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TELEVISION SYSTEM

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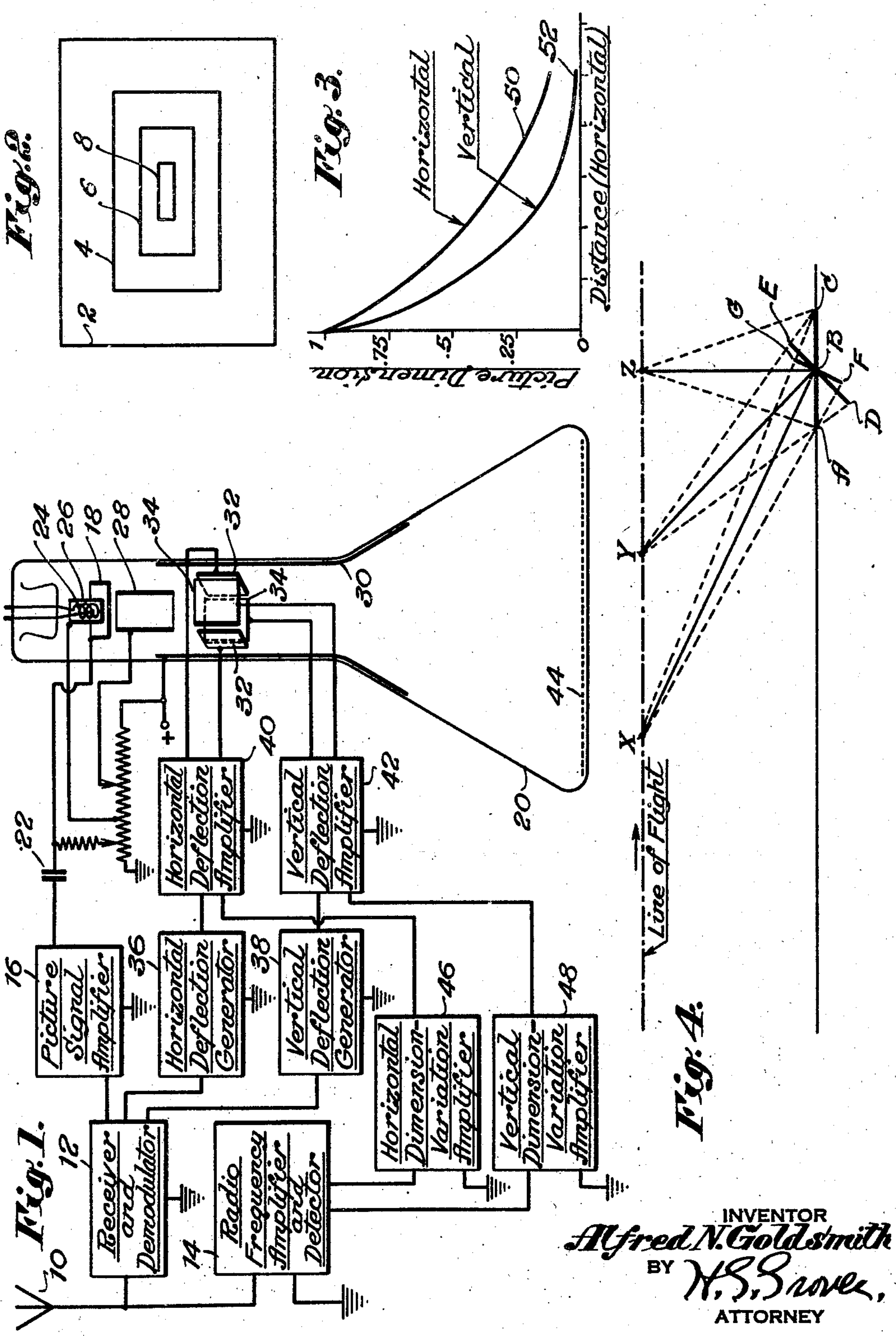

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TELEVISION SYSTEM

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The present invention relates to television systems and is particularly adapted to television systems wherein the size and aspect ratio of the television image produced at the receiving apparatus is proportional or related to or representative of the distance separating the point of instantaneous reception and the point from which television video or picture signals are transmitted.

