Sept. 4, 1945. G. L. BEERS 2,384,232

TELEVISION VIEW FINDER

Filed May 2, 1942 2 Sheets-Sheet 1

Fig. 1.

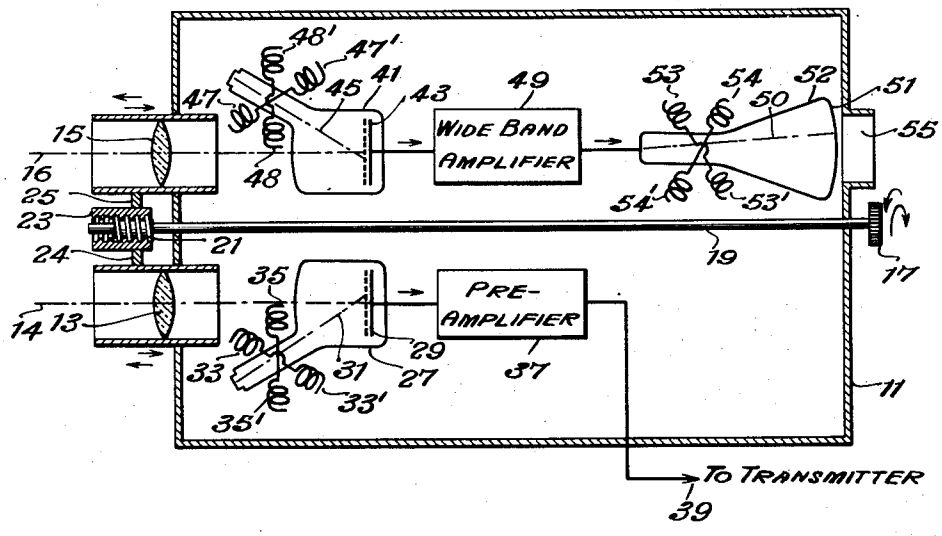

Fig. 2.

