

June 20, 1939.

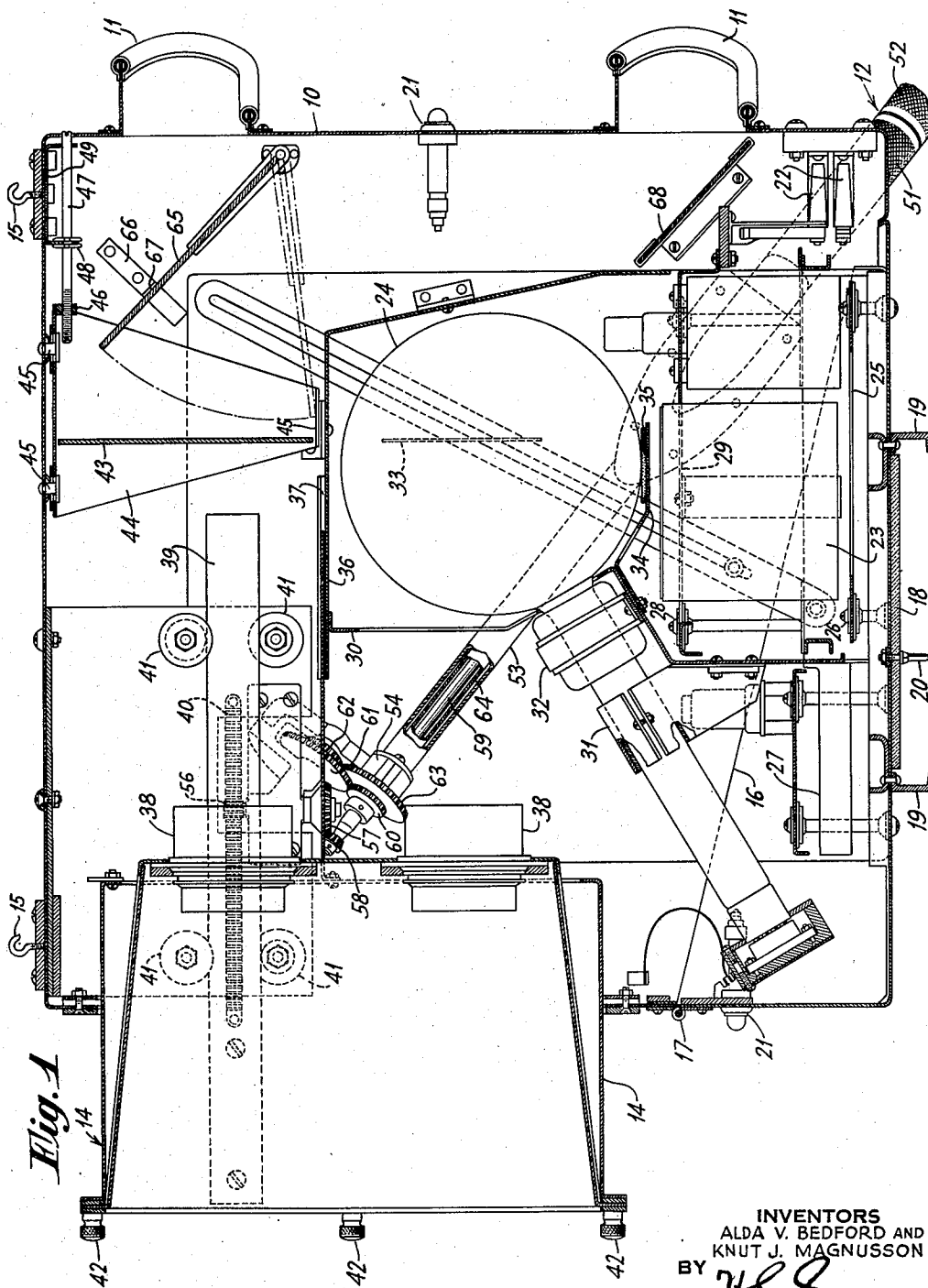
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2,162,908

