March 9, 1937. A. N. GOLDSMITH ET AL 2,073,370

TELEVISION SYSTEM

Filed Nov. 1, 1932

Fig. 1

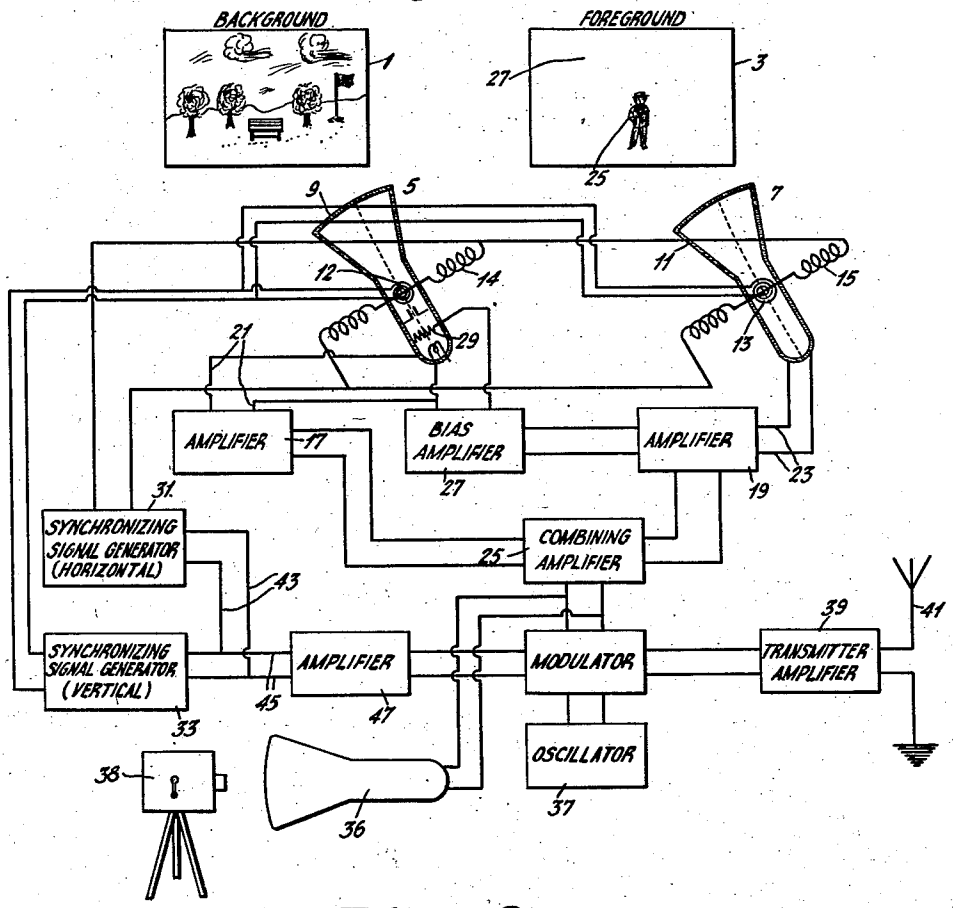
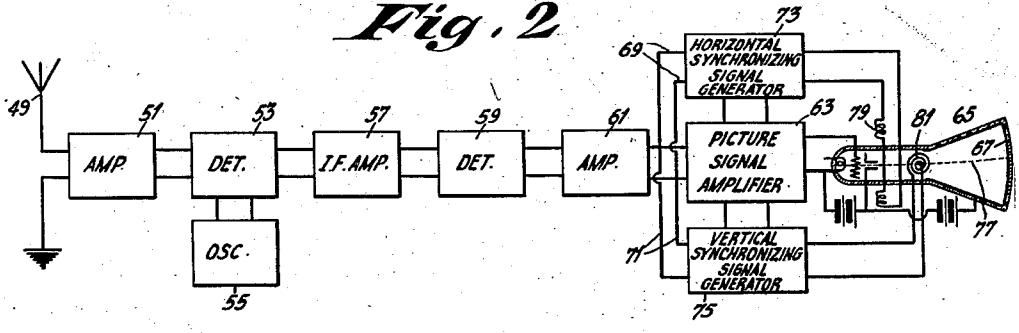


Fig. 2



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TELEVISION SYSTEM

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Application November 1, 1932, Serial No. 640,616

25 Claims. (Cl. 178—6)

The present invention relates to a system by which independent series of signals may be combined. In a particular form the invention is applied to television systems and is particularly directed to what may be termed a system for producing composite television pictures.

