

Aug. 4, 1942.

C. E. BURNETT

2,292,045

DEVICE FOR MAKING DESIGNS

Filed April 29, 1939

3 Sheets-Sheet 1

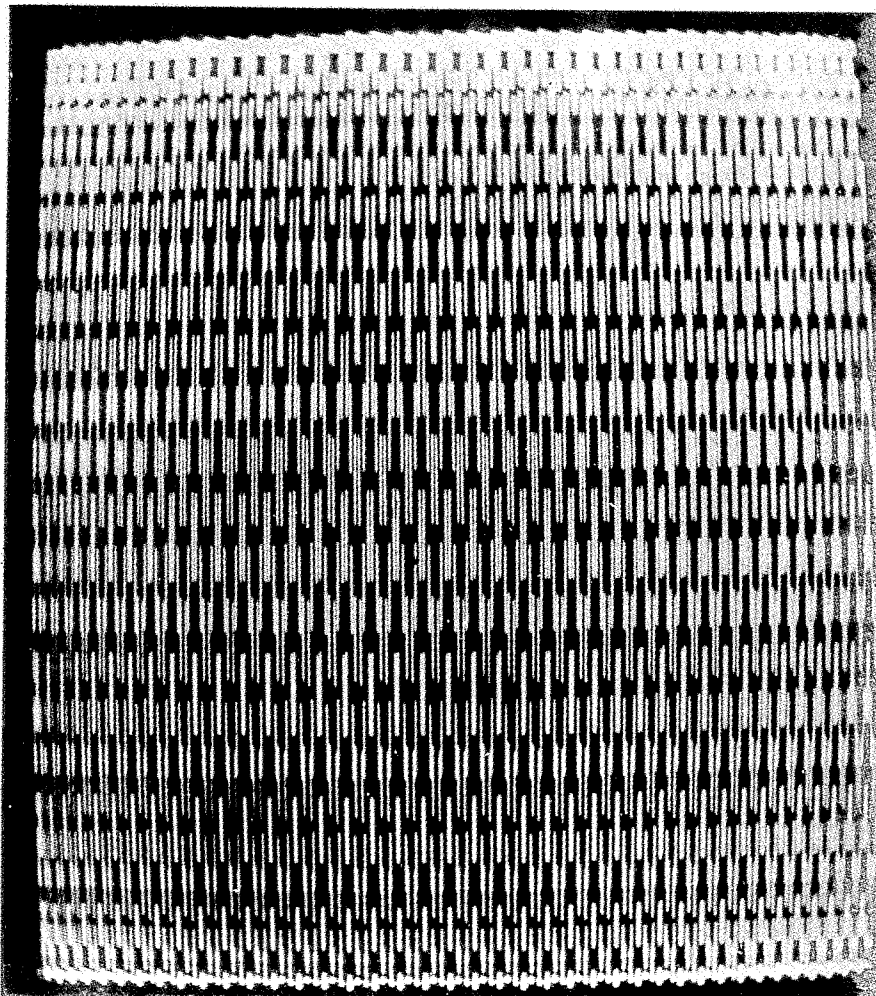


Fig. 1

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Fig. 4

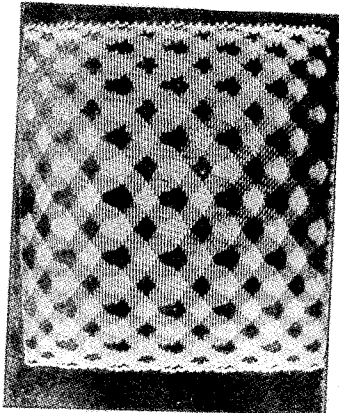


Fig. 7

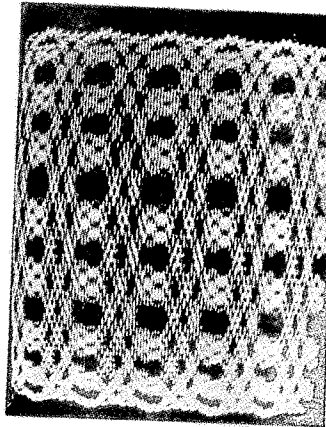


Fig. 3

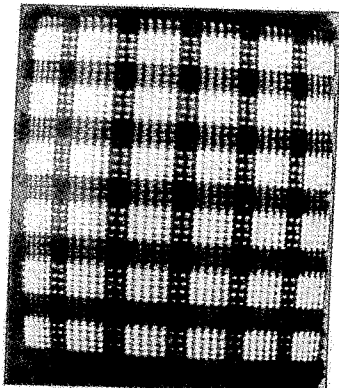


