March 18, 1947. F. W. REYNOLDS 2,417,446

STEREOTELEVISION AND TELEVISION RANGE FINDING

Filed Aug. 1, 1941 3 Sheets-Sheet 1

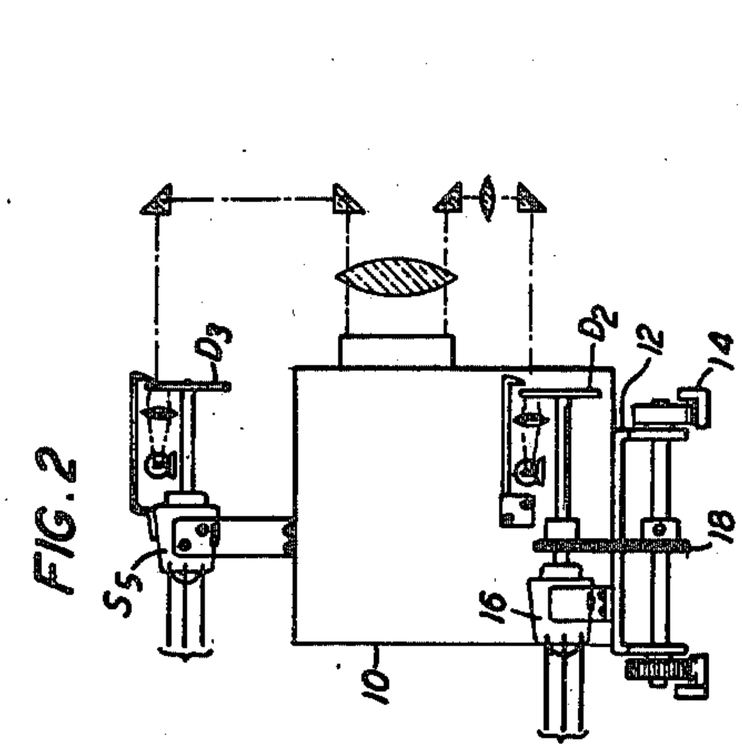

FIG. 2

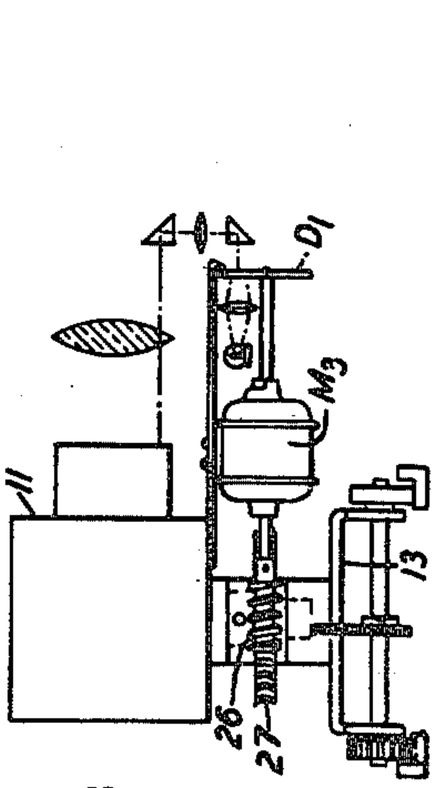