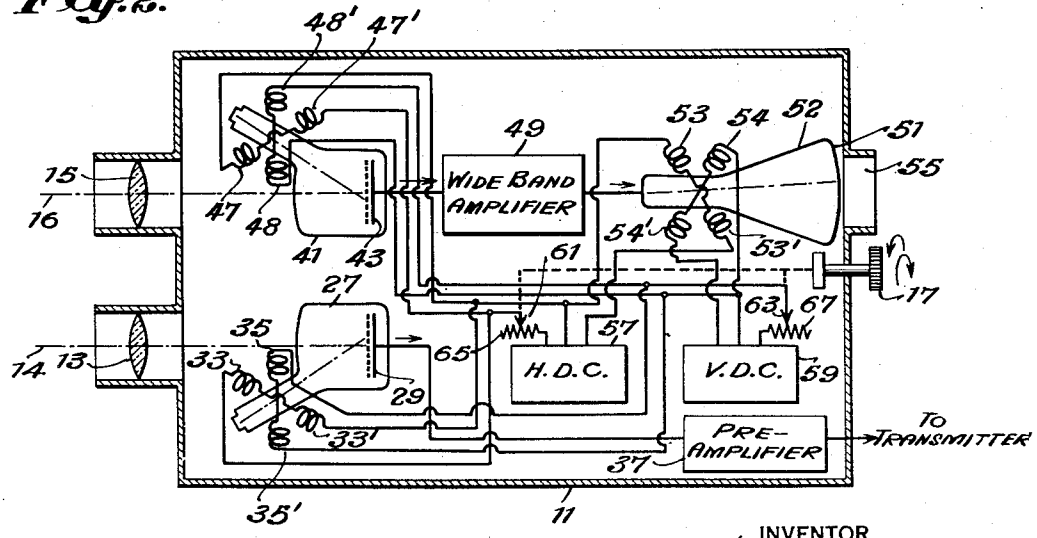

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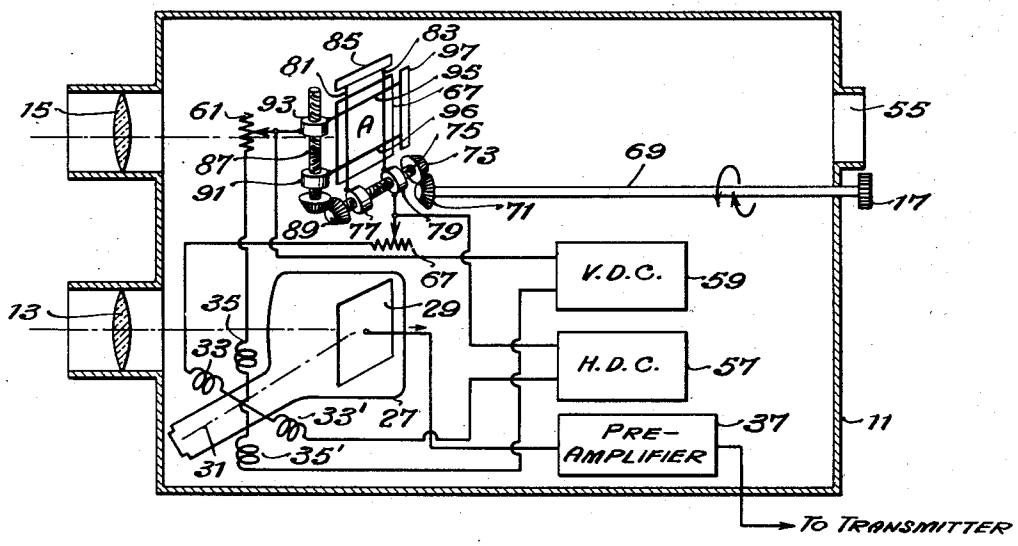
Fig. 3.



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TELEVISION VIEW FINDER

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10 Claims. (Cl. 178—7.2)

This invention is directed to television apparatus and particularly to a view finder for use on television cameras.

In one of its preferred forms the invention has as its object that of providing a view finder which, when used cooperatively with a television camera tube, will give satisfactory performance of the television system irrespective of the sensitivity of the pickup tube.

In the operation of television systems the picture signals which are transmitted to the receiving points may originate from the scanning of motion picture film, for instance, or from direct pickup in a studio or out of doors. The present invention is particularly concerned with the latter type of pickup and, as such, is directed to a form of view finder which not only provides the camera operator with a view of the scene of which the image is to be focused upon the television camera pickup tube for the production of the television signals, but also indicates when the lens picking up the scene is properly focused thereon.

The present invention is one which is intended to simplify and improve the performance of television camera equipment and accordingly it will be found that among the various objects of the invention are those of providing a view finder which at all times shall accurately indicate when the television camera is properly focused upon the desired scene or object.

Another object of the invention is that of providing a television view finder which not only will define the particular portion of the scene which it is desired to convert into the television image, but shall also reproduce a sufficient portion of the scene external to the camera field so that the cameraman will know in advance what will be included in the field of the camera if he "pans" the camera in any direction.

A further object of the present invention is that of providing a view finder which will give an erect image which is of sufficient size and brightness to minimize substantially eye strain on the camera operator.

Still other objects and advantages of the invention are those of providing a system which is efficient in its operation, relatively free from complex parts and yet capable of being controlled by a single operator.

In the past it has been found that with the increase in sensitivity of television camera tubes and with an adequate amount of illumination on the desired scene, the camera lens can frequently be stopped down to provide a greater depth of focus while still being able to produce an adequate signal output from the television pickup tube. Under such circumstances, those view finders which obtain the view finder image either directly or indirectly from the camera lens, do not provide an accurate focus, since the view finder image has the same depth of focus as the camera image. In other words, no apparent change in detail is observed by the cameraman as the lens is moved back and forth through an appreciable range. Numerous view finders likewise do not provide a view of at least a small part of the scene on each side of the television picture area. Unless the view finder provides this information, the cameraman will not know in advance what will be included in the picture if he "pans" the camera in any direction. In television studios several sets are frequently used in limited space, so that a camera can be changed quickly from one scene to another. This makes it necessary for the cameraman to know what is included in a small area outside the field of his camera, so that he does not inadvertently include an edge of an undesired set in the picture. If the view finder does not provide an image of this additional area, it is frequently necessary for the cameraman to move his head sufficiently so that he can look along one side of the camera to determine the effect of "panning" the camera in a desired direction. Not only is this inconvenient, but when the cameraman looks around the camera at the brighter scene and then again looks at the image in the view finder, it is necessary for his eyes to readjust themselves to the difference in the light intensity.