Fig. 6

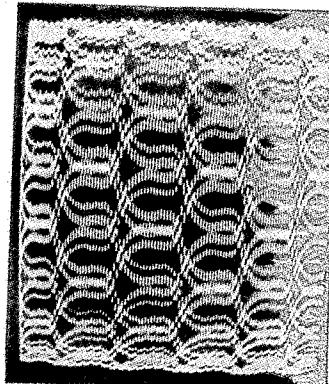


Fig. 2

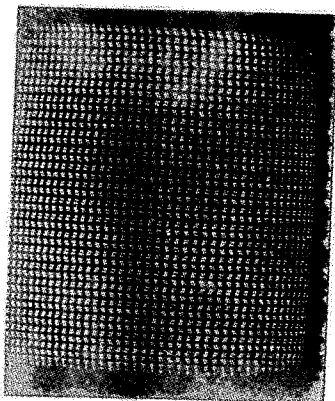
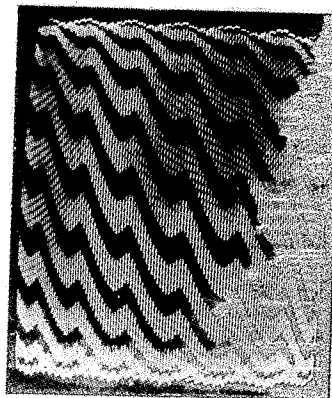


Fig. 5



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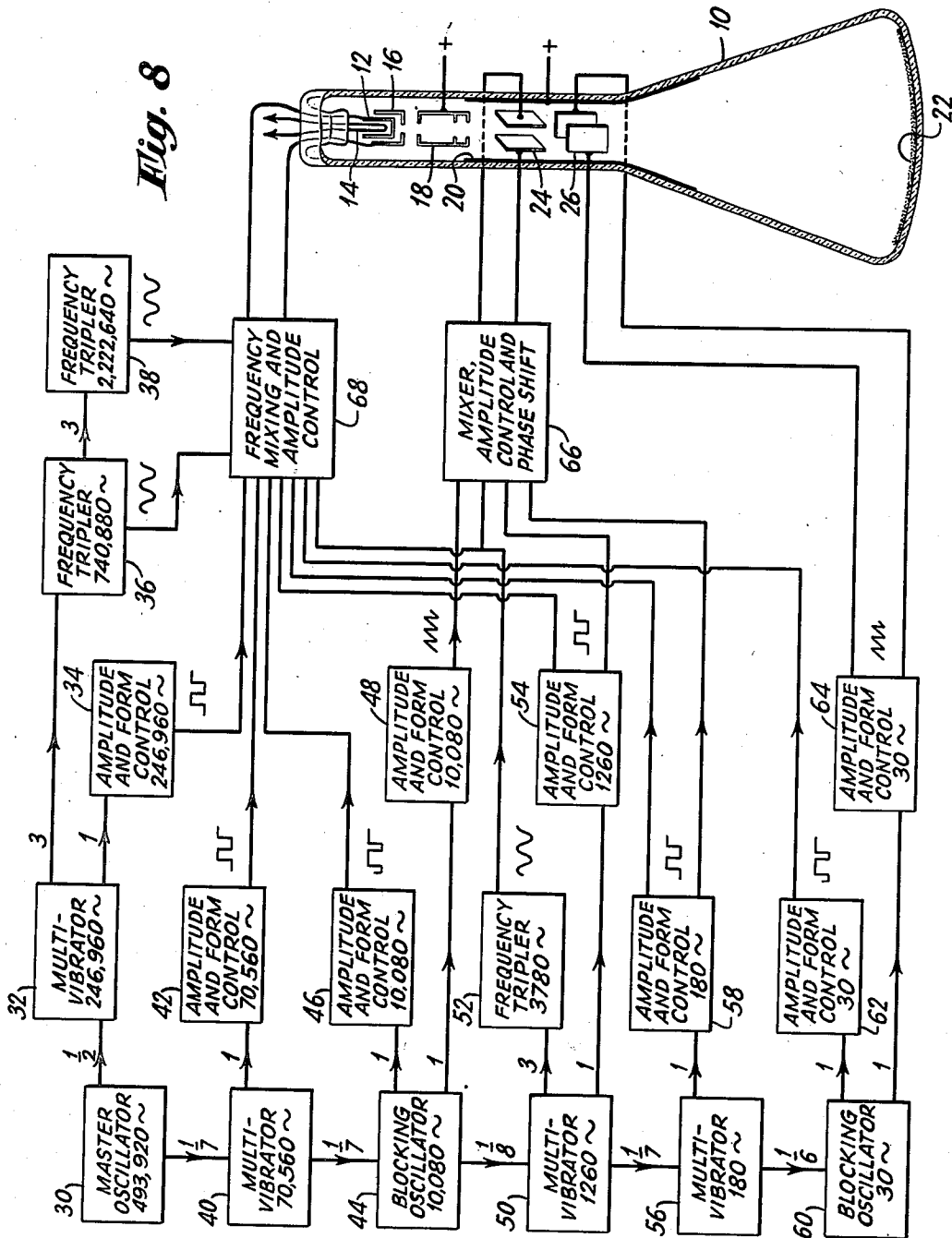
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DEVICE FOR MAKING DESIGNS

