

Dec. 15, 1936.

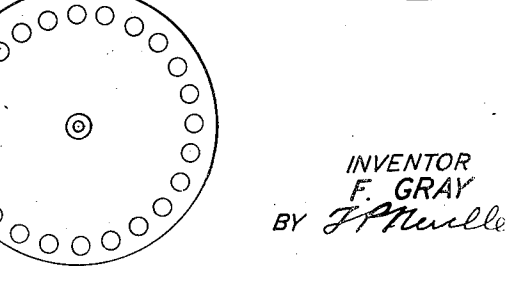
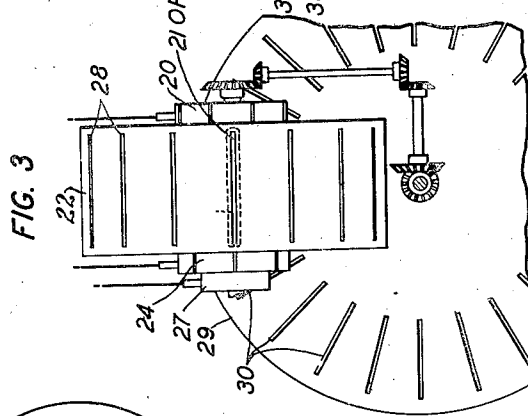
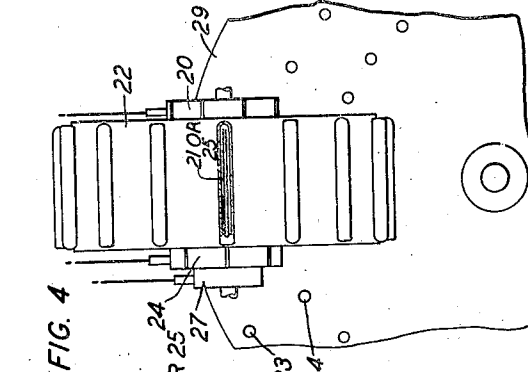
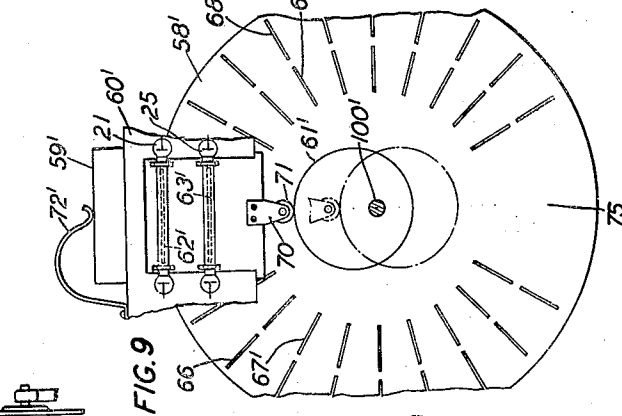
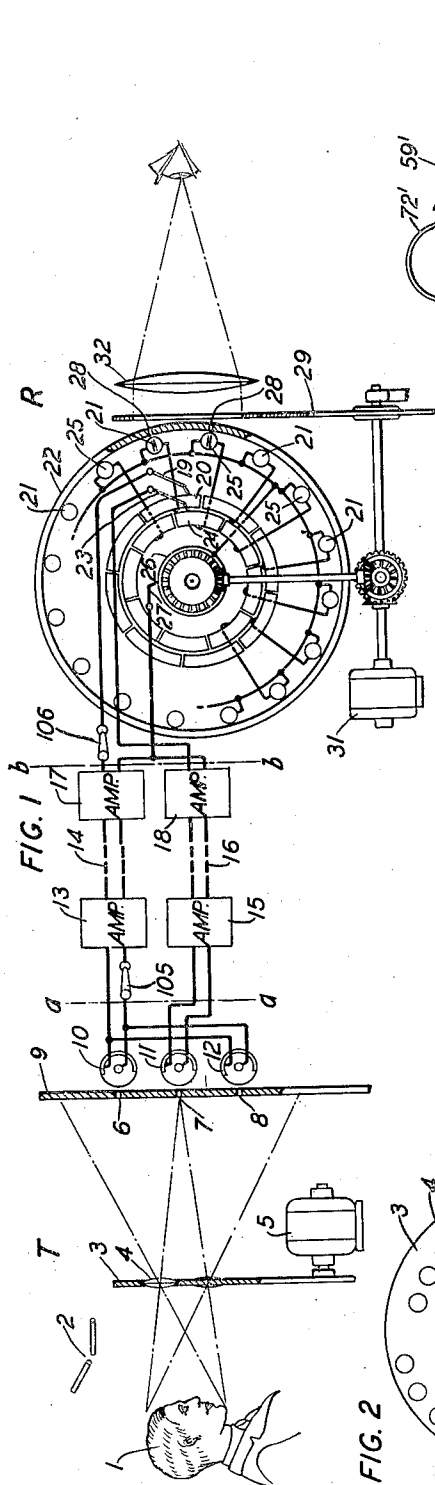
F. GRAY