FIG. 3

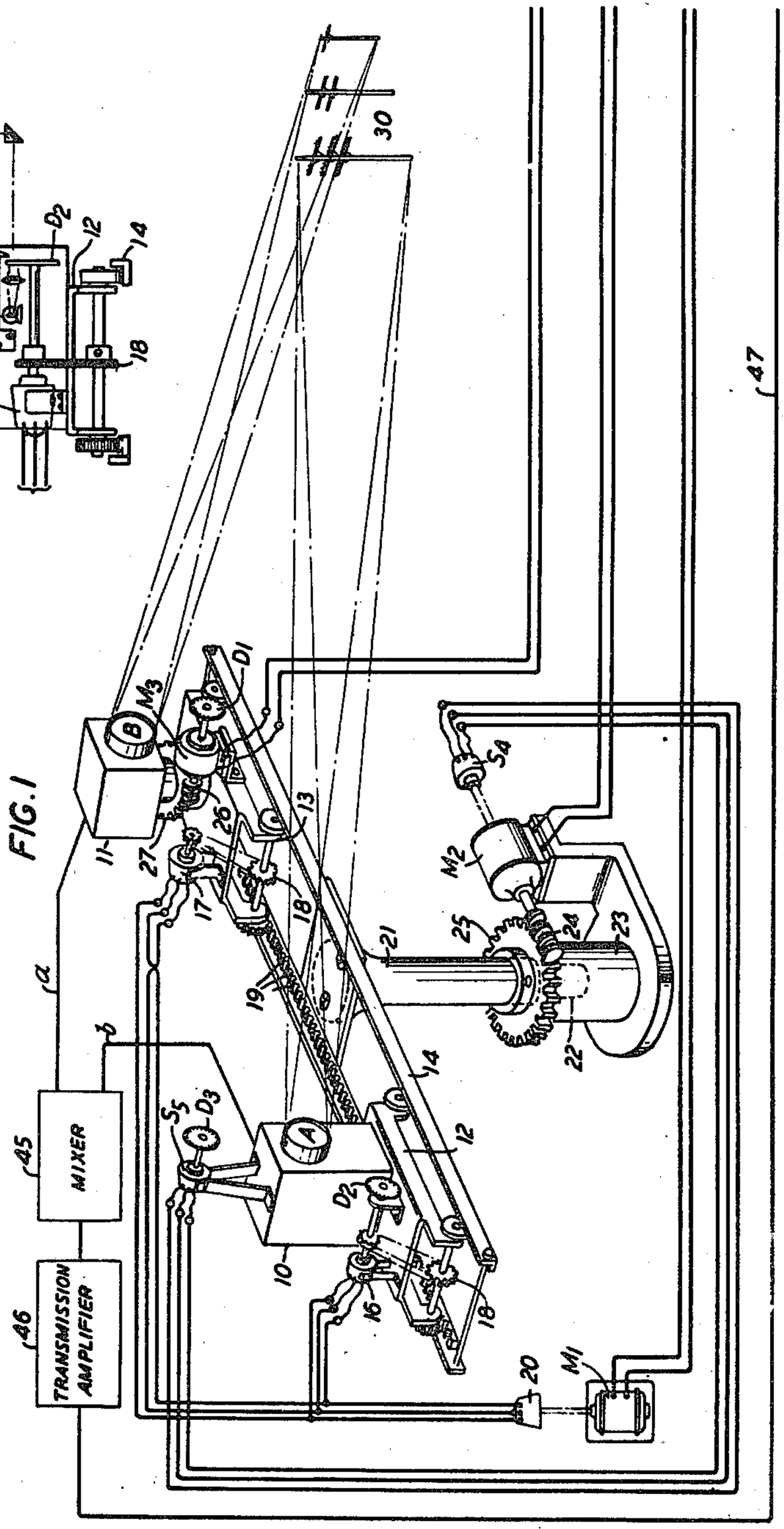

FIG. 1

INVENTOR
F. W. REYNOLDS
BY Chas. Sprague
ATTORNEY

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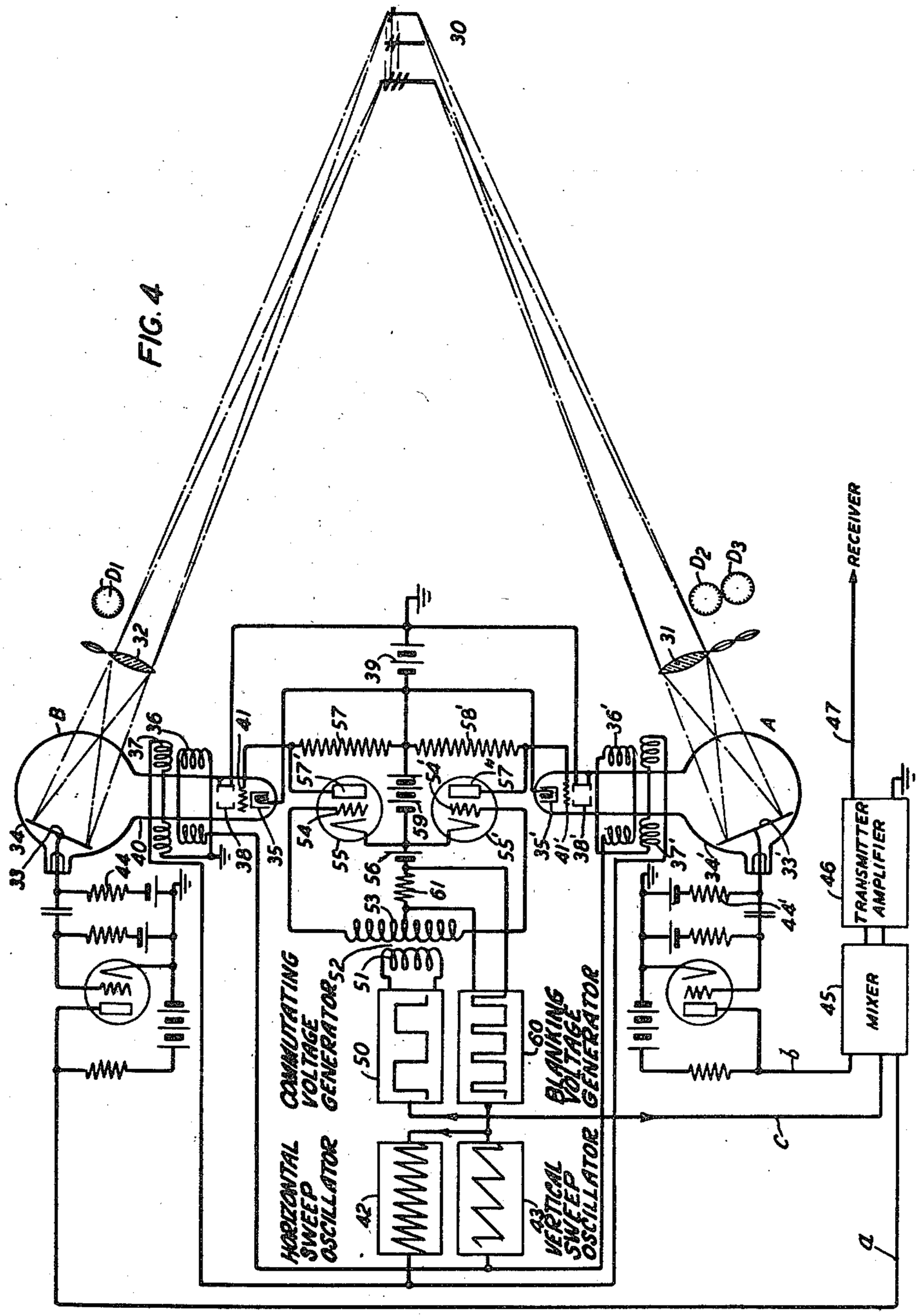
FIG. 4



