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21403
 [21] Appl. No. **745,613**
 [22] Filed **July 17, 1968**
 [45] Patented **Jan. 12, 1971**

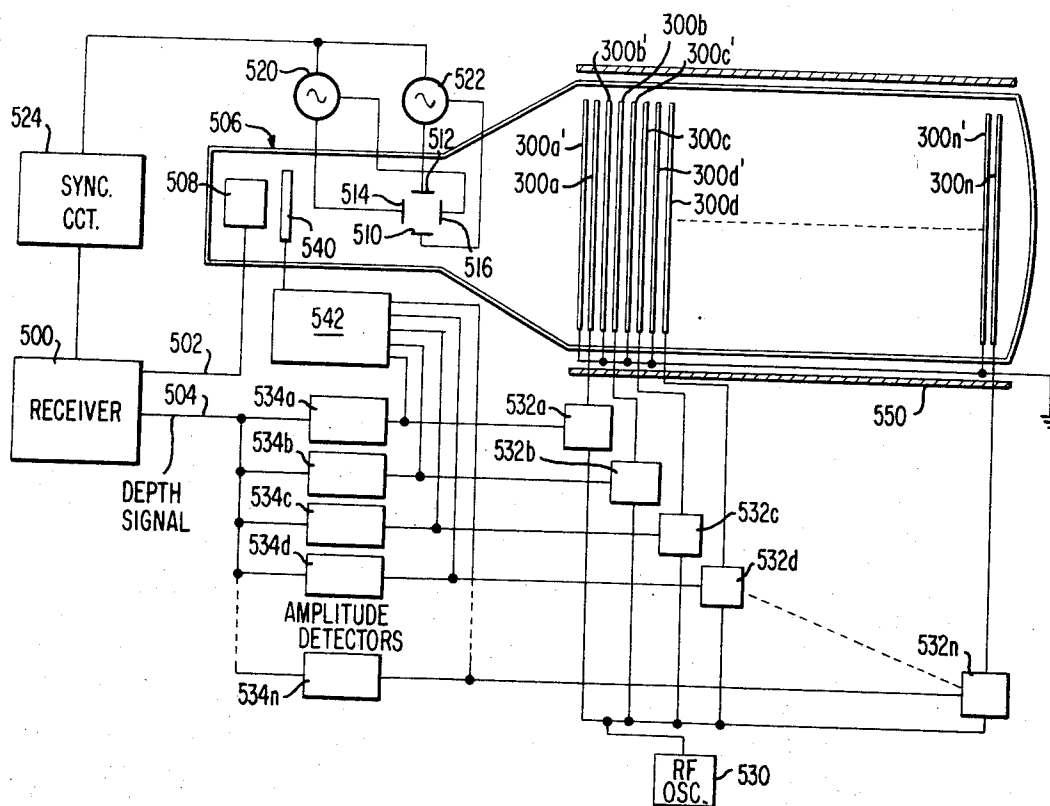
3,177,486 4/1965 Crooker 343/7.9
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[54] **THREE-DIMENSIONAL TELEVISION SYSTEM**
11 Claims, 4 Drawing Figs.

[52] **U.S. Cl.**..... **315/21,**
 178/6.5; 313/73; 343/7.9
 [51] **Int. Cl.**..... **H01j 1/54,**
 H01j 1/66
 [50] **Field of Search**..... 178/6.5;
 313/73; 315/21; 343/7.9

[56] **References Cited**
UNITED STATES PATENTS
 2,806,216 9/1957 Fryklund 343/7.9X
 3,005,196 10/1961 Aiken 343/7.9
 3,089,917 5/1963 Fernicola 178/6.5

ABSTRACT: A three-dimensional display device including a cathode ray tube having a plurality of spaced, parallel light and electron pervious display planes. Each of the display planes is divided into a plurality of display zones disposed in a two-dimensional array such that a line perpendicular to any display zone passes through a corresponding display zone in every display plane. Each of the display zones is provided with a single luminescent element of smaller area than that of the display zone. The luminescent elements on successive corresponding display zones are nonoverlapping so that substantially all of the luminescent elements are visible from one end of the plurality of display planes, and an electron beam from a gun disposed at one end of said plurality of display planes may readily impinge against selected ones of the luminescent elements in any one of said planes. The single display plane whose luminescent elements are to be excited at any given time is selected in accordance with a depth signal, and the elements to be excited are then selected by sweeping and modulating the beam.



