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TELEVISION AND SOUND SYSTEM

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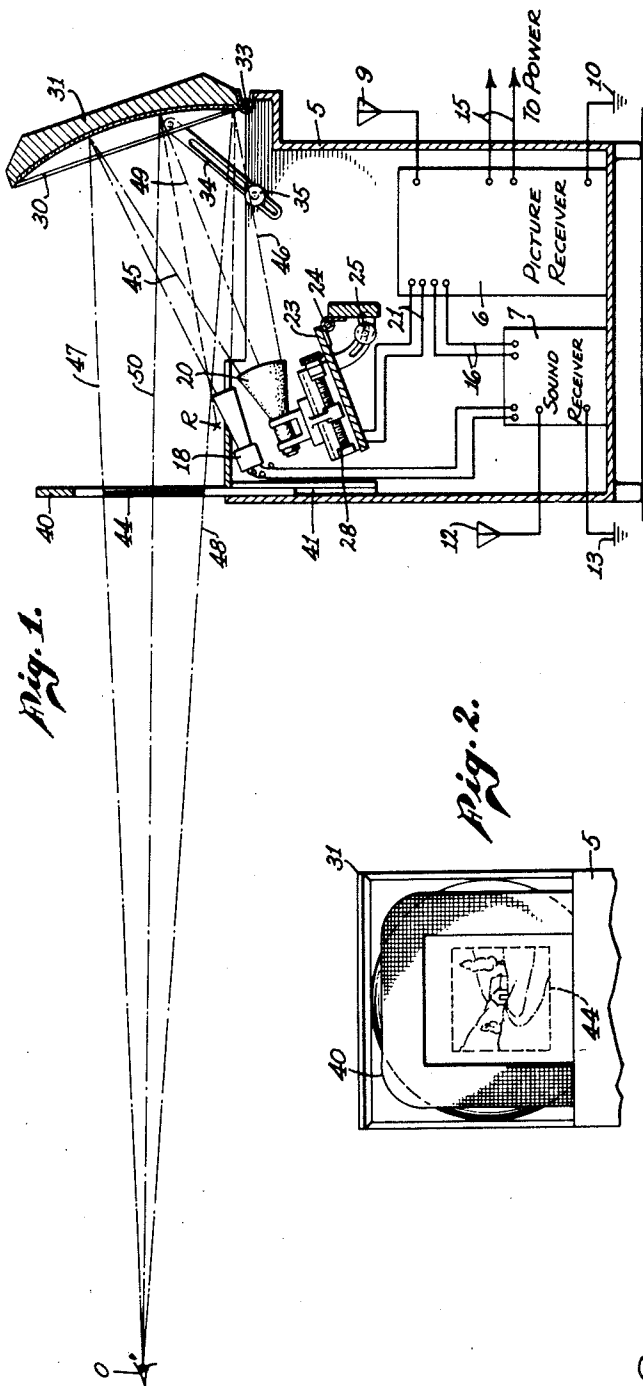


Fig. 1.

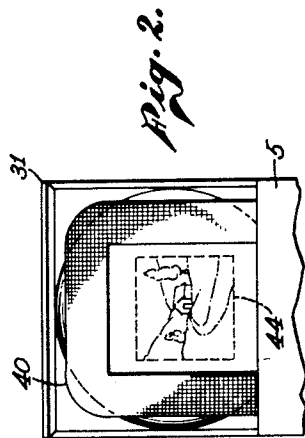


Fig. 2.

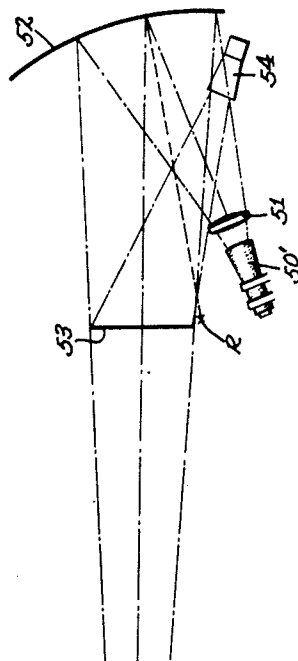


Fig. 3.

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TELEVISION AND SOUND SYSTEM

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8 Claims. (Cl. 178—5.8)

This invention relates to television systems and particularly to methods of and means for presenting the reproduced image and the concomitant sound for observation.