INVENTOR
F. W. REYNOLDS
BY C. L. Sprague
ATTORNEY

March 18, 1947. F. W. REYNOLDS 2,417,446

STEREOTELEVISION AND TELEVISION RANGE FINDING

Filed Aug. 1, 1941 3 Sheets-Sheet 3

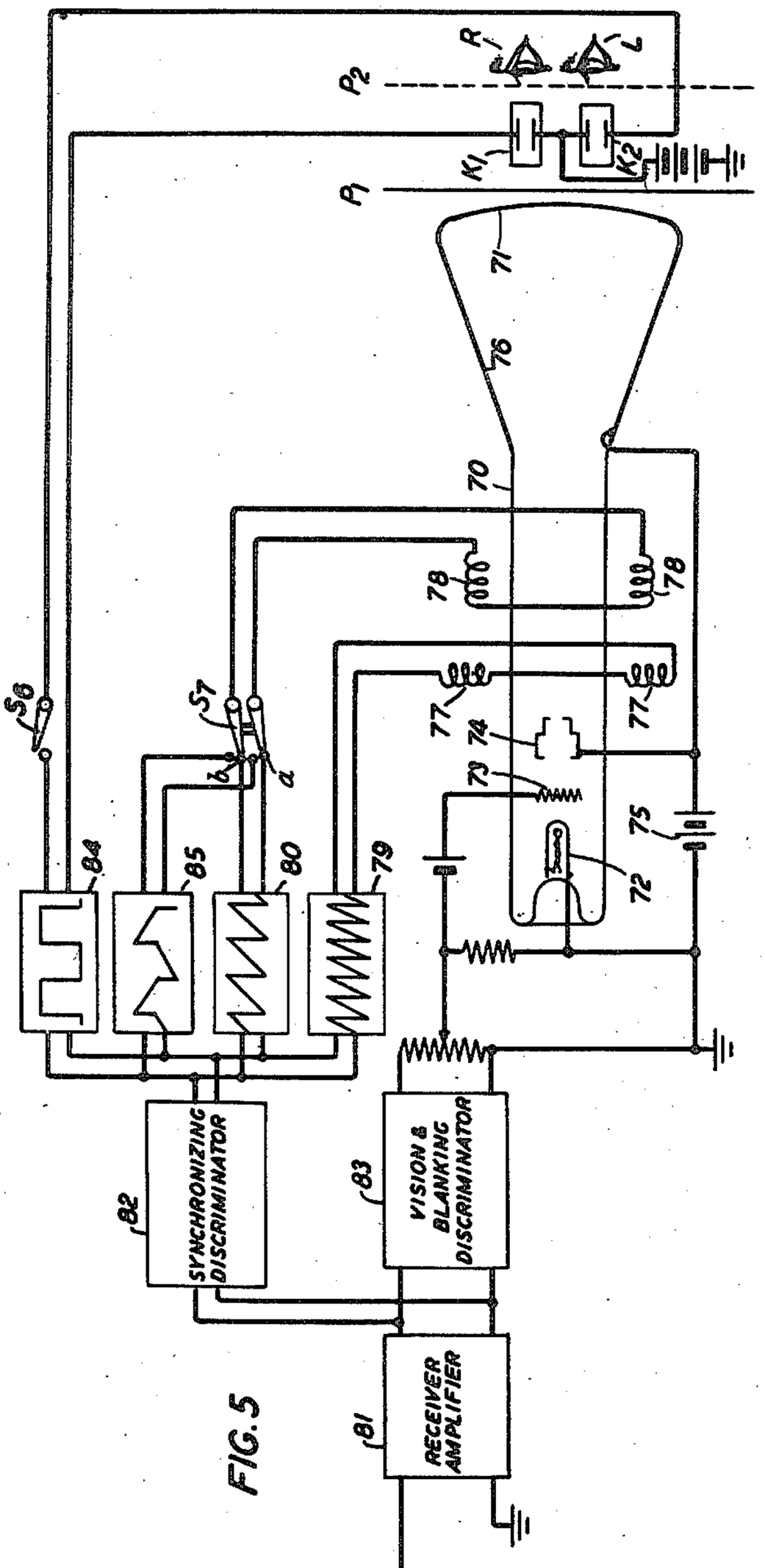


FIG. 5

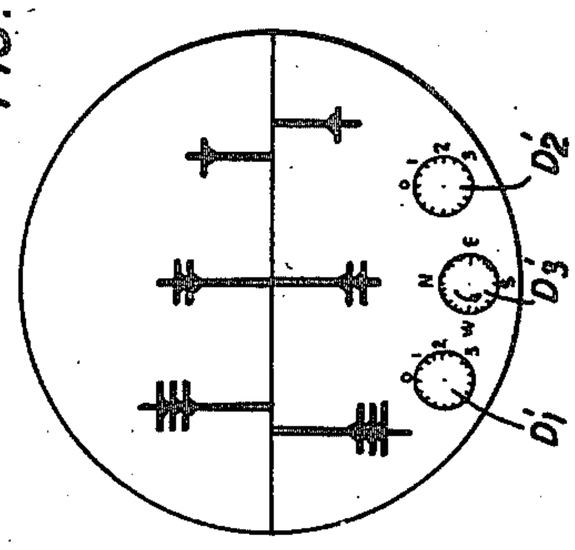


FIG. 6

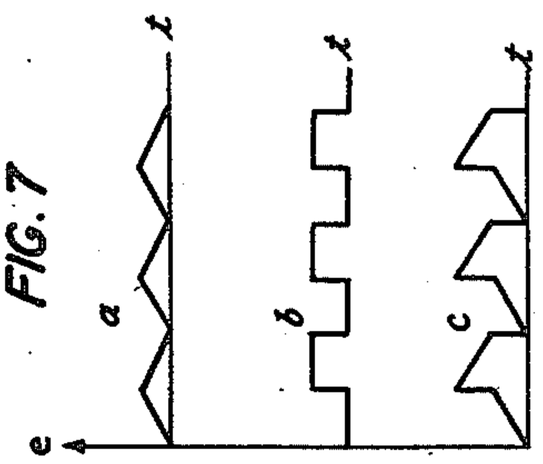
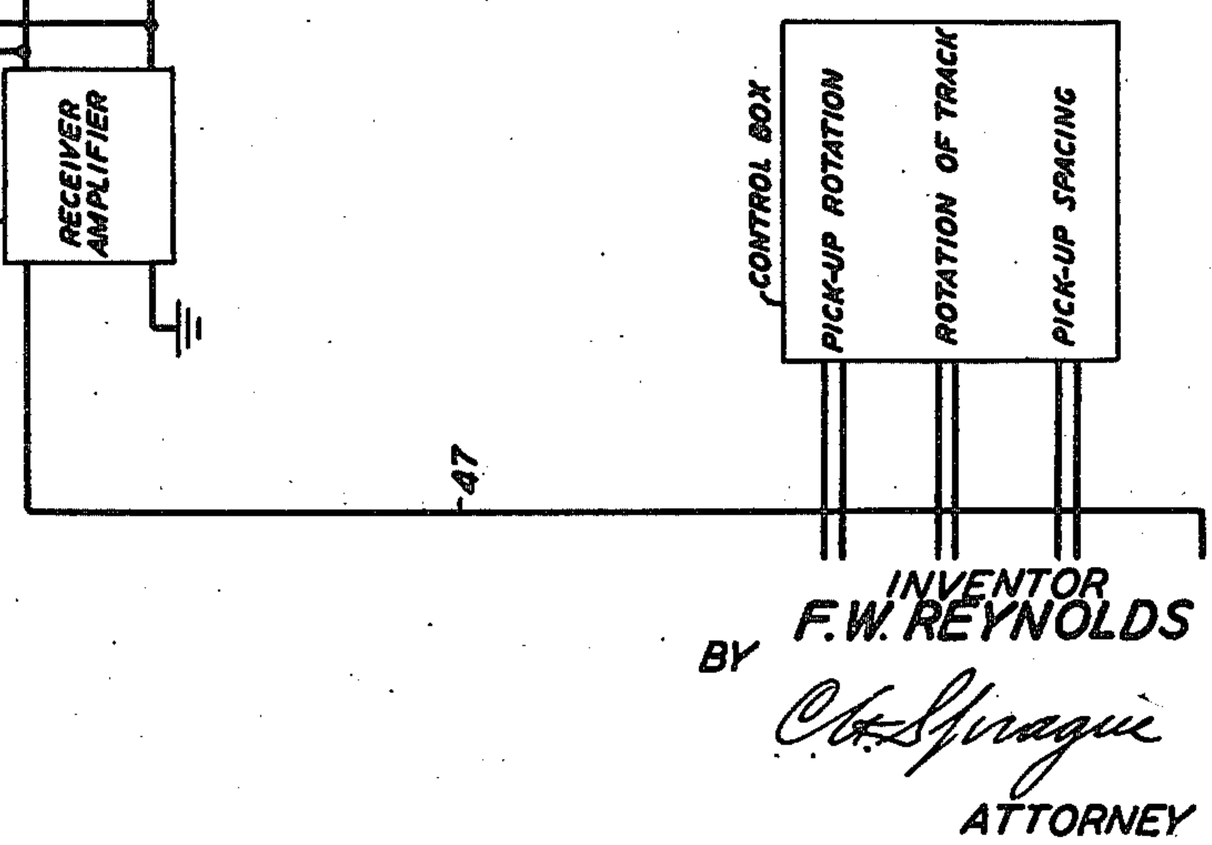


FIG. 7



INVENTOR
F. W. REYNOLDS
BY
Chas. L. Sprague
ATTORNEY

Patented Mar. 18, 1947 2,417,446

UNITED STATES PATENT OFFICE

2,417,446

STEREOTELEVISION AND TELEVISION RANGE FINDING

Frederick William Reynolds, Ridgewood, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application August 1, 1941, Serial No. 405,031

7 Claims. (Cl. 33—65)

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This invention relates to stereoscopic television.

It is an object of the invention to provide a method and means for synthesizing on a television receiver screen from appropriately produced vision signals, an image containing information as to the distance of an object field as well as an impression of its depth.

Another object of the invention is to provide a television receiver image which conveys an enhanced depth impression.

Another object is to provide a television image conveying a depth impression which is controllable at the will of an observer viewing the receiver screen.

Another object is to provide for the synthesis of television images in a juxtaposition such as to convey to an observer information as to the location and distance of the object field, or otherwise additional to the information contained in a single conventional television image.

Another object is to provide range-determining apparatus which can be operated with a far longer base line, and which therefore gives far greater accuracy than is possible with range-determining apparatus of known construction.

In pursuance to these objects there are provided spaced means for deriving vision signals representative of the light tone values of different aspects of a selected portion of an object field as seen from different points of view, and means at a receiver station for remotely controlling the direction in which the pick-up devices are aimed and synthesizing these vision signals into separate images for viewing in an appropriate manner by an observer. These images may be reproduced in alternation, frame by frame or line by line, and juxtaposed in any suitable manner. The images of