In accordance with this invention a composite picture, by which is meant a picture in which the background is separately produced from the foreground, is suitably transmitted without resorting to elaborate masking schemes or without the need of resorting to elaborate sets at the point of transmission. In any theatrical presentation it is usually customary to develop for each change of scene to the observed a set and then to position the actors relative to the set so that the entire visible area may be subjected to view by the audience. Similarly, it is usually customary in the operation of television apparatus to produce the image signals representative of both the set and the subject simultaneously from the background and foreground for the purpose of transmission. However, in connection with television where the action is extremely rapid and where the need of continuity of performance will become more and more apparent as the art progresses, such procedure obviously indicates great and useless expenses to provide interesting programs with an adequate number of changes of scene to evoke in the mind of the observer the same interest in the television transmission as is had in the usual motion picture presentation.

It is, therefore, an object of the present invention to provide a system for producing composite pictures or television images wherein the foreground and background action may take place at widely separated points or may take place at two or more closely adjacent points although the points are not in direct view of one another and the action at each point can be entirely separate from the action at the other point.

It is a further object of this invention to provide a system of television by which ordinary motion picture films may, if desired, be used to produce the background and wherein the foreground action may take place separately and then be combined with the background to present actions which appear to take place at predetermined locations with respect to the background.

It is a further object of this invention to provide ways and means by which a single background may serve simultaneously for a plurality of different foreground actions so that by using a single background it may be possible to transmit television signals representative of different foreground actions without resorting to re-setting the studio to provide for each separate action.

A further object of this invention is to provide ways and means by which the background and foreground actions may be separately scanned and analyzed and by which the foreground action may serve to cause in the transmission an omission of transmitted signals representative of the background. In this manner the present invention is so constituted that the complete transmission will represent the combination of foreground and background properly coordinated in sequence to produce at receiving points a single combined or composite picture or image representation representative of both the foreground and the background action or scene.

Another object of the invention is to provide a system by which it is relatively simple to photograph composite pictures representing combined foreground and background action. This may be done in a convenient manner by providing a monitor viewing system and then photographing the image appearing thereupon.

A further object of this invention is to produce a system for transmitting television images in which it is possible to use a single background set and to maintain the desired focus with variations in position of the foreground action without motion of the background which will evoke in the mind of the observer the impression of a moving background. Such actions and effects are producible, for example, by virtue of the fact that whenever it is desired to have the foreground action move nearer or further away from the point of scanning than for conditions of normal transmission the predetermined fixed relative locations of the foreground and background actions may be suitably provided for without any physical shift of either foreground or background through a suitably arranged optical system.

Further objects of the invention are to provide a system for transmitting composite pictures which utilizes for the most part only the existing types of television transmission apparatus and with this known apparatus arrange new and novel methods for coordinating the scanning actions at a plurality of points for the combined transmission of a single series of image signals representative of the action or scene at both the background and the foreground.

Other objects of the invention are, of course, to provide a system of television which is new and novel in its appeal to the public interest; to provide a system which is relatively simple in

its construction and arrangement, and a system which fulfills substantially the features now lacking in the art of producing television image signals which bear the same interest to the observer that the motion picture bears in the motion picture theatre or in connection with portable sound motion picture apparatus.

Still other and further objects of the invention will become apparent and at once suggest themselves to those skilled in the art to which this invention is direct by reading the following specification and claims in connection with the accompanying drawing, wherein:

Fig. 1 illustrates the transmitter end of the television system developed in accordance with this invention; and

Fig. 2 illustrates also schematically a suggested form of receiver apparatus for receiving the image signals transmitted from the transmitter of Fig. 1.

If reference is now made to the accompanying drawing forming a part of this disclosure, it will be seen that the background action, designated by the numeral 1, and the foreground action, designated by the numeral 3, are physically separated one from the other. This separation of background and foreground may, as above suggested, be a true geographical separation or may be a slight separation with the background action even so close as adjacent to the foreground action, provided, of course, that the general features concerning the scanning operations to be hereinafter described are still maintained.

