

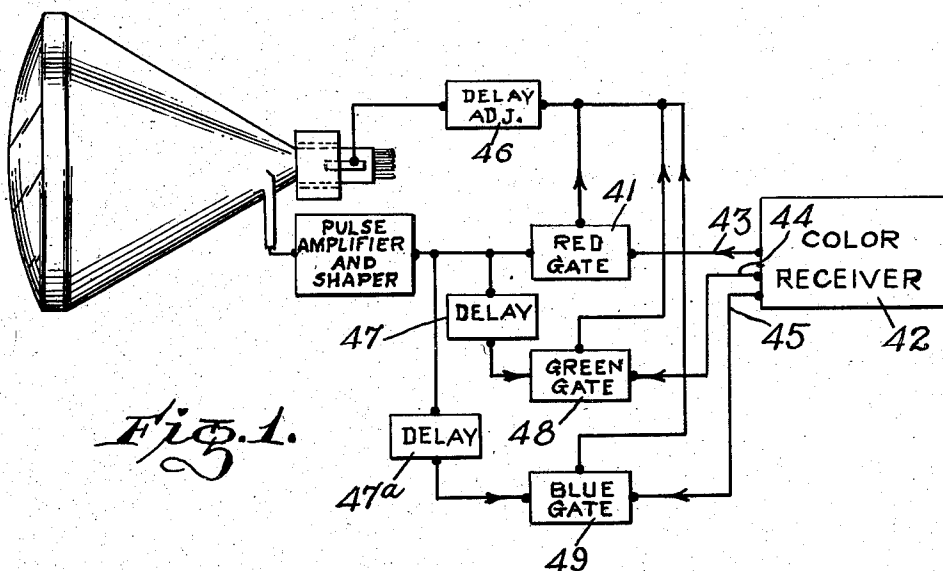
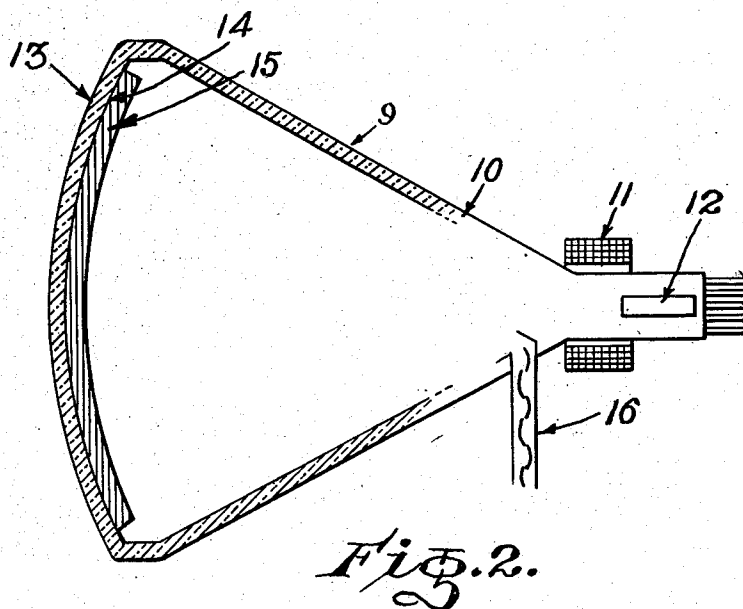
July 28, 1959

D. M. GOODMAN
SYSTEM FOR SELECTED TRANSMISSION, STORAGE, DISPLAY, CODING
OR DECODING OF INFORMATION

2,897,398

Filed Aug. 5, 1954

2 Sheets-Sheet 1



INVENTOR.
David M. Goodman,
BY
A. J. Nydick
ATTORNEY.