the two field aspects, if superimposed to create the depth impression, may be differentiated in terms of polarization, color or otherwise while the observer may be provided with a suitable differentiating mechanism such as a pair of alternately opened light valves, in accordance with well-known technique. If preferred, the image may be synthesized in separate parts and the distance of the object field determined from the amount of misalignment between them.

In accordance with the invention in one embodiment the pick-up devices are spaced much more widely apart than is usual in stereoscopic systems, and, further, their spacing is variable under control of the observer, so that the images which the observer sees upon the receiver screen are derived from vision signals corresponding to

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aspects of the object field which may differ as much or as little in point of view as the observer may desire. Thus a greatly enhanced depth effect may be obtained, and at the same time a depth effect which is variable at the will of the observer.

In the case of extreme spacing between the pick-up devices, they will be directed or "aimed" toward the same point of the object field only if one of the pick-up devices is aimed in a slightly different direction from the other. Means are therefore provided for rotating one of the pick-up devices angularly with respect to the other so that they may both be directed toward the same selected part of the object field independent of whether the selected part of the object field be near or far.

Furthermore, advantage is taken of the television characteristics of the system for transmitting to the receiver information regarding the distance of the selected portion of the object field in a simple and convenient manner. To this end the motors which perform the movements of the pick-up devices are provided with indicators and dials whose relative movements and therefore whose indications are correlated with the movements of the pick-up devices. Each indicator and dial is placed in the field of view of one of the pick-up devices in such a way that it is televised along with the object field proper. Thus the received image contains representations of the dial indications as integral parts thereof, so that the system may serve not only to give an impression of the depth of the object field, but also a fairly precise measure of its distance.