For the purpose of scanning the background and foreground and producing image signals which are representative thereof we have provided two independently operable scanning systems generally designated as 5 and 7. These scanning systems are preferably in the form of cathode ray tube scanning devices and may be of the general type disclosed and set forth in the co-pending application of Vladimir K. Zworykin filed November 13, 1931, Serial No. 574,772 assigned to Radio Corporation of America. The details of these scanning tubes 9 and 11 have not herein been shown in detail. It should, however, be understood that each includes a light-sensitive plate electrode 12 adjacent to which is a pick-up or grid-like electrode serving as an anode. The image of the illuminated background and foreground action is adapted to be projected upon the light-sensitive electrode by way of a suitable optical system (not herein shown) so as to cause at each elemental area of the light-sensitive electrode a space charge which is proportionate in density to the illumination at the coordinated elemental area. If now within each cathode ray tube scanner 9 and 11 a cathode ray is generated and caused to sweep the light-sensitive electrode within the tube by means of deflecting fields 12, 13, 14 and 15 of which the fields 12 and 13 provide motion in one direction and the fields 14 and 15 provide motion of the beam in a direction transverse, and if the corresponding fields of each scanning tube are coordinated, it can be seen that the cathode ray generated within the tubes 9 and 11 will simultaneously impinge upon coordinated elemental areas of the light-sensitive screen contained within each tube. In this manner the space charge coordinated with the particular elemental area on which the cathode ray pencil instantaneously impinges is released. Precision adjustment of this simultaneity of impact on coordinated elemental areas can be arranged by suitable electrical adjustment of the circuits associated with the tubes 9 and 11 as hereinafter described.

So controlled the released space charge may then be applied to the amplifiers 17 and 19 by way of conductors 21, 21 and 23, 23 respectively so as to cause output currents to appear in the output circuits of the amplifiers which correspond in intensity or are proportionate to the intensity of the light impinging upon each elemental area of the light-sensitive electrode within the scanning tube.

Let it now be assumed that the scanning tube 9 scans the background 1 and that the scanning tube 11 scans the foreground 3. It can be seen easily that at points where there is a scanning operation taking place in the foreground, as scanned by tube 11, it will usually be undesirable to permit output energy for transmission to result from the background scanned by the tube 9. If this were not so the receiving points would view the combined simultaneous scanning of background and foreground and the produced electro-optical image signals at the receiver would be "ghost-like" in appearance because both the background and foreground would be simultaneously observed with the result that the foreground action would appear unreal. Under normal conditions "ghost-like" effects are not desired, but they can, when desired, be made use of, as will hereinafter appear.

To avoid ghost-like effects in the observed image there should be provided, under usual conditions, some means whereby in the absence of any foreground action, such as an absence of the actors 25, there will be no energy pick-up or substantially no energy pick-up in the scanning tube 11. Similarly, where there is action taking place in the foreground there should be no energy pick-up representative of the background. Consequently, it is desirable to surround or enclose the entire foreground area with a material, preferably in the form of a black matte 27 which is usually of a valvet-like material, from which there will be substantially no reflection of light from an illumination source to the scanning tube 11. However, where an object or subject is interposed between the black background or screen 27 and the scanning tube 11 so that the absorption of light is less than that of the matte 27 light will be reflected, preferably through a suitable optical system, to the scanning tube 11. Image signals will then be produced in the output circuit 23 of the scanning tube 11 so as to be transferred for amplification to the amplifier 19.

At this time it is desirable to prevent any signals which represent the background from appearing in the combining amplifier unit 25 which is connected to both the background signal amplifier 17 and the foreground signal amplifier 19. Accordingly, the output from the amplifier 19 representative of the foreground action, is directed not only to the combining unit amplifier 25 but also to a biasing amplifier 27. The biasing amplifier 27, which may include any appropriate number of stages, has its output connected to the scanning tube 5 used for scanning the background. The scanning tube 5, which is substantially a duplicate of the scanning tube 7 as above mentioned, has, however, provided therein a grid control element 29 to control, in accordance with the teachings of Nicolson Patent #1,470,696, for example, the intensity of the cathode rays from the source which are projected within the tube. Whenever signals representing foreground action appear in the amplifier 19 these same sig-

