July 18, 1933. J. J. ROGAN 1,918,827

ELECTROOPTICAL SYSTEM

Filed Nov. 22, 1929

Fig. 1.

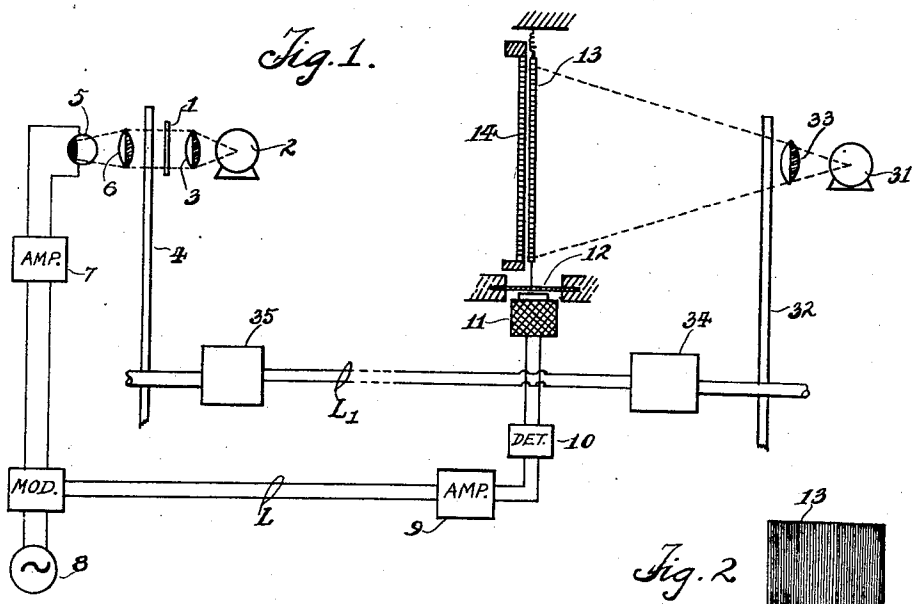


Fig. 2

Fig. 3.

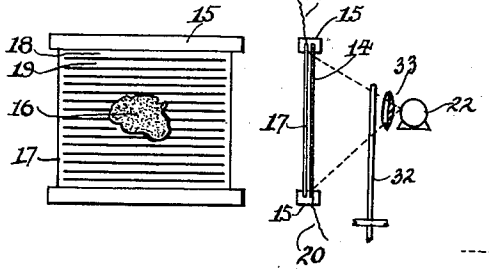


Fig. 4.

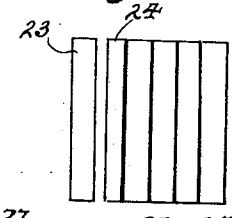
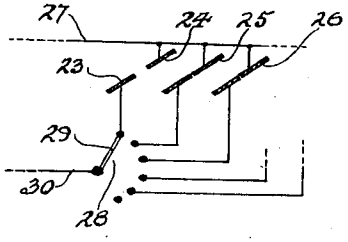


Fig. 5.



John J. Rogan
Inventor

Patented July 18, 1933 1,918,827

UNITED STATES PATENT OFFICE

JOHN J. ROGAN, OF ELMHURST, LONG ISLAND, NEW YORK, ASSIGNOR TO HYGRADE SYLVANIA CORPORATION, OF SALEM, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

ELECTROOPTICAL SYSTEM

Application filed November 22, 1929. Serial No. 409,003.

This invention relates to electro-optical systems and in particular to systems for transmitting visual representations to a distance.

The invention is directed to a system of the general character disclosed and claimed in co-pending application of John J. Rogan, Serial No. 409,002, filed Nov. 22, 1929, and has for its main object the provision of methods and means for simplifying the transmission of pictures, images or the like.

Another object of the invention is to provide a system of television or picture transmission wherein greater brilliancy may be attained in the reproduced image or picture.

A feature of the invention pertains to a novel type of reproducing screen which enables the images or pictures to be reproduced and viewed by an audience using a single source of light of high brilliancy and uniform intensity. As a result of this feature the defect which has been encountered in all systems of television heretofore proposed, namely, the use of low intensity reproducing lamps such as Neon lamps or the like, is avoided.