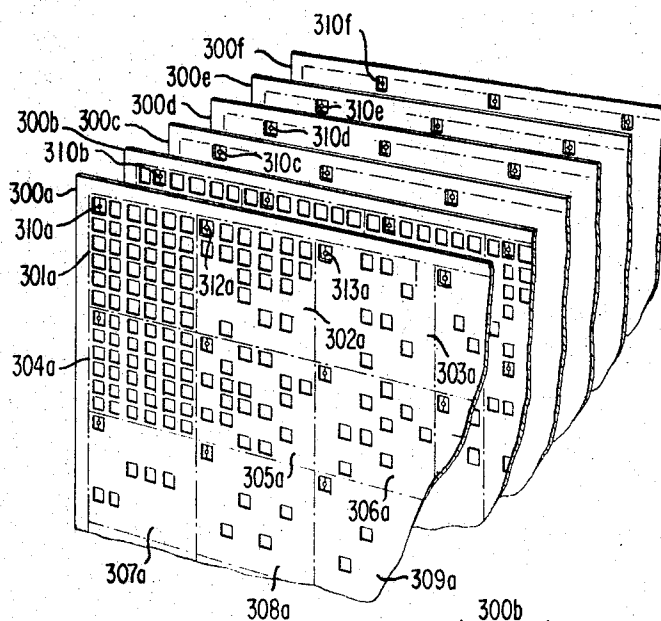


FIG. 1

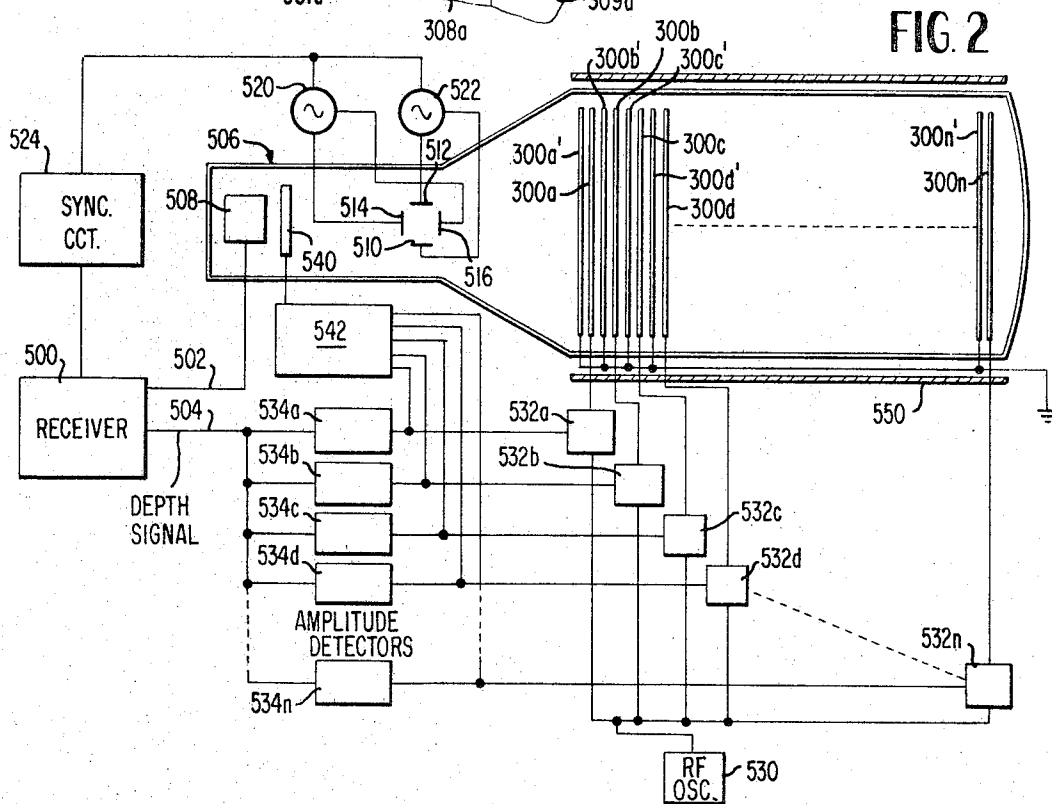
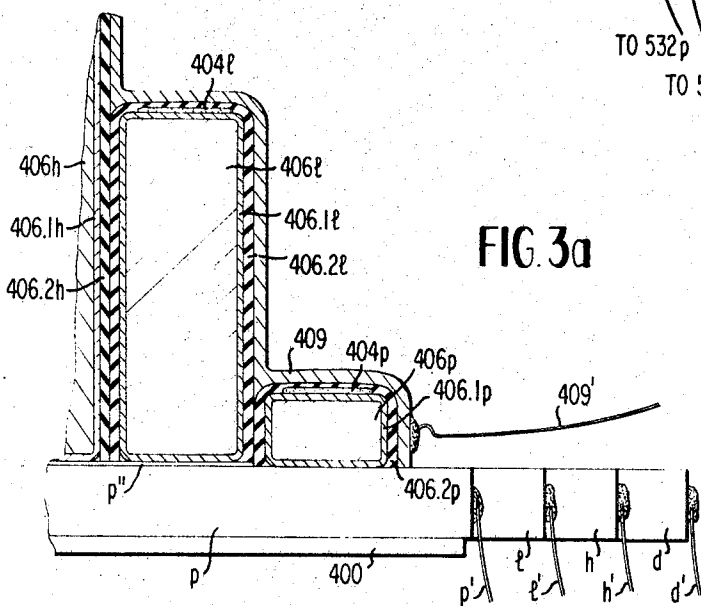
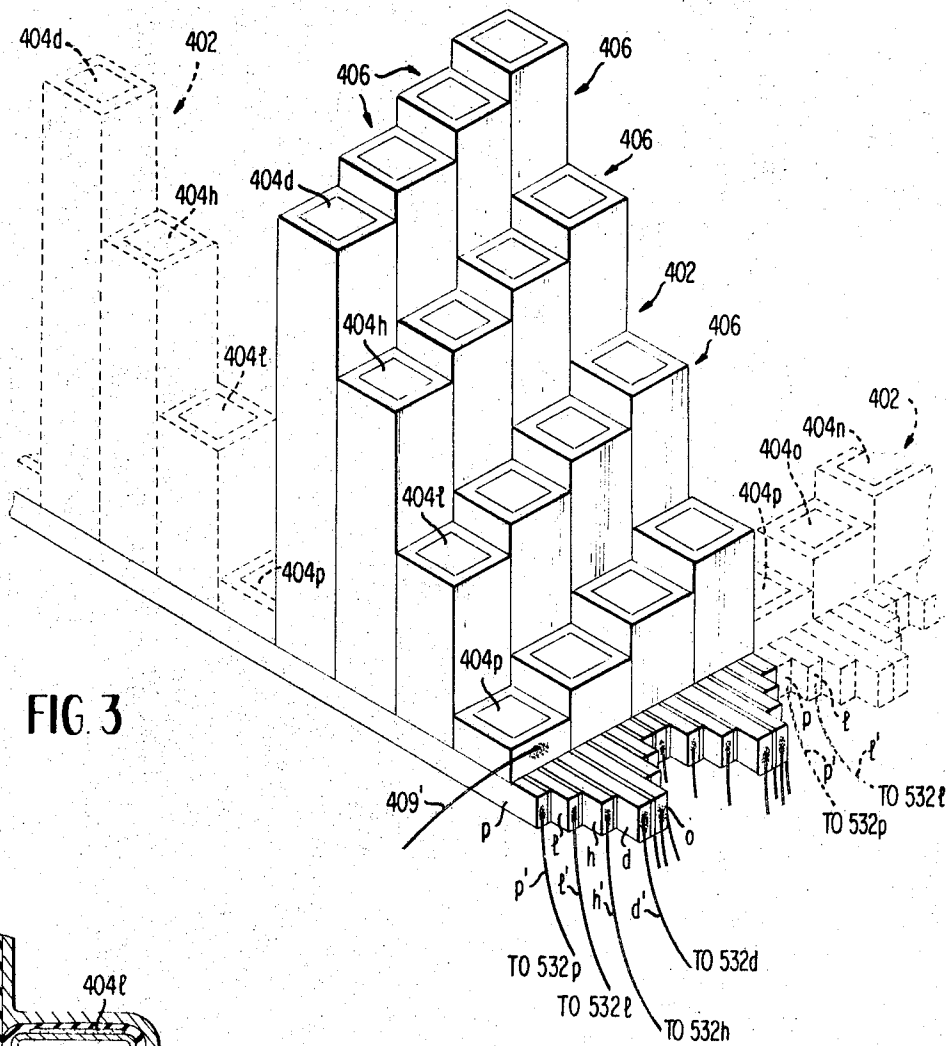


FIG. 2

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THREE-DIMENSIONAL TELEVISION SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

The present application is related to my earlier applications now U.S. Pat. Nos. 2,911,538, 3,258,766. These earlier applications relate generally to three-dimensional display systems.

BACKGROUND OF THE INVENTION

This invention relates to three-dimensional display systems and, more particularly, to three-dimensional display systems employing a plurality of spaced parallel display planes in a cathode ray tube.

In addition to my prior disclosures as shown in Pat. Nos. 2,911,538 issued Nov. 3, 1959 3,258,766 issued Jun. 28, 1966, there have been a number of proposals in the prior art for three-dimensional display systems.

