

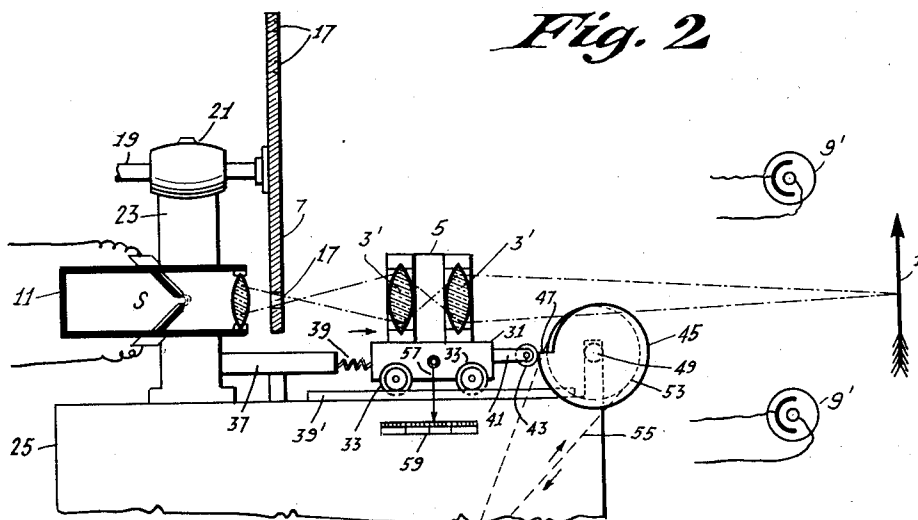
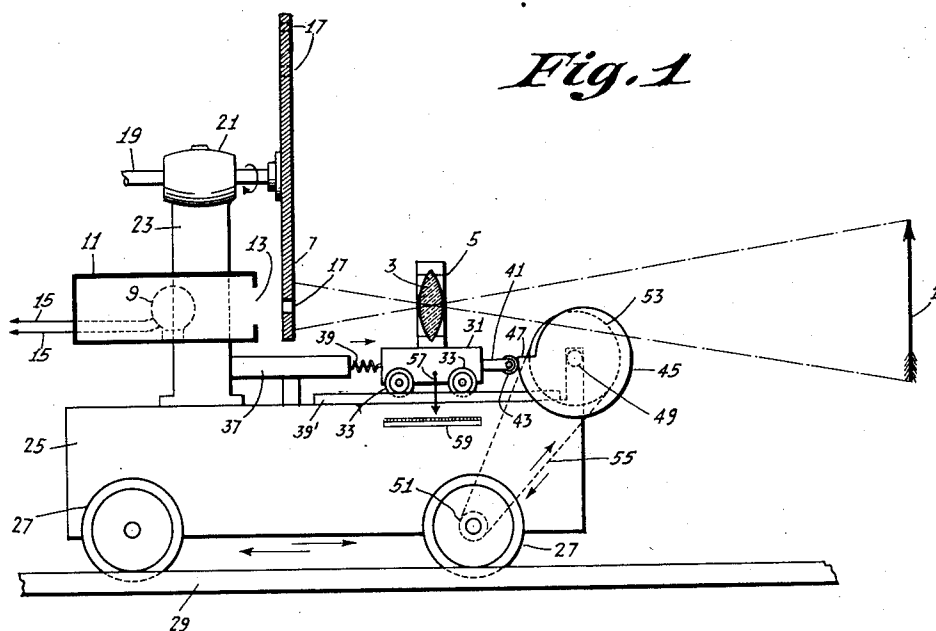
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TELEVISION SYSTEM

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TELEVISION SYSTEM

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The present invention relates to television systems, and, in particular, to television systems wherein the transmitter of the system is so arranged that both approaching and receding shots may be made while still maintaining an automatic focusing of the transmitted picture image upon the scanning element, or of a light spot, as in "spot or direct scanning", upon the picture surface.