Essentially the present invention comprises ways and means by which a desired image is focused upon the mosaic of a television pickup tube.

In one of its preferred forms, the invention comprises a pair of optical systems. One of the optical systems is arranged to direct the light of the image on to the television scanning tube used for picking up the scene to be transmitted and for translating the light values of that scene into electrical signal impulses which are then transmitted in an appropriate manner to receiving stations. The second optical system is arranged to direct light from the scene upon a view finder pickup tube which is associated with and independent amplifier and arranged to convert the variations in light intensity of the scene into electrical impulses which may be then reproduced as a view finder image before the eyes of the camera operator.

In combination with these optical systems there is provided a single focus control to focus properly the light image on the respective pickup tubes.

Another form of the invention utilizes a plurality of optical systems. Means is provided for focusing an image on the mosaic of a pickup tube on one hand, and upon a separate view finder viewing screen on the other hand. By providing an arrangement whereby the area of the pickup tube mosaic which is scanned may be controlled, the effect of changing the focal length of the camera lens or of changing the distance between the scene and the camera can be achieved by employing novel means which are included in one embodiment of the invention.

The view finder is controlled simultaneously with the control of the scanned area of the pickup tube mosaic so that it indicates at all times the area of the scene which is being converted into the television image.

The foregoing forms of the invention are schematically illustrated by the accompanying drawings, wherein:

Fig. 1 shows the form of the invention wherein a plurality of optical systems is utilized in combination with a camera pickup tube and a view finding pickup tube which is directly associated with a viewing tube;

Fig. 2 shows a modification of the arrangement of Fig. 1 where provision is made for varying simultaneously the scanned area of the camera pickup tube and the view finding pickup tube to achieve telephoto effects and the like; and,

Fig. 3 represents a modification of the arrangement of Fig. 2.

Referring now to the drawings for a further understanding of the invention, and first to Fig. 1 thereof, there is provided within the camera housing 11, a pair of lens elements 13 and 15 which are each capable of being moved along their axes 14 and 16 respectively in the directions shown by the arrow. Adjustment of the lenses 13 and 15 backward and forward is provided by means of a suitable focus control knob 17 located on the rear portion of the housing and connected with a shaft or spindle 19, preferably passing directly through the housing and supported in the housing walls in bearing members (not shown specifically).

At the end of the spindle or shaft 19 there is provided a gear or pinion element 21 which is adapted to mesh, for instance, with a rack 23 which is, in turn, supported by a supporting element 24—25 connected, in turn, respectively to the lens mounts for the lenses 13 and 15, so that rotation of the focus control knob 17 is adapted to move the lenses 13 and 15 backward and forward as conventionally indicated.

In one portion of the housing element 11 there is provided a camera pickup tube 27 having a mosaic element 29, onto which the light forming the image is adapted to fall when focused thereupon by the lens element 13.

The camera tube 27 is conventionally represented as being of the type known in the art as the "Iconoscope," which has been described in many publications of the prior art, such, for instance, as in the article entitled "Television Pickup Tubes with Cathode Ray Beam Scanning" by Messrs. Iams and Rose, as published in the "Proceedings of the Institute of Radio Engineers" for August, 1937, volume 25, No. 6, commencing on page 1048. This tube is merely represented as schematic of various types of tubes which can be used with equal efficiency.

Developed within the tube 27 is a cathode ray beam 31 which is arranged to scan the mosaic element 29 in accordance with its position of impact thereon, as controlled by the horizontal deflecting coils 33—33' and the vertical deflecting coils 35—35'. The impact of the cathode ray beam upon the mosaic element releases to an external circuit signals representative of the image, in known manner. Thus, output television signals are then supplied to a pre-amplifier 37, usually contained within the camera housing and schematically represented herein. The output from the pre-amplifier 37 is then supplied to the transmitter (not shown) and its appropriate amplifiers and modulators from the terminal point 39.

