminal of the burst separator and oscillator 15 is coupled to an input terminal of the color demodulators 16. Another input terminal of the color demodulators 16 is coupled to the chroma amplifier 14 to receive the amplified chrominance signal. The function of the color demodulators 16 is to demodulate the chrominance information contained in the amplified signal from chroma amplifier 14 and to provide at suitable output terminals of the color demodulators 16 a plurality of color difference signals, such as the R-Y, B-Y and G-Y signals. Techniques to obtain color difference signals may include suitable matrixing networks coupled to the demodulator 16 outputs.

The three color difference outputs from the demodulators 16 are applied to three input terminals of a video adder circuit 17. The adder circuit 17 has a fourth input terminal coupled to the luminance amplifier 12. The function of the adder 17 is to combine the color difference signals with the luminance or Y signal to obtain therefrom three signals representative of the primary colors utilized for producing a color display, namely red, green and blue. The three color signal outputs from the video adder 17 are applied to three separate inputs of a video line switch

18 which drives the cathode electrode of a penetration type kinescope 20.

A sync separator circuit 19 is coupled to receive the composite video signal and functions to separate the synchronizing components from the composite signal. The separated horizontal and vertical synchronizing information is applied to the deflection circuits 21. The deflection circuitry 21, under control of the synchronizing signals, provides vertical and horizontal sweep signals for the yoke 22 to produce a synchronized raster for proper display of the color picture. The deflection circuitry 21 includes suitable high voltage circuitry to produce voltage levels necessary to properly operate the kinescope 20. For example such levels provide suitable magnitude accelerating voltages for the electron beam in order to obtain adequate brightness and optimum phosphor excitation. The lead designated as 23 connects the high voltage circuitry with the kinescope 20.

The circuitry described above may be similar to that used in currently available color television receivers. The receiver of FIGURE 1 additionally includes a ring counter 24 with an input terminal coupled to receive horizontal synchronizing pulses from the sync separator circuitry 19. The ring counter 24 functions to divide the horizontal synchronizing pulses by a factor of three. Examples of ring counters, including binary or bistable flip-flops are shown in a text entitled *Pulse and Digital Circuits*, McGraw-Hill (1956) by Millman and Taub, Chapter 11 entitled "Counters." Three output signals emanating from ring counter 24 and applied to three input terminals of the video line switch 18 are sequentially occurring pulses of equal width with each of the pulse trains having a repetition rate of $\frac{1}{3}$ of the horizontal line rate.

When the ring counter 24 impresses a pulse of one horizontal line duration in the conductor 30, the video line switch 18 is conditioned to pass the signals from the video adder 17, which correspond to the red image. During this interval the signals corresponding to the green and blue images are blocked. The following pulse from the ring counter 24, also of one horizontal line duration is impressed on the conductor 31 to cause the video line switch 18 to pass the green signals. The third pulse, impressed on the conductor 32 enables the video line switch 18 to pass the blue signals. At the fourth pulse the sequence begins again as can be seen from the waveshapes included in FIGURE 1, and designated as red, green and blue. Interline flicker effects may result if the order of color line sequence is not chosen properly when using the normal 525 line interlace scanning system. Fixed line sequence has been found to be relatively free of flicker effects. In the fixed line system the scan lines of the first field alternate as red, green, blue, red, green, blue and so on. The scan lines of the second field also alternate in the same manner and consequently fall in between those of the first field to give color interlace. The resulting line order of the interlace frames will be red, blue, green, red, blue, green and so on. The fixed line sequence system therefore results in approximately 175 lines of each color so that the vertical color resolution is reduced. A coarse line structure particularly in solid areas of red, green and blue is produced unless some method to suppress the line structure is used. However, the reduced vertical resolution of a line sequence color system such a system has not been found to be objectionable in receivers employing a relatively small kinescope.