Filed April 29, 1939

3 Sheets-Sheet 3



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2,292,045

DEVICE FOR MAKING DESIGNS

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Application April 29, 1939, Serial No. 270,938

4 Claims. (Cl. 250—27)

This invention relates to a new and unique use of a cathode ray tube for the production of an unlimited number of pleasing and artistic designs.

Heretofore cathode ray tubes have been extensively used for making oscillographic observations of very rapid transient conditions, and more recently, for reproducing the images transmitted by a television transmitting station. It has been found, however, that through the use of the present invention a cathode ray tube may be utilized to produce various distinctive and artistic designs in accordance with the frequencies applied to the electrodes of the tube. These designs may readily be used in the textile or paper industry where various different designs are desirable, as well as for backgrounds for television scenes or, in fact, for various other purposes.

It is therefore one purpose of the present invention to provide a system wherein a cathode ray tube may be used to produce an unlimited number of geometric, distinctive or artistic designs on the viewing end of the tube.

It is still another purpose of the present invention to provide a system wherein an unlimited number of designs or configurations may be created in accordance with various frequencies, wave forms, and phase relationships of the frequencies applied to the electrodes of the tube.

A still further purpose of the present invention resides in the provision of means whereby the produced design may be maintained fixed and stationary upon the viewing end of the cathode ray tube in order that photographic or other reproductions of the design may be made.

It is still another purpose of the present invention to provide means whereby the geometric or artistic design may be caused to change position or appear to move at a varying rate or to change in design at a predetermined rate in accordance with the phase displacement of the frequencies applied to the electrodes of the tube, or in accordance with other gradual changes in the applied voltages or in the wave forms of the applied frequencies.

Still other purposes of the present invention will become more apparent to those skilled in the art from a reading of the following specification and claims, particularly when considered with the drawings, wherein:

Figures 1 through 7 are reproductions of examples of designs which may be created, and

Figure 8 is a schematic diagram showing a system for developing various frequencies and wave forms which may be used to produce different designs on the viewing end of the cathode ray tube.

Referring now to the drawings and more particularly to Figure 8, a cathode ray tube 10 is

shown which includes a cathode or electron emitter 12, a heating element 14 for maintaining the cathode at proper operating temperature, and a control electrode 16 by means of which the intensity of the electron stream may be controlled. For accelerating the electrons as produced by the cathode through the cathode ray tube, a first anode 18 is provided which is maintained positive with respect to the cathode 12. In order that the cathode ray beam may be properly focused to a very small cross-sectional area, and in order to further accelerate the electron beam, a second anode member 20 is provided which is maintained positive with respect to the cathode 12, and with respect to the first anode 18. The potentials of these anodes 18 and 20 determine the focus of the cathode ray beam, and also determine the velocity of the cathode ray beam through the tube. In order to indicate the presence and position of the cathode ray beam, the viewing end of the tube is provided with a fluorescent or luminescent screen 22, which, when bombarded by the stream of electrons, is caused to produce light in a manner well known in the art.