The invention in its preferred form is so constituted that the size of the television image produced at the receiving apparatus is related to the received signal strength in order that the reproduced image size may be indicative of the distance separating the transmitting station from the receiving station. Furthermore, the preferred form of the invention is so constituted that the aspect ratio of the receiver image is also related to the received signal strength in order that the image produced at the receiver may have a variable aspect ratio in order to produce a quantitative or qualitative visual indication of the subject matter being transmitted.

The invention is designed primarily for use in an airplane and is so constituted that the pilot of the plane may have reproduced before him a visual indication in proper perspective of the airport or landing field that he is approaching. In order that a proper visual representation of the landing field may be reproduced on the picture tube of the receiving apparatus, it is necessary to effect a control of the size of the reproduced image in accordance with the distance of the plane from the landing field and, furthermore, it is desirable to alter the aspect ratio of the reproduced image in accordance with the distance of the plane from the landing field or in accordance with the angle subtended between the line of sight to the airport and a horizontal plane coinciding with the airport. When both the size of the reproduced image and the aspect ratio are automatically altered in accordance with the distance of the plane from the landing field, then an instructive visual indication will be presented to the pilot of the plane.

In accordance with the present invention it is only necessary to transmit from the airport video or picture signals representative of a single visual representation, the transmitted representation being that which would normally be sent from a point immediately above the particular airport. Video or picture signals representing a view of the airport taken from a point directly above the airport may therefore be transmitted from the airport in all directions for reception by incoming planes. Naturally, if the airport were visible from a distance of say 25 miles and from an altitude of for example 5,000 feet the relative size of the airport would be quite small and dimensions of the airport parallel to the line of sight would naturally be foreshortened by reason of the angle from which the airport is observed. When a system incorporating the features of this invention is provided in the incoming airplane, the received video or picture signals, when applied to the present invention, cause an image to be reproduced on the receiving tube in the airplane, the size of the image being a function of the distance of the plane from the airport and the aspect ratio of the image being also a function of that distance. As the plane approaches the airport the size of the reproduced image gradually and automatically increases and, furthermore, at the same time the aspect ratio of the received image is automatically altered to correspond to the change in the viewing angle by reason of the approach of the plane to the airport. Such a system is particularly desirable when the airplane is approaching a landing field during adverse weather conditions when the visibility is low or during the night time.

Accordingly, one of the purposes of the present invention resides in the provision of means by which television images may be obtained and produced upon a screen or viewing surface in such a manner that the size of the reproduced image may be a measure or function of the distance separating the receiving point from the transmitting point.

Another object of the present invention resides in the provision of means whereby television images may be obtained and produced on the screen or viewing surface in such a manner that the aspect ratio of the reproduced image may be a measure or function of the distance separating the receiving point from the transmitting point.

A still further purpose of the present invention resides in the provision of means for automatically altering or varying the size of the produced image on the viewing surface or screen of the receiving tube in accordance with variations in the signal strength of the received signals transmitted from a particular point adjacent or near the significant surface.

Still another purpose of the present invention resides in the provision of means for automatically and gradually altering the aspect ratio or the proportionate dimensions of the produced image at the receiver in accordance with the signal strength of the received signals.

A still further object of the present invention resides in the provision of means for visually indicating and for quantitatively or qualitatively depicting the relative size and dimensions of a significant surface in accordance with the displacement and viewing angle of the receiver from the particular significant surface.

Still other purposes and advantages of the present invention will become more apparent to those skilled in the art from the following detailed description particularly when considered with the drawing wherein:

Figure 1 represents a preferred form of the present invention.

Figure 2 shows a plurality of outlines indicating the relative size and dimensions of received images.

Figure 3 shows a plurality of curves representing the control of various elements of the system and

Figure 4 represents graphically the change in the relative size of a significant surface in accordance with the position of the viewer.

