

PATENT SPECIFICATION

(11) 1 443 151

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(21) Application No. 31354/72 (22) Filed 17 Oct. 1975

(44) Complete Specification published 21 July 1976

(51) INT CL² H04N 9/58; G03B 21/60

(52) Index at acceptance

H4F D15 D1B9 D27C9 D27H D27T1 D42C8

G2X 42

H1D 18L3 18LY 34 4A4 4A7 4K4 4K7Y



(54) MEANS FOR REPRODUCING THREE-DIMENSIONAL PICTURES

(71) I, TIMOTHY BAK-KWAN LEUNG, a Chinese citizen, of P.O. Box No. 97, Yuen Long, New Territories, Hong Kong, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to the reproduction of pictures on the screens of television receivers and cinematograph apparatus.

The object of the invention is to improve the appearance of pictures shown on television screens and movie-screens by imparting a three-dimension effect thereto. It is a particular object of the invention to provide an economical and simple way of assisting a cinematograph of television screen to exhibit three-dimension pictures which show the spaces or distances between objects.

To this end, according to one aspect of the invention, there is provided a monochrome or colour television receiver which is provided with means for imparting a three-dimensional effect to the pictures exhibited thereon, said means comprising a transparent sheet of glass or plastics material, one surface of which is smooth and is affixed to the front surface of the screen of the picture tube of the receiver and the other surface of which is formed with a plurality of semi-cylindrical rectilinear convex lenses which contact one another tangentially throughout their length.

According to another aspect of the invention, there is provided a monochrome or colour television receiver which is provided with means for imparting a three-dimension effect to the pictures exhibited thereon, said means comprising a plurality of semi-cylindrical rectilinear convex lenses which cover and are formed integral with the front surface of the screen of the picture tube of the receiver and contact one another tangentially throughout their length.

According to a further aspect of the

invention, there is provided a back-projection cinematographic display system, the screen of which is provided with means for imparting a three-dimensional effect to the pictures exhibited thereon, said means comprising a transparent sheet of glass or plastics material, one surface of which is smooth and is affixed to the front surface of the screen and the other surface of which is formed with a plurality of parallel semi-cylindrical rectilinear lenses, the convex surfaces of which face outwards, contact one another tangentially throughout their length, and have not been subjected to non-reflecting treatment or provided with a non-reflecting layer.

The lenses form an arrangement of parallel lines which preferably extend in a vertical direction. So that the lenses will have a magnifying action the convex face of each lens is arranged to face outwards of the screen towards the viewer or audience. the lenses are preferably provided on one side of a sheet of transparent material, the other side of which is smooth to enable it to be affixed as closely as possible to the screen of an existing television receiver. With such an arrangement a three-dimensional effect is imparted to pictures shown on the screen.

With conventional television receivers and cinematograph equipment only two-dimensional pictures are shown on the screen, there being no clear impression given of space or distance between the persons and things in the picture. For example, when the smaller of two similar geometrical objects is placed at a certain distance between the camera and the larger object and the camera photographs the upper portions of the objects they may both appear to be the same size on the screen and the appearance of the picture lacks reality since there is no impression of space and therefore no indication of the relative positions in space occupied by the objects. Another disadvantage is that salient features such as the human nose do not stand out in a full-face shot on the screen except in so far

as this is brought out by degrees of light and shade. The present invention is designed to overcome these disadvantages by creating an illusion of space and giving the impression that some parts of a picture are closer to the viewer than others.

Neighbouring semi-cylindrical lenses contact each other at a tangent along their whole length so that the junction between each pair of lenses forms a straight line. The lenses, which are preferably integral with the screen or with a sheet affixed to the outer surface of the screen are preferably formed of transparent colourless plastics or glass and give to the outer surface of the screen the appearance of a plurality of straight parallel lines along the junctions between the lenses alternating with parallel lines covered by the convex surfaces of the lenses and this system of lines is used to improve the pictures appearing on the screen. The lenses are used for magnification and the tangential lines between them are used to retain details of the pictures in their original positions. The arrangement therefore comprises parallel magnifying lines alternating with parallel retaining lines which are continuously scanned when the screen forms part of the cathode ray tube in a television receiver, and the pictures will appear to the viewer or viewers as three-dimensional ones.