July 28, 1959

D. M. GOODMAN
SYSTEM FOR SELECTED TRANSMISSION, STORAGE, DISPLAY, CODING
OR DECODING OF INFORMATION

2,897,398

Filed Aug. 5, 1954

2 Sheets-Sheet 2

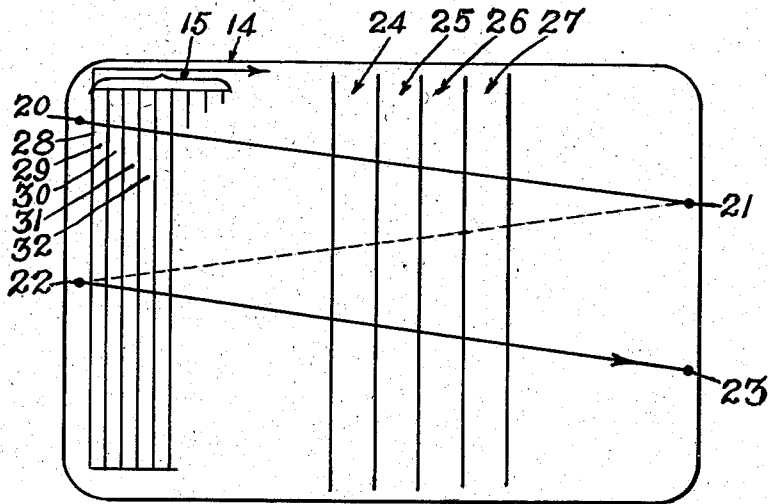


Fig. 3.

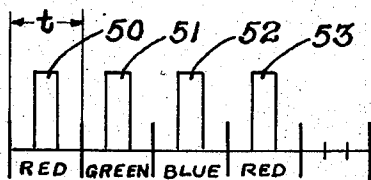


Fig. 4.

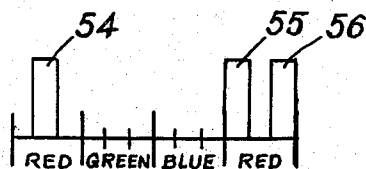


Fig. 5.

INVENTOR.
David M. Goodman,
BY
F. J. Nydick
ATTORNEY.

1

2,897,398

SYSTEM FOR SELECTED TRANSMISSION, STORAGE, DISPLAY, CODING OR DECODING OF INFORMATION

David M. Goodman, Wantagh, N.Y.

Application August 5, 1954, Serial No. 448,039

9 Claims. (Cl. 315—10)

This invention relates to signal producing, reproducing, coding, and decoding and the transmission, reception, display and storage of information. Such a system may be used in color television.

In one of its fundamental aspects, and, accordingly among one of its fundamental objects, this invention provides a system for selected transmission, storage, display, coding and decoding of information by combination of a cathode ray tube or tubes containing or having special phosphor or phosphors with appropriate pickup means responsive to the radiation of said special phosphor or phosphors whereby said radiation is utilized in the control or regulation of the system.

In another of its fundamental aspects and objects, this invention provides a system, as aforesaid, for selected transmission storage, display, coding and decoding of information by combination of a cathode ray tube or a plurality thereof having a special phosphor or plurality of special phosphors with appropriate pickup means responsive to the radiation of said special phosphor and to the decay characteristics thereof whereby said radiation and its decay characteristics are utilized in the control or regulation of the system.

One of the primary objects of this invention is to provide novel terminal equipment for color television systems so as to make more certain the color "purity" and the color "registration" at the viewed kinescope and which simultaneously allows for moderate distortions of the produced image. Although distortion in any sense is undesirable, this invention provides for maintenance of the proper relationships of the various colors to each other in the distorted image, if there be any.

Another object of this invention is to provide a system for accomplishing the aforesaid primary object with a maximum of consistency and reliability, and with a minimum of critical adjustments, components, and circuits, thereby affording a substantial, and desired, improvement over contemporary requirements and accomplishments in television receivers.

Another object of this invention is to provide means for accomplishing the aforesaid objects with inertialess and inexpensive devices requiring but little, if any, auxiliary power.

Another object of this invention is to provide a system as aforesaid having terminal equipment with low capacity, low inductance devices which will not produce appreciable unnecessary radiation. In reducing the natural frequency of the components, this invention permits rapid, flexible responses in any system wherein it is capable of incorporation.

Another object is to provide means for efficiently utilizing the scanned area of the cathode ray tube (hereinafter referred to, for brevity, as the "C.R.T.") and the emission current of the C.R.T. gun.

Another object of this invention is to provide means which allows complete freedom in the selection and relative positions of color and/or black and white sequence in a C.R.T. display.

2

Another object of this invention is to provide means which results in the elimination of high voltage connections and problems associated with deflection systems located near the phosphor screen.

The fundamental concept of this invention resides in providing on the inside face of a C.R.T., one, or a plurality of phosphors that are activated by the focused rays of the gun within the tube in order thereby to generate radiations which are directed to one or more pickup devices or detectors, positioned within the tube, the response thereby created in the pick-up then being applied to appropriate "triggering" or "locking" means for controlling proper sequential impingement of rays fired by the gun, wherein the C.R.T. functions in the decoding process of the video information.