The kinescope 20 of FIGURE 1 employs a single gun and produces a single electron beam. A high transmission mesh 33 mounted reasonably close to an aluminized phosphor screen 34. The phosphor screen 34 may be a multi layer type screen which contains three different excitable phosphors generally designated as P₁, P₂ and P₃. Examples of suitable screen, phosphors and configurations may be had by referring to United States Patent No. 3,204,143 entitled "Penetration Color Screen, Color Tube and Color Television Receiver" by Dalton H. Pritchard issued on

Aug. 31, 1965. The kinescope 20 further includes a funnel coating 35 located on the inside of the glass envelope or bulb. The funnel coating 35, mesh 33 and phosphor screen 34 are electrically separated by insulating members 80 and 81.

The phosphor screen 34 is connected to one terminal of a high voltage switch 36 whose action is controlled by a suitable trigger circuit 37. The trigger circuit 37 receives two input pulses developed by the ring counter 24, and is responsive to these pulses to cause the high voltage switch 36 to apply the proper voltage level to the phosphor screen 34 compatible with the color signal applied to the cathode of the kinescope. The phosphor screen voltage is switched during the horizontal retrace time and is maintained at a relatively fixed value during the succeeding line scan to obtain the desired primary color.

The mesh 33 generally is used to suppress the color fringing that would normally result from switching the screen potential, and provide constant accelerating voltage for the gun. The particular purpose of the mesh 33 and the separate electrical connections to the phosphor screen 34, the mesh 33 and the funnel coating 35 is to permit control of the electron beam velocity and landing position for various colors being produced. The voltage applied to the screen 34 determines the color of the line emitted. The voltage on the cone or funnel coating 35 is obtained from the high voltage lead 23 coupled thereto and is held constant at this level to provide a constant velocity, well formed electron beam in the deflection region of the kinescope 20. The voltage on the mesh 33 is obtained by coupling the mesh to another output terminal of the high voltage switch 36 and is used to modify the beam to prevent color fringing or to obtain convergence of the three color rasters. An electron beam 40, emanating from the cathode electrode of the kinescope 20 is shown to follow one of three different paths from a position just prior to the mesh 33 to a particular landing position on the screen.

The screen 34 is switched sequentially from a first voltage to a second voltage to a third voltage ranging from about 10 kv. to over 30 kv. to energize the red, green and blue phosphors, P₁, P₂ and P₃ respectively. The change in screen voltage causes a change in beam velocity which permits the selective energization of the phosphors. However, as the beam velocity increases, the deflection sensitivity decreases, causing a smaller raster. To compensate for this undesirable effect, the mesh 33 is modulated with a complementary voltage. For red signals, the lowest voltage is applied to the screen 34 and the highest to the mesh 33. The electron beam then follows the path 43. For green signals, intermediate voltage values are applied to both the screen 34 and mesh 33. For blue signals, the screen 34 is at the highest voltage and the mesh 33 at the lowest, and the beam follows the path 41. The resultant effect is to modify the beam trajectories as the screen 34 is switched so as to cause the red, blue and green rasters to coincide.

The H.V. switch 36, as will be explained subsequently functions to provide the three levels of voltage to the screen 34 and the required levels to the mesh 33. The output voltage from the high voltage generator 36 is divided by a suitable factor formed in part by the stray screen capacity 38 to ground and the parallel combination of the stray mesh and H.V. switch 36 shunt capacity 37 to ground. A capacitor 39 is then selected and coupled between the mesh electrode 33 and ground to determine the exact voltage division ratio for application of the proper magnitude signal to the mesh 33 with respect to the screen 34.

The above described system of deflection control permits improved kinescope registration because of the maintenance of the electron beam, due to the voltage on the cone of the kinescope, as a well formed small diameter beam, plus providing insensitivity of the beam to stray magnetic fields of normally expected intensities.

Referring to FIGURE 2 there is shown a high voltage generator for providing the three level high voltage switching waveforms for the screen 34 and mesh 33 of the kinescope 20 shown in FIGURE 1.