Marks, U.S. Pat. Nos. 2,543,793; 2,777,011; and 2,961,486 disclose three-dimensional display systems which include camera means for developing a depth signal (Z) whose amplitude is a function of the depth of an image in an image field as well as horizontal (X), and vertical (Y) location signals. Although these patents suggest the expedient of employing superposed display planes, each representing a plane in three-dimensional space, none of them has the simplicity of a conventional cathode ray display system.

Aiken Pat. No. 3,005,196 discloses a three-dimensional radar indicator in which superposed transparent display screens are employed in a cathode ray tube. However, this system requires a plurality of electron guns, one for each display screen, and the use of lateral beam scanning which requires that the display screens be rather widely spaced, making a large number of screens impractical.

Another three-dimensional display system is shown in Fericola Pat. No. 3,089,917. This patent discloses a stereoscopic cathode ray display tube having two spaced parallel display screens. The first screen is electron pervious and is provided with alternate spaced phosphor dots and holes, and the second screen is provided with phosphor dots at locations corresponding to the holes in the first screen. However, this display tube and system as disclosed by Fericola is inherently limited to two superposed display screens, providing a stereoscopic rather than a truly three-dimensional effect.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an improved three-dimensional display device.

A more particular object is the provision of an improved three-dimensional cathode ray display device providing a large number of superposed display planes. A related object is the provision of means for insuring that the luminescent elements of only one selected display plane at a time are excited by an impinging electron beam.

Briefly, the present invention contemplates the provision of a plurality of superposed, spaced, parallel light and electron pervious display planes arranged in a three-dimensional array. Each of the planes is provided with a plurality of display zones in a two-dimensional array. Corresponding zones of the display planes are in substantial alignment, and each of the zones is provided with a luminescent element, the luminescent elements on corresponding zones being so located that a line perpendicular to a zone and passing through all of the display planes passes through only one luminescent element. An electron beam is modulated while being swept successively from zone to zone, and a depth signal (Z) is employed for insuring that the luminescent elements in only one display plane at a time may be excited by the beam. This may be accomplished by means of a selection circuit which closes a gate to a respective display plane from a radio frequency oscillator to remove a radio frequency quenching field. The successive planes may be formed of transparent frames provided with suitable apertures at regions corresponding to the zones with the luminescent elements supported on transparent wires suspended

across the apertures. Alternatively, the frames may be formed of a transparent electron pervious mesh made by well known photoetching methods.

Other objects, features, and advantages of the invention will become apparent from the following drawings, description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary perspective diagrammatic view of a three-dimensional screen system of the present invention, greatly magnified for purposes of illustration.

FIG. 2 is a diagrammatic representation of a display system of the invention.

FIG. 3 is a fragmentary perspective view showing the screen of another embodiment of the invention.

FIG. 3a is a fragmentary view of the screen of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, it will be seen that a cathode ray display tube of the invention comprises a plurality of spaced, parallel light and electron pervious display planes 300a, 300b, 300d, 300e, 300f, and so on. Although any number of display planes may be employed, it is contemplated that as many as 105 display planes may be used in a cathode ray display device of the invention. However, it is to be understood that a smaller number can be used and still provide a meaningful three-dimensional effect.

While the term "planes" is employed generically herein, it is to be understood that according to a particular aspect of my invention the planes need not be flat but may, for example, be formed on concentric spherical surfaces, thus imparting an apparent increase in depth to the scene presented by the tube. Other means of so increasing the apparent depth of scene will occur to those having ordinary skill in the art who read this specification.

In the embodiment shown in FIG. 1, the planes are formed of frames constructed of a transparent material such as Photoform glass. As will be described more fully hereinafter, these transparent frames are provided with a plurality of apertures, or otherwise electron pervious areas, in superposed corresponding zones. Thus, for example, frame 300a is provided with a zone 301a which contains a single discrete luminescent element such as a phosphor coated area or dot 310a. Zone 301a has its counterparts at corresponding locations on the succeeding frames: zone 301b on frame 300b, zone 301c on frame 300c, and zone 301d on frame 300d are illustrative. If the electron beam provided in the device is collimated, as described hereinafter, the corresponding zones may be in substantial alignment in a direction normal to the planes. If, on the other hand, no collimating means is employed, the zones must be in substantial alignment radially with respect to the electron gun, and apparent increase of depth will be attained. It is to be understood that the term "alignment" is used herein generically to cover both cases.

As will be apparent from FIG. 1, the frame 300a is provided with a two-dimensional array of zones. In addition to zone 301a, zones 302a, 303a, 304a, 305a, 306a, 307a, 308a, and 309a are shown in FIG. 1; these zones are illustrative, since only a fragment of frame 300a is shown in the FIG. It is to be understood, moreover, that while frame 300a is, in fact, transparent, it is not shown so in the FIG. in order to avoid visual confusion.