nals can be caused to block the cathode ray pencil within the tube 5 or, in other words, can be used to bias the cathode ray tube 5 to cut-off. With the tube 5 biased in this manner it is quite obvious that no scanning action can result for the particular area of the illuminated photosensitive layer or surface which corresponds to the area at which the foreground action is projected upon the light-sensitive surface of the scanning tube 7. However, as soon as the scanning tube 7 has completed the scanning of the particular illuminated area the black background adjacent the foreground action will, of course, prevent output signals from the scanning tube 7 from appearing in amplifier 19. The voltage upon the control grid 29 of the scanning tube 5 will then immediately rise and the tube 5 will again commence to scan the background action, with the result that operating voltages representing background will be supplied to the amplifier 17 to be directed from the output thereof to the combining unit amplifier 25 where the outputs of amplifiers 17 and 19 are assembled, pieced or patched together.

For the purpose of insuring the synchronous movements of the cathode ray pencils within each scanning tube 5 and 7 a pair of synchronizing signal generators have been provided to control jointly both tubes. These two synchronizing signal generators, of which the generator 31 is of a relatively high frequency and generates currents to move the cathode ray pencil horizontally in each scanning tube along a saw-tooth path, and the vertical synchronizing generator 33 which serves to move the cathode ray within each scanning tube vertically so as to frame properly the pictures along a saw-tooth path, are preferably in the form of oscillators which have already been disclosed, for example, by the co-pending application of W. A. Tolson, Serial No. 608,460, filed April 30, 1932 and assigned to Radio Corporation of America, or by the co-pending application of R. C. Ballard, Serial No. 584,943, filed January 16, 1932 also assigned to Radio Corporation of America. The synchronizing signals for moving the cathode ray pencil within each scanning tube are directed from the synchronizing signal generator 31 for horizontal movement of the ray to the deflecting coils 14 and 15, respectively, of the scanning tubes 5 and 7. Similarly, from the vertical synchronizing signal generator 33 the signals for controlling the vertical motion of the cathode ray pencil are directed to the deflecting coils 12 and 13, respectively, of the scanning tubes 5 and 7. It is to be understood that while the invention has been illustrated as utilizing electromagnetic fields to control the movement of the cathode ray pencil within the scanning tubes, electrostatic means may also be provided, in which case a saw-tooth voltage wave would be generated in the synchronizing signal generators 31 and 33 to be applied to the electrostatic ray deflecting plates in contrast to the saw-tooth current wave herein shown as developed to produce the electromagnetic cathode ray deflection.

The combined output signals representative of the combined background and foreground scanning action are transferred from the combining amplifier unit 25 to a modulator 35 to which is also supplied a carrier frequency as generated, for example, in the oscillation generator 37. In suitable manner the carrier frequency is modulated by the output signals from the combining amplifier unit 25. The modulated carrier frequency signals are then suitably amplified in the transmitter amplifier 39 and transmitted to geographically spaced points of reception by way of the radio transmission link conventionally designated by the antenna 41 or by way of a wire line or network transmission where desired.

A portion of the output from the synchronizing signal generators 31 and 33 for producing the horizontal and vertical deflection of the cathode ray pencil within the scanning tubes 5 and 7 is also supplied by way of suitable conductors 43 and 45 to the modulator unit 35 through an amplifier 47 which contains one more or less stage, for example, of amplification than the combined stages of the amplifiers 17 and 25 or 19 and 25 so that the amplified signals of the synchronizing signal generators are 180° out of phase with respect to the combined amplified signals representative of the values of light and shadow representative of the background and foreground. In this manner the synchronizing signals have the effect of a "black signal" and thus serve to counter-balance any signals representative of a picture occurring at the same time instant that the synchronizing signals are generated and reach an amplitude value sufficient to overcome a predetermined and established bias on the amplifier unit 47. In this manner it is quite apparent that the signals transmitted from the transmitting means 41 consist of image signals for a time period corresponding to the time required to move the cathode ray pencil within each of the scanning tubes from left to right, for example, of one elemental strip of the object areas 1 and 3.

These image signals are then followed by a synchronizing signal indication which is produced during the time period required to cause the cathode ray pencil within the scanning tubes 5 and 7 to sweep back from right to left across one elemental strip of the object areas 1 and 3, after which the same preceding sequence is repeated again and again.