An overload relay 50 and associated components is connected in series with a silicon controlled rectifier or thyristor triggering circuit. The overload relay 50 includes a relay coil 52 having a terminal connected to one arm of the normally opened contacts 55 of the relay. The other arm of the contacts 55 is coupled to the +V supply. A current sensitivity adjustment resistor 53 is coupled across the coil 52, as is a diode 54, used to limit the amplitude of voltage transients across the coil when current is interrupted therethrough. Capacitor 56 serves to protect the relay contact 55 against voltage surges.

The output of the V+ supply is filtered by capacitor 51 connected between a terminal of the relay coil 52 and ground. The V+ voltage is applied through the primary winding of a transformer 57 to the anode of a silicon controlled rectifier or S.C.R. 58. A semiconductor diode 59 having its anode coupled to the cathode of S.C.R. 58 provides a return path to ground. The junction formed between the anode of diode 59 and the cathode of S.C.R. 58 is returned to the +V supply through resistor 60. The gate electrode of S.C.R. 58 is coupled to ground through the secondary winding of a pulse transformer 61, the primary winding of which, has a terminal coupled to ground. The other terminal of the primary winding of transformer 61 is coupled to an output of the ring counter circuit 24 of FIGURE 1, and receives a pulse representative of the start of the blue scan sequence.

A second S.C.R. 62, has an anode electrode coupled to the junction of the anode of S.C.R. 58 and the terminal of the primary winding of transformer 57. The cathode electrode of S.C.R. 62 is coupled through a resistor 63, bypassed by capacitor 64, to the other terminal of the primary winding of transformer 57. S.C.R. 62 and its associated circuitry thus shunts the primary winding of transformer 57. The gate electrode of S.C.R. 62 is coupled through the secondary winding of a pulse transformer 65 to the junction of capacitor 51 and relay coil 52. The primary winding of transformer 65 is coupled between ground and an output of ring counter 24 of FIGURE 1, to receive a pulse during the green scan.

A capacitor 68 is coupled across a voltage stepped up secondary winding of transformer 57. The upper terminal of transformer 57 secondary winding is coupled to the screen electrode 34 of a kinescope 20 of FIGURE 1, while the bottom or lower terminal is coupled to the mesh electrode 33, of the kinescope 20. A high level D.C. voltage is applied to the lower terminal and therefore to the secondary winding of transformer 57 via a resistor 69. The junction between the secondary winding of transformer 57 and capacitor 68 is shunted to ground by a capacitor 70.

Operation of the circuit shown in FIGURE 2 is as follows. S.C.R. 58 is turned on by the application of a trigger pulse from the ring counter to the primary of transformer 61. The trigger pulse is applied to the gate electrode of S.C.R. 58 causing it to conduct through the primary winding of transformer 57 to ground. This action applies +V across the primary winding of transformer 57. The +V level is stepped up at the secondary winding of transformer 57 and capacitor 68 charges to this high voltage level, which level is superimposed upon the +HV coupled via resistor 69 to the secondary tap. When capacitor 68 is fully charged, the primary current decreases to a value less than that required to maintain conduction through the S.C.R. 58 and the S.C.R. 58 becomes an open circuit. The voltage level across capacitor 68 represents the blue excitation voltage which would be applied to the screen electrode of the kinescope. The mesh electrode receives a potential represented by the difference of the voltage across capacitor 68 and that of the +HV supply. This voltage in turn would be divided down by a

suitable dividing network including capacitor 70 at the mesh of the kinescope to provide a compensating voltage thereto, to allow suitable registration of the blue beam.

Capacitor 68 starts to discharge through the secondary winding of transformer 57 as soon as the S.C.R. 58 turns off. About 53 microseconds later, which is approximately the duration of a horizontal line, the discharge current from capacitor 68 saturates the core of the transformer 57. The transformer 57 has a saturable core of substantially square loop material. The discharge time constant of the capacitor 68 and the secondary winding when the core is unsaturated is such as to cause the secondary current to saturate the core in about 53 microseconds.