TELEVISION CAMERA APPARATUS

Filed Nov. 5, 1936

4 Sheets-Sheet 1



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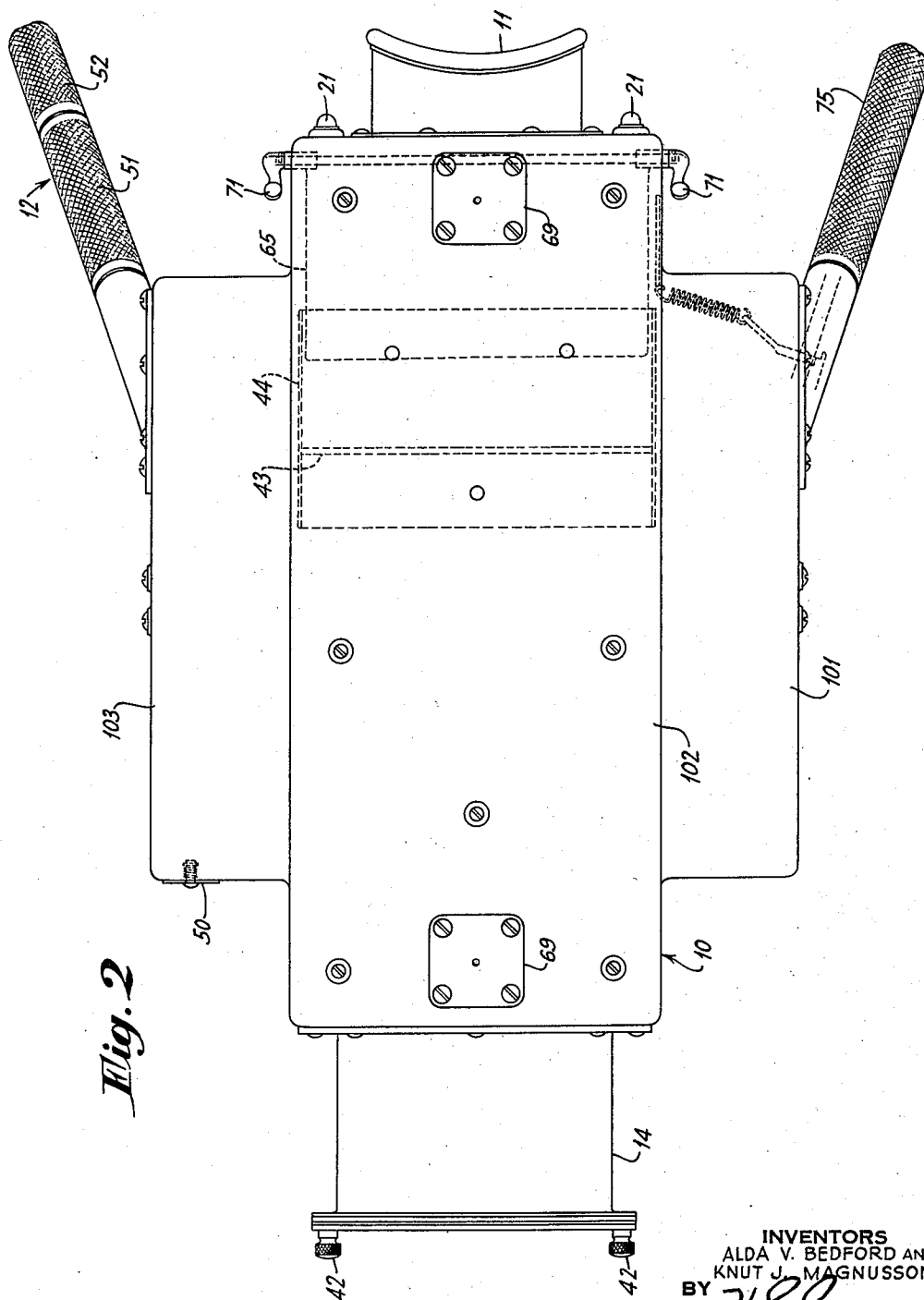


Fig. 2

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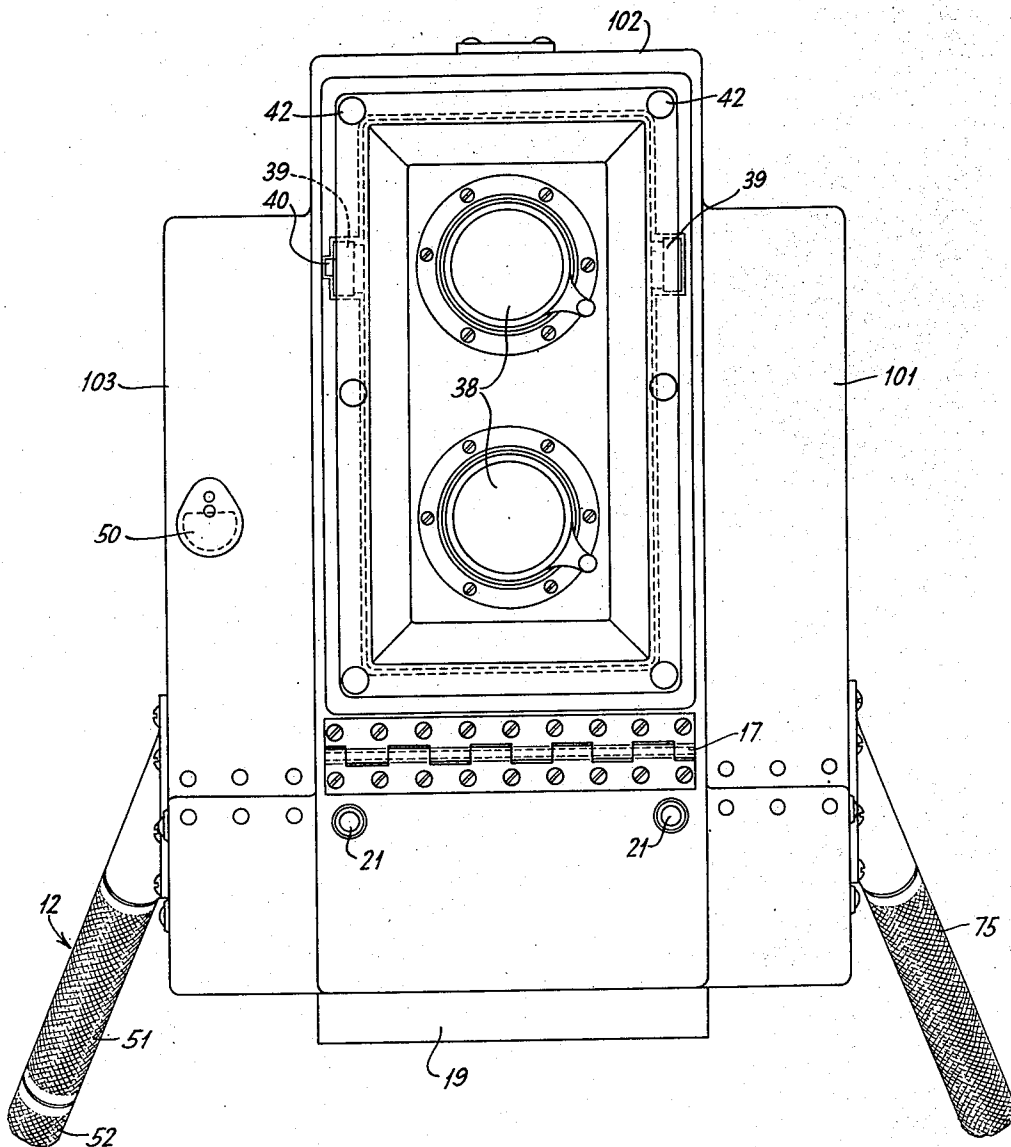
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Fig. 3