Under certain circumstances, as for example when the actors 25, for example, appearing in the foreground 3 wear dark colored clothing, it has been found expedient to utilize a highly reflecting back-drop for the foreground instead of the black velvet drop hereinbefore described. In such event, the connections to the bias amplifier 27, and the further connections in the system, are so arranged that maximum output from the tube 11 causes the tube 5 to become inoperative and any output from the said tube 11, less than maximum, permits the tube 5 to transmit a background signal. Inasmuch as the connections necessary to practice this modification of my invention will be obvious to those skilled in the art, they have not been illustrated in detail.

To receive the signals transmitted from the transmitting means 41 a suitable receiver 49 is provided from which the signals are suitably amplified in an amplifying means 51 and supplied to the detector 53 to which is also supplied energy from a local oscillator 55. In the output of the detector 53 there appear intermediate frequency signals which are suitably amplified in the intermediate frequency amplifier 57 and directed to a second detector 59. The output signals from the detector 59 are then suitably amplified in an amplifier unit 61. As has already been explained in co-pending application of W. L. Carlson, Serial No. 583,193, filed December 26, 1931, assigned to Radio Corporation of America, the picture signals appearing in the output of amplifier 61 are ampli-

fied to a still further degree by way of picture signal amplifier 63 and are then supplied across the grid cathode circuit of a cathode ray viewing tube 65. The tube 65 is provided with a fluorescent end wall 67. The impressed signals serve to control the intensity of the observable or luminous effects produced upon the tube fluorescent end wall 67 in accordance with the teachings of Nicolson Patent #1,470,696, although it is, of course, obvious that other forms of control of the effective intensity of the cathode ray could be substituted without involving invention and without departing from the spirit and scope of the present disclosure.

The synchronizing signals are suitably separated and supplied by way of conductors 69 and 71 to the horizontal synchronizing signal generator and the vertical synchronizing signal generator 73 and 75 respectively. The synchronizing signal generators 73 and 75 are preferably of the general form suggested by the above mentioned application of W. A. Tolson, Serial No. 608,460, although, here again, other forms might be substituted, such as, for example, the form shown in the above mentioned application of W. L. Carlson, so that the cathode ray pencil 77 produced within the viewing tube 65 is controlled both as to its horizontal and vertical positions by means of the deflecting fields 79 and 81, respectively, and the observable effects produced by the cathode ray pencil 77 impinging upon the fluorescent screen 67 is an electro-optical image representation of the combined foreground and background object areas 1 and 3 viewed by the scanning tubes 7 and 5, respectively.

If now it is desired to provide for rapid changes in focus of the viewed areas 1 and 3 so that, for example, the foreground action appears to come rapidly toward the viewing tube or to move rapidly away from the viewing tube, or if it is desired to maintain in the foreground action fixed but to produce the effect of rapid motion with respect to the background, each of the scanning tubes 5 and 7 may have as a part of the optical system (not specifically shown herein) by which the light from the object areas 1 and 3 is directed to the light-sensitive electrode of the scanning tubes, a so-called "Zoom" lens system of the general type shown and described in considerable detail in the article by Messrs. Warmisham and Mitchell which appeared in "The Journal of the Society of Motion Picture Engineers", vol. XIX, No. 4, for October 1932, pages 329 to 339, inclusive. It should be noted that when the "Zoom lens" is used the lenses coordinated with each scanning tube 5 and 7 should be mechanically coordinated one with the other under usual conditions so as to maintain always the proper focus.. Furthermore, if it is assumed that the scanning tubes are arranged at one fixed location and that at a predetermined distance from each tube there is the separate foreground and background object areas and that, for example, the foreground action moves nearer to the foreground scanning tube and the background, of course, does not change, then the "Zoom" lens system may be effectively used by first establishing the set for the originally assumed condition, then producing a so-called perambulator shot carrying the action of the foreground nearer to the center so as to provide for a close-up, then simultaneously maintaining the focus of the scanning tube for background in accordance with the varying position of the foreground action.

Where it is found desirable to produce the "ghost-like" effects, already mentioned, the biasing amplifier unit 27 may be so adjusted that signals directed thereto from the foreground signal amplifier 19 will not serve to bias to complete cut-off the scanning tube 5 but rather will serve only to reduce the amplitude of the output signals from the background scanning device 5 so that the combined signals appearing in the combining amplifier unit 25 for related and coordinated areas of the background and foreground simultaneously scanned by the scanning tubes 5 and 7 will be the combined light effect influencing each scanning tube, with the intensity of the signals resulting from any one scanning tube however usually diminished or reduced in intensity.