Due to the saturation the effective inductance of the transformer 57 decreases. The low inductance of the transformer 57 together with the value of capacitor 68 act as a resonant circuit and energy is transferred rapidly from capacitor 68 to the inductance of the secondary winding and back to the capacitor, causing the voltage across capacitor 68 to reverse polarity. As the capacitor voltage reverses polarity the transformer 57 core comes out of saturation, and the discharge time constant is as mentioned above. This state corresponds to the red voltage level applied to the screen electrode 33 of the penetration kinescope 22. The mesh voltage is higher because the voltage across capacitor 68 appears in series aiding with the +HV level.

Charge continues to be transferred from the capacitor 68 to the inductance of the secondary winding of transformer 57, and if the cycle were allowed to continue, the transformer core would saturate and the windings would "switch" inductance to the low value state. However, before this occurs a green trigger pulse is applied from ring counter 24 through transformer 65 to gate S.C.R. 62 into conduction. The charge across capacitor 68 is rapidly transferred to capacitor 64 during the retrace interval via transformer 57. When the transferral of charge is complete, S.C.R. 62 turns off. Charge across capacitor 64 is dissipated in resistor 63. The value of resistor 63 and capacitor 64 are chosen so that the remaining voltage on capacitor 68 is near zero when S.C.R. 62 turns off. This level represents the green scan level which corresponds to +HV applied to the screen of the kinescope and +HV applied to the mesh. The waveshape of the resultant voltages are shown in FIGURE 2, for the screen and mesh. The circuit described requires only one charging cycle for producing the three step waveform instead of two and therefore reduces the power requirement by one half.

The relay 50 is included to prevent damage to the circuit if the secondary of transformer 57 is shorted and S.I.R. 58 cannot be turned off, which would result in damage to S.C.R. 58 and the V+ supply.

The following levels were applied to a penetration kinescope of the type described in FIGURE 1 and operating in a line sequential mode. These voltages provide good registration and brightness associated with the color display for red, green and blue phosphors.

	Screen 34 voltage	Mesh 33 voltage	Funnel 35 voltage
Color:			
Red.....	10.4 kilovolts.....	16.56 kv.....	16 kv.
Green.....	16.0 kilovolts.....	16.00 kv.....	16 kv.
Blue.....	23.4 kilovolts.....	15.26 kv.....	16 kv.

Although the above voltages may vary with the penetration phosphor design the changes in mesh voltage is approximately 10% of the change in screen voltage.

The staircase waveshape generator of FIGURE 2 produced the screen and mesh waveforms at the above voltage levels using the following components.

V+: +200 v. at 150 ma.

Relay 52, and associated contact 55: A410-061650-01 75

Guardian or equivalent, 6 volt coil.

Resistor 53: 27 ohms.

Resistor 60: 15,000 ohms.

Resistor 63: 25 ohms.

Resistor 69: 2,000,000 ohms.

Capacitor 56: .003 microfarads.

Capacitor 64: .18 microfarads.

Capacitor 68: 70 micromicrofarads.

Capacitor 70: 500 micromicrofarads.

Transformer 61 and 65: UTC United Transformer Co. #51 pulse transformer.

Transformer 57: Toroid core G-L Electronics #GL3811-A4012 or equivalent, 100 turns #30 wire primary, 2430 turns 18 sections secondary and 270 turns 2 section tapped between the 2430 turns and 270 turns.

The 20 sections are to minimize voltage stress of the wire insulation between turns of the winding. Complete transformer 57 was operated in oil to minimize the corona and voltage breakdown. The primary is bifilar wound over the insulated nickel alloy type wound core.

S.C.R. 58, 62: 2N689.

Diode 59: 1N3254.

+HV: 16,000 volts.

What is claimed is:

1. A color display device of the penetration type comprising:

(a) an envelope with a neck portion and a funnel portion, the end of said funnel portion defining a viewing area,

(b) a screen on said viewing area comprising a plurality of color phosphors which emit different color light in response to different velocity electron beams,

(c) an electron gun in said neck portion for providing an electron beam to scan said screen,

(d) an electron permeable mesh spaced from and substantially parallel to said screen, the funnel portion of said envelope between said electron gun and said mesh providing a conductive surface, said screen, mesh and conductive surface being insulated from each other, and

(e) means providing electrodes externally to said envelope respectively connected to said screen, mesh and said conductive surface.