In all cases where it is necessary or desirable to transmit a complete television program, with or without a sound accompaniment, it is desirable to provide a system whereby the transmission of the subject matter may not be interrupted or delayed by shifting from one picture to another. By this I mean that, during the transmission of the program, one picture subject might be relatively close to the transmitting element while another picture subject might be somewhat removed therefrom. This relationship will change, of course, many times, dependent upon the type of action transmitted. It may be desirable also to transmit a picture subject while the subject is moving toward or away from the transmitting element. In any such cases as above suggested, it is necessary that the picture subject be maintained in proper focus in order that a clearly defined image may be viewed at the receiving end of the system.

It is, therefore, one of the objects of my invention to provide a system for automatically maintaining proper focus during both approaching and receding shots or during the change between near and distant images, and, at the same time, to provide a system capable of accomplishing these results which will not require any adjustment whatever during operation except slight movements of the complete transmitting assembly in accordance with the distance at which the picture subject is located relative to the transmitting element.

A further object is to provide a system for transmitting television subjects wherein the lens arranged to focus the picture subject upon the scanning element or a light spot on the subject is automatically adjusted in accordance with the position of a carriage or like element carrying the complete television transmitter assemblage.

Other objects are to provide an arrangement for transmitting television picture images which, at the receiver, will bear a true likeness to the transmitted subject because of the fact that the transmitted subject is continually maintained in proper focus with respect to the scanning element, and to provide a system for producing this

result which is relatively simple in its construction and arrangement of parts; a system in which there are no complicated mechanical details; and a system which is compact and may be installed in any studio with substantially no inconvenience.

Still other and further objects will, of course, become apparent and at once suggest themselves to those skilled in the art to which the invention relates by making reference to the accompanying drawing forming a part of my disclosure, which illustrates two examples of a suitable assemblage for carrying out the aims and objects of this invention.

According to the drawing showing two of the many forms of the invention, it will be observed that the television scanning is produced by means of a rotatable disk having a spiral track thereon provided with either lenses or apertures, mirrors or other optical means, so arranged that successive picture elements, as scanned, influence the current output from a suitable light translating element. The current output from the light translating element may then represent directly a function of the intensity of light and shadow on each elemental area of the transmitted subject. In addition to the scanning features which have previously been known in the art, I have provided a suitable lens system for focusing the picture image to be transmitted upon the scanning element, as in "indirect scanning", or a light spot from the scanning element upon the subject, as in "direct or spot scanning", and this lens element has been so arranged that it is automatically adjusted in accordance with the position of the transmitted picture subject with respect to the scanning element. In accordance with a preferred embodiment of my invention, I have so arranged the system that the complete transmitter assemblage is mounted upon a carriage which may be moved back and forth relative to the picture subject to be transmitted, and as the carriage is moved, in accordance with the distance of the picture subject from the scanning element, the focusing lens for focusing the subject upon the scanning element or the light from the scanning element on the subject is automatically adjusted without need of the operator doing any more than to observe the position of the carriage with respect to the subject.

According to the accompanying drawing, Fig. 1 illustrates one form of system suitable for indirect scanning wherein the image to be transmitted is suitably focused upon the scanning element; and,

Fig. 2 illustrates one form of apparatus capable of indirect or spot scanning wherein a light beam is suitably focused upon the picture image for transmission.

Now referring more particularly to the drawing, and first to Fig. 1 thereof, I have conventionally illustrated the subject for transmission by the line 1, and the lens 3 mounted in a lens carrier 5 is adapted to focus the picture subject upon the scanning disk 7. As the disk 7 is rotated, light corresponding to the intensity of light and shadow of each elemental area of the picture subject 1 is caused to pass through the apertures or lenses 17 carried by the disk and through the opening 13 in the housing 11 for the photo cell 9, so that the photo cell 9 is subjected to all varying light intensities corresponding to each area of the picture. As the scanning disk 7 is rotated by means of the drive shaft 19 carried in the bearing surface 21, the varying intensities of light and shadow of the picture subject 1 affecting the photo cell 9 cause varying strength electric currents to flow in the line 15-15. These varying strength electric current impulses are then suitably amplified by any desired type of amplifier and according to well known means, such as have been disclosed for example by Nicolson Patent No. 1,470,696, and may then, through appropriate modulators or limiters be caused to influence a radio or wire line transmission circuit.