Each of the zones includes a single discrete phosphor coated dot or area. Thus, in zone 301a there is a phosphor coated area 310a. Similarly located areas 312a, 313a, 314a, 315a, 316a, 317a, 318a and 319a are positioned in the other zones shown on frame 300a.

It is to be noted that the phosphor areas or luminescent elements on successive corresponding zones are staggered with respect to each other and are nonoverlapping with respect to an observation point. Thus, area 310b on zone 301b is displaced to the right of area 310a, and area 310c (on frame

300c) is displaced to the right of area 310b. The positions of the areas on corresponding zones are distributed both horizontally and vertically, area 310e and 310f being shown in a vertically displaced row. The distribution is continued for all the frames so that a particular set of corresponding zones exposes to view the phosphor areas on each of the corresponding zones. Since the frames are either apertured (as will be described in more detail hereinafter), or otherwise formed of electron pervious material, an electron beam approaching the frames from either side thereof may strike a selected area to luminesce the same. Likewise, since each of the frames is formed of a transparent material, all of the phosphor coated areas will be visible from at least one view point.

Each of the frames may be formed of a sheet of transparent conductive material, such as a transparent plastic or glass coated with a transparent conductor, such as tin oxide. The regions of the zones are provided with apertures, and the phosphor coated areas are suspended across the apertures on transparent wires or filaments of, for example, fiberglass, similarly coated with a transparent conductive coating.

Alternatively, the frames may be made of an electron pervious conductive transparent wire mesh with the phosphor coated areas located thereon. It will thus be seen that each set of corresponding zones on the successive apaced frames represents a volume in empty space with staggered and spaced display areas being laid bare in a sequence moving backward in space. Since each of the frames includes a plurality of zones in a two-dimensional array, the totality of the frames with their corresponding two-dimensional arrays of zones forms a three-dimensional display space which will be useful for displaying three-dimensional images.

In order to expeditiously remove the radio frequency quenching field referred to above from the luminescent elements of only one at a time of said display planes one may provide a grounded plane electrode or ground plane closely adjacent each display plane on its side adjacent the electron gun which supplies the exciting beam. Each ground plane may conveniently consist of a frame substantially like the frames of the above described display planes but without said luminescent elements, and in some designs without the above described filaments, or the like, for supporting the luminescent elements. The transparent conductive coatings of the ground planes will be connected in common to a drive circuit ground point external of the display tube.

It is contemplated that the spacing of the display planes in the cathode ray tube will be of the order of the spacing of the lines in a conventional television display tube. As already mentioned, the number of frames need not be a full 525, since it is not necessary for a three-dimensional picture that a full cube of frames be provided. If, for example, a depth of one-fifth of the height of 525 lines is selected, 105 frames will be stacked in depth. In such an instance, a screen having a 20 inch lateral dimension would have a 4 inch depth of frames. In each of the corresponding zones on these frames, there will appear in staggered relationship a phosphor dot or area in full view to the vision of an observer and to an impinging electron beam.

It is contemplated that means may be provided to adjust the spacing between the several frames manually or otherwise. The frames may be formed from transparent rigid resilient sheets such as those made of plastic, glass and similar materials with a minimum thickness and maximum transparency. Only as much of the sheet is required as is necessary to attach it fixedly within the container and to provide a support for the phosphor coated areas. The remainder of the sheet may be cut out, as by photoetching, leaving windows or apertures. This avoids glare and obstructions to the beam of electrons and to viewing light rays.

Since the luminescent elements are minute, a screen that is woven of thin fiberglass filaments may be used instead of apertured sheets. In this instance, the luminescent elements may be provided in appropriate locations on the screen or at appropriate intersections of the filaments and the remainder of

the filaments not necessary to fixing the screen in the container and supporting the luminescent elements may be omitted. Methods of accurately depositing luminescent elements derived from silk screen printing are well known in the color television art and may be used in carrying out the present invention.

It is also possible to provide a three-dimensional screen as a composite relief member. Thus, referring to FIG. 3, it will be seen that the screen is formed of a composite transparent member having projecting therefrom a plurality of relief members or projections 406 grouped, for example, in groups of 16, each of which is designated 402. It is to be understood that these members project inwardly of the screen and face the electron beam apparatus. Each of the groups 402 corresponds to one of the aforesaid zones. The luminescent elements are shown in FIG. 3 as 404p, 40l, etc., each on the end of a projection 406, each of these luminescent elements being located in a different display plane in accordance with a scheme similar to that employed in the embodiment of FIG. 1. That is to say, each projection 406 has a luminescent element 404 in each of a plurality of successive planes stepping backwardly in space so that the three-dimensional image may be formed thereon.