Another feature of the invention resides in the novel means for simultaneously producing the visual sensations of spatial and intensity variations without the need of complicated optical systems.

A still further feature of the invention is to provide a television reproducing system wherein the reproduction may be viewed by a large audience without the necessity of providing expensive lamp-banks and the necessary commutating mechanism therefor.

Other features and advantages of the invention will be revealed upon a consideration of the following descriptions and the appended claims.

While the broad idea of the invention will be disclosed in connection with one well-known type of transmission system, it will be understood that this is done merely for the purposes of description.

While the broad idea of the invention will be disclosed in connection with the type of system disclosed in co-pending application, Serial No. 409,002, referred to hereinabove, it will be understood that this is merely for the purposes of illustrating one preferred mode of carrying out the invention. The application of the invention to other types of systems is within the scope thereof. Accordingly,

Fig. 1 of the drawing shows the invention applied to a television or picture transmission system.

Fig. 2 is a detail view of one of the elements of the novel screen according to the invention.

Fig. 3 shows a modified form of screen embodying features of the invention.

Fig. 4 shows the invention applied to another type of television system.

Referring more particularly to Fig. 1, the numeral 1 designates for the purposes of illustration merely, the representation which is to be transmitted and this representation may take the form of a motion picture film. Light from the source 2 is projected by means of a suitable optical system, represented schematically by the numeral 3, upon the film 1. The successive elemental areas of the film 1 are scanned by any well-known means, for example, as shown in Fig. 1, a rotating spirally perforated disc 4 is positioned between the film 1 and the photo-sensitive cell 5 and the light which passes through each successive perforation is projected upon the cell by means of a suitable optical system 6. Thus the cell 5 generates currents which vary in accordance with the varying transparencies of the successive elemental areas of the film 1. These varying currents may then be amplified to the required level as indicated schematically by the block 7 and either applied directly to the transmission channel L or they first be modulated with a source of carrier current 8 as will be clear to those familiar with the carrier transmission art.

At the receiving station, shown in the right-hand portion of Fig. 1, the incoming currents may be further amplified as indicated schematically by the block 9. In the case of carrier transmission, a suitable demodulator 10 may be provided for detecting the modulations corresponding to the varying transparencies of the elemental areas of the film 1 at the receiving station. These

modulations are then applied to the field winding 11 of an electro-mechanical reproducer of any well-known type. As shown in the drawing, the modulations cause corresponding vibrations in the diaphragm or armature 12 of the reproducer. Suitably linked to the member 12 is a lined screen 13 which may be made of any transparent or translucent material, such as celluloid or the like, having a series of spaced non-transparent lines formed on the surface thereof. Or if desired, this screen member may take the form of a very fine mesh wire fabric which is mounted in a suitable frame to be operated by member 12. Half-tone screens which are well known in the printing art may also be used for this purpose. Fixedly mounted adjacent to screen member 13 is a similar screen 14. Members 13 and 14 are so positioned with respect to each other that when the minimum current is applied to winding 11, the opaque lines of one screen are in registry with the transparent lines of the other screen. Thus as the current in winding 11 increases, the screen 13 is given correspondingly increased vibrations and permits a correspondingly greater amount of light to be transmitted through the screens.

Positioned in the rear of screen member 13 is a source of light 31, preferably of high and constant intensity, such as an arc lamp or projection lamp well known in the motion picture art. Positioned between the light 31 and screen 13 is a rotating member 32 which may be similar to the member 4 at the sending station. The light from source 31 is focussed by means of a suitable optical system represented schematically by lens 33 in the form of a spot upon the member 32. As member 32 rotates the screen 13 is therefore illuminated in a point-by-point fashion with a light spot of high and constant intensity, this spot moving in synchronism with the analyzation of the elementary areas of the picture 1. It will be understood that the motors 34 and 35 at the receiving and sending stations are rotated in synchronism either by local synchronizing means or over the channel L_1 as is well known in the art. Consequently, if an observer views the screen 14 from the front, the moving spot of light appears to vary in intensity in accordance with the magnitude of vibration of screen 13 as hereinbefore described.