The scanning disk assemblage and the related photo cell amplifier is preferably carried upon a carriage 25 resting upon rollers or wheels 27 which is capable of moving back and forth upon the guide rails 29.

As has been above stated, a lens 3 is mounted directly in front of the scanning disk 7 for focusing the picture image upon the disk. This lens with its housing 5 is preferably supported upon a small carriage 31 having rollers 33 adapted to bear upon the guide rail 35 which is in turn mounted on the carriage element 25. Projected outwardly from the standard 23, I have provided a stud or projection element 37 having a coil spring 39 mounted at one end thereof and adapted to exert a force against the carriage element 31 in the direction shown by the arrow, so that the carriage element 31 tends to move to the right as shown by the drawing. On the opposite end of the carriage 31 is mounted a pin 41 carrying a roller 43 which is adapted to bear upon the cam surface 45 which is carried by and is rotatably mounted in a bearing 49. This cam surface is appropriately designed so that as it is rotated by means of the drive belt or chain 55, deriving motion from the gear or pulley 51 carried upon one of the wheels 27 of the carriage 25 translating its rotary motion to the gear or pulley 53, it may be rotated so as to cause the carriage 31 to move either to the right or left, depending upon whether the carriage 25 is moved toward or away from the scanned picture subject 1. The cam surface 45 is so shaped that the pitch of the cam is represented by the distance 47, and substantially according to the well known law

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2},$$

where F equals the focal length of the lens 3; f_1 is equal to the back focus, and f_2 equals the front focus or the working distance. Thus, if the carriage is moved, the image of the object 1 on the scanning disk is at all times maintained in proper focus, since, by knowing the approximate

distance of the subject 1 from the disk 7, it is possible to move the carriage 25 toward or away from the subject in order to properly focus the subject upon the disk, so that there will be a sharply defined image of the transmitted subject upon the disk which may influence the photo cell 9 in accordance with the varying intensity of light and shadow of each elemental area of the subject.

In order to indicate the position of lens 3, I have provided a pointer 57 on the carriage 31, and this pointer will indicate, on scale 59, the working distance for which the system is adjusted.

Now making reference to Fig. 2 of the drawing showing a direct or spot scanning system, it will be observed that an arrangement of substantially the same type as the indirect scanning system of Fig. 1 has been utilized with certain modifications.

According to Fig. 2, the light S for illuminating the subject 1 which is to be transmitted originates behind the scanning element 7 and is projected through the apertures or lenses 17 thereof to the lens system 3'. As the light passes beyond the lens system 3', it converges so as to illuminate intensely an elemental area of the subject for transmission. Suitable light responsive elements 9', so arranged as to respond to the diffusely reflected light from the illuminated elemental areas of the subject 1, may be placed at convenient points between the scanning element 7 and the subject 1. As the scanning element 7 rotates, so as to cause light issuing from the source S to pass through different lenses or apertures, it is quite apparent that different elemental areas will be subjected to the intense point of light as focused upon the subject 1 by the lens system 3'. Thus, in a line for line manner all elemental areas of the subject are illuminated, and in proportion to the intensity of light and shadow on all of these elemental areas a response occurs in the light responsive elements 9'. In cases where there are a plurality of light responsive elements 9', it is, of course, desirable that all of these elements be parallelly connected.

As was the case in Fig. 1, it is possible that the subject for transmission may be moving toward or away from the television scanning device, and, therefore, in order to illuminate brilliantly each elemental area of the subject irrespective of its distance from the scanning device, I have again provided a lens carrier 5' for the lens system 3' which may be adjusted as to its distance from the scanning element through a movement of the carriage 25 which supports the lens system, the scanning element, and the light source. As was the case in connection with Fig. 1, the lens system 3' may be adjusted by movement of the carriage 25 which causes the cam 45 to rotate, and as it rotates the roller 43 which bears against the cam surface 45 forces the lens carrier to the left from the position shown against the force of the spring 39, or it permits the spring 39 to force the lens carrier to the right from the position shown.