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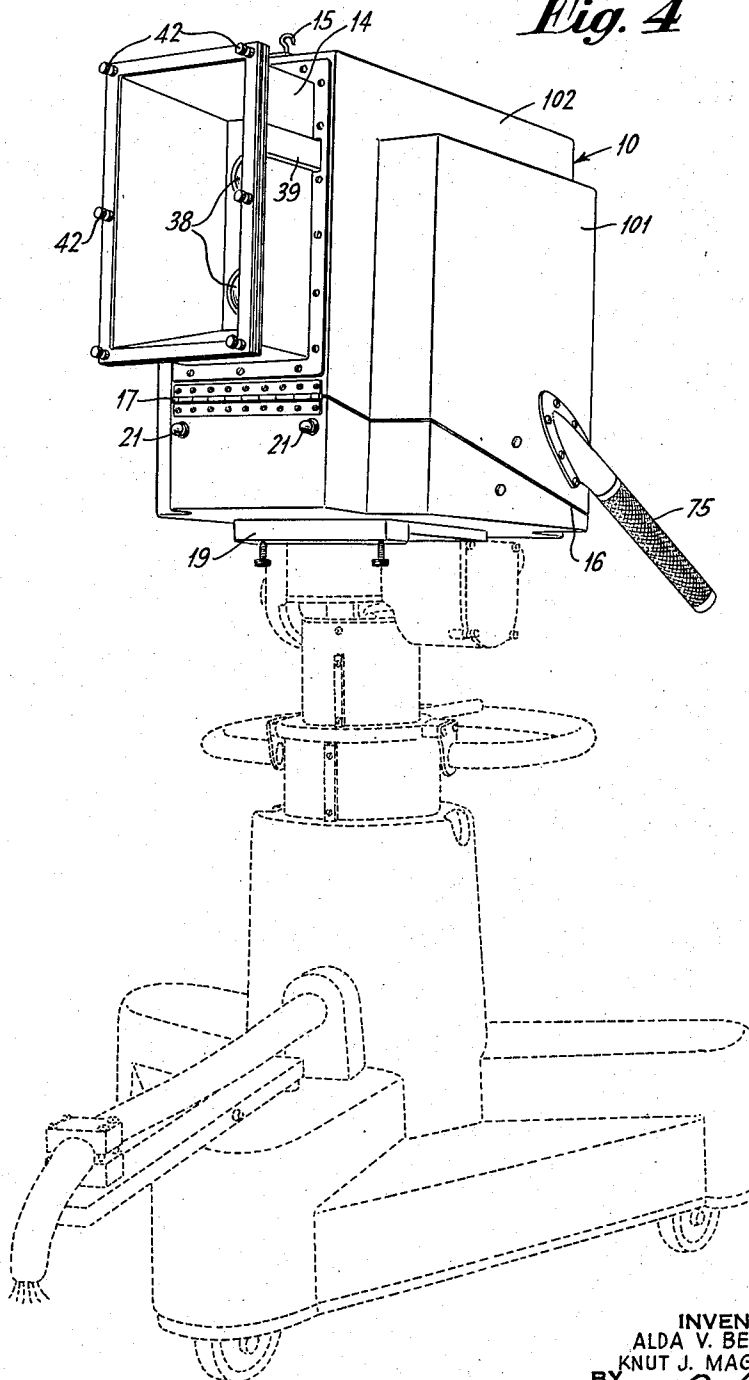
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Fig. 4



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UNITED STATES PATENT OFFICE

2,162,908

TELEVISION CAMERA APPARATUS

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Application November 5, 1936, Serial No. 109,391

17 Claims. (Cl. 178—6.8)

The present invention relates to television cameras used in conjunction with television transmission apparatus.

With television apparatus it is necessary to provide a suitable device for translating optical images with a series of electric signalling impulses which can be transmitted to receiving points for producing at receiving points an electro-optical image of the light image falling upon the translating device. It has been proposed in connection with television transmission apparatus to utilize both electrical and mechanical devices in the light translation process. With the approach of a commercial development of television, the demand for high definition, high fidelity, complete lack of flicker, distortion and other allied defects known and recognized in mechanical or electro-mechanical systems, the purely electrical or so-called electronic type of translating or scanning device is the only type by which the aforesaid picture quality demands can be met. Hence this disclosure will relate to the camera equipment for a television scanning or translating device of the purely electrical type wherein there is a complete lack of moving elements insofar as the scanning or translating device per se is concerned.

In connection with camera equipment of this nature, it is desirable to appreciate first the nature of the scanning or translating device of the electronic type in order that the nature of the invention shall be more clearly discernible. In an electronic scanning device there is provided a photosensitized surface upon which the optical image is projected to cause electronic emission of a density proportional to the brilliance of the optical image. Such a photosensitized surface may be found as a mosaic electrode structure wherein there is a conducting signal plate supporting a dielectric surface upon which is carried the photosensitive material in the form of isolated and discrete particles of photoelectric material or the surface may be equivalent to the surface of the usual photoelectric cell photo-electrode from which electrons are released by light. In the first type device the release of photoelectrons under activation by the light image to be transmitted produces across the dielectric an electrostatic charge image of the optical image where photoelectrons are released. This charge is scanned and neutralized by a cathode ray beam to produce in a signal circuit, usually connected with the conducting signal plate, a series or train of electric impulses representative of the picture or light image. In the

other type of electronic scanning device above referred to, the photoelectrons representing elemental areas of the optical image are directed through a scanning aperture to cause current measured by the photoelectron density to flow in a signal circuit which is so connected as to be influenced by the electron flow through the scanning aperture.