In the operation of a system of the general type hereinabove described, the first condition usually to be encountered is a condition where there is no action in the foreground; secondly the condition should be obtained wherein the foreground which is assumed, for purposes of illustration, to be a black matte, such as velvet in the form of a shade box, which is to be illuminated to the fullest extent which the action will require. At this time the biasing amplifier 27 should be adjusted until the background scanning tube 5 just operates completely. This condition is the test to determine the sensitiveness of control of the system to select automatically the separate image signals.

To provide for checking this adjustment it is usually desirable to increase very slightly the foreground illumination. If proper adjustment of the biasing amplifier 27 has been made this increase in illumination of the foreground completely wipes out the background scanning effects from the output signals. At this time it may be necessary to adjust slightly the biasing amplifier 27 which controls the control grid of the scanning tube 5 in order that the resultant combined signal from the scanning tubes 5 and 7 may appear in the proper relationship and intensity in the combining amplifier unit 25. After these adjustments have been made the originally assumed maximum illumination for the foreground should be re-established and the operation of the system should be maintained with as nearly this value of illumination as possible in order that further adjustments of the biasing amplifier system 27 need not be made in order that the relative intensity of the signals from the scanning tubes 5 and 7 may be properly regulated in the combined output energy from the combining unit amplifier 25.

In this connection it is, of course, to be understood that where "ghost" effects are desired the adjustments hereinabove described will not hold true and that the biasing amplifier 27 for producing "ghost" effects should, with the maximum illumination of the foreground, permit signals of varying intensity according to the particular type of effect desired to appear in the output of the scanning tube 5 for the background.

Where it is desired to reduce the eye strain from excessive illumination of the foreground action it may be desirable to substitute for the black velvet 27, assumed for the foreground, a red velvet, under which condition the actors 25 will use green make-up and garments and green illumination will be supplied. The light-sensitive photocells or photo-sensitive areas of the scanning tube 7 will be sensitive to green or covered by appropriate green light filters in order that use may be made of the so-called complementary black in contrast to the true black.

It should be noted that the present invention, as above described, is not limited to television but may be used also in any other art where it is necessary to superpose one series of energy impulses upon another and at the same time to diminish or extinguish one series of impulses during the presence of another. One of the particular fields in which such a system would be quite useful is in what is commonly known as "dubbing in" of sound effects on sound records, for example, where the action of a picture has a musical accompaniment and dialogue is superposed thereon. In this manner the system hereinabove disclosed can be used to depress the volume level of the musical background during the dialogue.

In addition, it should be understood that any suitable form of scanning device may, where desired, replace the cathode ray tube scanning system. Such types of scanning devices which might be used in alternative constructions include the so-called Nipkow disk, with or without lenses; the rotary Weiller wheel; vibratory mirrors; multispiral and shutter disk combinations; and, in general, any and all types of television scanning devices.

Also, where the background is moving continuously it is frequently desirable to provide a system by which the actors can view the scene providing the background effect. This may be provided by arranging the foreground and background areas 1 and 3 so that they face toward each other so that the actors in the foreground can always view directly the instantaneous background effect, or, where desired, the background may be projected in either full or reduced size upon a separate area within the view of the actors but out of view of the scanning medium for foreground action. In this manner the foreground action may at times be made easier for the actors and better coordination may be secured.

In some instances it may be found desirable to monitor the combined signals representative of foreground and background. For this purpose a monitor image reproducing system 36 may be controlled by the signals appearing in the combining amplifier 25 output circuit which will produce on the monitor, assuming that a cathode ray monitor tube is used, varying intensity electro-optical image effects properly coordinated with foreground and background. The monitor image must also be controlled as to its instantaneous position on the image reproducing device by means of the synchronizers for each view scanning tube in a manner similar to the control produced upon the tubes 5, 7 or 65 by the synchronizing signal generators 31 and 33.