2,063,998

ELECTROOPTICAL SYSTEM

Filed Dec. 13, 1930

2 Sheets-Sheet 1



INVENTOR
F. GRAY
BY *J. H. M. M. M.*

ATTORNEY

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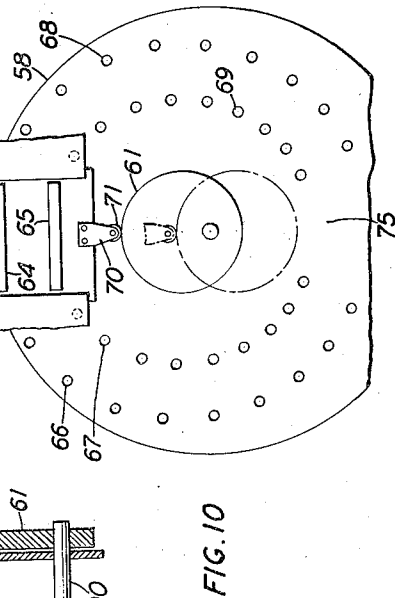
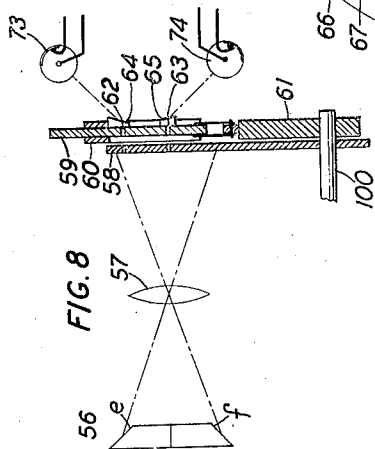
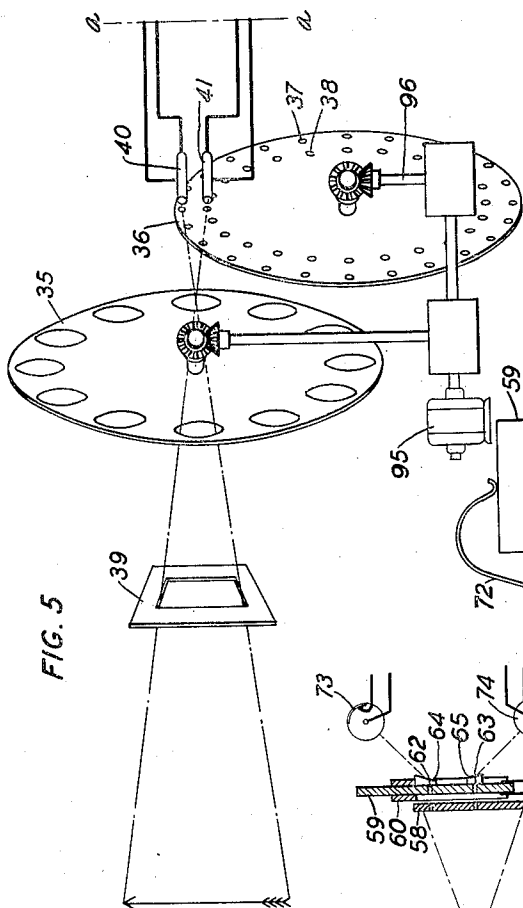
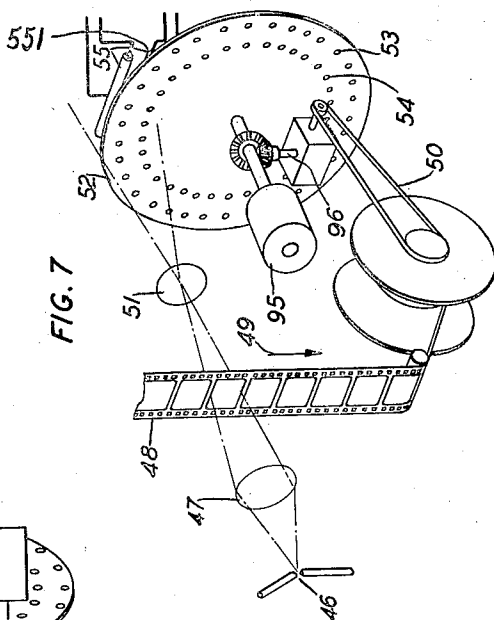
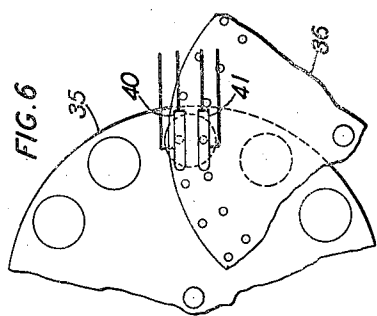
F. GRAY