For deflecting the produced cathode ray beam in order that it may be caused to traverse the fluorescent screen 22, horizontal and vertical deflecting plates 24 and 26, respectively, are provided, the horizontal deflecting plates 24 causing the cathode ray beam to be deflected across the screen 22 in horizontal direction, whereas the vertical deflecting plates 26 cause the cathode ray beam to be deflected in a vertical direction. When various frequencies and potential differences are applied to the horizontal and vertical deflecting plates, the cathode ray beam is caused to traverse substantially the entire area of the viewing end of the tube to cause the electron responsive coating or layer 22 to produce light as a result of luminescence or fluorescence.

Normally, the control electrode 16 is maintained negative with respect to the cathode 12, and is varied in potential in order that the electrons which are projected through the tube may be controlled in intensity. When varying potentials are applied to the control electrode 16 the intensity of the cathode ray beam may be controlled, and if sufficient negative potential is applied thereto with respect to the cathode 12, the cathode ray beam may be blocked or eliminated entirely.

The construction of the cathode ray tube as described above is more or less conventional and so far as this invention is concerned, tubes of somewhat altered construction could as well be used. For instance, so far as the present invention is concerned, electromagnetic focusing may be used in place of the electrostatic focusing as produced by the anodes 18 and 20, and further-

more, electromagnetic deflection may be used in place of electrostatic, but when electromagnetic deflection is used, the pattern presented on the viewing end of the cathode ray tube may be slightly altered in view of the inherent inductiveness of the electromagnetic deflecting unit. A combination of electrostatic and electromagnetic deflection may, of course, be used.

In order that the cathode ray beam as produced in the cathode ray tube 10 may be controlled to produce various designs such as those shown, for example, in Figures 1 through 7, a system has been provided wherein various frequencies and wave forms may be produced. Since all of the frequencies which are applied to the control electrode 16 and to the deflecting plates of the cathode ray tube must be synchronized with respect to each other in order to produce a suitable and satisfactory stationary pattern on the viewing end of the tube, it is desirable that all of these frequencies be derived from a single master oscillator, and in the present invention a master oscillator 30 is provided. As indicated in the drawings, this oscillator operates at a frequency of 493,920 cycles per second, and through the use of harmonics of this frequency various other frequencies may be produced. From the master oscillator 30 impulses are supplied to a multi-vibrator 32 in order that a different frequency may be produced, and the output from the multi-vibrator 32 is supplied to an amplitude and wave form control device 34 in order that a frequency of 246,960 cycles per second of symmetrical square wave form may be produced. The numerals or fractions between the blocks in the diagram in Figure 8 designate the frequency ratios. The output from the multi-vibrator 32 is also supplied to other frequency generating devices 36 and 38 for producing different related frequencies of symmetrical sine wave form. The output from master oscillator 30 is also supplied to a multi-vibrator 40 which responds to the seventh sub-harmonic of the master oscillator to produce a frequency of 70,560 cycles per second, which is supplied to an amplitude and wave form control device 42, the output of which is a symmetrical square wave of 70,560 cycles per second. The output from the multi-vibrator 40 is also supplied to a blocking oscillator 44 which operates on the seventh subharmonic of the multi-vibrator frequency to produce oscillations of 10,080 cycles per second. These oscillations are then supplied to an amplitude and wave form control device 46 which results in the production of an unsymmetrical square wave form, the purpose of which will be explained later. The output from the blocking oscillator 44 is also supplied to another amplitude and wave form control device 48 in order to produce an oscillation of 10,080 cycles per second of saw-tooth wave form.

The output from the blocking oscillator 44 is supplied to a multi-vibrator 50 which operates on the eighth subharmonic of the blocking oscillator to produce an oscillation of 1260 cycles per second. These oscillations are then applied to a frequency tripling device 52 in order to produce oscillations of 3780 cycles per second and to an amplitude and wave form controlling device 54 for producing a symmetrical square wave form of 1260 cycles per second. The multi-vibrator 50 also supplies energy to a further multi-vibrator 56 which operates on the 7th subharmonic of the multi-vibrator 50 to produce oscillations of 180 cycles per second. The out-

put from the multi-vibrator 56 is supplied to an amplitude and wave form control device 58 the output of which is a symmetrical square wave form of 180 cycles per second. The multi-vibrator 50 also supplies energy to a blocking oscillator 60 which operates on the sixth subharmonic in order that the blocking oscillator 60 may operate at 30 cycles per second. The output from this blocking oscillator is supplied to an amplitude and wave form control device 62 in order to produce an unsymmetrical square wave form of 30 cycles per second. Furthermore, the blocking oscillator 30 supplies energy to a further amplitude and wave form control device 64 for the production of saw-tooth wave form oscillations of 30 cycles per second.