There is no necessity for three-dimension video signals to be transmitted and the invention is applicable to existing television receivers or to new receivers in the course of manufacture.

The arrangement of parallel lines can be utilised in both monochrome and colour television receivers as well as in cinematographic equipment. For television reception there are usually 525 or 625 lines per frame, each frame comprising two interlaced field scans, the horizontal sweep frequency being 15625Hz or 15750Hz, and the vertical sweep frequency being 50Hz or 60Hz. The diameter of each semi-cylindrical lens for a television screen is between 50 and 10,000 microns and is preferably 1/100 cm., so that for each centimeter of the screen according to the invention there will be 100 semi-cylindrical lenses constituting magnifying lines and 101 tangential lines, or for each inch of the screen there will be 254 lenses and 255 tangential lines.

In a ten-inch television receiver, measured diagonally across the screen, the width and height of the screen is 8 inches and 6 inches respectively. Hence there will be 2032 lenses and 2033 tangential lines making a total of 4065 parallel lines preferably extending vertically when the screen formed in accordance with the invention forms part of a ten-inch television receiver.

The intensity or brightness of the picture

shown on the screen of the cathode ray tube of a television set or on a cinema screen is increased due to the magnifying action of the semi-cylindrical lenses. The pictures, therefore, are clearly visible at a longer distance than pictures shown on an ordinary screen and the viewer or viewers may therefore be able to sit farther away from the television screen in order to avoid harmful radiation.

The present invention will be described with reference to the accompanying drawings in which:—

Figure 1 is an enlarged sectional elevation, of part of a sheet to be affixed to an existing screen;

Figures 2, 3 and 4 are an enlarged end elevation, sectional elevation and plan view respectively of the sheet shown on a reduced scale compared with Fig. 1;

Figure 5 is a side view of the picture tube or cathode ray tube of a television receiver showing, in section, the deflection coils located at the neck of the tube;

Figure 6 is a front view of the tube shown in Figure 5, the width and height of the screen being in the ratio 4:3;

Figure 7 is a perspective view of a sheet to be affixed to the outer surface of the screen of the tube shown in Figures 5 and 6;

Figure 8 is a side view of the outer protective glass screen of the television tube and its mounting frame;

Figure 9 is a side view of the blue-tinted outer window of a television set; and

Figure 10 shows the back projection of a film onto a cinematograph screen formed in accordance with the invention.

Figures 1 to 4 of the drawings show a sheet of plastics or glass presenting in plan view an arrangement of parallel lines of which the back points 12 constitute tangents 14 to a plurality of semi-cylindrical lenses 11. When the sheet is affixed to the surface of the screen 1 of Figs 5 and 6 or the screen A of Fig. 10 the lines 14 retain the objects in the picture while the lenses 11 magnify the objects. The sheet is preferably provided with a blue or greenish blue tint to protect the eyes when used in a monochrome television receiver. For colour television receivers and cinematograph screens the sheet is preferably made colourless to avoid disturbing the balance of the original colour pictures or rasters. The protective glass screen 16 shown in Fig. 8 is colourless and an outer tinted window 18, Fig. 9, supported in front of the screen is preferably employed in colour television receivers to protect viewers eyes. The window 18 is preferably made of plastics and is one to five mm. in thickness. The window 18 may be omitted in monochrome television receivers in which case the protective glass 16 is tinted.

The tube shown in Fig. 5 has deflection

coils 2 and 3 at its neck, pins 4 and a key 5 at its base and a screen 1, to the outer surface of which the smooth surface 17 of the sheet shown in Fig. 7 is to be closely affixed. The stated size of a television screen corresponds to the length of the diagonal shown at 10 in Fig. 6 and the ratio of the width to the height is equal to 4:3.

The convex portion 13 (Figs. 7 and 10) of each semi-cylindrical lens portion 11 of a sheet according to the invention, has a diameter 8 and contacts the adjacent lens portion 11 at the point 12 from which a tangent 14 to the convex portion of the lens extends. The thickness 9 of the sheet, excluding the lenses, is preferably from $\frac{1}{2}$ mm. to 1 cm. and is such as to enable it to be fitted between the screen and the outer protective glass 16 of a television receiver and secured in a frame 15.