FIG. 3a shows the internal construction and electrical lead arrangements of two typical projections 406. Every part of the structure shown in FIG. 3a is transparent except leads p', l', etc. Considering the two projections shown in full, it may be seen that one is formed on insulating member 406 l and the other on insulating member 406 p. These insulating members are individually coated with conductive layers, 406.1 l and 406.1 p, respectively. Luminescent elements 404 l and 404 p are superposed on these layers, and the individual members are then coated with insulating material layers 406.2 l and 406.2 p, respectively. Busses p, l, etc., are joined in side-by-side mutually insulated relationship as indicated in FIG. 3. The tops of these busses are then coated with insulating material (see p'', FIG. 3a) in such a pattern that layers 406.1 can contact their corresponding busses (e.g., all layers 406.1 p can contact busses p, and busses small p only, etc.). The complete set of projections is then mounted on the conjoined busses, and leads p'', l', etc., are connected to their corresponding busses p, l, etc. A single ground layer 409 is then deposited over the electron impingent side of the entire structure, this ground layer, and insulating layers 406.2, being sufficiently thin to permit electron bombardment of the luminescent elements 404 sufficient for excitation. The entire structure is then mounted in its associated tube, and all of the leads having the same designation are attached to a common base pin and the like (e.g., all of the leads p' are attached to a single base pin, etc.), and ground layer lead 409' is attached to its corresponding base pin. The potential applied to all of the elements 404 p will then be controlled by corresponding gate 532 p, etc., and, as will be apparent to those having ordinary skill in the art, the composite structure of FIGS. 3 and 3a will then function electrically in a manner analogous to the structure of FIG. 1, serving to produce three-dimensional views in the same manner.

The manner in which a received signal is utilized to cause the luminescence of proper phosphor coated areas to create a desired received three-dimensional image will now be explained with reference to the schematic diagram of FIG. 2. It is to be noted at the outset that the controlling three-dimensional image signal may be developed by systems of the character disclosed in the Marks patents identified above. Consider, for example, the signal described in Marks U.S. Pat. No. 2,777,011, column 11. As there disclosed, a depth signal (Z) whose signal voltage is instantaneously proportional to a depth factor is developed. Such a signal may be transmitted by modulating a subcarrier in the manner familiar in the color television art. The remainder of the three-dimensional image signal are analogous to signals familiar in the television art, including the usual raster synchronizing, brightness, and blanking signals.

A receiver 500 (FIG. 2) will include means for separating these components of the complete three-dimensional image signal, and will provide the brightness signal component information on line 502 and the depth signal component information on line 504. The cathode ray tube 506 is built in accordance with the present invention and includes an electron gun 508 the beam of which is modulated in accordance with the brightness signal on line 502. Two pairs of deflecting plates, which might also be magnetic deflection coils, are provided. Plates 510 and 512 are the vertical deflection plates, and plates 514 and 516 are the horizontal deflection plates. As is usual in the television art, a horizontal sweep generator 520 is coupled to horizontal deflection plates 514 and 516, while a vertical sweep generator 522 is coupled to vertical deflection plates 510 and 512. A synchronizing circuit 524 receives synchronizing information from the receiver and serves to insure that the sweep circuits act in synchronization with the brightness and blanking signals in the manner known in the art.

As previously described, the cathode ray tube 506 includes a plurality of successive frames 300a, 300b, 300c, 300d, and so on, the last or nth frame being designated by reference number 300n, and a corresponding plurality of ground planes 300a' through 300n'.

In the usual manner the electron beam is swept in a raster as controlled by the deflection plates and thus sweeps all of the zone apertures of all of the frames.

In order to insure that only the luminescent elements of the display plane corresponding to the instantaneous value of the depth signal Z are caused to luminesce by the swept beam from gun 508, the principle of radio frequency quenching is employed. This principle, which is employed in the color television systems disclosed in Fromm et al., U.S. Pat. No. 2,795,730 and Koller, U.S. Pat. No. 2,827,593, is based upon the fact that the application of a radio frequency field to a phosphor layer inhibits the luminescence which would otherwise be excited by the impingement of an electron beam. Thus, a radio frequency oscillator 530 is provided which is normally connected through gates or amplifiers 532a, 532b, 532c, 532d ... 532n to corresponding frames 300a, 300b, 300c, 300d, ... 300n. Thus, normally, with radio frequency oscillator 530 connected to all or all but one of the frames a quenching field exists between each frame so connected and its associated ground plane and since the luminescent elements on each frame so connected are in the corresponding field, they are inhibited from luminescence even when electron beam excited.