While the invention has been shown and illustrated as applicable to scanning systems of the lens or aperture disk type, it should be borne in mind that the principle herein disclosed is distinctly applicable to all other types of television systems, such as the systems using the Braun tube for scanning, such as has been disclosed by United States patent to Zworykin No. 1,691,324; systems using a mirror disk for scanning as has been shown, for example, by United States appli-

cation Serial No. 351,488, filed April 1, 1929, by Bernard Cioffari; oscillating mirror type of scanners, such as has been shown, for example, by Edgerton Patent No. 1,605,930, and, in fact, all general types of television scanning, since the particular type of scanning element per se forms no specific part of my invention only in so far as it is necessary to cooperate with the lens focusing system to form a complete assemblage.

While the invention has herein been described in connection with television transmission, it is believed that it will be recognized that the same principle may be applied to facsimile systems without departing from the scope of the invention. In such a case it would be possible to have a photoelectric or other light sensitive device definitely positioned relative to the record carrying drum so that for different size pictures different drums having a circumferential path substantially equal in length to the width or length of the picture transmitted (depending, of course, upon the manner of positioning the picture upon the record carrying drum) might be interchanged. Thus, for each change in the size of record carrying drum the optical system would be adjusted relative to the light sensitive element.

Such a system would, of course, provide a means by which, for example where a small size picture is wrapped upon a small drum so as to extend substantially around the circumference thereof, the full transmission time may be utilized for the message, whereas if a large drum were used for a small picture there would be a large part of the transmission time wasted. In such a case it is obvious that where the size of drum is changed the adjustment of the optical system will appropriately form the image, as represented by suitable intensities of light and shadow of elemental picture areas, upon the light sensitive translating element.

Many other modifications and changes will, of course, suggest themselves and at once become apparent to those skilled in the art to which the invention relates, and I, therefore, believe myself to be entitled to make any and all changes such as fall fairly within the spirit and scope of my present invention as set forth by the hereinafter appended claims.

Having now described my invention, what I claim and desire to secure by Letters Patent is the following:

1. In combination, a scanning device for analyzing the varying intensities of light and shadow upon cyclically recurring series of successive elemental areas of a subject of which the image is desired, an optical system associated with the scanning device, means for carrying the said scanning device toward or away from the subject of transmission, and automatic means operable upon movement of said carrying means for maintaining in focus the optical system used in the scanning operation.

2. In combination, a scanning device for analyzing the varying intensities of light and shadow upon cyclically recurring series of elemental areas of a subject of which the image is desired, an optical system associated with the scanning device, movable means for producing relative movement between the subject of transmission and the scanning device, and automatic means operable upon movement of the movable means for maintaining in focus the optical system used in the scanning operation.

3. In combination, a scanning device for analyzing the varying intensities of light and

shadow upon cyclically recurring series of successive elemental areas of a subject of which the image is desired, an optical system associated with the scanning device for focusing a subject for transmission thereupon, means for carrying both said scanning device and optical system toward or away from the subject for transmission, and automatic means operable upon movement of said carrying means for maintaining the subject for transmission in focus upon said scanning device.

4. In combination, a scanning device for analyzing the varying intensities of light and shadow upon cyclically recurring series of successive elemental areas of a subject of which the image is desired, an optical system associated with the scanning device for focusing a subject for transmission thereupon, means for carrying both said scanning device and optical system toward or away from the subject for transmission, and automatic means operable upon movement of said carrying means for focusing a spot of light upon an elemental area of the subject for transmission.