A fuller understanding of this invention and the objects and advantages thereof will become more apparent from the following detailed description thereof taken in connection with the accompanying drawing wherein:

Fig. 1 is a block diagram of an embodiment of this invention.

Fig. 2 is a sectional view of the C.R.T. forming a component of the system illustrated in Fig. 1.

Fig. 3 is a partially expanded illustration of the phosphor screen on the viewed face of the C.R.T. illustrated in Fig. 2.

Fig. 4 is a diagrammatic representation, on a time scale, of the positions of pulses (ideally shaped) in a correctly registered raster being swept at a linear rate.

Fig. 5 is a diagrammatic representation, on a time scale akin to Fig. 4, of pulse positions in a correctly registered raster being swept at a non-linear rate.

In the drawing, the C.R.T. 9 comprises the cathode ray tube envelope 10, a pair of deflection coils 11, and a single gun 12. The location of the high voltage accelerating connection or connections is not critical. The viewed end of the C.R.T. is 13. On the inside surface 14 thereof is a novel phosphor coating 15 which will be described infra. A "detector" 16 is located within the tube as shown, or it may be disposed in concentric fashion with respect to deflection coils 11 (or other suitable deflection means) and the gun structure 12; or in any other suitable disposition that does not interfere with the flow of the electron stream from gun 12 to phosphor face 14 and is not excessively affected by fields associated with the deflection system.

As shown in Fig. 3, the phosphor screen 15 positioned on the inside surface 14 of the kinescope 9, comprises a plurality of individual phosphor strips. A typical television receiver raster deflection is also illustrated, on a magnified scale for clarity, that scans from 20 to 21, that flies back from 21 to 22, that resweeps from 22 to 23, with subsequent repetitions of the scanning cycle. The phosphor strips that constitute 15, are arranged vertically with respect to the normal raster, and are shown on enlarged scales for clarity.

In accordance with known techniques, a colored image is developed from three primary colors, e.g., red, green and blue, presented in proper relationship and magnitude. This is accomplished by appropriate components of screen 15, to wit: phosphor strip 24, the red; strip 25, the green; strip 26, the blue; strip 27, the red again, etc. The composition and the particle sizes of the phosphors to produce the desired colors, the width and spacing of the individual phosphors and other factors are in accordance with known techniques.

In this invention, however, strips of selected color as for example the red, include an additional special phosphor that emits radiation in the invisible portion of the spectrum. Accordingly, when the electron beam in its sweep or scan across the face, as from position 20 to 21, etc., hits phosphor strips 24, the invisible radiation

emitted by the special phosphor component thereof is detected by pick-up 16. This signal may be used as shown in Fig. 1. The special phosphor component of the red strips radiates in the invisible portion of the spectrum so that the detector 16 is responsive to this activation and so that it does not interfere with the image. It is of the rapid decay type i.e. with an appropriate decay time constant, as of the order of 10^{-7} seconds. It is efficient in that it emits adequate numbers of photons under excitation of the electron stream; and saturates so that the number of photons emitted becomes independent of the number of electrons striking the phosphor, or in combination with detector 16 saturates so that the output pulse is independent of the gun current.

A typical phosphor which may be used as the special phosphor component for this purpose is hex.ZnO (designated sometimes as Hex. ZnO:[Zn]). See, "An Introduction to Luminescence of Solids," Humboldt W. Leverenz, Wiley & Sons, New York (1950), as for example at page 362, and bibliography cited.

An alternative C.R.T. structure in accordance with this invention is one wherein a thin layer of a special phosphor is deposited in strips, congruent or parallel with the red phosphor strips, on the gun side of the regular phosphor screen. Such layer is of a depth sufficient to provide the transparency required to permit electrons to activate the visible color radiating phosphors. The aforesaid hex.ZnO may be used in this instance.

Another form of C.R.T. in accordance with this invention is one wherein an aluminum screen is deposited on the regular luminescent screen as is now done to increase the visible light output of the kinescope by reflection of the image towards the observer, and the special phosphor is deposited on the gun side of the aluminum screen. The radiant energy emitted by the special phosphor is reflected by the aluminum screen to the detector 16.

The detector 16 is responsive to invisible radiation. Since the hex.ZnO emits radiation of approximately 3700 Angstroms, detector 16 is selected which is responsive thereto. The combination of any such special phosphor and appropriately responsive detector will mutually accept and singly reject signal transfer. To assist in the selection process an "optical" filter may be placed between the special phosphor and the detector which will pass only the radiation emitted by the special phosphor. An example of a detector which may be used is the RCA multiplier phototube 931-A.