While for the purpose of the present invention the camera device to be herein disclosed is applicable to either of the aforesaid types of devices, as well as to devices of a closely related nature, the particular form which the invention assumes, according to one desired and satisfactory construction, will be described as exemplary in connection with the storage type scanning device. The storage type scanning element wherein the electrostatic charge image of the optical image is developed already has been described by Zworykin (see Journal of the Institute of Electrical Engineers, vol. 73, No. 442, October, 1933) and, therefore, the details of the electronic scanning device, except as necessary for an understanding of the present invention, are not herein included, although reference may be made to the aforesaid paper by Zworykin in this connection.

It has been found in television, as in the motion picture art, that it is both desirable and necessary to provide televising equipment which will lend itself readily to the control of the camera operator where changing from "close-up shots" to "remote shots" and vice versa. Also, it is necessary that the operator of the equipment shall be able constantly to control the operation in the event of tilting the camera to obtain low elevation shots as well as high elevation shots from a predetermined position of camera mounting. In the event of changing the field of view of the camera from one to another position, it is necessary that the field of view actually reaching the photosensitive mosaic of the scanning tube through an appropriate optical system shall be accurately focussed upon the plane of the photosensitive material in order that there shall be no distortion in the resultant transmission due to the light image upon the photosensitized mosaic electrode being out of focus. The camera equipment to be herein disclosed makes provision for maintaining such proper and suitable focus of the light image upon the electronic scanning or translating device irrespective of the actual distance of the camera equipment from the subject or its angular position relative to the subject.

However, unlike motion picture apparatus, tele-

vision image transmitting apparatus of this nature wherein an electronic scanning tube upon which the light image is projected is utilized the system is so constituted that in the assembly of the apparatus the position of the scanning tube must be substantially fixed upon initial assembly. This fixed location of the scanning tube is maintained to preclude any possibility of the scanning tube moving in the support for even slight movement would cause a blurred and distorted received image due to changing position from or during each scanion by the scanning cathode ray beam of the mosaic photosensitized electrode upon which the electrostatic charges representing the light image develop. Any motion of the scanning tube, furthermore, would introduce vibrations into the system which could not well be compensated. Hence, where it is desired to maintain the focus suitably adjusted at all times, it is necessary to provide same means by which the instantaneous focussing of the subject can be determined and measured while assuming a like degree of focussing of the light image upon the mosaic or photoelectric surface of the transmitting tube. However, since the light falling upon image transmitting tube should be only the light of the image, without reflections from other surfaces which would cause optical distortion to be reflected into the transmitted signals, separate optical paths for optically determining instantaneous focus and for focussing the subject on the photoelectric surface are provided. A light image similar to that reaching the photosensitive mosaic of the image transmitting tube is directed along a path adjacent that along which the light reaches the transmitting tube in order to provide suitable focussing control. To accomplish this result, a pair of like optical systems are utilized. Any change in the position of the optical system to change the focus along one path produces an identical change in focus along the other path, assuming, of course, that both optical systems are co-planar, as well as each surface subjected to the optical image.

Accordingly, in the initial adjustment of the equipment there must be coincidence between the distance of the photoelectric surface with its optical system and the distance of the optical viewing plane with its optical system. The position of the photoelectric surface within the scanning tube being fixed and the position of the scanning tube in the housing being fixed precludes the possibility of adjusting the photoelectrically sensitized mosaic surface of the scanning tube with respect to the optical viewing plane in the event of lack of initial coincidence. Hence the present invention provides ways and means by which the optical image may be suitably focussed upon the photosensitized surface and simultaneously cast upon the viewing plane. In the event of lack of coincidence of focus of the optical image upon the viewing plane when the optical image is focused upon the photoelectrically responsive surface the viewing plane is arranged to be adjusted independently of any adjustment of the optical system until the light image is brought into exact focus upon the viewing plane and a co-planar adjustment of the viewing plane with respect to the scanning tube mosaic electrode is established. This co-planar adjustment provides a so-called "zero position" and henceforth any movement of the co-planarly double optical system relative to the viewing plane and to the photoelectrically sensitized mosaic will focus accurately each optical image upon

the two surfaces so that the operator by observing the character of the light image upon the viewing plane can be certain that an optical image of like definition and focused to the same degree is being cast upon the scanning tube mosaic electrode.

The adjustment of focus is provided by this invention through the adjustment of the lens or optical system positioned at one end wall of the camera housing. The operator is provided with suitable handle means to move the camera from place to place and the same handle members by which the camera is so moved also operate by a mere twisting or turning of the handle controls, as will hereinafter be explained in detail, to shift the position of the optical system relative to the planes upon which the optical images are cast.

Another feature which the present invention seeks to provide is that of enabling the operator of the camera equipment to observe the optical viewing plane irrespective of the position of tilting of the camera. Accordingly, a plurality of observation windows through which the viewing plane can be observed are provided. Within the housing, suitable means to select and allocate the optical image upon the desired viewing window are provided. In conjunction with the selection of the viewing window, provision is made for establishing a light path from the optical image viewing plane to the selected window while at the same time masking out all light which would normally enter the housing from other than the selected viewing window.