In order that the operator may be able to determine exactly the scene being transmitted and to maintain that scene properly focused upon the camera tube 27, a second pickup tube 41 is provided within the housing. This pickup tube has the usual mosaic element, conventionally represented at 43, and the cathode ray beam 45 developed therein is adapted to be deflected back and forth across the mosaic in a horizontal direction by the horizontal deflecting coils 47 and 47', and in a vertical direction by the vertical deflecting coils 48 and 48'.

The deflecting voltages or currents are supplied to the deflecting coils associated with each of the tubes 27 and 41 from a suitable source of energy (not shown in Fig. 1), and preferably operate so that the two sets of coils for the tubes 27 and 41 are simultaneously energized.

Connected to the output of the scanning tube 41 is a wide band amplifier 49 which is arranged to amplify the signal output from the tube 41. This amplifier is of the general type well known in the art, except that it is designed to be uniformly responsive to a wider pass band of frequencies than those normally used with the camera tube used to produce the television signal output energy. This wide band amplifier enables the operator to view the produced monitor image as a picture of greater resolution or detail than is permitted by the normally used television broadcasting system.

The output of the wide band amplifier 49 is then supplied to control the intensity of light produced by a cathode ray beam 50 on the luminescent target 51 of a cathode ray image producing tube 52, which will herein be termed a "monitoring" view finder tube. The cathode ray beam developed within the monitoring tube 52 is also arranged to be deflected in both horizontal and vertical directions by means of the horizontal and vertical deflecting coils 53—53' and 54—54' which may be activated from the same source of energy that deflects the beams developed in the tubes 27 and 41 and which are operating simultaneously and concurrently therewith.

The light image produced upon the luminescent screen or target area 51 of the tube 52 is then observed through the view finding window by the operator or cameraman who is controlling the transmission and, in accordance with the transmission needs, he is able to control and focus properly the image upon the tubes 27 and 41 by manipulation of the control knob 17 which moves the lens elements.

The use of the wide band amplifier 49 enables the view finder tube 52 to provide a more critical indication of when the optical image on the camera tube 27 is in focus than is apparent to the television audience, because the additional

detail provided by the view finder system makes a slight degradation in detail more apparent.

The amplitude of deflection for the view finder pickup tube 41 is also slightly greater than that of the tube 27, so that with this type of view finder system, there is provided a view of a part of the scene on each side of the television picture area.

In a conventional optical view finder system, the brightness of the view finder image is dependent upon the illumination on the scene and the over-all efficiency of the optical system and is, therefore, independent of the sensitivity of the television pickup tube. Any increase in the sensitivity of the pickup tube results in a corresponding decrease in the brightness of the view finder image, in a conventional optical view finder system when the maximum sensitivity of the pickup tube is utilized. The brightness of the view finder image in the arrangement illustrated in Fig. 1 is determined primarily by the characteristics of the viewing tube 52 and the operating potentials which are utilized.

If the view finder pickup tube 41 always has a sensitivity which is comparable to that of the camera pickup tube 27, the brightness of the view finder image is automatically compensated as more sensitive pickup tubes are developed.

In the modification of the invention as shown by Fig. 2, for instance, there is provided within the housing element 11, two pickup tubes 27 and 41 as hereinabove pointed out. The modification of Fig. 2 is particularly concerned with an arrangement whereby the telephoto effects are obtained by a reduction in the area of the mosaic element 29 of the camera tube 27 which is scanned.

In the arrangement of Fig. 2, the lens elements 13 and 15 are focused simultaneously, as in Fig. 1, and, in addition, the effects of either moving the camera closer to the scene of action or changing the focal length of the lens for obtaining telephoto effects or closeups, are obtained by a variance of the amplitude of the energy applied to the deflecting coils so as to control the scanned mosaic area in each of the tubes 27 and 41. As the scanned mosaic area is reduced, the size of the object on a television viewing tube is correspondingly increased, since the deflection of the beam in the viewing tube is normally independent of the amplitude of deflection at the pickup tube.