In operation the system functions as follows: At the start of the raster, shown as position or point 20 on Fig. 3, there is no excitation of any phosphor. As the sweep progresses from left to right, the gun stream strikes edge 28 of the first phosphor strip 29 (a counterpart of 24). Strip 29, contains the special phosphor. The coincidence of the electron stream fired by the gun and the edge 28 of strip 29, resulting in the emission of radiation by the special phosphor, is detected and amplified by pick-up 16, further amplified by pulse amplifier 40, and the resultant pulse opens the red information gate 41 of color receiver 42, which supplies the video information in three channels, 43, 44 and 45. This pulse will exist for " t " microseconds, depending upon the number of vertical strips in the kinescope, which in turn is correlated to the horizontal resolution of the system. Since a finite time elapses between the excitation of the special phosphor and the arrival of the pulse created thereby at the color gate 41, as well as to the kinescope gun 12, an additional delay 46, is provided which further delays the release of the "red" electron stream until the next or succeeding red phosphor strip 32 is reached by the electron stream. Phosphor strip 32 is "red," and contains the special phosphor, so that the process described is repeated. This process continues

across the face of the kinescope. Phosphor strips 30, and 31, simulate the green and blue strips.

In an alternative system there may be utilized a second pre-registration strip, akin to 29, and positioned to the left of 29 by the three strip distance, whereby a larger overall delay is inserted in the process described.

Another alternative system utilizes a delay wherein the synchronizing pulses are delayed for an interval of a full raster line so that registration is maintained on a line to line basis.

As has been explained, the red video signal is gated at a rapid rate and in synchronism with the red phosphor strips on the face of the C.R.T. Since a green phosphor strip is, as shown, to be energized after each red strip, the detected and amplified signal originating from the special phosphor component of the red strip is delayed for an interval of t microseconds, the time it takes for the pulse to travel across the red strip; green gate 48, accordingly, opens at precisely the time that the electron stream strikes the leading edge of the green phosphor strip. This green gate also opens for an interval of t microseconds following which blue gate 49 opens, for an interval of t microseconds since the output of pulse amplifier 40 is delayed by an interval of $2t$ in 47a before feeding the pulse to the blue gate 49. The pulse to the blue gate 49, may alternatively be obtained by delaying the output of delay 47 by an additional time t microseconds.

The foregoing describes means by which color "registration" is achieved by this invention.

Color "purity" is achieved as follows: As shown in Fig. 4, the special phosphor signal, as described, is shaped to exist for an interval of $t/3$ (one-third of the interval t), as by electronic means. With an ideally linear sweep, this pulse, and subsequent pulses 51, 52, and 53, follow in time sequences whereby the video color signals are centrally aligned with respect to the color producing phosphor strips. In Fig. 5 the effects of a non-linear sweep are illustrated. The initiating pulse 54, akin to 50, is centered properly. The result of a retarded or advanced sweep is illustrated by the positions of pulses 55 and 56 which are at the extreme edges of the red band. Further non-linearity would cause color impurity. This particular example thus illustrates how a sweep distortion of approximately ± 10 percent can be tolerated, with a maintenance of color "registry" and "purity," while utilizing approximately 33 percent of the scanned phosphor area.

An alternative means of shaping the initiating pulse in a color group is that of varying the width of the special phosphor strips in relation to the width of the correlated color producing strip. The succeeding color strips of a group may be varied in width, if desired, to provide further control of the developed color being viewed.

As will be understood, although the system described employs vertically disposed phosphor strips, other dispositions or arrangements of the color phosphors may be utilized. Furthermore, instead of the pulse-delay system shown, a phase-lock system may be used to provide synchronization between the coded or simultaneous signals and the decoding thereof which is made possible by this invention.

In its broadest aspect the terms "pick-up" and "pick-up means" embrace a detector and a filter, if desired, so that the wave length of the radiation impinging on the detector may be regulated or held within a selected extent.

It will be observed from the foregoing that this invention provides a system for selected transmission and/or storage and/or display and/or coding and/or decoding of information which comprises in combination at least one cathode ray tube, at least one special phosphor and at least one appropriate pick-up responsive to the radiation characteristics, including the decay characteristics, of the aforesaid special phosphor.