The principal object of the invention is to facilitate the presentation of a television image and the reproduction of the concomitant sound.

Another object of the invention is to produce an image and reproduce its accompanying sound in the same spatial position without interference therebetween.

A further object of the invention is to enlarge a reproduced television image with negligible loss of light and to reproduce the concomitant sound thereof at its optimum position.

A further object of the invention is to increase the efficiency and simplify the projection of a television image and the reproduction of its accompanying sound.

A still further object of the invention is to enable the observation of television images without substantial interference from extraneous illumination and to simultaneously reproduce the accompanying sound at the image point with no interference from the image.

It is well known that television images are usually produced by the serial arrangement of a very large number of unit areas adjacent one another whose light intensities differ in accordance with respective areas of the object. This has previously been accomplished by varying a constant intensity light beam with shutters or by a light valve such as a Kerr cell, or by modulating a light source of small inertia such as a neon tube, or by modulating the electron stream of a cathode ray tube to produce light by bombardment of a fluorescent screen. At present the latter system has been developed so that images of various sizes can be produced with satisfactory light intensity, although a medium dark room or light shield is desirable. Brighter light intensities, however, are now provided by smaller images on tubes of the order of five-inch diameters. Any of these images, of course, are only viewable by a few persons because of their size and position, although the light intensities are sufficient for enlargement of the image to make it observable for a larger number of persons, if accomplished with negligible loss of light. To provide the concomitant sound for those images, loudspeakers are usually positioned in the television cabinet and directed toward the front thereof.

The problem presented is to more efficiently utilize the light producing a television image and

to properly direct the accompanying sound so that the image and sound are related to one another from the observer's standpoint. The present invention solves the problem by presenting the television image for observation by the creation of a magnified aerial image thereof and directing the sound through this image. This method is particularly well suited for cabinet televisions for home use, since the cover of the cabinet may have attached thereto a specular reflecting concave surface into which is projected the television image as well as the concomitant sound, both of which are created or recreated within the cabinet. Since the image is reproduced within the cabinet, it will thus be shielded from the room illumination and the light image, presented in front of the mirror in an optimum viewing position, will not be subject to diffusion from extraneous light. Also, since the image is created only by intersecting light rays, there is no interference to the passage of the sound waves therethrough.

As to the production of the television image, specular reflection is employed to eliminate the large losses in light attendant upon the use of reflecting screens such as used in theatres. These reflecting screens diffuse the light projected thereon and each point of a screen divides the quanta of light reaching it in all directions so that only an extremely small portion of the original projected ray reaches the observer's eyes. Furthermore, there is a light loss due to absorption which is evidenced by a slight rise in the temperature of the screen upon which the light falls. Also the image must be focused exactly in the plane of the screen or it becomes blurred. However, by the use of specular reflection with a concave mirror, the entire light ray projected into the mirror is returned to the observer, there being substantially no loss in intensity of the original ray.

As to the production of the sound, the same type of reflection is employed, and since there is no physical screen and the same reflector serves for both the image and sound, they are both present at the same point without interference.

There are different types of concave reflecting surfaces such as parabolic, hyperbolic, spherical and ellipsoidal and certain combinations thereof. Although any of these types are usable for this invention, the ellipsoidal form is preferred as it provides less distortion and a larger viewing angle for the practical dimensions of a cabinet television.

The details of the invention will be more fully

understood from the following description read in conjunction with the accompanying drawing, in which:

Fig. 1 is a cross-sectional view of a television cabinet in operating position;

Fig. 2 is a front view of the upper portion of the cabinet showing the image as it appears to the observer; and

Fig. 3 is a schematic view showing projection enlargement and direct sound propagation.

Referring to the drawing in detail, in which like numerals identify similar elements, a television cabinet 5 has mounted therein a picture receiver 6 and a sound receiver 7. The picture receiver obtains its signal input from an antenna 9 grounded at 10 while the sound receiver receives its signal input from an antenna 12 grounded at 13. House supply power may be obtained from conductors 15 and transmitted to the sound receiver by conductors 16. The sound receiver may feed its output into the sound reproducer or loudspeaker 18 while the picture receiver supplies a television cathode ray tube 20 over conductors 21. It is to be understood that the details of the synchronizing and sweep circuits for the television have not been shown for the sake of clarity and that any standard circuit or apparatus producing images in different manners may be used.