When, however, the depth signal (Z) indicates that the received three-dimensional image signal momentarily corresponds to a particular display plane or frame, say, 300c, a display plane selection signal is provided to the corresponding gate or amplifier 532c to close that gate or bias that amplifier to cutoff and thus unquench the luminescent elements on frame 300c, thereby permitting the impinging electron beam to cause the luminescent elements on frame or display plane 300c to luminesce and become visible.

In order to provide such display plane selection signals, a corresponding set of detectors 534a, 534b, 534c, 534d, ... 534n are arranged to produce output signals in response to particular magnitudes of the depth signal (Z). Each of these detectors is responsive to a narrow range of depth signal magnitudes. When a depth signal of a magnitude within the range of a particular detector is received, it causes the corresponding gate or amplifier to close or cutoff and unquench the luminescent elements of the corresponding display plane.

It is to be understood that the electron beam must have a cross section which is about equal to the area of the zones so that all of the luminescent elements in a set of corresponding zones will be excited by the beam during a complete scan. Because of the quenching of the luminescent elements of all of the remaining display planes, only the luminescent elements of the display plane whose depth corresponds to the magnitude of the received depth signal may be caused to luminesce by the impinging electron beam.

In order to insure that the cross section of the beam is of the proper size and shape at each of the successive display planes, it may be necessary to adjust the focus as a function of the amplitude of the depth signal. To this end, the voltage applied to a focusing electrode 540 (which might also be a focusing coil) may be controlled by means of a function generator 542. It is to be observed that each of the detection circuits 534a, 534b, 534c, 534d ... 534n has its output coupled to the function generator 542. This function generator may take the form of a potentiometer or fixed resistor having tapping points coupled to focusing electrode 540 through electronic switching means controlled by the output signals received from the detection circuits.

As mentioned hereinabove, when the corresponding zones of a set are in alignment in a direction normal to the display planes, it is necessary to collimate the beam. This is accomplished by means of a collimating coil 550 surrounding the region of the cathode ray tube within which the frames are located. The collimating coil will tend to direct the beam along a straight overall path through a set of aligned corresponding zones. It will also tend to maintain the cross-sectional area of the beam constant, thereby reducing the need to alter the focusing field provided by electrode 540 markedly. In fact it may be possible with collimation of the beam as provided by coil 550 to omit the focusing control function generator 542. It still may be necessary, however, if radial, rather than normal alignment is employed, to control the focus, because collimation of the beam would then be omitted.

Alternative techniques may be employed for controlling frame energization. For example, instead of employing the radio frequency quenching technique as described hereinabove, the technique employed in Cutler U.S. Pat. No. 2,850,677 may be adapted to the present system.

As shown in that patent, FIG. 5, potentials are synchronously applied to wires adjacent to a selected wire to cause the electron beam, which is normally collimated, to pass through the spaces between adjacent wires and be deflected into engagement with a selected wire. In adapting this concept to the present system, it is merely necessary that the detector circuits control gates or amplifiers to provide the proper potentials to the frames adjacent to the frame selected by the depth signal for effecting the deflection of the beam into impingement with the selected frame.

In the case of a system of this character, the cross-sectional area of the electron beam must be small relative to the size of the zones so that impingement of the beam against an area on a frame which is not selected may be avoided.

While I have shown and described certain specific embodiments of my invention, many modifications thereof are possible. It is to be understood that in certain embodiments of my invention collimated ultraviolet light which may be reflected from an electron beam swept screen or produced by modulating a collimated beam of ultraviolet light by a Nipkow disc or the like may be employed to excite the luminiscent elements. My invention, therefore, is not to be restricted except in accordance with the prior art and the spirit of the appended claims.

I claim:

1. A three-dimensional display device, comprising: a cathode ray tube having more than two spaced, parallel, light and electron pervious display planes arranged in a three-dimensional array, each of said planes being provided with a plurality of display zones arrayed in a plurality of elongated arrays, corresponding zones in successive planes being in substantial alignment, each of said zones being provided with a single luminescent element having no dimension exceeding one-half the diameter of said display planes, said zones being otherwise substantially light and electron pervious, a normal to any one of said planes at any one of said elements passing through only said any one of said elements, whereby substantially all of said elements are visible from one side of said three-dimensional array and an electron beam may readily impinge against said elements from one side of said three-dimensional array, means for sweeping an electron beam in a

scanning raster to scan across successive ones of said zones, the intensity of said beam being modulated so that the luminous intensity of each element impinged by said beam will correspond with the luminous intensity of the corresponding point in a three-dimensional image space, and means for insuring that only the ones of said elements on the one of said planes corresponding to this point in space may be caused to luminesce by said beam.

2. A three-dimensional display device as recited in claim 1 wherein said display planes comprise a plurality of spaced, parallel, light pervious frames.