2,063,998

ELECTROOPTICAL SYSTEM

Filed Dec. 13, 1930

2 Sheets-Sheet 2



INVENTOR
F. GRAY
BY *J. M. Melle*

ATTORNEY

UNITED STATES PATENT OFFICE

2,063,998

ELECTRO-OPTICAL SYSTEM

Frank Gray, New York, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application December 13, 1930, Serial No. 502,087

44 Claims. (Cl. 178—6)

This invention relates to electro-optical systems and more particularly to a method of and means for producing an image.

It has heretofore been proposed to provide television receivers including separate light sources, adapted to provide illuminated surfaces corresponding in area to different sections of the image field and to supply the respective light sources with image currents transmitted over different communicating channels, in combination with one or more movable scanning discs operating synchronously with similar scanning discs at a transmitting station and having a plurality of spirals of apertures individual to the different sections of the image field, whereby elemental areas of the respective sections may be simultaneously viewed or light therefrom may be projected upon a screen to produce an image of the subject or field scanned at the transmitter.

Another system, similar to that described above, embodies a scanning mechanism comprising two movable members provided with slots lying in different planes which cooperate to produce a plurality of cross-slots, each individual to an extended illuminated sectional portion of the image field, whereby these portions are simultaneously but separately reproduced.

In such systems the image currents transmitted over the respective channels energize a light source corresponding in area to a complete section of the image field and require scanning members operating at high speed.

The present invention relates to a system including movable strip light sources, each corresponding in area to a unit line of the image, which are used to effect the reproduction of an image.

In accordance with one aspect of the invention, image currents, varying as the tone values of successive elemental areas of different sections of the field of view or subject, are transmitted over separate channels simultaneously and are distributed to spaced apart movable strip light sources, the varying currents corresponding to the different sections being transmitted over each channel in succession, or repeatedly over one channel, to control the production of an image in a period of time equal to the time required to scan the complete image within the period of persistence of vision multiplied by the number of channels employed. If two channels are used to produce twenty images per second, each image section will be scanned and reproduced in a tenth of a second.