For the sake of simplicity, the focusing control for the lenses 13 and 15 has been omitted in Fig. 2. It is to be understood, however, that any control like that illustrated in Fig. 1 may be used.

Horizontal deflection control circuits 57 and vertical deflection control circuits 59, each conventionally represented since they are per se well known, are provided. These circuits are connected to energize the horizontal and vertical deflection coil pairs 33—33' and 35—35', and 47—47' and 48—48', and 53—53' and 54—54' of the tubes 27, 41 and 52 respectively.

As was explained, for instance, in Iams patent, No. 2,098,390, of November 9, 1937, by varying the amplitude of deflection of the cathode ray beam across the mosaic target, the area of the target which is scanned may be controlled.

In order to vary the area of the target scanned, the focus control knob 17 is arranged simultaneously to vary the position of adjustable contacts 61 and 63 on resistors 65 and 67 respectively. These resistors are so connected as to receive energy from the horizontal control circuit and vertical control circuit 57 and 59 respectively, and, when varied, they vary the energy supplied to the deflecting coils (or plates when deflection is electrostatic).

As indicated conventionally by the dotted lines connected between the sliders 61 and 63 and the control knob 17, it can be seen that the controls are preferably varied in unison. However, it is to be noted in this connection that the variance in the control of the amplitude of the deflecting energy supplied to the horizontal and vertical deflecting coils should be maintained in such a ratio that the amplitude of deflection remains such at all times that the desired and normal aspect ratio be maintained between the horizontal and the vertical deflection. In cases where the aspect ratio is four to three for horizontal to vertical, as customarily used, of course the variance will be maintained in this order, and for other aspect ratios proportional changes will be provided.

The amplitude of the energy supplied to the deflecting coils 53—53' and 54—54' of the image reproducing tube 52 is not varied simultaneously with the control of the deflection on the camera tubes because it is desired that the viewed picture shall cover the entire area of the target 51, and by maintaining the deflection in the monitor tube 52 as fixed, the scanned area of the camera tube 27 is expanded to occupy the full target area 51 of the monitor tube 52 (or any receiver tube) and then provide the desired image enlargement for the closeup effect.

Simultaneously with a variance in the amplitude of deflection of the cathode ray beam in the tubes 27 and 41, provision is made for varying the focus of the cathode ray beam in a manner similar to that shown, for instance, by the Iams patent above referred to so that the scanning detail shall be increased in each of the tubes 27 and 41 for reduction in the area scanned. In this way the reduced size pattern of the transmitter may be expanded on the image reproducing tube 52 or the tubes of television receiving instrumentalities to retain the desired size and aspect of the picture viewed and still maintain the desired picture detail. The increase in scanning detail is obtained by decreasing the size of the scanning spot on the mosaic targets 29 and 43 respectively, while, at the same time, retaining the same time period to traverse each horizontal path of scanning and the complete number of vertical paths of scanning, so that the frame periodicity and line periodicity remain invariant.

By providing a wide band amplifier 49 in the arrangement of Fig. 2, and associating this wide band amplifier with the reproducing tube 52, and by arranging the system so that the scanned area in the tube 41 is slightly greater than for the tube 27, it is apparent that the advantages of the system of Fig. 1 may be retained.

Referring now to the modification of Fig. 3, the disclosed system provides essentially the features shown by the arrangement of Fig. 2. However, in this instance, the view finder monitor tube 52 is replaced by a view finder screen 67, onto which the view or field received by the optical system 15 is directly projected.

As in the arrangement of Fig. 2, changes in position of rotation of the control knob 17 are arranged to control the amplitude of deflection of the cathode ray beam 31 developed within the scanning tube 27. In the preferred arrangement of Fig. 3, the control knob 17, when turned, is adapted to rotate a spindle or shaft 69 which is

supported in a suitable bearing member, not shown, both at the point where it enters the housing 11 and at some intermediate point.

At the end of the shaft or spindle 69, remote from the control knob, is a gear 71 arranged to mesh with a second gear 73, which, in turn, rotates a spindle 75. This spindle has both right and left hand threads, with the division between right and left hand threads being made about midway thereof.