2. A color display system of the type employing a penetration kinescope comprising:

(a) an envelope with a neck portion and a funnel portion, the end of said funnel portion defining a viewing area,

(b) a screen on said viewing area comprising a plurality of color phosphors which emit different color light in response to different velocity electron beams,

(c) an electron gun in said neck portion for providing an electron beam to scan said screen,

(d) an electron permeable mesh spaced from and substantially parallel to said screen, the funnel portion of said envelope between said electron gun and said mesh providing a conductive surface, said screen, mesh and conductive surface being insulated from each other, and

(e) means providing electrodes externally to said envelope respectively connected to said screen, mesh and said conductive surface,

(f) deflection means for causing said electron beam to scan a raster of horizontal lines on said screen,

(g) means for generating first and second high voltages each of which is switched at a horizontal line rate between a corresponding plurality of different voltage levels, said first and second high voltages being 180 degrees out-of-phase,

(h) means for applying said first and second high voltages to said screen and mesh electrodes respectively,

(i) means for providing a relatively fixed voltage, and

(j) means for applying said relatively fixed voltage to said electrode for said conductive coating.

3. Apparatus for use in a color display system, comprising:

- (a) a kinescope having a screen constructed and arranged to produce different types of light in response to the velocity of an electron beam, said kinescope including an electron gun for producing a beam of electrons focussed on said screen, and including an enclosure surrounding said gun and contiguous with said screen, said enclosure having a conductive coating on a surface thereof closest to said gun which coating is electrically isolated from said screen, deflection means for causing said beam to define a raster on said screen in response to a signal produced by said deflection means, and a mesh electrically isolated from said coating and said screen and interposed between said screen and said gun,
 - (b) first means coupled to said screen for applying a potential waveshape thereto specifying a plurality of different potential levels for varying the velocity of said electron beam whereby a different type of light is emitted by said screen according to said velocity.
 - (c) second means coupled between said first means and said mesh for applying to said mesh a selected portion of said potential waveshape to cause each of said different velocity beams to impinge upon said screen in a relatively similar area for a given deflection signal,
 - (d) means coupled to said conductive coating for applying a potential thereto of a magnitude substantially equal to one of said potential levels applied to said screen to collimate said electron beam between said gun and said mesh irrespective of the velocity of the same, whereby any deviation of impingement of said beam from said similar area is further compensated for.
4. The television receiver according to claim 3 wherein:
- (a) said second means coupled between said first means and said mesh includes a capacitive divider of a selected magnitude to cause said selected portion of said potential waveshape on said mesh to be of the order of magnitude of one-tenth of that potential waveshape level on said screen.
5. The television receiver according to claim 3 wherein:
- (a) said kinescope screen has a green, red and blue color producing phosphor deposited thereon, each of which is excited by a different velocity electron beam to produce a selected one of said colors.
6. The television receiver according to claim 5 wherein:
- (a) said potential applied to said conductive coating is substantially equal to that potential required by said electron beam as supplied to said screen for exciting said green phosphor.
7. The television receiver according to claim 5 wherein:
- (a) said first means coupled to said screen produces a repetitive potential waveshape having three distinct potential levels, each of which has a duration approximately equal to the duration of one television line.
8. In combination:
- (a) a kinescope having a screen constructed and arranged to produce different color light in response to the velocity of an electron beam, said kinescope including an electron gun for producing a beam of electrons focused on said screen, and including an enclosure surrounding said guns, said enclosure having a conductive coating on a surface thereof closest to said gun, which coating is electrically separated from said screen by a suitable insulating material, an electron permeable mesh interposed between said screen and said coating and electrically separated by insulating means from both said screen and said coating,
 - (b) deflection means coupled to said kinescope for causing said beam of electrons to define a raster on said screen,
 - (c) first means coupled to said screen for sequentially

applying a potential thereto whose magnitude varies according to a desired velocity to be imparted to said electron beam for sequentially producing a different color light,

- (d) second means coupled between said first means and said electron permeable mesh for applying to said mesh a selected portion of said potential and of a polarity determined by said beam velocity, to cause each of said different velocity beams to impinge upon said screen in a relatively similar area for a given output from said deflection means,
- (e) means coupled to said conductive coating for applying a fixed potential thereto of a magnitude substantially equal to one of said potential levels applied to said screen, for focussing said electron beam between said gun and said mesh irrespective of the velocity of the same and of the potentials applied to said screen and mesh, whereby any deviation of impingement of said beam from said similar area is compensated for.