As indicated in the drawings, the vertical deflecting plates of the cathode ray tube are supplied with energy from the amplitude and wave form control device 64, the output of which is an oscillation of saw-tooth wave form, the frequency of which is 30 cycles per second. By reason of this voltage application to the vertical deflecting plates the cathode ray beam is caused to be deflected in a vertical direction at a rate of 30 deflections per second, the deflection in one direction being very rapid with respect to the deflection in the opposite direction.

For deflecting the cathode ray beam in a horizontal direction, energy from various of the devices may be used, and in order that proper amplitude and phase relationship of the various frequencies may be applied to the horizontal deflecting plates, a control device 66 is provided, which device operates as a mixer for individually and selectively controlling the amplitudes as well as the phase relationship of the energy supplied by the devices 42, 52, 54 and 58.

For modulating or altering the intensity of the cathode ray beam in order to produce various patterns, different frequencies may be used. The rate of modulation is determined by the frequency applied to the control electrode 16 and for producing rather intricate patterns or designs, a plurality of superimposed modulating potentials of various wave forms and phase relationships may be applied to the control electrode. In order to determine and control the voltages, frequencies, and wave forms applied to the control electrode, a frequency mixing and amplitude control device 68 is provided. The output from this device is applied directly across the control electrode and cathode of the cathode ray tube, whereas the device is supplied with input energy from various of the devices as indicated in the drawings. The unsymmetrical rectangular wave forms as produced by the devices 46 and 62 are mainly for the purpose of blanking or eliminating the cathode ray beam during the return deflection period.

When several frequencies are applied to the frequency mixing and amplitude control device 68, for controlling the potential of the control electrode 16, these frequencies are superimposed and produce a resultant wave form which is determined by the proportion of the frequencies and voltages which are permitted to be transmitted through the device 68. The resultant wave form may be rather complex in nature, and may vary in potential with respect to the cathode 12 from a value below beam cut-off to a value sufficiently positive to permit the production of a full intensity electron beam.

From the above it may be seen that the control electrode, as well as the deflecting electrodes

for the cathode ray beam 10, may be supplied with various potentials and frequencies or various combinations of potentials and frequencies in order to cause a desired deflection and modulation of the cathode ray beam which is produced within the tube. This deflection and modulation of the beam causes a distinctive pattern to be produced on the viewing end of the cathode ray tube, and, for each set of circumstances, a new and different pattern may be developed.

It is conceivable that an infinite number of different patterns may be produced, and furthermore, even though somewhat specific means are shown schematically in Figure 8 for producing definite frequencies, it is to be understood that various other frequencies or wave forms may as well be applied to the electrodes of the cathode ray tube. By way of example, Figures 1 through 7 are photographic reproductions of some of the patterns which may be produced by a cathode ray tube through the use of this invention, and for the production of these patterns, the following deflection and modulating potentials were applied to the deflecting electrodes and the control electrode of the cathode ray tube.

Figure 1:

Deflection:

Vertically, 30 cycles saw-tooth.

Horizontally, 3780 cycles sine-wave plus small component of 1260 cycles.

Grid—

(a) 30 cycles square-wave, negative portion the width of the vertical-deflection return-line time.

(b) 70,560 cycles square-wave.

Figure 2:

Deflection:

Vertically, 30 cycles saw-tooth.

Horizontally, 10,080 cycles saw-tooth.

Grid—

(a) 30 cycles square-wave, negative portion the width of vertical deflection return-line time.

(b) 10,080 cycles square-wave, negative portion the width of horizontal-deflection return-line time.

(c) 740,880 cycles sine-wave.

(d) 246,960 cycles square-wave.

(e) 1,260 cycles square-wave.

Figure 3:

Deflection:

Vertically, 30 cycles saw-tooth.