This invention has had as one of its primary objects that of providing television camera apparatus which will embody the foregoing novel features. Nevertheless, it is obvious that while the foregoing have been some of the primary objects and advantages of the present invention, many other objects and advantages not specifically enumerated are inherent in the apparatus and, therefore, it is believed that all such objects and advantages as well as various modifications shall fall within the spirit and scope of this invention as it is set forth by the claims hereof. In this connection it is well to point out that while the invention finds practical application to television image transmission systems, it is of course readily adaptable to the motion picture art and should be considered accordingly unrestricted as to its specific usage.

For a more complete understanding of the aims, objects, advantages and structural characteristics of this invention in one of the forms which it may assume, reference may be had to the following specification and claims in connection with the several figures of the accompanying drawings, wherein:

Fig. 1 is a side elevation of the camera structure viewed on a cutting plane along its major axis.

Fig. 2 is a top view.

Fig. 3 is a front view.

Fig. 4 is a perspective of the camera structure.

Referring to Fig. 1, the camera itself is housed in a metallic housing member 10 wherein are contained apertures for the viewing windows 11 at the rear. The focussing control handle 12 and the motor control handle 13 (not shown by Fig. 1) are supported from the rear of the housing and at the front of the housing member 10 is the lens housing 14. Hooks or other suitable holding means 15 are furnished by means of which the camera may be suspended from cables, for instance, rather than supported on its normal sup-

porting pedestal or dolly, which is described in our copending application filed on even date herewith, Serial No. 109,390. When the camera is supported on the pedestal, the apertures leading to said hook members or other appropriate fastening means are, naturally, closed by suitable closure members in order to provide a light tight device.

One suitable shape of the camera housing is in general that of a box-like structure formed of three rectangular shaped solid sections which will be more clearly brought out by the other views. The housing is split along a line 16 in order to permit opening the housing and facilitate ready access to the interior thereof. The two sections thus formed in the box are hinged by a hinge member 17 more clearly shown in Fig. 3. The metallic structure of the box has ordinarily been steel, but it will be realized, of course, that the structure might be formed of other and perhaps lighter materials which act not only as a light-tight supporting unit for the interior arrangements but also as a magnetic shield against exterior electrical fields, which normally might affect the comparatively sensitive electron image transmitting apparatus which is necessary for a television system.

Secured to the bottom of the metallic housing by rivets, for example, is a plate 18 and guide member 19 immediately adjacent thereto. This plate contains a number of pins 20 of which only one is illustrated for the purposes of clarity. These pins are adapted to fit into openings in the supporting plate on the pedestal upon which the camera is normally supported, thus holding the box housing in a fixed position with respect to its supported pedestal member, the details of which are set forth more clearly in the copending application to which reference has hereinbefore been made.

It is highly desirable that both the artist performing and within the field of view of the camera and the operator have some means of knowing whether or not the camera is operating or is, so-to-speak, "on the air". For this purpose, there are two signal lights 21 at the front of the cabinet which are in full view of the artist. One of these lights is red and the other green, and are termed "cue-lights". As a warning signal, the green light flashes, usually under control of the master control booth, to let the artist know that the camera is ready, and the red light becomes permanently illuminated for the entire time a program picked up from the camera is being transmitted. A counterpart of these lights is also shown at the rear of the camera for the benefit of the operator thereof. In addition to this, it is desirable that the camera operator be in constant contact with the control room and for this purpose a plug-in arrangement comprising a pair of plugs 22 are contained at the rear of the camera housing and to which ear phone plugs (not shown) may be attached.

The arrangement herein shown has been illustrated with an image transmitting tube, such, for example, as the well known "Iconoscope", which serves as the light responsive electronic television transmitting device. As above pointed out the optical image to be televised is projected by means of a lens system upon the mosaic electrode structure of the tube. Closely adjacent to the image transmitting tube and connected to the output thereof are the amplifiers and synchronizing signal producing apparatus 23. Since the specific circuit embodiment of these amplifiers and gen-

erators forms no part of this invention, they are not described with particularity herein. However, it is highly desirable that the electrical equipment and the "iconoscope" 24 be mounted in such fashion that microphonic disturbances due to physical shocks or impulses be minimized. For this purpose, a supporting framework 25 is mounted on resilient holders 26. These holders are of a form well known and their specific structure plays no part in this invention. Joined to the aforementioned supporting structure 25 is another support 27 and joined thereto by resilient mounting means 28 is a further support 29 to which the amplifying equipment is fastened. It will thus be seen that in effect two mechanical filters have been provided for minimizing the effect of physical vibrations both on the amplifier equipment and more importantly on the electronic image transmitting tube itself.

The light translating image transmitting tube is supported in place by a metallic supporting member 30 to which is fastened an adjustable collar member 31 and the cathode ray deflecting coils 32. The support member 30 is apertured in order to enable the optical image system to project the optical image upon the photosensitized mosaic electrode 33 of the transmitting tube. One section of the support member 30 has joined thereto another support member 34 carrying a resilient cushion 35 upon which the bulb portion of the image transmitting tube 24 rests. Further joined to the member 30 is a metallic member 36 with an exterior slot arrangement 37 which is adapted to guide a still further metallic member, the latter being joined to the lens housing, the purpose of which will be more fully explained hereinafter. The housing member 36 bends around the rear of the bulbous portion of the image transmitting tube and is supported in this fashion by the camera box or housing. It will be seen readily from the drawings that the members 30, 34 and 36 form a chamber which is adapted to act as a light tight chamber to prevent extraneous light from reaching and/or affecting the light sensitive mosaic electrode 33 of the tube 24. This housing also serves as a magnetic shield member.