The invention will be more fully understood from the following illustrative embodiment thereof, taken in connection with the appended drawings, in which:

Fig. 1 shows in perspective view the pair of television pick-up devices arranged to be spaced apart by a variable distance and rotated both together and relatively to each other;

Fig. 2 is a side view of one pick-up device and an arrangement for indicating the direction toward which the apparatus is aimed and the spacing between the devices;

Fig. 3 is a side view of another pick-up device and an arrangement for indicating their relative rotation;

Fig. 4 shows in schematic form the electrical and optical component parts of a system according to Fig. 1;

Fig. 5 shows schematically receiver apparatus

to cooperate with the pick-up apparatus of Figs. 1 and 4;

Fig. 6 shows a dual range-indicating image which may be produced on the screen of the receiver of Fig. 5; and

Fig. 7 is a diagram showing how a wave form useful in practicing the invention may be built up.

Referring now to the figures and particularly to Fig. 1, the two television pick-up devices A and B, which may also be referred to as television cameras and camera tubes, may conveniently be mounted in housings 10, 11 on trolleys 12, 13 to roll or slide toward and away from each other on a track 14. The track may be as long or as short as desired, though in practicing the invention it is preferred to employ a track of the order of 20 to 50 feet in length. Any suitable means may be employed for driving the trolleys carrying the pick-up devices toward and away from each other along the track. These means are preferably synchronized with each other and may comprise, for example, self-synchronous motor units 16, 17 mounted on the trolleys and coupled to pinions 18 which mesh with the teeth 19 of a rack fixed to the track 14. The self-synchronous motors 16, 17 may be connected in parallel as shown in a manner such as to produce rotation in opposite directions when similarly energized as by rotation of a like unit 20 fixedly mounted on the base of the apparatus or elsewhere and arranged to be driven by suitable means such as a direct current motor M_1 which in turn may be remotely controlled. They must naturally be provided with field windings excited with alternating current in accordance with well-known technique, which field windings have been omitted from the drawing in the interest of simplicity.

In accordance with the invention, the track 14 itself may be mounted for rotation in a horizontal plane. Thus, for example, it may be rigidly fixed to a column or pedestal 21 which is pivoted on a vertical pivot 22 to a stationary base 23, the pedestal 21 being arranged to be driven in rotation about the pivot 22 by any suitable means such as a motor M_2 fixed to the base 23 and driving a worm 24 which meshes with a worm gear 25 fixed to the pedestal 21. If desired the track as a whole or the housings 10, 11 may further be provided with means for rocking about a horizontal axis to facilitate aiming the pick-up devices in an upward or downward direction. Such means may be of any desired type and may be for example of the type shown and described in Patent No. 2,306,862, December 29, 1942, of R. Bown, Serial No. 401,441, filed July 8, 1941.

In accordance with the invention, one of the pick-up devices, for example, the one mounted in the housing 11 is further provided with means for rotating it about a vertical axis. Such means may be of any desired type and simple and suitable means are shown in Fig. 3 in which trolley 13 in turn supports a pivot on which the housing 11 may rotate in the horizontal plane, being governed and controlled in rotation by any suitable means such as a motor M_3 mounted on the housing and driving a worm 26 which meshes with a worm gear 27 fixed to the trolley.

It is contemplated that indications of the rotation of the housing 11 about the vertical axis shown in Fig. 3 and of the spacing between the two pick-up devices shall be transmitted to the receiver station along with the vision signals derived from these devices. In the normal course

of operation the amount of this rotation will be comparatively slight, for example, of the order of 5 degrees of arc or less. In order to transmit reliable information as to this small amount of rotation, it is preferred to couple an indicator dial D_1 to the shaft of the motor M_3, the index which cooperates with the dial being mounted on the motor casing, the gear ratios between camera and dial being such as to spread a 5-degree rotation of the camera out into a 360-degree rotation of the indicating dial. A like dial D_2 and indicator may be coupled to one of the pick-up spacing motors 16. Reduction gears, not shown, may be inserted between the motor 16 and the dial D_2 so as to compress the full excursion of the pick-up devices, i. e., to the ends of the track, into a 360-degree dial rotation.

Still another dial and indicator may be employed to indicate the direction or point of the compass toward which the apparatus as a whole is aimed. Thus the track rotation motor M_2 may be arranged to drive a self-synchronous unit S_4 which feeds a like unit S_5 mounted on the trolley of one of the pick-up devices and having a dial D_3 calibrated, for example in points of the compass geared to its shaft and in cooperative disposition with an index. As before, a gear reduction unit may be included to compress a rotation of many revolutions of the motor M_2 and the units S_4 and S_5, into a single revolution of the dial D_3.

In accordance with the invention, the dials and indices are so disposed that they may be televised by the pick-up devices. To this end reflecting prisms and lenses may be suitably disposed as indicated in Figs. 2 and 3 for projecting onto the screen of each camera, along with an image of the field of view proper, images of the dial portions with which the indices are at any instant in registry. These auxiliary dial images are then scanned along with the image of the field of view proper so that the images as ultimately synthesized at the receiver will contain representations of the dial readings.

The invention may conveniently be practiced with apparatus whose electrical connections may be as shown on Fig. 4, in which the mechanical elements such as the track 14, the trolleys 12, 13 which travel along the track and the various motors which cause their movements have in the interests of simplicity been omitted. In this figure a selected portion of an object field 30 having appreciable depth is imaged as by lenses 31, 32 on the light sensitive screens of two television pick-up devices A, B which, in accordance with the invention, are spaced apart by a substantial distance. The pick-up devices may be of any desired type and are shown in the figure by way of illustration as being of the well-known charge storage type in which the image receiving screen 33 of the device B consists of a mosaic of photosensitive discrete elements backed by a conductive plate and contained in an insulating vessel or tube 34. The vessel 34 is provided with a cathode 35 or other source of an electron beam, means such as coils 36, 37 for deflecting the beam in two directions and a suitable electron optical system for accelerating the electrons of the beam and focussing them in a scanning spot on the mosaic screen. Such electrode systems are well known per se and may be of any desired type. They have therefore not been shown in detail in the drawing but are merely indicated by an electrode 38 mounted in the neck of the tube and connected to a source of operating voltage 39.