9. In a display system employing a single electron gun, penetration type kinescope, having a screen upon which is deposited a plurality of phosphors, each of which phosphor when excited by a different velocity electron beam produces a different color light, said kinescope being enclosed within a vacuum retaining envelope, said envelope having a conductive coating on the inside surface thereof closest to said gun, said television system including means for biasing said screen at a plurality of different voltage levels to select one of said phosphors by one of said voltage levels imparting a suitable velocity to the electron beam emanating from said gun, in accordance with said selected color or phosphor, and means for deflecting said electron beam to produce a raster on said screen, the combination therewith comprising:

- (a) an electron permeable grid located between said gun and said screen and electrically insulated from said screen and said conductive coating,
- (b) means coupled to said grid for biasing said grid with a varying potential whose magnitude at any one instance is selected to be a fraction of that varying potential applied to said screen, to cause a plurality of different velocity electron beams to impinge upon said screen within substantially the same area on said screen for the same amount of beam deflection,
- (c) means coupled to said conductive coating to bias said coating at a fixed potential whose magnitude is independent of said varying grid voltage and selected according to the magnitude of one of said plurality of voltages applied to said screen for selecting one of said phosphors, to cause said beam to be collimated between said gun and said grid irrespective of the potential on said screen whereby said beam will always impinge upon said screen at substantially the same location within said area irrespective of the velocity of said beam.

10. A light display system comprising:

- (a) a screen construction and arranged to produce different types of light in response to the velocity of an electron beam,
- (b) an electron gun positioned with respect to said screen for producing a beam of electrons focussed on said screen,
- (c) an envelope for enclosing said electron gun and supporting said screen, said envelope containing a conductive coating on a surface thereof closest to said gun which coating is electrically isolated from said screen,
- (d) an electron permeable mesh electrically isolated from said screen and coating and positioned within said envelope between said screen and said gun,
- (e) deflection means positioned with respect to said envelope for deflecting said beam to define a raster on said screen,

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(f) means coupled to said screen and mesh for applying a potential waveshape to said screen specifying a plurality of different potential levels for varying the velocity of said electron beam, whereby a different type of light is emitted by said screen according to said velocity of said beam, said means including means coupled to said mesh for applying to said mesh a selected portion of said potential to cause each of said different velocity beams to impinge upon said screen in a relatively similar area for a given deflection signal,

(g) means coupled to said conductive coating for applying a fixed potential thereto of a magnitude selected to sharply focus said beam between said gun and said mesh to cause said beam to impinge upon a similar location within said similar area irrespective of the velocity of said beam.

11. The system according to claim 10 wherein said means coupled to said screen and mesh includes a capacitive divider coupled between said screen and said mesh including any interelectrode capacitance, therebetween;

said divider being of an impedance magnitude selected to apply a fraction of approximately one tenth of

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the potential level applied to said screen to said mesh.

12. The system according to claim 10 wherein said means coupled to said conductive coating applies a fixed potential thereto of a magnitude substantially equal to one of said different potential levels applied to said screen for varying the velocity of said electron beam, said magnitude of said fixed potential serving to further shield said beam from stray magnetic fields.

References Cited

UNITED STATES PATENTS

2,714,688	8/1955	Reed	315—13
3,204,143	8/1965	Pritchard	315—13
3,284,662	11/1966	Kagan	315—13
3,416,731	12/1968	Matzen	315—13
3,424,939	1/1969	Clingman	315—14

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