The television tube is shown mounted on an adjustable platform 23 pivoted at 24 and having a slot and a pin arrangement 25 for varying the angle of throw. Mounted on the table or platform 23 is an adjusting means comprising a lead screw 28, this adjustment permitting the tube 20 to be moved toward and away from a concave mirror 30 mounted in the cabinet cover 31. The cabinet cover 31 is hinged at 33 and may have its angle of reflection adjusted by a slotted brace 34 passing over a screw pin 35.

At the front of the cabinet 5, a U-shaped slide 40, having no screen but simply an opening therein, may be moved up and down in grooves 41 for not only providing a setting for the television image which appears substantially in the plane thereof but also for concentrating the observer's gaze upon the image. It is to be understood, however, that the image is observable and of the same quality when the slide 40 is not employed.

In operation of the above-described system as shown in Figs. 1 and 2, the television image is created on the fluorescent surface of the cathode ray tube 20. The mirror 30 reflects the image on the tube and creates an aerial image thereof at 44, within the opening of the slide 40, the boundary rays for one image position being shown at 45, 46, 47 and 48, while the axial rays are shown at 49 and 50. From any point within the observing angle such as "0," the image on the tube 20 will be formed enlarged and with a light intensity inversely proportional to the increase in area of the image. The image at 44 will be viewable through a considerable angle, thus accommodating a larger number of persons inasmuch as only a small portion of the mirror 30 is utilized to produce each image, while the distance within which the image can be observed has increased because of the enlargement.

The enlargement occurs because the object or image of tube 20 is between the center of the radius of curvature "R" of the mirror 30 and the mirror, thus producing an enlarged real aerial image beyond the point "R" as at 44. If the

image on the tube 20 were at the same distance from the mirror as point "R," the real aerial image at 44 would be of the same size as the image on the tube. With the original image between the focus of the mirror and the mirror, an enlarged virtual image may be produced. It is therefore possible by adjustment of the position of the tube 20 by lead screw 28 to obtain any desirable enlargement within certain limits and to obtain the positioning of the image 44 wherever desired, preferably, of course, in the plane of the U-shaped slide 40. In experimental tests with real images using a twenty-four inch spherical mirror, two to one enlargements were reproduced satisfactorily.

To perfectly correlate the sound accompanying the television image, the loudspeaker may be in the form of a horn or similar device which will direct the sound waves to the mirror 30 at an angle substantially the same as that of the light rays from the image on the tube 20. Thus, the sound waves will be reflected from the mirror 30 in the direction of rays 47, 48 and 50 through the opening in slide 40 and, consequently, directly through the image 44. There is, therefore, perfect spatial coordination between image and sound with no interference of one with the other. This coordination is further enhanced by placing the sound speaker within the cabinet and providing no visual indication of its presence. Furthermore, as to obtaining coordination between picture and sound, the mirror 30 could be flat and the virtual image on tube 20 viewed therein, the sound waves still being reflected from the mirror.

Another feature of interest is that because the tube 20 is a vacuum tube, the end thereof on which the image occurs is curved to provide the necessary strength. The image, therefore, is curved and, necessarily, has foreshortened corners. As this curvature, however, is in the same sense as the curvature of the mirror 30, correction of the final image is accomplished by the distorting action of the mirror 30 which flattens out the image so it appears flat. Thus, the interaction between the curved original image and the concave mirror produces a better final image than the original on the tube.

Another advantage of this type of projection is that each eye of the observer sees a slightly different view of the image on the tube, thereby providing a certain pseudo-stereoscopic effect, which adds depth to the image and enhances its quality.

It also will be observed that the tube 20 is shielded from the light by an overlying portion at the top of the cabinet, the only light therefore which could reduce the brilliancy of the image being that which falls on the mirror at an angle to be reflected to the image. This light is an extremely small portion of the surrounding illumination and will therefore result in no substantial light intensity loss. The image 44 is thus always observable, there being no light obstructing or reflecting surface at 44 to interfere with the brilliancy of the image formed thereat. This method, therefore, eliminates the use of light shields, shadow-boxes and peep-holes or darkening of the room.