3. A three-dimensional display device as claimed in claim 2 wherein said frames are formed of electron pervious fine wire mesh, and said luminescent elements are provided on said mesh.

4. A three-dimensional display device as recited in claim 3 wherein said wire mesh is formed of conductive transparent wires.

5. A three-dimensional display device, comprising: a cathode ray tube having a plurality of spaced, parallel, light and electron pervious display planes arranged in a three-dimensional array, each of said planes being provided with a plurality of display zones in a two-dimensional array, corresponding zones in successive planes being in substantial alignment, each of said zones being provided with a single luminescent element, said zones being otherwise substantially light and electron pervious, a normal to any one of said planes at any one of said elements passing through only said any one of said elements, whereby substantially all of said elements are visible from one side of said three-dimensional array and an electron beam may readily impinge against said elements from one side of said three-dimensional array and an electron beam may readily impinge against said elements from one side of said three-dimensional array, means for sweeping an electron beam in a scanning raster to scan across successive ones of said zones, the intensity of said beam being modulated so that the luminous intensity of each element impinged by said beam will correspond with the luminous intensity of a three-dimensional image in a corresponding point in space, and means for insuring that only the ones of said elements on the one of said planes corresponding to this point in space may be caused to luminesce by said beam, said display planes comprising a plurality of spaced, parallel, light pervious frames, said frames being formed of transparent sheets, a plurality of apertures being provided through said sheets at the positions of said zones, and means being provided for supporting said luminescent elements within said apertures.

6. A three-dimensional display device as recited in claim 5 wherein said means for supporting said elements comprises conductive filaments extending across said apertures.

7. A three-dimensional display device, comprising: a cathode ray tube having a plurality of spaced parallel, light and electron pervious display planes arranged in a three-dimensional array, each of said planes being provided with a plurality of display zones in a two-dimensional array, corresponding zones in successive planes being in substantial alignment, each of said zones being provided with a single luminescent element, said zones being otherwise substantially light and electron pervious, a normal to any one of said planes at any one of said elements passing through only said any one of said elements, whereby substantially all of said elements are visible from one side of said three-dimensional array and an electron beam may readily impinge against said elements from

one side of said three-dimensional array, means for sweeping an electron beam in a scanning raster to scan across successive ones of said zones, the intensity of said beam being modulated so that the luminous intensity of each element impinged by said beam will correspond with the luminous intensity of a three-dimensional image in a corresponding point in space, and means for insuring that only the ones of said elements on the one of said planes corresponding to this point in space may be caused to luminesce by said beam, said device further comprising a composite transparent support member, said support member having a plurality of projections presenting their ends to said electron beam, said projections being arranged in groups corresponding to said corresponding zones, the ends of said projections being so disposed that successive ones of said display planes include one of said projections from each group, said elements being located on said ends of said projections.

8. A three-dimensional display device, comprising; a cathode ray tube having a plurality of spaced, parallel, light and electron pervious display planes arranged in a three-dimensional array, each of said planes being provided with a plurality of display zones in a two-dimensional array, corresponding zones in successive planes being in substantial alignment, each of said zones being provided with a single luminescent element, said zones being otherwise substantially light and electron pervious, a normal to any one of said planes at any one of said elements passing through only said any one of said elements, whereby substantially all of said elements are visible from one side of said three-dimensional array and an electron beam may readily impinge against said elements from one side of said three-dimensional array, means for sweeping an electron beam in a scanning raster to scan across successive ones of said zones, the intensity of said beam being modulated so that the luminous intensity of each element impinged by said beam will correspond with the luminous intensity of a three-dimensional image in a corresponding point in space, and means for insuring that only the ones of said elements on the one of said planes corresponding to this point in space may be caused to luminesce by said beam, said electron beam having a cross-sectional area at said zones of substantially the same size as said zones.

9. A three-dimensional display device as recited in claim 8 further comprising means responsive to a depth signal whose amplitude varies as the depth in space of said instantaneously scanned point of said image for inhibiting the luminescence of all of said elements except for the elements in the plane which corresponds to said depth in space.

10. A three-dimensional display device as recited in claim 8 further comprising a source of radio frequency oscillations, switch means normally coupling said oscillations to each of said planes to quench the luminescence of the ones of said elements disposed thereon, and means responsive to a depth signal whose amplitude varies as the depth in space of a point corresponding to an instantaneously scanned point of said image for operating the one of said switch means corresponding to the plane on which said instantaneously scanned point lies.

11. A three-dimensional display device as recited in claim 10 wherein said means responsive to a depth signal comprises a plurality of detectors each responsive to a different range of magnitudes for operating the switch means corresponding to one of said planes when the magnitude of said depth signal is within its range.