Horizontally, 10,080 cycles saw-tooth.

Grid—

(a) 30 cycles square-wave, negative portion the width of the vertical-deflection return-line time.

(b) 10,080 cycles square-wave, negative portion the width of the horizontal-deflection return-line time.

(c) 2,222,640 cycles sine-wave.

(d) 740,880 cycles sine-wave.

(e) 246,960 cycles square-wave.

(f) 70,560 cycles square-wave.

(g) 1,260 cycles square-wave.

(h) 180 cycles square-wave.

Figure 4:

Deflection:

Vertically, 30 cycles saw-tooth.

Horizontally, 3780 cycles sine-wave plus small components of 1260 and 180 cycles.

Phase of horizontal deflection is changed from that in Figure 1.

Grid—

(a) 30 cycles square-wave, negative portion the width of the vertical-deflection return-line time.

(b) 70,560 square-wave.

Figure 5:

Deflection:

Vertically, 30 cycles saw-tooth.

Horizontally, 3780 cycles sine-wave plus small components of 1260 and 180 cycles.

Phase is shifted slightly from Figure 4.

Grid—

(a) 30 cycles square-wave, negative portion the width of the vertical-deflection return-line time.

(b) 3780 cycles sine-wave.

(c) 70,560 cycles square-wave.

Figure 6:

Deflection:

Vertically, 30 cycles saw-tooth.

Horizontally, 3780 cycles sine-wave plus small components of 1260 and 180 cycles.

Phase is shifted some from Figure 4, is almost same as that for Figure 5.

Grid—

(a) 30 cycles square-wave, negative portion the width of the vertical-deflection return-line time.

(b) 70,560 cycles square-wave.

(c) 246,960 cycles square-wave.

Figure 7:

Deflection:

Vertically 30 cycles saw-tooth.

Horizontally 3780 cycles sine-wave plus small components of 1260 and 180 cycles.

Phase is shifted considerably from Figure 4.

Grid—

(a) 30 cycles square-wave, negative portion the width of the vertical-deflection return-line time.

(b) 70,560 cycles square-wave.

(c) 246,960 cycles square-wave.

As previously stated, all of the patterns and designs shown in Figures 1 through 7 are photographic reproductions of the original photographs which were taken of the patterns produced on the viewing end of a 9-inch cathode ray tube and represent examples of the possible infinite number of patterns which may be produced. In order to produce other patterns it is merely necessary to change any of the frequencies, to change the voltage or intensity of such frequencies, to alter their phase relationship, etc., or in fact any change so far as the frequency, phase relationship, wave form, or intensity of the voltages is concerned will produce different patterns. If the pattern is to remain stationary on the viewing screen of the cathode ray tube, then it is obviously necessary that all of the frequencies be synchronized and since they are derived from the same master oscillator, such synchronization may be readily maintained. If separate oscillators are provided and the oscillators are not accurately synchronized, a variation in the pattern may be produced, the rate of change of the variation being determined by the lack of synchronization.

From the above it may be seen that a new and desirable method of and means for using a cathode ray tube has been developed whereby various

artistic and distinctive designs or patterns may be produced, which designs may be readily used in the making of textiles or wrapping paper, or in fact any material in which a striking and unique design is desirable. Furthermore, the present invention may be used in a television system, signals being transmitted in such a manner that the viewing screen of the receiving tube will have presented thereon a certain desirable pattern, either in stationary or slowly moving or transitory form. Simultaneous with the transmission of the signals for producing the pattern, may also be transmitted picture or television signals of headings, titles, etc., in order that they may appear superimposed on the pattern at the television receiver. Furthermore, transient or slowly changing patterns may be transmitted alone for the purpose of presenting interesting and attractive designs during an interlude between acts of a play or between portions of a complete television program. Such transient designs could, of course, be accompanied by music or appropriate sound accompaniment.