It will further be noted that this invention provides a

cathode ray tube comprising a sequential or ordered disposition of a special phosphor that emits a specially desired radiation, as for example, invisible radiation, when bombarded by cathode rays and pick-up means which is responsive to the specially desired radiation when the same is emitted by the special phosphor.

It will be understood that the foregoing description of the invention and the embodiment shown are merely illustrative of the principles thereof. Accordingly, the appended claims are to be construed as defining the invention within the full spirit and scope thereof.

I claim:

1. A system for displaying a plurality of colors comprising: a cathode ray tube having an electron gun, a display screen, and electron-beam indexing means; a switching arrangement to gate periodically modulating-information applied to said cathode ray tube; detection means that provide indexing pulses when the electron beam of said cathode ray tube impinges upon said beam indexing means; means that generate a train of pulses from said indexing pulses, said train of pulses being applied to operate sequentially said switching arrangement; said display screen comprising strips of materials that generate different colors when scanned by said electron beam; and pulse-shaping means to provide said train of pulses with individual pulses that have a duration in time substantially less than the time required for said electron beam to traverse one of said strips of materials.

2. A system in accordance with claim 1 including delay means that shift, in time, the output of said switching arrangement.

3. A system in accordance with claim 1 wherein said pulse shaping means comprise strips of electro-magnetic radiation generating materials with dimensions substantially less than that of the strips of materials that generate the different colors.

4. A system in accordance with claim 1 wherein the electron beam indexing means comprises material that emits electro-magnetic radiation upon excitation by said electron beam, the radiation from said material being characterized by the feature that the amplitude thereof saturates upon being excited.

5. A system in accordance with claim 1 wherein the detection means comprises a secondary emission amplifier being characterized by the feature that the output thereof saturates in amplitude.

6. A system for displaying a plurality of colors comprising: a directed ray tube having a beam of energy, a display screen, and indexing means responsive to said beam of energy; a switching arrangement to gate periodically modulating-information applied to said directed ray tube; detection means that provide indexing pulses when the beam of energy of said directed ray tube impinges upon said beam indexing means; means that generate a train of pulses from said indexing pulses, said train of pulses being applied to operate sequentially said switching arrangement; said display screen comprising

strips of materials that generate different colors when scanned by said beam of energy; and pulse-shaping means to provide said train of pulses with individual pulses that have a duration in time substantially less than the time required for said beam of energy to traverse one of said strips of materials.

7. A viewing apparatus comprising: a directed ray tube having an ordered distribution of materials which emit electro-magnetic radiation when bombarded by a scanning beam, means within said tube for detecting at least a portion of said emitted electro-magnetic radiation which means produce pulses; a pulse amplifier; a first pulse delay arrangement, the output of said delay arrangement being connected to operate switches sequentially in time; the input to said switches being derived from sources containing the information to be viewed; the output of said switches being connected to control the scanning beam; and a second pulse delay arrangement to shift in time the output of said switches, the second delay arrangement being connected in series with a loop comprising said radiation detecting means, amplifier, first pulse delay arrangement, switches, and scanning beam.

8. A color television viewing apparatus comprising: a directed ray tube having an ordered distribution of substantially vertical strips of materials which fluoresce in different colors when bombarded by a scanning beam which scans said strips at substantially right angles thereto; an electro-magnetic radiation emitter, which emits a second electro-magnetic radiation when bombarded by said scanning beam, disposed in ordered relationship to said strips; said second electro-magnetic radiation being substantially different from that of the strips; means to detect said second electro-magnetic radiation thereby to produce pulses; a pulse amplifier; a first pulse delay arrangement; the outputs of said delay arrangement being connected to operate switches; the input to said switches being derived from sources containing the electrical information of the image to be presented; the output of said switches being electrically connected to control the scanning beam; and a second pulse delay arrangement to shift in time the output of said switches, said second delay arrangement being connected in series with a loop comprising the said radiation detecting means, the pulse amplifier, the first pulse delay arrangement, switches, and scanning beam.

9. A system in accordance with claim 1 wherein said beam indexing means comprises an electro-magnetic radiation emitting layer deposited on said display screen on the side nearer the source of the cathode rays.

References Cited in the file of this patent

UNITED STATES PATENTS

2,633,547	Law	Mar. 31, 1953
2,657,257	Lesti	Oct. 27, 1953
2,750,533	Schwartz	June 16, 1956
2,785,221	Carpenter	Mar. 12, 1957