According to another aspect of the invention, a plurality of spaced apart movable strip light

sources may be simultaneously energized by image currents, corresponding to alternate lines of the field of view, respectively transmitted over a plurality of channels, or the sources may be energized in succession by image currents transmitted over a single channel to control the production of an image at a rate within the period of persistence of vision.

One object of the invention is to produce a brightly illuminated image.

Another object is to utilize the image currents transmitted to control the illumination of a single line of the image field.

A further object is to distribute the image currents, transmitted over different channels of a plural channel system, to simultaneously energize a plurality of movable strip light sources.

A still further object is to scan successive elemental areas of the simultaneously energized light sources.

A feature of the invention relates to a scanning mechanism including cooperating members one of which moves at low rate of speed compared with that of the other.

One embodiment of the invention comprises a transmitter including a rotary scanning disc provided with lenses arranged in a spiral line for moving an image of the object or field of view across a plurality of light sensitive devices, two of which are connected in parallel to one communicating channel and are activated successively by light from different sections of the field scanned, while the other is connected to a separate channel and is activated by light from all sections of the field in succession, the image traversing the light sensitive devices so that one or the other device in the first channel and that in the other channel are simultaneously activated by light from the respective sections of the field of view, and a receiver including a revolving cylinder provided with slots behind each of which is a source of light having a length equal to the width of the cylinder and a commutator through which the image currents, transmitted over the respective communicating channels, are simultaneously supplied to a like number of light sources, and a disc having slots long enough to extend across the slots of the cylinder which are associated with the energized sources; whereby a like number of elemental areas, having tone values corresponding to elemental areas similarly positioned in the respective sections of the field, or subject, are simultaneously viewed or light therefrom is projected upon a screen.

In another embodiment the transmitter is

provided with scanning means adapted to supply light from the successive elemental areas of different sections of the field to light sensitive devices respectively included in separate communicating channels.

In either case, the cylinder of the receiver is rotated at a rate determined by the number of lines into which the field of view is to be resolved and the number of illuminated lines or light sources being simultaneously scanned. The co-operating slotted disc is mounted upon an axis at right angles to that of the cylinder, is substantially tangential thereto, and is driven at a rate determined by that of the cylinder, the number of slots in the disc and the number of elemental areas constituting a line.

In alternative embodiments the light sources may be mounted externally of the cylinder, or may be carried by a member moved back and forth across the field by a cam arrangement and adapted to cooperate with a disc having a number of spirals of apertures corresponding to the number of lines being simultaneously scanned.

A detailed description of the invention follows and is illustrated in the attached drawings. Fig. 1 diagrammatically illustrates a television system including the invention;

Fig. 2 is a detail of the transmitter of Fig. 1;

Fig. 3 shows a detail of the receiver of Fig. 1;

Fig. 4 illustrates a slightly different arrangement which may be used in place of the apparatus shown in Fig. 3;

Fig. 5 shows another arrangement which may be substituted for that illustrated at the left of section line *a-a* in Fig. 1;

Fig. 6 is a detail of the apparatus of Fig. 5;

Fig. 7 shows an arrangement similar to that of Fig. 5 for transmitting a motion picture film;

Fig. 8 illustrates a different type of receiving apparatus;

Fig. 9 shows a receiver for use with the transmitter of Fig. 8; and

Fig. 10 is a face view of the apparatus shown in Fig. 8.

By way of example there is illustrated in Fig. 1 a two-channel television system, which comprises a transmitting terminal apparatus T and a cooperating receiving apparatus R.

Apparatus T constitutes one form of transmitter which may be used to scan a field of view or subject 1 illuminated by a constant source of light 2, herein shown as an arc lamp. However, the subject may be illuminated by daylight or any suitable artificial light source.