A further advantage of the monitor image is that it may be easily photographed to produce a motion picture record, for example, of the composite scene representative of both foreground and background. In this manner motion pictures of a most unusual type, which later can be transmitted or projected in well known manner, can be produced. Such motion pictures which could be made by a device conventionally shown at 38 would place foreground action at points where it would otherwise be impossible to locate such action because of danger of position, difficulties in photographing, expense of the picture and setting or numerous other factors. For example, it might be possible to photograph as background a great conflagration and then by ways and means herein disclosed have the actor appear as if actually in the origina actually exposing the artist to

Further, in many instances i desirable to form objects in t such manner that the light refl istics of the entire object areas the background. The scannin be unable to "see" or disting from the background with a actors in the foreground may around the objects so as to ma picture more realistic.

Fade-in and fade-out scene desirable in the viewed composi fade-ins and fade-outs may be background and foreground sce transmission may readily be a the apparatus herein disclose several foreground and backgro vices in parallel and under t single controlling source. Eac would then scan an independen normal conditions only one fo background scanning device wo with the combining amplifier u when a fade-out from one scan fade-in to another scanning de be background or foreground is desired the action may be desired or known type of fad apparatus, such, for example, by the copending application o smith, Serial No. 475,188, filed and assigned to Radio Corporat

Many other modifications an invention and application to o will, of course, become apparen in the art and it is therefore invention shall be construed in read upon all modifications s within the spirit and scope o appended claims wherein it is sired to secure by Letters Paten

1. A system of composite t ing means for producing two signals by simultaneously a scanning at least two object patching together the series sentative of the two object a means for nullifying the signa of one of the series of signals of the signals of the other s periods when signals in the co produced simultaneously with trolling series.

2. In a system for produci constructing composite televisi for independently and simult in synchronism at least two o duce from each scanning sepa nal impulses, means for grou nals representative of the scanned, and means for contr together of the signals of the to produce a new series of sign in the signals of one original under the control of and du of signals of the other serie being a series of signals rep scanned area having superi area corresponding to that p scanned area which initiated nals which served to nullify signals.

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thod of composite television trans-
mission which comprises simultaneously and synchronously scanning a plurality of related size object areas representing the background and foreground areas, producing simultaneously in accordance with the intensity of light and shadow on co-ordinated elemental areas of each separate scanned area an independent series of signals representative thereof, grouping together the plurality of independent series of signals into a single series of signals representative of the light intensity upon the two separate areas transformed into like dimensions and superimposed, and rendering one scanning operation ineffective to produce useful signal representations during each appearance of signal energy output from the other scanning and under the control thereof so that the single series of signals produced from grouping together of the independent series represents an intermingled series of signals representative of like size foreground and background areas superimposed.

9. The method of transmitting composite television image signals which comprises simultaneously scanning two related object areas representing foreground and background along paths coordinated one with the other, producing by each separate scanning a series of variable character signals each representing the intensity of light and shadow upon the scanned object area, combining the separate series of signals to form a single series of variable character signals representative of both scanned object areas superimposed, and reducing the signal strength of one series in the combined series to a value at least equal to cut-off in accordance with the presence of simultaneously produced signals in the other series.

10. In the method of producing signals for television image transmission, the steps which comprise scanning simultaneously and synchronously two separate object fields of view to produce two separate series of signals each normally different from the other, reducing the energy output representative of one of the independent series during periods of presence of energy impulses exceeding a predetermined threshold value in the other series and under the control thereof, and simultaneously maintaining the energy impulse level of the controlling series at normal value.

11. In a television system the method steps which comprise producing for spaced background and foreground areas a plurality of series of energy impulses of electrical characteristics representative of varying values of light and shadow, each of said series being representative of one only of the background and foreground areas, combining the independent series to produce a composite series of impulses having electrical characteristics varying in accordance with both background and foreground areas, and reducing the amplitude of the impulses representative of background to a zero value during periods of simultaneously produced electrical characteristics constituting representations of foreground.

12. In a television system the method steps which comprise separately and sychronously scanning background and foreground areas to produce independent series of energy impulses of electrical characteristics representative of varying values of light and shadow of the areas scanned, combining the independent series to produce a composite series of impulses having electrical characteristics varying in accordance with both the background and foreground areas

scanned, and reducing the effective signal level of the impulses representative of background to cut-off value during periods of simultaneously produced signal representations of foreground.

13. In a television system the method steps which comprise synchronously scanning independent foreground and background areas, producing from the scannings a plurality of independent electric waves representative of the varying intensity of light and shadow on elemental areas of the scanned foreground and background areas, combining the electric waves, and upon combining the waves reducing the signal level of one of the electric waves representing one area to zero value during time periods where the electric wave representing the other area exceeds a predetermined effective intensity.