The image optical system, as shown, comprises two lenses 38 mounted in a co-planar fashion in a lens housing 14. This lens housing comprises a substantially rectangular box-like structure and a frustro-pyramidal structure which are joined together at one of their extremities. The rectangular box-like section of the housing fits closely with the camera box so as to form a unit which is light tight and admits no light other than the light actually admitted through the optical lenses. Joined to one side of the rectangular box-like section of the mount is a guide rail 39 upon which is mounted a rack 40. There is a similar guide on the opposite side of the housing but for obvious reasons no rack is contained thereon. The rail member 39 passes between a plurality of rollers 41 which are adapted both to guide and support the lens housing. The rail may ride on the outer surface of some of the rollers, but in this particular case at least two of the rollers are formed with slots on their exterior face which are cut to the width of the guide rail in order that the motion of the lens housing may be a smooth in-and-out motion and not a chattery motion. At the front of the lens housing and disposed around the front of the periphery thereof are a number of knurled screws 42 which may be removed. A further lens mount (not shown) may be fastened

into place by the screws 42, thus ensuring an accurate spacing of the additional lenses with respect to the normal lens system shown in the drawings. This is particularly important where it is desired to use telescopic lenses in conjunction with the arrangement for distant views and the focussing system for the camera acts to focus the telescopic arrangement as well as the normally shown arrangement.

At the rear of the camera housing is located an optical viewing screen 43 which in this particular instance is a ground glass member held firmly in place on a slidable mount 44. The member 44 is supported by three supporting bearings 45, two of which are fastened to the camera housing and the other of which is joined to the light and magnetic shield member 36. The portion of the sliding mount which rests on the bearings 45 is slotted for a short distance to allow adjustment of the viewing screen as will be more fully explained hereinafter. One section 46 of the viewing screen mounting member 44 is screw threaded, and passing therethrough is a screw threaded member 47. Joined to the screw threaded member 47 is a collar 48 which is held in position by a bracket member 49 fastened to the camera housing. The function of the screw threaded arrangement is as follows:

In view of the fact that the optical lenses 38 are co-planar and focus on the same plane, it is necessary that the viewing screen 43 be co-planar with the mosaic electrode structure 33 of the image transmitting tube 24. Due to manufacturing difficulties, this is not always possible since it will be appreciated that the mosaics electrode structure of various tubes will vary in position by slight amounts, and hence it is necessary to bring the optical viewing screen into a co-planar relationship with said mosaic electrode structure in order to provide assurance of focussing the image with mosaic by optical viewing on screen 43. For this purpose, there is provided in the front of the cabinet a normally covered peep aperture 50 (see Fig. 3) by means of which it is possible to look directly onto the photoelectrically sensitized mosaic electrode 33. The operator observes the light image falling upon the mosaic electrode and moves the lens housing inwardly or outwardly until an optical image is sharply focussed on the photoelectric mosaic electrode. The end of the screw threaded member 47 protrudes through the camera housing and may be turned in order to move the viewing screen mount 44 inwardly or outwardly until a correspondingly sharp image appears thereon. When this is done, it will be obvious that the viewing screen 43 and the mosaic electrode 33 are in co-planar relationship.

The focusing of the optical image onto the viewing and mosaic screens is accomplished in the following manner: Located on one side of the cabinet is a knurled arm member 12 which has been hereinbefore referred to and which passes through the wall of the camera housing. This arm member is, at its outer extremity, divided into two independent sections 51 and 52, and each of these sections is a knurled cylindrical member which is adapted to be rotated by the operator. These two sections which are located immediately adjacent each other, continue as a rigidly held supporting cylindrical member 53 which passes through the wall of the camera housing and continues upwardly to a supporting collar 54. This supporting collar is joined in this particular instance to a gear housing 55 which

contains gears, the function of which will be explained more fully hereinafter. It will have been noted that a pinion gear 56 is located in co-operative relationship with the rack 40 on the guide rail 39 located on the lens housing 14. This pinion is joined to a driven gear 57 which is driven by a driving gear 58. The driving gear 58 is joined to a solid shaft member 59 which runs interiorly of the cylindrical housing 53 and is joined at its end to the knurled handle member 52. Also connected to the solid shaft 59 is a driven gear 60, and a driving gear 61, the latter being mounted on the same axis and rigidly joined to a driven gear 62 and co-operatively placed with respect to the latter gear is the driving gear 63. The gear 63 is joined to a hollow shaft 64 which runs throughout the length of the housing cylinder 53 and is joined at its opposite end to the knurled handle member 51. It will be seen in view of the fact that the gear 63 exceeds in size the gear 62 and the gear 61 exceeds in size gear 60, what has been formed is in fact a step-up drive for the gear member 58 with respect to its normal drive by rotating the handle 52. Therefore, the handles 51 and 52 provide a direct and a vernier movement respectively for changing the position of the lenses and the lens housing 14 with respect to the mosaic electrode 33 and the optical viewing plane 43.

The camera operator by looking through one of the viewing windows 11 looks at the image formed on the image screen or viewing plane 43. The operator may then roughly adjust his focus thereon by means of rotating the knurled member 51 and may make his fine adjustment by a small angular rotation of the knurled member 52. The image screen and the light sensitive screen being co-planar, a like focussed image is formed on the light sensitive screen.

It will be noted that there are provided in the camera box two viewing windows 11 for viewing the image formed on the ground glass viewing screen 43. The reason for this is that it oft times becomes necessary to make a very low pitched shot from the camera particularly in the case of televising children, and for this purpose the top viewing window is provided. Interposed between the top viewing window and the ground glass screen 43 is a pivoted member 65 which may be pivoted by handles 71 (see Fig. 2). When the member 65 is tilted upwardly, its edge comes into frictional contact with a contact member 66 which is fastened to the camera housing, the latter member also having therein an indented portion the extremity of which acts as a stop member for the upward swing of the member 65, as noted at 67.