The tube 34 is further provided with a conductive lining 40 connected to the source 39 of anode potential for withdrawing secondary electrons, and with a beam-modulating electrode which may likewise be of any desired type and is indicated in the drawing by a conventionalized grid electrode 41. The cathode beam may be caused to scan the screen by the magnetic fields of the coils 36, 37, supplied with scanning currents of suitable wave form by a horizontal sweep oscillator 42 and a vertical sweep oscillator 43. The other pick-up device A may be similar and provided with similar elements indicated by the reference characters 33' to 38' inclusive, 40' and 41'. It is supplied with operating voltage and deflecting currents by the sources 39, 42, 43.

As is well known, when an image is projected on the mosaic screen of such a device and the cathode beam is caused to scan this image, a current flows in the external circuit of the mosaic screen electrode 33 or 33' which appears as a signal voltage drop across a resistor 44 or 44' which signal voltage is representative of the particular aspect of the selected portion of the field of view 30 toward which the pick-up device is directed or aimed. Thus in the arrangement shown the vision signal output of the tube A differs slightly from the vision signal output of the tube B in dependence upon the difference in aspect of the selected portion of the field from the two points of view of the pick-up devices A and B, respectively. The two resulting vision signals are then mixed with other associated signals by suitable apparatus 45 of well-known type, amplified and transmitted to the receiver as by a line or channel 47 for synthesis into an image.

In accordance with the invention, the signals from the pick-up devices A and B are to be reconstituted as images in a juxtaposition such as to convey to the observer information as to the depth and distance of the field 30. To this end the signals are preferably kept separate. This separateness of the signals may be achieved in any suitable manner but a time separation is believed to be entirely adequate and lends itself well to the use of a single transmission channel. Thus commutating means are provided so arranged that vision signals from the camera tube A will be delivered to the transmission channel 47 for a short period, for example, the period required for a single complete scanning of the field, whereupon the A signals are blocked and replaced in the transmission channel by signals from the camera tube B which continue during the ensuing complete field scanning. This process is repeated, the A signals and the B signals being delivered to the transmission channel 47 in alternation throughout the televizing of the field. Commutation of the signal may, if desired, be effected at a much higher rate, for example, the line scanning frequency.

To effect commutation of the A and B signals, respectively, there may be provided a generator 50 of a substantially square voltage wave of a fundamental frequency equal to the frame repetition frequency or vertical scanning frequency of the vertical sweep generator 43. The output of this generator, whose internal connections may be of any suitable and convenient sort, may be fed to the primary winding 51 of a transformer 52 whose secondary winding 53 is connected to the grids 54, 54' of two discharge devices, for example, triodes 55, 55' connected in push-pull, and biased as by a battery 56 for operation in the normal amplifier range. The anodes 57', 57'' of these tubes are supplied with operating potential through load resistors 57, 58' from a suitable source such as a battery 59, being connected respectively to the modulating electrodes 41, 41' or grids of the pick-up tubes A and B. With this arrangement, during a positive half cycle of the square wave voltage of the generator 50, the potential of the modulating electrode 41 is depressed and that of the electrode 41' elevated, so that the cathode beam of the A camera tube is cut off while that of the B tube is turned on. During the ensuing negative half cycle of the voltage of the commutating generator 50 the opposite is true. Thus the vision signals eventually reproduced at the receiver station are derived in alternation from the pick-up devices A and B and therefore are representative alternately of the two different aspects of the field of view 30 as seen by the devices A and B, respectively.

In accordance with common practice, it is desirable to provide means for "blanking" the cathode beam of each tube during the rapid flyback or return sweep of its cathode beam. To this end a blanking voltage generator 60, whose internal connections may be of any suitable type and arrangement, feeds its voltage across a resistor 61 to excite the grids 54, 54' of the tubes 55, 55' in parallel. As will be understood by those skilled in the art, its effect is therefore to periodically reduce the voltages of the modulating electrodes 41, 41' together, and so to cut off the cathode beam of whichever of the camera tubes A or B is permitted by the square wave generator 50 to operate, for a brief flyback interval at the conclusion of each scanning line.

In accordance with common practice, it is preferred to maintain the commutating generator 50 and the blanking generator 60 in exact synchronism with the horizontal line sweep generator 42 and the vertical frame sweep generator 43. Such synchronizing means may include periodic tripping means or the like and are indicated in the drawing merely by electric coupling connections.

In accordance with the invention, the vision signal output from whichever of the pick-up devices A and B is instantaneously operative is mixed with a synchronizing signal which may be derived from each of the horizontal and vertical scanning generators, which synchronizing signal may govern the scanning, blanking and commutating operations at the receiver station. To this end the vision signals of the pick-up devices A and B are fed together with the synchronizing pulses through conductors *a*, *b* and *c* to a mixer device 45 which may be of any suitable internal arrangement. The resulting composite signals are then fed from this mixer to a transmitter amplifier 46 which may be of any desired type for transmission over the line 47 to a receiver station.

The receiver may be of any suitable sort and for the sake of illustration is schematically shown in Fig. 5 as a cathode ray tube 70 provided at one end with a fluorescent beam receiving screen 71 and a cathode 72 or other source of an electron beam at the other end. In a common construction the cathode end of the tube 70 is also provided with a beam-modulating electrode and means for accelerating the cathode beam toward the fluorescent screen and focussing it sharply thereon in a narrow spot. Such means are symbolically indicated in the drawing by a grid 73 and an anode member 74 connected to a po-

tential source such as a battery 75. The beam receiving end of the tube may likewise be provided with a conductive lining 76 connected to the accelerating and focussing anode, for withdrawing secondary electrons.

Deflection of the cathode beam in the course of the scanning operation may be effected in any desired manner and electromagnetic deflecting means are shown by way of illustration on the drawing, consisting of vertical beam deflecting coils 77 and horizontal beam deflecting coils 78 supplied with current from horizontal and vertical sweep generators 79, 80 which may be held in synchronism with the scanning sweep generators 42, 43 at the transmitter by the synchronizing signals received by the amplifier 81 along with the vision signals and directed to their proper destination by a discriminator 82 which is constructed to pass only the synchronizing signals and exclude the vision signals. At the same time the vision and blanking signals are passed by a discriminator 83 to the beam modulating electrode 73 of the receiver tube. As is well known, with apparatus of this type a visible image appears on the fluorescent screen 71 at the beam receiving end of the tube whose character is dependent upon the vision signals received at the input terminals of the apparatus.