Carried upon the spindle and adapted to be controlled by a rotation thereof are two slidable elements 77 and 79 which are prevented from turning as the spindle 75 rotates, but by means of guide elements not shown, are arranged to slide laterally in opposite directions. Attached to the slidable elements 77 and 79 respectively are the vertical wires 81 and 83 of a view finding mask to define the area A over which the view is to be scanned. As the slidable elements 77 and 79 move in the direction shown by the arrows, the wires 81 and 83 are likewise brought closer together, or farther apart, as the case may be, with respect to each other, and are prevented from rotating by means of the guide element 85 into which they are fitted. For any rotation of the shaft or spindle 75, this motion is translated to a second shaft or spindle 87 by means of a pair of gear elements 89 carried on the end of the shaft or spindle 75 and the shaft or spindle 87.

In a manner similar to that heretofore explained, a similar pair of slider elements 91 and 93 is adapted to slide on right and left hand threads of the spindle 87, so as to move the wire mask elements 95 and 96 upwardly and downwardly, and toward and away from each other within the guide member 97, as indicated. Thus, the wire mask elements 81—83 and 95—96 together define an area A which is representative of the picture area to be scanned in the camera tube 27.

For the purpose of controlling the amplitude of deflection of the scanning beam of the camera tube 27 in both the horizontal and vertical directions, the movable elements 79 and 93 respectively are arranged to vary the slider element on the potentiometer elements 61 and 67 respectively, which are connected to the horizontal deflection control unit 57 and the vertical deflection control unit 59, so that the area of the mosaic target 29 which is traversed by the scanning cathode ray beam 31 shall be varied.

As was shown by the aforesaid Iams patent, and explained in the reference to Fig. 2 hereof, a uni-control is adapted to be provided for simultaneously focusing the beam 31 to a more sharply defined spot so as to vary the scanning detail in order that the area corresponding to the area A on the mask shall be scanned in greater detail. The focus control for adjusting the position of the lenses has likewise been omitted from this diagram for the sake of simplicity.

Many other modifications of the system herein disclosed may be made without departing from the spirit and scope of what is herein shown and described.

Having described the invention, what is claimed is:

1. A device of the class described comprising a camera tube having included therein a light sensitive target and a cathode ray source for producing an electron beam to scan the target, optical means for directing the light of an image upon the camera tube target, a view finder observation screen, optical means to focus light representing the said image along a second light path, means to utilize the light directed along the second path to produce upon the view finder observation screen a view of greater boundary limits than the image cast upon the camera tube and which larger image includes within its boundaries a substantial duplicate of that image focused upon the camera tube, and a control means for varying the defined image area viewed upon the said view finder observation screen and for simultaneously varying the boundary limits of the image scanned in the said camera tube.

2. A device of the class described comprising a camera transmission tube having included therein a light sensitive target and a cathode ray source for producing an electron beam to scan the target, optical means for directing the light of an image upon the image transmission tube target, a view finder observation screen, optical means to focus light representing the said image along a second light path, means to utilize the light directed along said second path to produce upon the view finder observation screen a view of greater boundary limits than the image cast upon the camera tube and which image includes within its boundaries a substantial duplicate of that image focused upon the camera tube, and a common control means for varying the defining areas of the image viewed upon the said view finder observation screen and for simultaneously varying the boundary limits of the image scanned in the said camera tube.

3. A device of the class described comprising a camera tube having included therein a light sensitive target and a cathode ray source for producing an electron beam to scan the target to produce signal output energy therefrom, optical means for directing and focusing the light of an image upon the tube target to control thereby the said signal energy output, a spatially separated view finder observation screen, optical means to focus light representing the said image along a second light path, means dependent upon the light directed along the second light path to produce upon the view finder observation screen an image which is a substantial duplicate of the image focused upon the camera tube and which includes also contiguous border areas of the image upon the camera tube, and control means for varying the defining borders of the image viewed upon the said view finder observation screen and simultaneously modifying the area of the light sensitive target scanned by the produced electron beam so that the scanned image of the camera tube includes only a fractional portion of the complete image instantaneously observable on the view finder screen.