Referring now to the drawing and particularly to Figure 4 there is shown a significant surface A—C which may represent a landing field or airport. Above the ground surface is shown a broken line representing the line of flight of an approaching airplane. Along this line of flight are shown three points X, Y and Z representing three different positions of an airplane. Naturally, when the airplane is at position Z which is directly over the airport, the dimensions of the airport or significant surface A—C will appear quite large and the surface will not be distorted by reason of any obliquity of vision. If, however, the airplane is at position Y then naturally the over-all appearance of the significant surface or airport will be reduced and, furthermore, the dimension A—C of the airport will be reduced to a dimension corresponding to the line D—E which is drawn normal to the line of sight Y—B. If the airplane is located at the point indicated at X then the over-all dimensions of the airport will be further reduced and the dimension of the significant surface parallel to the direction of flight will be very greatly reduced by reason of the decreased viewing angle. The dimension of the airport in the direction of flight will therefore be reduced to correspond to the length F—G as shown in Figure 4. The apparent dimensions of the airport in a direction perpendicular to the direction of approach is affected only as a function of distance since the viewing angle does not cause any foreshortening in that particular direction. Foreshortening, however, is effective to materially reduce the apparent dimensions of the airport or significant surface in a direction parallel to the line of flight.

Figure 2 shows a series of rectangles which represent the dimensions of the produced images on the receiving tube in the airplane. The largest rectangle 2, for example, represents the dimensions and aspect ratio presented on the viewing screen of the receiving tube when the plane is at a position corresponding to Z in Figure 4. Under these conditions there is no foreshortening of the dimensions of the significant surface and the produced image should preferably fill substantially the entire screen surface of the receiving tube. The rectangle 8, however, represents by way of example, the size and dimensions of the same significant surface when the receiving station or airplane is at a position corresponding to the point X or at some remote point with respect to the location of the airport. Under these conditions the dimensions of the airport in a direction parallel to the line of flight (the vertical dimensions on the screen) are materially reduced for two reasons; one being the distance from the airport, and the other being the relative viewing angle. The horizontal dimensions of the airport, however, are reduced by reason of distance only since obliquity of vision does not effect a reduction in this dimension of the reduced image. As the plane approaches the airport the size of the reproduced image is increased and the aspect ratio is decreased or altered so that at various stages of the approach of the plane to the airport the received image might cover areas represented by the rectangles 8, 6, 4 and 2, respectively. It is to be understood, however, that the change in the dimensions and the change in the aspect ratio of the produced image on the receiving tube is gradual and is not stepwise.

It may be appreciated therefore that when a circuit arrangement is provided to alter the size and aspect ratio of the produced image in an airplane a natural depiction of the airport is produced simulating an actual view of the airport from the airplane.

In Figure 1 is shown one form of the present invention for accomplishing the above desired purposes and results. An antenna system 10 is shown which receives the signals transmitted from the transmitting station at the airport or significant surface and the antenna supplies radio frequency energy to a receiver and demodulator 12 as well as to a radio frequency amplifier and detector 14. Demodulated picture or video signals from the receiver 12 are then applied to a video or picture signal amplifier 16 which, in turn, supplies amplified video or picture signals to the control electrode 18 of an image producing tube 20. These signals are applied by way of coupling condenser 22. The image producing tube 20 also includes a heating element 24, a cathode 26, a first anode 28 and a second anode 30. When proper operating potentials are applied to the electrodes of the tube a focused cathode ray beam is generated. For deflecting the cathode ray beam in a horizontal direction horizontal deflecting plates 32 are provided and likewise for deflecting the cathode ray beam in a vertical direction vertical deflecting plates 34 are provided.

The television video or picture signal receiver and demodulator 12 also supplies synchronizing signals to a horizontal deflection generator 36 and to a vertical deflection generator 38. Naturally proper horizontal and vertical synchronizing impulses are transmitted from the transmitting station as is conventional and well known in television transmission practice. These synchronizing signals that are applied to the horizontal deflection generator 36 and to the vertical deflection generator 38 cause the deflection generators to produce voltage variations of substantially saw tooth wave form or of a wave form necessary to deflect the cathode ray beam in the receiving tube 20 in mutually perpendicular directions and at the proper uniform rates. The voltage variations which are developed by the horizontal deflection generator 36 are applied to a horizontal deflection amplifier 40 while the output from horizontal deflection amplifier 40 is applied to the horizontal deflecting electrodes 32. Similarly the output from the vertical deflection generator is applied to a vertical deflection amplifier 42 which in turn supplies energy to the vertical deflecting plates or electrodes 34.