The pivoted member 65 is rendered opaque on its upper surface facing the viewing window and is made reflective on its lower surface facing the viewing screen (as shown). In its upward position, the member 65 will then reflect light from the viewing screen 43 downwardly towards a second mirror structure 68 which is mounted on the cabinet housing at a suitable angle relative to the lower viewing window 11. Thus, it will be seen that in its upper extremity any optical image formed on the viewing screen 43 may be readily viewed from the lower viewing window 11. Also in its upper position, the member 65 being opaque on one side, will mask out any light which enters through the upper viewing window 11.

When the member 65 is at its lower extremity, it is adapted to rest on the viewing screen mount-

ing member 44 and when in this position, the viewing screen may be viewed directly through the upper viewing window 11. At this position then, the member 65 will mask out any light which might enter through the lower viewing window. The purpose of the lower viewing window is to provide a readily accessible means of viewing the object formed on the viewing screen 43 when the camera is in an elevated position. Thus, as well as a two-fold viewing arrangement, we have provided means for maintaining the camera box substantially light-tight so that no disadvantage accrues from the presence of the added viewing arrangement.

It should be appreciated that the internal structure of the box has been so arranged so that the housing forms two substantially light-tight chambers. Located in the upper chamber is the focussing and optical viewing means, while located in the lower chamber is the electronic image transmitting tube or other light sensitive arrangement, and its appurtenant amplifiers and synchronizing generators. In this manner, any disturbances which would influence the electronic image transmission tube due to the reflection or diffusion of light from the focussing and viewing arrangements thereon are obviated. Accordingly, the light sensitive mosaic electrode 33 responds only to the actual optical image projected directly thereon by the lower lens member 38.

Referring now to Fig. 2 for a more complete understanding of the invention, there is shown a top view of the camera which brings out more clearly the general contour of the apparatus. As has been stated previously, the shape in general of the housing is that of three rectangular solid sections joined together and these are noted in this figure as 101, 102, and 103. The top of the housing contains two plate members 69 which may be removed in order to permit access to the hooks or other holding members 15 hereinbefore referred to. The focussing control handle 51 is shown in its relative position to the motor control handle 75. The latter handle comprises a knurled cylindrical member and is so constructed as to be rotatable for a definite number of degrees about its axis. Upon reaching one extremity of its rotating position in one direction, it closes the elevating motor circuit in the supporting pedestal and, accordingly, moves the pedestal either upwardly or downwardly. At the other extremity of its rotating position the handle is adapted to close contacts which change one of the phases of the elevating motor in the pedestal, and the pedestal accordingly either raises or lowers as desired in an opposite fashion to its movement when the handle is at the first-referred-to extreme position. Accordingly, it will be seen that these handles form a very convenient means to enable a single operator to not only focus and elevate the camera arrangement, but also to tilt and "pan" the arrangement as well. The position of the lens housing 14 is brought out clearly, and the "peep" aperture 50 used in making the initial adjustment of the viewing screen in order to bring it into co-planar relationship with the photosensitized mosaic electrode is clearly illustrated. The relative position of the viewing screen 43 with respect to the camera housing is brought out as well as the position of the reflecting and masking member 65. This latter member which has hereinbefore been referred to and explained, is tiltable about a hinge 70 by means of the tilting rods 71.

Referring to Fig. 3, there is shown a front view of the camera which brings out more clearly the relative position of the co-planarly housed optical image lenses, and the lens housing with respect to the rest of the camera structure. Also there is shown the guide rails 39 and the rack arrangement 40.

The hinge 17 by means of which the major portion of the housing may be lifted to permit ready access to the interior of the camera is clearly illustrated and also there is illustrated the details of the peep aperture 50 used in making the initial adjustment of the ground glass viewing screen, that is to say, its bringing into a co-planar relationship with the mosaic of the particular "iconoscope" used.

Referring to Fig. 4, there is shown a perspective view of the camera and herein is clearly set forth the general contour of the arrangement for the purposes of clarity. The reference numerals enumerated thereon each refer to parts which have been clearly and fully explained hereinbefore, and it is thought that no repetition of these various elements is needed.

It will be appreciated that one suitable arrangement for a structure of this type has been shown particularly, but equivalent arrangements may be used without departing from the spirit and scope of the invention and, hence, applicants consider themselves entitled not only to the particular arrangement shown where obvious equivalents are well known per se in the art and, therefore, consider themselves entitled to all forms which fall fairly within the spirit and scope of the hereinafter appended claims.

We claim:

1. A camera comprising a light tight housing, a pair of co-planar optical systems supported by said housing to admit light therein along selected optical paths said optical systems having substantially the same focal length, a light responsive screen positioned within the housing to receive the light from one of the optical systems, a viewing screen positioned within the housing co-planarly with respect to said light responsive screen to receive the light from the second of said optical systems, means to adjust the position of the co-planar optical systems simultaneously with respect to said screens, and a plurality of viewing windows formed as a part of the housing wall for permitting the viewing of the image upon the viewing screen.

2. In a television camera, a pair of co-planar optical systems for producing two similar optical images said optical systems having substantially the same focal length, a light responsive screen, an optical viewing screen, means to project one of said similar optical images onto said light responsive screen, and means to adjust said optical viewing screen to a position co-planar with said light responsive screen.

3. In a television camera, a pair of co-planar optical systems for producing two similar optical images said optical systems having substantially the same focal length, a light responsive screen, an optical viewing screen, means to project one of said similar optical images onto said light responsive screen, a support member for said optical viewing screen slidably mounted, and fixedly positioned means to slide said support member on its mountings, whereby said viewing screen may be moved to a position co-planar with said light responsive screen.