Referring now to Fig. 3, a cathode ray tube 50 has positioned in front thereof a projection lens 51 projecting an image into a concave mirror 52 for creating an aerial image 53 as shown by the boundary lines of the image rays. A loudspeaker 54 is shown projecting sound directly through

the image with no reflection from mirror 52. With this arrangement two advantages are obtained, one of which is that within the same space requirements and the same center of curvature "R" for the mirror, a greater practical enlargement is obtainable. That is, the focal lengths of the lens 51 and of the mirror 52 are coordinated to produce the image 53 exactly the same distance from the mirror as that of the center of curvature "R." In other words, if the lens 51 were not employed, an image of the same dimensions as 53 would have to be present the same distance from the mirror as the center "R" in order to produce the image 53. A particular advantage of producing the image at the center of curvature is that the image will remain stationary when an observer moves back and forth within the viewing angle. The pseudo-stereoscopic effect is also present in this modification as well as that shown in Fig. 1, while the final coordination of the image and sound is the same as in Fig. 1.

It is also to be understood that the original image may be formed further within the cabinet 5 for better light protection, but directed at the concave mirror at a different angle than that shown in Figs. 1 and 2. To aid in decreasing extraneous light interference, all interior portions and parts of the cabinet would be made black to absorb stray light. In reproducing the image upon the tube 20, the sweep circuits will be reversely connected so that the image will occur on the tube upside down and reversed from left to right since a concave mirror reverses both coordinates in forming the aerial image.

What I claim as my invention is:

1. The method of presenting a television image and its concomitant sound to an observer comprising receiving and producing a television image out of direct view of the observer, magnifying said image by reflection from a curved specular reflecting surface to form a real image of said received and reproduced television image, receiving and reproducing concomitant sound accompanying said received image, and directing all the effective sound waves through said image along the path of said light waves to the observer.

2. The method of presenting an image and its concomitant sound comprising reproducing said image out of direct view of an observer, magnifying said reproduced image and producing a new image by reflection from a specular reflecting surface, said new image being a real aerial image produced by converging light rays, and simultaneously reflecting said concomitant sound from said surface through said new image.

3. In a television system, the combination of means for creating a television image, a cabinet for housing said means, a specular reflecting surface on said cabinet and adapted to reflect light rays from said image to form an image for observation between said surface and an observer, said image being a real aerial image formed by converging light rays, and means for producing concomitant sound for said image, said sound being directed to said reflecting surface for reflection therefrom through said image.

4. In a television system, the combination of a cabinet, a cover for said cabinet, means within said cabinet for creating a television image, means within said cabinet for creating concomitant sound for said image, and means mounted on said cover and adapted to reflect and converge all of said light rays from said television image to form a real aerial image between said cover and an observer for observing said entire image, said means also adapted to reflect substantially all of said sound for projection through said real aerial image.

5. In a television system, the combination of a cabinet, means within said cabinet for producing a television image, means within said cabinet for reproducing concomitant sound, a cover for said cabinet, and a reflecting surface mounted in said cover and adapted to reflect light from said television image to form an image thereof between said surface and an observer and to reflect the sound from said sound reproducing means for projection through said image.

6. A system for receiving television pictures and sound accompanying said pictures comprising means for receiving and producing a television image out of direct view of an observer, means for magnifying and projecting said image, said means including a curved specular reflecting surface for creating a real image for direct observation of said entire image by said observer, and means for receiving and reproducing the accompanying sound for said received and produced television image, said image projecting means and said sound reproducing means being so related that the light rays of said image and all of said effective sound waves are substantially parallel, said effective sound waves passing through said image.

7. The method of producing a television image for observation and reproducing its concomitant sound comprising receiving and reconstructing a television image out of direct view of an observer, specularly reflecting the light from said image, said reflection enlarging said image for direct observation of the entire image and producing a real aerial image of said reconstructed television image, receiving and reproducing the concomitant sound for said television image, and projecting all of said effective sound waves to the observer substantially parallel with said light waves, said effective sound waves passing through said image.

8. A system for the reproduction of television images with concomitant sound comprising a cabinet, a cathode ray tube within the cabinet for producing television images, a loudspeaker within said cabinet for reproducing sound waves, a cover for said cabinet, means in said cover for specularly reflecting the light rays of said television images for observation between said cover and an observer, said light rays intersecting to form an aerial image, said last-mentioned means also reflecting said sound waves, and means for adjusting said tube and said cover to obtain substantial coincidence between said sound waves from said speaker and said light rays.

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