In order to simplify the apparatus shown and described herein the various circuit elements for producing the desired frequencies and for mixing the frequencies are shown schematically in Figure 8. The actual apparatus for producing the various frequencies is not vital, however, for the master oscillator 30, an oscillator such as shown and described in any of the patents to R. V. L. Hartley, #1,571,006, January 26, 1926; L. De Forest, #1,507,016 and #1,507,017, September 2, 1924 or E. H. Colpitts, #1,624,537, April 12, 1927 could, for example, be used. For the multi-vibrators 32, 40, 50 and 56 a system such as shown and described in either of the patents to J. P. Smith, #2,132,654, October 11, 1938 or V. T. Braman, #1,976,384, October 9, 1934, for example, may be readily used. For the blocking oscillators 44 and 60, the device shown and described in the patent to W. A. Tolson, Reissue #20,338, April 20, 1937 could, for example, be used. An example of a device which could be used as the frequency multiplier or tripler elements 36, 38 and 52 is shown and described in either of the patents to B. W. Kendall, #1,446,752, February 27, 1923 and L. B. Headrick #2,069,441, February 2, 1937; of these patents the latter shows the use of an electronic beam while the former uses the more conventional electron discharge type tube. For producing phase shifts in the device 66 an apparatus such as shown and described, for instance, in the article "Distortion Correction in Electrical Circuits with Constant Resistance Recurrent Networks" by O. J. Zobel, to be found in the Bell System Technical Journal for July 1928, volume VII, page 438, could be used. The mixer and amplitude control devices 66 and 68 might incorporate, for example, a system similar to that shown in the patents to E. B. Craft, et al., #1,540,317, June 2, 1925 or S. Read, Jr., #1,916,187, June 27, 1933. For the amplitude and form control devices 34, 42, 46, 48, 54, 58, 62 and 64 a device such as shown and described in the patents to A. V. Bedford, #2,085,409, June 29, 1937 or J. P. Smith #2,132,655, October 11, 1938 could, for instance, be advantageously used.

It is to be understood that devices or systems other than those shown in the above referred to patents and publications may be used and other currently available publications show and describe systems designated by the same terminology which could as well be used.

In addition to the fact that the design as produced on the viewing end of the cathode ray tube may be photographed in a conventional manner as suggested above, it is possible to place a sensitized plate or film adjacent a tube which is provided with a Lenard window in order that the cathode ray beam within the tube may affect the sensitized plate which is positioned outside the tube. In addition, it is possible to place a sensitized plate or film inside the tube per se in order that the cathode ray beam may be caused to strike the film directly. When it is desired to place the film inside the tube, a cathode ray tube such as that shown and described in Patent #2,086,546 to R. H. George dated July 13, 1937, may well be used. Through the use of a device such as that disclosed in the patent referred to, a film may be used upon which a plurality of exposures of different designs may be made.

It is to be understood that although means are shown for deriving only a limited number of frequencies of particular wave forms, various additional and different frequency producing devices could as well be employed in order to produce different designs.

Various other alterations or modifications may be made in the present invention without departing from the spirit and scope thereof, and it is desired that any and all such modifications be considered within the purview of the present invention except as limited by the hereinafter appended claims.

I claim:

1. In a system for producing geometric or artistic designs on the viewing screen of a cathode ray tube, a cathode ray tube having means including an electron emitter, a control electrode and an accelerating means for generating a beam of electrons, a luminescent target in said tube for producing luminous effects when impacted by the generated beam of electrons, a master oscillator for generating voltage variations of a predetermined relatively high frequency, means responsive to the generated voltage variations for producing a plurality of voltage variations of different sub-harmonic frequencies each directly related to and synchronized from the frequency at which the master oscillator generates energy, means for repeatedly and cyclically deflecting the beam of electrons in a vertical direction at a frequency corresponding to one of the produced sub-harmonic frequencies, means for repeatedly and cyclically deflecting the beam of electrons in a horizontal direction at a frequency corresponding to another of the produced sub-harmonic frequencies, means for combining certain of the generated voltage variations of sub-harmonic frequencies to produce a composite voltage variation the frequency components of which are harmonically related to the frequency of operation of the master oscillator, means for applying the composite voltage variations only to said control electrode and emitter to modulate the cathode ray beam from a value at least coinciding with beam cut-off to a value permitting the production of a predetermined maximum beam intensity, whereby both the intensity of the generated cathode ray beam and the rates of horizontal and vertical deflection are controlled solely by frequencies harmonically related to the master oscillator.