In accordance with the invention the received vision signals are derived in alternation from the pick-up devices A and B which see the object field from different points of view and therefore the synthesized image on the fluorescent screen will consist of successive images of these different aspects of the field of view, replacing one another at a frequency of, for example, thirty or sixty times per second. In order to receive an impression of depth from an image of this sort, it is necessary that the A image be viewed by the observer exclusively with one of his eyes, for example his right eye, while the B image is viewed exclusively by his left eye. This may be accomplished in various ways. One way of securing the separation is by the use of paired optical polarizers and a suitable device for rotating the plane of polarization of the emergent light synchronously with the oscillations of the commutating generator 50 at the transmitter. Thus, a sheet of light polarizing material P_1 may be placed immediately in front of the fluorescent screen and another like sheet of material P_2 placed beyond, the two sheets P_1 and P_2 being so oriented that their polarization planes are mutually at right angles. Between these two sheets, P_1, P_2, there may be placed any suitable means for rotating the planes of polarization of a light beam, for example, Kerr cells K_1 and K_2. Activating voltage may be supplied through a switch S_6 to these Kerr cells from a commutating generator 84 which may be identical with the generator 50 at the transmitter and held in synchronism therewith by the synchronizing signals.

In operation, as the commutating signal is impressed on the Kerr cells K_1, K_2 which, of course, must be properly constructed and biased in a manner well known in the art, each one rotates the plane of polarization of the light emerging from the polarizing sheet P_1 through 90 degrees in alternation so that, during one commutating half cycle, the Kerr cell K_1 transmits light through the polarizing sheet P_2 while K_2 blocks it and during the ensuing half cycle the cell K_2 transmits through the sheet P_2 while the cell K_1 is inoperative. In accordance with the invention, these cells are so placed with respect to the eyes R, L of an observer that light passing the cell K_1 enters his right eye and light passing the cell K_2 enters his left eye. It will be understood that with such an arrangement, when the transmitivities of the cells alternate in synchronism with the change of the image on the fluorescent screen 71 from an A image to a B image, that the observer will receive left-eye images and right-eye images in rapid succession. As is well known, if these right-eye and left-eye images succeed one another at a rate of 30 reversals per second or more, the changes themselves are unnoticeable and the observer receives an impression of an unflickering stereoimage of the selected portion of the field 30 as viewed from a point substantially half way between the positions of the two pick-up devices A and B.

In accordance with the invention, control means are provided at the receiver station for operating the transmitter motor M_2 to rotate the track 14 in a horizontal plane to direct the cameras toward different selected portions of the field of view, for operating the motor M_1 for increasing or decreasing the separation along the track of the pick-up devices in order to enhance or diminish the depth effect of the received image, and also for operating the motor M_3 to rotate the B camera in a horizontal plane to cause its line of aim to intersect that of the A camera at a desired distance from the pick-up apparatus as a whole. These three control means are preferably independent but may conveniently be operated by a single manual controller unit having at least three degrees of freedom. A suitable controller unit and the associated electric circuits therefor are disclosed and claimed in Patent No. 2,306,862, hereinbefore mentioned. As the observer of the image synthesized on the receiver screen operates the camera movement controls, the readings of the indices on the various dials D_1, D_2, D_3 will change and images of all three dial readings will be reproduced on the receiver screen 71 as above described. The common rotation dial D_3 may be calibrated in points of the compass. The spacing dial D_2 and the angular displacement dial D_1 may be calibrated in angular measure or in feet or miles as desired. The observer may thus receive not only an impression of the depth of the selected portion of the field of view, enhanced or diminished in accordance with his taste, but at the same time a direct and precise indication of the distance of this portion of the field of view from the television pick-up devices.

With a comparatively slight change in the receiver circuits, which may be effected by throwing the switches S_6, S_7 shown in Fig. 5, the apparatus may be modified to give a still more precise measurement of the distance of a selected portion of the object field when this is of primary importance, with the sacrifice of the depth effect. For this purpose the Kerr cells K_1, K_2 or other light valves, the polarizing screens P_1, P_2 and the commutating generator 84 are dispensed with, the switch S_8 being opened. An auxiliary modified vertical sweep generator 85 is substituted for the conventional one 80, merely by throwing the switch S_7 to the position *b*. This generator is so constructed as to produce a modified saw-tooth wave of the form shown, each individual saw-tooth, however, being about one-half as great in amplitude as the individual saw-teeth of the conventional generator 80 so that the full peak-to-peak amplitude is substantially the same as in the generator 80. This generator 85 may comprise a circuit arrangement adapted to produce

a triangular wave as shown in Fig. 7*a* and another circuit arrangement adapted to produce a square wave as shown in Fig. 7*b* and a third circuit arrangement for combining these waves additively as shown in Fig. 7*c*. Each of these component parts may be of a type well known per se. When the vertical sweep coils 78 are fed by this generator 85, alternate images as seen by the pick-up devices A and B, respectively, will appear on the upper and lower halves respectively, of the receiver screen 71, one being inverted with respect to the other. Furthermore, they will be laterally displaced from each other except in the case of an object field portion toward which both pick-up devices are exactly directed. The appearance of the receiver screen may then be as indicated in Fig. 6, for an object field 30 containing objects at different distances as in Fig. 4. Thus, by operating the motor controls until exact coincidence is obtained between the inverted and erect images and then reading the dial images, the remote observer may obtain a very exact measurement of the distance from the pick-up devices to the object field.