4. The system claimed in claim 3 comprising, in addition, means operating simultaneously with changes in scanned area of the target of the camera tube to maintain the electron beam cross-sectional area in substantially constant ratio to the said scanned area.

5. A device of the class described comprising a camera tube having included therein a light sensitive target and a cathode ray source for producing an electron beam to scan the target to produce signal output energy therefrom, optical means for directing and focusing the light of an image upon the tube target to control thereby the said signal energy output, a view finder observation screen spatially separated from the said tube target, optical means to focus light representing the said image along a sec-

ond light path, means to define upon the view finder observation screen under the control of the light directed along the second path an image which is a substantial duplicate of the image focused upon the camera tube and which view finder image includes also border areas contiguous to the image upon the image scanning tube, and means for altering the boundary limits of the image viewed upon the said view finder observation screen and simultaneously controlling the image scanning in the camera tube so that the scanned image of the camera tube includes only a fractional portion of the complete image instantaneously observable on the view finder screen.

6. A device of the class described comprising a camera tube having included therein a light sensitive target and a cathode ray source for producing an electron beam to impact said target together with means to deflect said beam to scan the target thereby to produce signal output energy, optical means for directing the light of an image upon the camera tube target so that the signal output is determined by the image upon the target, a spaced view finder observation screen, optical means to focus a second light image substantially like the said first-named image along a second light path, means to develop, under the control of the light directed along the second path, upon the view finder observation screen a view generally similar to that upon the camera tube target, said view upon the observation screen being of greater boundary limits than the said image upon the camera tube and which includes within its boundary limits the entire image focused upon the said camera tube, and a control means for relating a portion of the image area viewed upon the said view finder observation screen to a scanned area of the camera tube target and simultaneously varying the scanning of the said tube target to boundary limits coinciding substantially to the selected area of the view finder.

7. Television apparatus comprising a television camera tube having included therein a light sensitive target area and means to develop a cathode ray scanning beam for scanning the said target area, optical means for directing the light of an image upon said target, means for causing the said cathode ray beam to scan said target area according to a predetermined scanning pattern to produce a signal output representative of the optical image upon the target, a second television camera tube having a light sensitive target, and means to develop a cathode ray beam for scanning said second tube target, a second optical system for directing the light of an image including within its boundaries the image upon the first camera tube upon the second tube target, and means for causing the said second developed beam to scan the said second target according to a similar predetermined scanning pattern, a view finder target area, and means to produce upon said view finder target area an electro-optical replica of the image on the second of said camera tubes, and control means operable to control simultaneously the area of each target scanned by the developed cathode ray beams to produce signal energy so that on the said view finder target there is directly observed an enlarged picture area corresponding substantially to a closeup of the image projected upon said tubes.

8. Television camera apparatus comprising a first camera tube having included therein a light sensitive target area, and means for developing a cathode ray beam to be directed toward said target area for developing output signal energy, means for traversing the target area by said cathode ray beam according to a predetermined traversal pattern, an optical means for focusing the light of an image upon said target, a second camera tube having a light responsive target area, and means to develop therein a cathode ray beam for scanning said target, deflecting means associated with the second tube for deflecting the scanning beam across the target according to a pattern similar to the scanning pattern of the first camera tube, and a second optical system for focusing a light image upon the second camera tube which is substantially like that focused upon the first camera tube and which includes also border areas contiguous to the first image, a monitoring image view finding tube for reproducing an electro-optical image of substantially constant size of the scanned image area of the second camera tube, and a single control means for controlling the image area scanned on each of the two said camera tubes, whereby with variances in scanned image areas, output signals from the first camera tube representative of closeup and remote views are generated and said signals may be monitored by viewing the constant size image thereof on the said image reproducing tube.

9. In a television transmission system including optical means for focusing an image upon the light responsive element of a television camera tube, a second optical system for focusing a substantially like image on a second camera tube, means associated with said second camera tube to provide a view finder image, and means for simultaneously controlling both optical systems.

10. The system claimed in claim 8 comprising, in addition, means to control the relative area of the cathode ray beam cross-section to the area of the target area scanned so that a substantially constant ratio of beam cross-section to scanned area is maintained for all changes in total target area scanned.

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