2. In a system for producing geometric or artistic designs on the viewing screen of a cathode ray tube, a cathode ray tube having means including an electron emitter, a control electrode

and beam accelerating means for generating a beam of electrons, a luminescent target in said tube for producing luminous effects when subjected to the beam of electrons, a pair of means to deflect the generated beam in two mutually perpendicular directions to trace a predetermined raster in an unmodulated state, a master oscillator for generating voltage variations of a predetermined relatively high frequency, means responsive to the generated voltage variations for producing a plurality of voltage variations of different sub-harmonic frequencies each directly related to and synchronized from the frequency of operation of the master oscillator, means for repeatedly and cyclically deflecting the beam of electrons in one of the two mutually perpendicular directions at a frequency corresponding to one of the produced sub-harmonic frequencies, means for repeatedly and cyclically deflecting the beam of electrons in the other of the two mutually perpendicular directions at a frequency corresponding to another of the produced sub-harmonic frequencies, means for combining certain of the generated voltage variations of sub-harmonic frequencies to produce a composite voltage variation the frequency components of which are harmonically related to the frequency of operation of the master oscillator, means for applying the composite voltage variations only to said control electrode and emitter to modulate the cathode ray beam from a value at least corresponding to beam cut-off to a value permitting the production of a predetermined beam intensity, whereby both the intensity of the generated cathode ray beam and the rates of deflection in the two mutually perpendicular directions are controlled solely by frequencies harmonically related to the frequency of operation of the master oscillator.

3. In a system for producing geometric or artistic designs on the viewing screen of the cathode ray tube, a cathode ray tube, means including an electron emitter, a control electrode and beam accelerating means for generating a beam of electrons, a luminescent target in said tube for producing luminous effects when impacted by the generated beam of electrons, a pair of means to deflect the generated beam in two mutually perpendicular directions to scan a predetermined pattern on the luminescent target, a master oscillator for generating voltage variations of a predetermined frequency, a plurality of means for producing a plurality of voltage variations of predetermined wave form, each of the produced voltage variations bearing a harmonic relationship to the frequency of operation of the master oscillator, means for repeatedly and cyclically deflecting the generated beam of electrons in one of the two mutually perpendicular directions at a predetermined fixed rate corresponding to a harmonic of the frequency of operation of the master oscillator, means for repeatedly and cyclically deflecting the generated beam of electrons in the other of the two mutu-

ally perpendicular directions at a predetermined cyclically varying rate corresponding to a plurality of combined harmonic frequencies each harmonically related to the frequency of operation of the master oscillator, means for selectively combining predetermined amplitudes of certain of the produced voltage variations of frequencies harmonically related to the frequency of operation of the master oscillator to produce a composite voltage variation, means for applying the produced composite voltage variation only to the control electrode of the cathode ray tube to modulate the cathode ray beam from a value of at least beam cut-off to a value permitting the production of a predetermined beam intensity, whereby the current intensity of the generated cathode ray beam and the rates of deflection in the two mutually perpendicular directions may be controlled solely by frequencies each of which is harmonically related to the frequency of operation of the master oscillator.

4. In a system for producing geometric or artistic designs on the viewing screen of the cathode ray tube, a cathode ray tube, means for generating a beam of electrons including an electron emitter, a control electrode and beam accelerating means, a luminescent screen for producing luminous effects when subjected to the generated beam of electrons, a master oscillator for generating voltage variations of a predetermined relatively high frequency, a plurality of means for producing a plurality of voltage variations of predetermined wave form each of the produced voltage variations bearing a sub-harmonic relationship to the frequency of operation of the master oscillator, means for repeatedly and cyclically deflecting the generated beam of electrons in a vertical direction at a predetermined fixed rate corresponding to a sub-harmonic of the frequency of operation of the master oscillator, means for repeatedly and cyclically deflecting the generated beam of electrons in a horizontal direction at a predetermined cyclically changing rate corresponding to a plurality of combined sub-harmonic frequencies each harmonically related to the frequency of operation of the master oscillator, means for selectively combining predetermined amplitudes of certain of the produced voltage variations of frequencies sub-harmonically related to the frequency of operation of the master oscillator to produce a composite voltage variation, means for applying the produced composite voltage variation only to the control electrodes of the cathode ray tube to current intensity modulate the cathode ray beam from a value of at least beam cut-off to a value permitting the production of a predetermined maximum beam intensity, whereby the generated cathode ray beam may be modulated and deflected solely by frequencies each of which is harmonically related to the frequency of operation of the master oscillator.

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