The invention may be practiced with various degrees of completeness. For example, if the apparatus is to be aimed exclusively in one direction, provision for rotating the track may be omitted. If measurement of distance only is contemplated, the variable spacing means may be omitted; and if the variable depth effect alone is desired, for objects at comparatively great distances, the angular movement of the camera B may be omitted. Furthermore, for some purposes it may be desirable to provide for angular movement of both pick-up devices toward or away from the center line of the transmitter apparatus. This may simply be accomplished by arranging one member of a pair of like self-synchronous motors to rotate one of the pick-ups in one direction and the other member to rotate the other pick-up synchronously in the opposite direction. One indicating device, properly calibrated, will naturally serve for both movements.

Indeed, for some purposes, in particular for long distance range finding, the track 14 and the variable spacing apparatus of Fig. 1 may be entirely dispensed with and the two pick-up devices spaced apart along a base line of half a mile or so. With such an arrangement, which is impossible of attainment with a conventional optical range finder, the apparatus of the invention provides high accuracy while the associated remote controls and indicating means are well adapted to this use.

Still other modifications will occur to those skilled in the art.

What is claimed is:

1. In a television system, a first means for deriving vision signals representative of the light-tone values of one aspect of a selected portion of an object field, a second means variably spaced from said first means for deriving vision signals representative of the light-tone values of a different aspect of said selected field portion, means for transmitting said signals to a receiver station, means at said receiver station for synthesizing separate images from said signals in a juxtaposition such as to convey to an observer binocularly viewing said images an impression of the depth of said object field, means under control of said observer for varying the spacing of said signal deriving means to vary said impression of depth, means operated by said spacing means for deriving auxiliary signals dependent upon and indicative of the spacing of said signal deriving means and means for transmitting said auxiliary signals to said receiver station.

2. In a television system, a first means for deriving vision signals representative of the light-tone values of one aspect of a selected portion of an object field, a second means variably spaced from said first means for deriving vision signals representative of the light-tone values of a different aspect of said selected field portion, means for transmitting said signals to a receiver station, means at said receiver station for synthesizing separate images from said signals in a juxtaposition such as to convey to an observer binocularly viewing said images an impression of the depth of said object field, means under control of said observer for varying the spacing of said signal deriving means to vary said impression of depth, and an indicator and dial coupled to one of said signal deriving means for movement therewith to indicate said spacing, said indicator and dial being disposed in position to be televised by one of said signal deriving means, whereby the synthesized image contains an image of said indicator and dial.

3. In a television system, a first means for deriving vision signals representative of the light-tone values of one aspect of a selected portion of an object field, a second means for deriving vision signals representative of the light-tone values of a different aspect of said selected field portion, said second means being spaced from said first means and being angularly rotatable relatively to said first means to permit aiming of both of said means towards said selected field portion, means for transmitting said signals to a receiver station, means at said receiver station for synthesizing separate images from said signals in a juxtaposition such as to convey to an observer binocularly viewing said images an impression of the depth of said object field, means under control of said observer for varying the relative angular displacement of said signal deriving means to bring them to bear on a field portion which is more or less remote, and means coupled with said rotatable signal deriving means for deriving auxiliary signals dependent upon and indicative of the angular displacement of said signal-deriving means effected under said control, and means for transmitting said auxiliary signals to said receiver station.

4. In a television system, a first means for deriving vision signals representative of the light-tone values of one aspect of a selected portion of an object field, a second means for deriving vision signals representative of the light-tone values of a different aspect of said selected field portion, said second means being spaced from said first means and being angularly rotatable relatively to said first means to permit aiming of both of said means towards said selected field portion, means for transmitting said signals to a receiver station, means at said receiver station for synthesizing separate images from said signals in a juxtaposition such as to convey to an observer viewing said image binocularly an impression of the depth of said object field, and means under control of said observer for varying the relative angular displacement of said signal deriving means to bring them to bear on a field portion which is more or less remote, an indicator and dial coupled to said rotatable signal deriving means for rotation therewith and arranged to indicate the amount of said rotation, said in-

dicator and dial being disposed in position to be televised by one of said signal deriving means.

5. In a television system, a first means for deriving vision signals representative of the light-tone values of one aspect of a selected portion of an object field, a second means for deriving vision signals representative of the light-tone values of a different aspect of said selected field portion, said second means being spaced from said first means and being angularly rotatable relatively to said first means to permit aiming of both of said means towards said selected field portion, means for transmitting said signals to a receiver station, means at said receiver station for synthesizing separate images from said signals in a juxtaposition such as to convey to an observer binocularly viewing said images an impression of the depth of said object field, means under control of said observer for varying the relative angular displacement of said signal deriving means to bring them to bear on a field portion which is more or less remote, other means under control of said observer for varying the spacing of said signal deriving means to vary said impression of depth, and means for deriving auxiliary signals dependent upon and indicative of said spacing and angular rotation and transmitting them to said receiver station.

6. In a television system, a first means for deriving vision signals representative of the light-tone values of one aspect of a selected portion of an object field, a second means for deriving vision signals representative of the light-tone values of a different aspect of said selected field portion, said second means being spaced from said first means and being angularly rotatable relatively to said first means to permit aiming of both of said means towards said selected field portion, means for transmitting said signals to a receiver station, means at said receiver station for synthesizing separate images from said signals in a juxtaposition such as to convey to an observer binocularly viewing said images an impression of the depth of said object field, means under control of said observer for varying the relative angular displacement of said signal deriving means to bring them to bear on a field portion which is more or less remote, other means under control of said observer for varying the spacing of said signal deriving means to vary said impression of depth, an indicator and scale coupled to said rotatable signal deriving means

and arranged to indicate the amount of said rotation, another indicator and scale coupled to one of said signal deriving means and arranged to indicate the amount of said spacing, each indicator and scale being disposed in position to be televised by one of said signal deriving means.

7. The combination with a television camera of means for synthesizing an image under control of video currents set up by said camera, a member pivotally mounted for rotational movement, means for mounting said camera on said member for rotation about an axis eccentric to the axis of said member, motive means for rotating said member, motive means independent of the last-mentioned means for rotating said camera, motive means independent of said two last-mentioned means for moving said camera along said member, and sweep control means located at the position of an observer of said image for controlling said three motive means respectively.

FREDERICK WILLIAM REYNOLDS.

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