5. In combination, a scanning element for analyzing the varying intensities of light and shadow upon cyclically recurring series of successive elemental areas of a subject of which the image is desired, an optical system associated with the scanning element for focusing an image for transmission upon said scanning element, means for moving said scanning element toward or away from the subject of transmission, and means automatically operable upon movement of said scanning element for maintaining the image of the subject of transmission in focus upon said scanning device for all positions thereof relative to the subject of transmission.

6. In a television system, a scanning element, a light source for directing light through said element and an optical system for directing the light passing through said scanning element upon a subject for transmission, means for moving said scanning element toward or away from the subject of transmission, and means operable upon movement of said scanning device for focusing the light rays passing through said scanning element upon the subject for transmission for all positions thereof relative to the position of the scanning element.

7. In a television system, a scanning element, a light sensitive medium for translating variable intensities of light and shadow of a subject of transmission as analyzed by said scanning element into proportionate strength electric current impulses, an optical system coordinated with said scanning element for focusing an image of the subject of transmission thereupon, a movable carriage carrying said scanning element and optical system and capable of movement toward or away from the subject of transmission, and means operable upon movement of said carriage relative to the subject of transmission for simultaneously maintaining said optical system in focus.

8. In a television system, a scanning element, a source of light for illuminating a subject for transmission, a light sensitive medium for translating variable intensities of light and shadow of elemental areas of the subject for transmission into proportionate strength electric current impulses, an optical system coordinated with said scanning element for focusing the light issuing from said source upon the subject for transmission, a movable carriage carrying said scanning element and optical system and capable of move-

ment toward or away from the subject of transmission, and means operable upon movement of said carriage relative to the subject of transmission for simultaneously maintaining the light from said source focused upon said subject.

9. In combination, a scanning device for analyzing the varying intensities of light and shadow upon cyclically recurring series of successive elemental areas of a subject of which the image is desired, an optical system associated with the scanning device, means for carrying said scanning device toward or away from the subject of transmission which is to be scanned, and automatically operable means for simultaneously maintaining said optical system in focus during the motion of said scanning device relative to the subject of transmission.

10. In combination, a scanning device for analyzing the varying intensities of light and shadow upon cyclically recurring series of successive elemental areas of a subject of which the image is desired, an optical system associated with the scanning device, means for carrying said scanning device toward or away from the subject of transmission, and a cam surface cooperating with said optical system and adapted to be changed as to its position by motion of the analyzing system so as to maintain automatically said optical system in focus during motion of said scanning device relative to the subject of transmission.

11. In combination, a scanning device for analyzing the varying intensities of light and shadow upon cyclically recurring series of successive elemental areas of a subject of which the image

is desired, an optical system associated with the scanning device, means for carrying said scanning device toward or away from the subject of transmission, and a rotatable cam surface cooperating with said optical system and adapted to be changed as to its position by motion of the analyzing system so as to maintain automatically said optical system in focus during motion of said scanning device relative to the subject of transmission.

12. In combination, a scanning element for analyzing the varying intensities of light and shadow upon cyclically recurring series of successive elemental areas of a subject of which the image is desired and an optical system associated with the scanning element for focusing an image of the subject for transmission upon said scanning element, a movable carriage for carrying both said scanning element and said optical system toward or away from the subject of transmission, and a cam surface in cooperative engagement with said optical system and adapted to be moved by the motion of said carriage relative to the subject of transmission for automatically adjusting said optical system to maintain the image of said subject in focus upon said scanning element.

13. In a television system, a scanning device for analyzing varying intensities of light and shadow on successive elemental areas of a subject of which an image is to be transmitted, an optical system associated with the scanning device, and means for moving the optical system to automatically maintain it in focus upon relative movement of the scanning device and the subject scanned.

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DISCLAIMER

1,924,277.—*Alfred N. Goldsmith*, New York, N. Y. TELEVISION SYSTEM. Patent dated August 29, 1933. Disclaimer filed June 17, 1937, by the patentee; the assignee, *Radio Corporation of America*, assenting.

Hereby enters this disclaimer to claims 2 and 13 of the specification.
[*Official Gazette July 13, 1937*]