The thickness 9 of a sheet B may be increased when used in conjunction with a cinematograph screen A as shown in Fig. 10, in which the smooth face of the sheet is affixed as closely as possible to the front face 23 of the screen. The material or thickness 22 of the screen A is suitable for back projection of a film through the rear face 21 of the screen by a projector 19 having a lens 20 which projects a beam of light defined by the broken lines 25. The extremities of the beam strike the rear face of the screen A at each end thereof as shown at 24 and the pictures projected are then transmitted through the screen and the sheet B and viewed on the front face of the sheet. The thickness of sheet B, excluding the lenses, is from 1 mm. to 1 cm., the diameter of each lens being between 100 and 20,000 microns, preferably 500 microns.

The semi-cylindrical lenses 11 are arranged to run vertically, horizontally or diagonally for both television and cinematograph pictures.

To apply the invention to existing television screens it is necessary to remove the tube from the receiver cabinet and place it on strong supports. The frame and protective glass must be removed from the tube and a sheet incorporating the lenses fitted by affixing its smooth face to the face of the fluorescent screen with the lens structure facing outwards and the edges of the sheet extending to the masking edges of the screen. It is preferable to ensure that the arrangement of parallel lines extends vertically and thus no air bubbles are left between the sheet and the screen. The protective glass and front frame are then replaced on the tube which is then returned to the receiver cabinet and secured in place.

The screen will then exhibit clear, three-dimensional pictures to the viewers who are able to sit farther away from the set and thus avoid injurious radiation.

WHAT I CLAIM IS:—

1. A monochrome or colour television receiver which is provided with means for imparting a three-dimensional effect to the pictures exhibited thereon, said means comprising a transparent sheet of glass or plastics material, one surface of which is smooth and is affixed to the front surface of the screen of the picture tube of the receiver and the other surface of which is formed with a plurality of semi-cylindrical rectilinear convex lenses which contact one another tangentially throughout their length. 70
2. A monochrome or colour television receiver which is provided with means for imparting a three-dimensional effect to the pictures exhibited thereon, said means comprising a plurality of semi-cylindrical rectilinear convex lenses which cover and are formed integral with the front surface of the screen of the picture tube of the receiver and contact one another tangentially throughout their length. 75
3. A television receiver according to Claim 1, wherein said sheet is interposed between the screen of the picture tube and the outer protective glass screen of the television receiver. 80
4. A television receiver according to any one of Claims 1 to 3, wherein the diameter of each lens is between 50 and 10,000 microns. 85
5. A television receiver according to Claim 4, wherein the diameter of each lens is 100 microns. 90
6. A television receiver according to Claim 1 or any one of Claims 3 to 5 when appendant to Claim 1, wherein the thickness of said sheet, excluding the lenses, is from $\frac{1}{2}$ mm. to 1 cm. 95
7. A back-projection cinematographic display system, the screen of which is provided with means for imparting a three-dimensional effect to the pictures exhibited thereon, said means comprising a transparent sheet of glass or plastics material, one surface of which is smooth and is affixed to the front surface of the screen and the other surface of which is formed with a plurality of parallel semi-cylindrical rectilinear lenses, the convex surfaces of which face outwards, contact one another tangentially throughout their length, and have not been subjected to non-reflecting treatment or provided with a non-reflecting layer. 100
8. A cinematographic display system according to Claim 7, wherein the diameter of each lens is between 100 and 20,000 microns. 105
9. A cinematographic display system according to Claim 8, wherein the diameter of each lens is 500 microns. 110
10. A cinematographic display system 115

coils 2 and 3 at its neck, pins 4 and a key 5 at its base and a screen 1, to the outer surface of which the smooth surface 17 of the sheet shown in Fig. 7 is to be closely affixed. The stated size of a television screen corresponds to the length of the diagonal shown at 10 in Fig. 6 and the ratio of the width to the height is equal to 4:3.