Disc 3 is provided with lenses 4 arranged in a spiral line and is driven by a motor 5 to project moving images of the subject upon a screen or mask 9 having three small apertures 6, 7, and 8, respectively associated with light sensitive devices 10, 11, and 12 herein shown as photoelectric cells. Cells 10 and 12 are connected together and to the amplifier 13 included in channel 14, and cell 11 is connected to the amplifier 15 included in channel 16. Cells 10 and 12 are opposite the centers of the positions occupied by the first and last lenses as the disc 3 rotates through one complete cycle, and cell 11 is midway between cells 10 and 12. During one half revolution of disc 3 light from successive elemental areas of successive lines of one section of the subject will pass through the aperture 6 and, simultaneously therewith, light from successive elemental areas of successive lines of the other section of the subject will pass through the aperture 7. During the other half revolution, light

from the successive elemental areas of successive lines of the first section will pass through the aperture 7, while, simultaneously therewith, light from the successive elemental areas of the successive lines of the other section will pass through the aperture 8. In this manner light from the successive elemental areas of the complete image will pass through the apertures 6 and 8 and also through the aperture 7.

An apertured screen may be placed in front of the lens disc, or scanning elements may be attached to the back of the disc, to define the edge of the image and thereby prevent simultaneous illumination of cells 10 and 12 by light from the subject.

Light from the successive elemental areas of the complete image will be applied to the light sensitive cells 10 and 12, which are thereby activated to cause the production of image currents corresponding to the tone values of all elemental areas of the subject and supply them to the amplifier 13 for transmission over channel 14. In like manner, the cell 11 is activated to cause the production of image currents corresponding to the tone values of all elemental areas of the image, which are amplified by the device 15 and transmitted over the channel 16.

By rotating the disc 3 at approximately ten revolutions per second, current corresponding to the successive elemental areas of a complete image will be transmitted over each channel in one-tenth of a second, but over the two channels in one-twentieth of a second.

Image currents transmitted over channels 14 and 16 respectively are amplified by the terminal amplifiers 17 and 18. Amplified image currents supplied by the amplifier 17, are transmitted via the brush 19 and commutator 20 in succession to one terminal of a series of light sources 21 secured to the inner periphery of the cylinder 22.

In a similar manner, amplified image currents produced by the device 18 are supplied through a brush 23 and commutator 24 in succession to one terminal of a second series of light sources 25, also secured to the inner surface of the drum 22. The opposite terminals of the two series of light sources 21 and 25 are connected to a slip ring 26 and through a brush 27 to the amplifiers 17 and 18.

Fig. 2 illustrates the disc 3 provided with the spiral of lenses 4.

As shown in Fig. 3 the cylinder 22 is provided with a number of parallel slots 28, which are spaced equal angular distances apart and extend substantially across the cylindrical surface. Behind each slot 28 is a light source 21 or 25. These sources alternate with each other and are of the same length as the slots 28, thereby constituting strip light sources.

Sources 21 and 25 are herein shown, see Fig. 4, as glow lamps of the type disclosed in U. S. Patent 1,865,516 of F. Gray, issued July 5, 1932. However, any other sources may be used, which will supply light varying with the changing amplitudes of the image currents.

As shown in Figs. 3 and 4, commutators 20 and 24 and slip ring 27 are mounted on the cylinder 22 for rotation therewith.

Adjacent the cylinder 22 and in a plane substantially tangential thereto, is a disc 29 provided adjacent its periphery with radial slots 30 of such length that they extend across two adjacent slots in the cylinder 22.

A motor 31 drives the cylinder 22 in synchronism with the lensed disc 3 at the trans-

mitting station through gearing, and its shaft carries the disc 29, which is thereby driven at a desired speed properly related to that of the cylinder 22. Any well-known means may be provided to maintain the disc 3 and cylinder 22 in synchronism. A suitable system for this purpose is disclosed in U. S. Patent 1,999,376 of H. M. Stoller, issued April 30, 1935.