When the horizontal and vertical deflection amplifiers 40 and 42 are operated at substantially optimum efficiency and gain the voltage variations supplied thereby are sufficient to cause the cathode ray beam to be deflected over substantially the entire screen or target area 44 of the television image producing tube 20 to produce thereon electro-optical images. In the absence of any control on the horizontal and vertical deflection amplifiers the size of the scanned area on the viewing screen 44 of the cathode ray tube 20 would remain substantially fixed. Furthermore, the aspect ratio or relative dimensions of the scanned area would remain relatively fixed.

For effecting a control of the size and relative dimensions of the scanned area, the signals which are derived from the radio frequency amplifier and detector 14 are applied to a horizontal dimension variation amplifier 46 and to a vertical dimension variation amplifier 48. These amplifiers supply a biasing potential or a control potential to the horizontal and vertical amplifiers 40 and 42 respectively in order to control the gain or amplification of the deflection amplifiers. Naturally the signal output from the radio frequency amplifier and detector 14 is a function of the received signal strength since it is preferable that no automatic volume control action be included in this portion of the circuit. Accordingly, potential variations are applied to the horizontal and vertical dimension variation amplifiers 46 and 48, the potentials being a function of the intensity of the received signals at the antenna 10. After these voltages have been appropriately amplified they are then applied to the horizontal and vertical deflection amplifiers 40 and 42.

Since the horizontal dimension of the produced image is to be varied in accordance with the received signal strength to indicate distance only from the airport or significant surface, it is desirable to alter the amplification of the horizontal deflection amplifier 40 according to a predetermined function, the function being represented by way of example by the curve 50 shown in Figure 3. The curve 50 shows the horizontal picture or image dimension as a function of the distance from the airplane to the airport. As the airplane approaches the airport or significant surface the gain or amplification of the horizontal deflection amplifier 40 is permitted to increase by voltage control from the horizontal dimension variation amplifier 46 in a manner represented by the curve 50 in Figure 3.

The vertical dimensions on the produced image, however, must be altered to represent both distance and obliquity of vision. Accordingly, the vertical deflection amplifier 42 should be supplied with control potentials such that the gain or amplification of the vertical deflection amplifier will vary in accordance with a curve such as shown at 52 in Figure 3 as a function of the received signal strengths. The vertical dimension variation amplifier 48 therefore responds to the received signal strength to produce control voltage variations which when applied to the vertical deflection amplifier 42 will be effective to alter the vertical deflection voltages in a manner represented by the curve 52 in Figure 3. This curve shows the vertical picture or image dimension as a percentage or fraction of its maximum value (corresponding to the dimensions of 2 in Figure 2) and as a function of the distance of the receiver or airplane from the transmitter or airport.

Assuming the horizontal and vertical dimensions of the produced image to be unity when the receiver is directly above the airport and at a point represented by Z in Figure 4, then it may be seen that if the plane is flying from the airport the horizontal and vertical dimensions will be decreased according to different functions. By an inspection of Figure 3 it is evident that a vertical dimension will decrease more rapidly as a function of increasing distance than will the horizontal dimension for the corresponding distance. Likewise, as a plane approaches an airport the first produced image will appear quite small in height and will have a relatively large aspect ratio. Both dimensions of the produced image will be materially reduced but the vertical dimension will be decreased by an amount considerably in excess of the decrease in the horizontal dimension. As the plane approaches the airport both dimensions will be increased as the distance between the airplane and the airport is decreased but the percentage increase in the vertical dimension will be more rapid than the percentage increase in the horizontal direction. Accordingly, there is presented before the pilot a proper or natural visual representation of the airport and the produced image will depict not only the proper visual size of the airport but also the proper visual dimensions or aspect ratio of the airport.