The convex portion 13 (Figs. 7 and 10) of each semi-cylindrical lens portion 11 of a sheet according to the invention, has a diameter 8 and contacts the adjacent lens portion 11 at the point 12 from which a tangent 14 to the convex portion of the lens extends. The thickness 9 of the sheet, excluding the lenses, is preferably from $\frac{1}{2}$ mm. to 1 cm. and is such as to enable it to be fitted between the screen and the outer protective glass 16 of a television receiver and secured in a frame 15.

The thickness 9 of a sheet B may be increased when used in conjunction with a cinematograph screen A as shown in Fig. 10, in which the smooth face of the sheet is affixed as closely as possible to the front face 23 of the screen. The material or thickness 22 of the screen A is suitable for back projection of a film through the rear face 21 of the screen by a projector 19 having a lens 20 which projects a beam of light defined by the broken lines 25. The extremities of the beam strike the rear face of the screen A at each end thereof as shown at 24 and the pictures projected are then transmitted through the screen and the sheet B and viewed on the front face of the sheet. The thickness of sheet B, excluding the lenses, is from 1 mm. to 1 cm., the diameter of each lens being between 100 and 20,000 microns, preferably 500 microns.

The semi-cylindrical lenses 11 are arranged to run vertically, horizontally or diagonally for both television and cinematographic pictures.

To apply the invention to existing television screens it is necessary to remove the tube from the receiver cabinet and place it on strong supports. The frame and protective glass must be removed from the tube and a sheet incorporating the lenses fitted by affixing its smooth face to the face of the fluorescent screen with the lens structure facing outwards and the edges of the sheet extending to the masking edges of the screen. It is preferable to ensure that the arrangement of parallel lines extends vertically and thus no air bubbles are left between the sheet and the screen. The protective glass and front frame are then replaced on the tube which is then returned to the receiver cabinet and secured in place.

The screen will then exhibit clear, three-dimensional pictures to the viewers who are able to sit farther away from the set and thus avoid injurious radiation.

WHAT I CLAIM IS:—

1. A monochrome or colour television receiver which is provided with means for imparting a three-dimensional effect to the pictures exhibited thereon, said means comprising a transparent sheet of glass or plastics material, one surface of which is smooth and is affixed to the front surface of the screen of the picture tube of the receiver and the other surface of which is formed with a plurality of semi-cylindrical rectilinear convex lenses which contact one another tangentially throughout their length.

2. A monochrome or colour television receiver which is provided with means for imparting a three-dimensional effect to the pictures exhibited thereon, said means comprising a plurality of semi-cylindrical rectilinear convex lenses which cover and are formed integral with the front surface of the screen of the picture tube of the receiver and contact one another tangentially throughout their length.

3. A television receiver according to Claim 1, wherein said sheet is interposed between the screen of the picture tube and the outer protective glass screen of the television receiver.

4. A television receiver according to any one of Claims 1 to 3, wherein the diameter of each lens is between 50 and 10,000 microns.

5. A television receiver according to Claim 4, wherein the diameter of each lens is 100 microns.

6. A television receiver according to Claim 1 or any one of Claims 3 to 5 when appendant to Claim 1, wherein the thickness of said sheet, excluding the lenses, is from $\frac{1}{2}$ mm. to 1 cm.

7. A back-projection cinematographic display system, the screen of which is provided with means for imparting a three-dimensional effect to the pictures exhibited thereon, said means comprising a transparent sheet of glass or plastics material, one surface of which is smooth and is affixed to the front surface of the screen and the other surface of which is formed with a plurality of parallel semi-cylindrical rectilinear lenses, the convex surfaces of which face outwards, contact one another tangentially throughout their length, and have not been subjected to non-reflecting treatment or provided with a non-reflecting layer.

8. A cinematographic display system according to Claim 7, wherein the diameter of each lens is between 100 and 20,000 microns.

9. A cinematographic display system according to Claim 8, wherein the diameter of each lens is 500 microns.

10. A cinematographic display system





according to any one of Claims 7 to 9, wherein the thickness of the sheet, excluding the lenses, is from 1mm. to 1cm.

- 5 11. A television receiver or cinematographic display system according to any preceding claim, wherein the semi-cylindrical lenses extend vertically, horizontally or diagonally of the screen.

12. A television receiver or cinemato-

graphic display system substantially as 10
hereinbefore described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1976.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.