Referring to Fig. 3 there is shown another modification of screen that may be used in place of the screen of Fig. 1. In this modification the screen comprises a thin preferably transparent metal electrode 14 which is fastened at opposite edges in a suitable frame 15. Instead of a transparent metal member such as gold beaters skin or the like, the member 14 may take the form of a thin metal plate profusely perforated to pass the required amount of light as indicated by the numeral 16. Mounted in the frame 15 is another electrode 17 also of very thin metal, but preferably non-transparent. Electrode 17 is in the form of a plurality of parallel strips 18, 19, etc. interconnected at their ends. Normally the strips are touching each other throughout their length, or are very closely spaced. When the incoming image currents are applied to the electrodes 14 and 17 through the respective conductors 21, due to the electrostatic attractions and repulsions the strips 18, 19, etc. are bowed with respect to the electrode 14 and the strips are correspondingly separated from one another. Thus the constant and high intensity moving light spot from source 22 when viewed from the opposite side of the screen, appears to vary in accordance with the movements of the strips 18, 19 etc. If desired, instead of using strips very thin wires may be employed, and in order that the screen may have a uniform appearance, it is preferable to make the length of the strips or wires very long as compared with their width and to utilize the central portion of the screen. As a modification, the electrode 17 may be the same as electrode 14 and reliance place upon the inverse law for the variation. In the latter case it is desirable to have both electrodes movable.

Referring to Fig. 4, there is shown another type of screen that may be used in place of the screens of Figs. 1 and 3. In this modification a plurality of sets of metal strips 23, 24 are provided and arranged in two parallel rows in the manner shown. Normally the strips are very close together to limit the quantity of light. The rear row of strips 24, 25, 26, etc. are connected to a common conductor 27, while each of the front strips is connected to a corresponding contact of a commutator 28, the brush 29 of which is connected to conductor 30. The incoming image currents are applied to conductors 27 and 30 whereby the set of strips which happen, at the moment, to be in circuit through commutator 28, are separated in accordance with the amplitude of current. Thus as shown in the drawing, brush 29 is in circuit with strips 23 and 24, which are shown separated, while the remaining sets are closed. Thus, if a constant and high intensity light source is placed on one side of the screen and moved in the manner shown in Fig. 1 and then viewed from the other side of the screen, the respective strip of the screen will appear illuminated in accordance with the separation of the strips. It will be understood that each set of strips corresponds to a linear element of the picture or image, and the brush 28 successively contacts with the sets of strips in synchronism with the scanning of the corresponding linear elements at the sending station. If desired, the front surface of each strip may be polished to reflect the light

which is then positioned in front of the screen, but the light itself being shielded from the observer, who likewise views the screen from the front. Instead of using a single set of strips for each linear element of the picture a greater or less number of sets may be employed, so long as the strip or wires of each set are connected to operate as a unit.

Other modifications and changes may be made without departing from the spirit and scope of the invention. Thus the several types of screns may be mounted in transparent evacuated envelopes to decrease the impedance to vibration. Likewise the relative movements of the screens may be produced by pneumatic means instead of electric means.

What is claimed is:

1. In an image reproducing system the method of reproducing a picture at a distance which comprises projecting a moving scanning light spot of constant intensity upon a first picture reproducing screen and moving a second picture reproducing screen relatively to said first screen.

2. A method of reproducing visual representations according to claim 1 in which the relative movement of the screens is controlled by incoming image currents.

3. A method of reproducing visual representations at a distance which comprises projecting a high and constant intensity moving scanning light spot upon a first screen, moving said spot over said screen and simultaneously moving another screen relatively to said first screen.

4. A method according to claim 3 in which said light spot is viewed through both screens.

5. The method of reproducing visual representations at a distance which comprises translating the characteristics of the representation into corresponding electric currents by analyzing each elemental area of the representation, projecting a moving scanning spot of light of constant intensity upon a first screen and vibrating a second screen relatively to the first screen and in synchronism with the analyzation of said elemental areas.

6. A method according to claim 5 in which the relative movements of the screens is in accordance with the translated currents.

7. In combination a reproducing screen comprising a plurality of sets of movable parallel strips, a source of varying signal currents, means for connecting said source to each of said sets in succession, and means for projecting a moving scanning spot of light on said screen.

JOHN J. ROGAN.