In the patent to Goldsmith, #2,168,566, is shown and described a system wherein the relative size only of the received image is altered in accordance with received signal strength. Such a system is naturally of considerable assistance in guiding aircraft or ships into airports or harbors where due to bad weather conditions or to darkness a direct and accurate view of the ultimate point of destination cannot be obtained by direct vision. In the case of a ship, it is not necessary that the aspect ratio or relative proportions or dimensions of the proposed image be altered, however, in the case of an aircraft or airplane it is desirable to alter not only the over-all dimensions but at the same time to alter the relative dimensions of the image since, as the aircraft approaches the landing field, not only does the size of the landing field change but also the aspect ratio or relative dimensions of the airport changes because of the change in the obliquity of vision. Accordingly, through the use of the present invention it is possible to produce a qualitative visual indication simulating and depicting the normal view of the approaches airport. This is accomplished by not only automatically and gradually varying the size of the produced image but also simultaneously, automatically and gradually altering the relative dimensions of the produced image to simulate changes in the angle of sight.

Various alterations and modifications of the present invention may become apparent to those skilled in the art and it is desirable that any and all such modifications and alterations be considered within the purview of the present invention except as limited by the hereinafter appended claims.

I claim:

1. A television receiver comprising means for receiving video signals, means energized by the received signals for producing electro-optical images, and automatic volume controlled means operating in accordance with the strength of received signals for controlling the size and aspect ratio of the produced electro-optical images so

as to represent the geographic separation and the angle of vision from the receiver to the point of transmission.

2. A television receiver, means for receiving video and accompanying synchronizing signals, means for producing, in accordance with the received video signals, electro-optical images representative of a significant area at the point of transmission, means for controlling, in accordance with the received synchronizing signals, the rate and spatial position at which the video signals are translated into electro-optical effects, and automatic volume controlled means for controlling, in accordance with the strength of the received signals, both the size and the ratio of the dimensions of the produced electro-optical image to qualitatively represent the geographic separation and angle of vision from the receiver to the point of transmission.

3. A television receiver, means for receiving video and accompanying synchronizing signals, means for producing, in accordance with the received video signals, electro-optical images representative of a significant surface at the point of transmission, means responsive to the synchronizing signals for controlling the rate and spatial position at which the video signals are translated into electro-optical effects, means responsive to the strength of the received video signals for automatically changing the horizontal dimension of the produced electro-optical images according to one function, and means also responsive to the strength of the received video signals for automatically changing the vertical dimension of the produced electro-optical images according to a different function, whereby both the size and the aspect ratio of the produced electro-optical images may be changed.

4. A television receiver, means for receiving video and accompanying synchronizing signals, means for producing, in accordance with the received video and synchronizing signals, rectangular electro-optical images representative of a significant surface near the point of transmission, and means responsive to received signal strength for automatically changing the horizontal dimensions of the produced electro-optical images according to a predetermined function, and means responsive to received signal strength for automatically changing the vertical dimensions of the produced electro-optical images according to a different function, whereby both the size and the aspect ratio of the produced electro-optical images may be changed in accordance with the received signal strength.

5. A method of producing television images comprising the steps of receiving video signals, producing bi-dimensional electro-optical images under the control of the received video signals, and developing automatic volume controlled energy measured as a predetermined function of variations in a received signal strength due to changing geographic separation of the receiving point and the signal transmission point for controlling each of the two dimensions of the produced electro-optical images so as thereby to vary the aspect ratio.

6. A method of producing television images comprising the steps of receiving video signals producing bi-dimensional electro-optical images under the control of the received video signals, developing automatic volume controlled energy measured as a function of the variation in received signal strength for modifying one dimension of the electro-optical images, and then developing independent automatic volume controlled energy measured as a predetermined function of variation in the received signal strength for controlling the second of the two dimensions of the electro-optical images, whereby the aspect ratio of the developed images varies substantially in accordance with the received signal strength as representative of the variations in geographic separation of the receiving point and the point of transmission.

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