4. In a television camera, a pair of co-planar optical systems for producing two similar optical

images said optical systems having substantially the same focal length, a light responsive screen, an optical viewing screen, means to project one of said similar optical images onto said light responsive screen, a support member for said viewing screen slidably mounted, and fixedly positioned means to slide said support member on its mountings, said latter-named means comprising a screw member and a restricting collar surrounding said screw member, whereby said viewing screen may be moved to a position co-planar with said light responsive screen.

5. In a television camera, a viewing screen, a light responsive screen co-planar with said viewing screen, a pair of co-planar image lenses having substantially the same focal length, and means for simultaneously changing the position of said co-planar lenses with respect to said co-planar screens.

6. In a camera, a viewing screen, a light responsive screen co-planar with said viewing screen, a pair of co-planar image lenses having substantially the same focal length, and a plurality of means for simultaneously changing the position of said co-planar lenses with respect to said co-planar screens.

7. In a television camera, a viewing screen, a light responsive screen co-planar with said viewing screen, a pair of co-planar image lenses, a mounting for said lenses, gear means for changing the position of the mounting with respect to said co-planar screens, and a pair of co-axially mounted rotatable control arms arranged in driving relationship to the gear means on said mounting, said arms having different ratios of gear drives for equal angles of rotation.

8. In a television camera, a viewing screen, a light responsive screen co-planar with said viewing screen, a pair of co-planar image lenses having substantially the same focal length, a housing for mounting said lenses, a guide and support means for said housing, a rack mounted on said guide means, a pinion gear operatively positioned with respect to said rack, a pair of co-axially rotatable control arms geared to said pinion, and a member fastened to said lens housing and adapted to move therewith forming a light shield between the pair of co-planar screens.

9. In a television camera, a viewing screen, a light responsive screen co-planar with said viewing screen, a pair of co-planar image lenses having substantially the same focal length, a housing for mounting said lenses, means for mounting additional lenses having the same focal length co-planarly in definitely spaced relationship to said aforesaid lenses, and a plurality of means for varying the position of said co-planar lenses with respect to the co-planar screens.

10. In a television camera, a camera housing, a light responsive screen, a viewing screen co-planar with said light responsive screen and on which an optical image to be televised may be projected, means for projecting said optical image onto said viewing screen, a plurality of viewing windows in said housing for viewing said screen, and means interposed between said optical viewing screen and said viewing windows for restricting viewing to a single optical window only.

11. In a television camera, a camera housing, a light responsive screen, a viewing screen co-planar with said light responsive screen on which an optical image to be televised may be projected, means for projecting said optical image onto said viewing screen, a plurality of viewing windows in said housing for viewing said screen, means

interposed between said optical viewing screen and said viewing windows for restricting viewing to a single optical window only, and means carried by said restricting means for directing light from said optical viewing screen to only one of said viewing windows.

12. In a television camera, a camera housing, a light responsive screen, a viewing screen co-planar with said light responsive screen on which an optical image to be televised may be projected, means for projecting said optical image onto said viewing screen, a plurality of viewing windows in said housing for viewing said screen, means interposed between said optical viewing screen and said viewing windows for restricting viewing to a single optical window only, and said restricting means being adjustable and comprising opposite reflecting and opaque surfaces for directing light from said viewing screen to said viewing windows, said adjustable means being so supported that in one extremity of adjustment the image on said image screen is viewed directly from one of said viewing windows and light from the second of said windows is masked, and in the other extremity of its position the optical image on said image screen is reflected to the second of said windows and light from the direct viewing window is masked.

13. In a television camera wherein two co-planar lenses are mounted so as to each project an optical image upon a viewing screen and a light responsive screen co-planar therewith respectively, a housing for said camera comprising a substantially light tight rectangular box whose outer walls form two hinged sections and whose walls have therein a plurality of viewing windows, a lens mount mounted in said cabinet in a slidable guided position so as to enable the projection of said image on said screens, a member joined to said lens mount in a position parallel to the axis of the aforesaid lens, a member positioned between said viewing screen and said light responsive screen and co-operating with the aforesaid member joined to the lens mount to form two substantially light-tight chambers in said camera housing, an apertured magnetically shielding supporting member for the light responsive screen holder joined to the fixed light shield, resiliently mounted supporting means joined to the wall of said camera housing, and positioning means for the light responsive screen holder mounted on said resiliently mounted support.

14. In a camera, a pair of co-planar optical systems for producing two similar optical images said optical systems having the same focal length, a light responsive screen, an optical viewing screen, means to project one of said similar optical images onto said light responsive screen, and means to adjust one of said screens to a position co-planar with the other of said screens.

15. A camera comprising a substantially light-tight housing, a light responsive screen positioned within the housing, a viewing screen positioned within the housing co-planarly with respect to said light responsive screen, a pair of optical systems for simultaneously focussing an optical image on to the viewing screen and the light responsive screen, means for simultaneously adjusting the position of said optical systems whereby the optical image remains focussed both on the viewing screen and the light responsive screen, and means allowing the viewing of the image formed on said viewing screen.

16. In a camera, a light responsive screen, an

optical viewing screen, means for adjusting one of said screens relatively to the other whereby the position of said screen is made co-planar with respect to each other, a pair of optical systems
5 adapted to focus upon co-planar planes, and means for adjusting said optical system and simultaneously maintaining the focus of said systems on to co-planar planes.

17. In a camera, a light responsive screen, an
10 optical viewing screen, means for changing the

position of one of said screens relatively to the other whereby the two screens may be adjusted to co-planar positions, a pair of optical systems each adapted to focus co-planarly, and means
5 for changing the position of said optical systems relative to said viewing and light responsive screens simultaneously and maintaining the focussing position thereof co-planar.

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