14. In a picture transmitting system, the method of producing a series of signals representative of a plurality of independent areas scanned which comprises independently and synchronously scanning a plurality of independent areas of similar boundary forms producing from each scanning independent electric waves of characteristics varying proportionally to light and shade variations of the scanned areas, changing the normal amplitude of one of the electric waves to zero value under the control of the other electric wave during time periods when the other electric wave exceeds a predetermined amplitude value, and patching together the electric waves to form a composite wave characteristic of the wave which would result from superimposing the independent areas.

15. In combination, a plurality of simultaneously and synchronously operating scanning systems, means to produce from each scanning system separate series of signals, means for controlling the output energy level from one system between zero and a finite amplitude in accordance with the output energy level from the other system and solely under the control thereof, and means for assembling the controlled and controlling series of signals into a single new series of signals representative of the superimposed fields of view scanned by the two scanning systems.

16. The method of producing motion picture film which comprises independently scanning a plurality of object areas to produce from each scanning a series of electrical signals representative thereof, controlling the energy level of one only of the series of electrical signals in accordance with the presence and absence of signals in the other series of electrical signals, developing from the controlled and controlling series of signals a composite series of signals representative of the scanned object areas superimposed, forming an electro-optical image from the composite series of signals, and photographing the composite electro-optical image to produce a motion picture film representative of the plurality of scanned object areas.

17. The method of transmitting television signals comprising the steps of independently scanning a background and a foreground area to produce an independent train of energy impulses from each scanning area according to a preestablished pattern of scanning, equalizing in time relationship the period of production of energy impulses so that the time duration of signals resulting from each scanning is such that effectively the background and foreground areas scanned have equal and similar size boundaries, combining the separate energy impulses, nullifying the effect of one of the se pulses in accordance with the impulses in the other series and resultant combination of en nals.

18. In television apparatus wh and foreground areas are indep means for synchronously scann to produce independent video ing the foreground and backgrc to co-ordinate in time relation of each of the produced serie means for reducing the signal of signals representing the back ing time periods of presence series representing the foreg means for producing from the ing the foreground area and th background area signals a singl representative of combined back ground areas.

19. The method of producin vision image signals which con ently and separately scanning a a foreground area synchronousl each scanning a series of signa of each scanned area, and utilizi duced series of signals to contro other series during periods of controlling signal.

20. The method of producin vision image signals which con ently and separately scanning a a foreground area synchronousl each scanning a series of signa of each scanned area, utilizing duced series of signals to contro other series during periods of pre trolling signal, and adding to th ries of signals the resultant co signals.

21. The method of producing vision image signals which co nously producing two separate trains of signal energy, and au pressing to a predetermined d trains of signal energy only d presence of the other train of s under the control thereof irresp plitude values thereof exceeding threshold value.

22. The method of producing vision image signals which co nously producing two separate trains of signal energy, automati to a predetermined degree one of nal energy representing the inde areas only during periods of pr in the other train of signal ener control thereof irrespective o values thereof exceeding a prede old value, and adding to the of signals the resultant controll nals.

23. The method of producing representative of spaced foregr ground areas which comprises t ning at least one background ously and synchronously scann foreground area of dimensions s the scanned background, produci nings image signals representat sities of lights and shadows on a controlling the signal level of t ing from background scanning a

produced foreground signals un-
of the foreground signals to re-
level of the signals resulting from
nning during control periods to
zero amplitude value, and com-
ıls subsequent to the control of
ıe signals resulting from back-
g to produce a new series of sig-
ıtive of a scanned background
posed thereon any scanned fore-

hod of producing composite tele-
which comprises independently
usly scanning a plurality of image
ı at least one represents a back-
roducing from each scanning a se-
ıge signals representative of the scanned areas, reducing the intensity of the signals representative of the background area under the control of one of the other simultaneously produced signals representative of another scanned area, and adding together, subsequent to the intensity reduction of the background area signals, all of the resultant signals to produce a new series of signals representative of all scanned areas superimposed.

25. The method claimed in the preceding claim comprising the additional step of producing from the last named series of signals an electro-optical image representation of the background area having superimposed thereon any scanned foreground area.

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