An optical system, herein represented by a lens 32, may be used to magnify the reproduced image as viewed by an observer O or a suitable optical system may be used to project it on a screen.

The separate image currents simultaneously received over the channels 14 and 16 are respectively supplied through the commutators 20 and 24 to adjacent light sources 21 and 25, which correspond to similarly positioned unit lines of the respective sections scanned at the transmitter. The light supplied by the sources varies from instant to instant with the tone values of elemental areas of the corresponding lines scanned at the transmitter.

Disc 29 rotates at a rate proportional to that of the cylinder 22, which is determined by the degree of definition employed and such that the unit lines of the complete image are produced in pairs and the elemental areas of the pairs of lines are simultaneously scanned in succession, whereby a complete image of the subject is produced within the period of persistence of vision. As stated above, if twenty images per second are to be reproduced, the cylinder 22 is rotated at a speed such that a lamp passes across one section of the field of view in one-tenth of a second.

Transmission may be effected over a greater number of channels by providing each additional channel with a light sensitive device to be activated as is cell 11, by light from the successive elemental areas of the complete field and utilizing additional commutators, brushes therefor and a light source for each channel at the receiver. Any desired rate of transmission may be used, within practical limits, which will permit a complete image to be produced within the period of persistence of vision.

The receiver scanning apparatus, illustrated in Fig. 4 differs from that of Fig. 3 solely in that the strip light sources 21 and 25 are mounted on the external surface of a cylinder 22 and the disc 29 is provided with two rows of apertures 33 and 34, each row being arranged in a different spiral line to scan the simultaneously energized sources 21 and 25.

The apparatus of Fig. 5, comprises a rotating disc 35 having lenses arranged in a circle to sweep images of the subject 1 across a disc 36 provided with two rows of apertures 37 and 38, each arranged in a circle. Disc 35 is driven by a motor 95 at a rate such that a lens traverses the field of view in an interval equal to twice the period of the persistence of vision. During each rotation of disc 36, the rows of apertures 37 and 38 scan successive elemental areas of the image and hence disc 36 should operate at a definite speed relative to that of disc 35. This may be secured by connecting disc 36 to the motor 95 by gearing 96.

A screen 39 limits the field of view so that the edges of the images, produced by two successive lenses, are in contact, but do not overlap.

Associated with the respective rows of apertures 37 and 38 in disc 36 are light sensitive devices 40 and 41 corresponding in length to a unit line of the image projected on the disc 36. These devices are simultaneously activated by light from

successive elemental areas correspondingly positioned in different sections of the subject.

The image currents produced by light sensitive device 40 are supplied to the amplifier 13 and transmitted over channels 14, and those resulting from the activation of cell 41 are amplified by device 15 and transmitted over channel 16. These image currents are supplied to the receiver shown in Fig. 1.

Fig. 6 illustrates the relative positions of the discs 35 and 36 and the cells 40 and 41.

In a similar manner images of a motion picture film may be transmitted over a multi-channel system, as shown in Fig. 7. Light supplied by a source 46 of constant intensity is gathered by a lens 47 and passes through a film 48, moved continuously in the direction of the arrow 49 by suitable driving means 50. A lens 51 projects an image of the view or scene upon the portion of a rotating disc 52 provided with two rows of apertures 53 and 54 each row being arranged in a circle. The film driving means 50 is connected by a gearing 96 to the motor 95 which actuates the disc 52, whereby the film and disc are operated in correct time relation.

Associated with each row of apertures 53 and 54 is a light sensitive device 55 and 55' corresponding in length to each unit line of the image. These devices are respectively activated to produce image currents which are transmitted over channels 14 and 16 to the receiver shown in Fig. 1.

Instead of using a lamp individual to each slot or unit line at the receiver a single lamp bent to provide a series of straight portions corresponding to the single lamps shown in Figs. 1, 3, and 4 may be used, in combination with a commutator for simultaneously supplying image currents to electrodes for two of the straight portions at any given instant and to the electrodes of the different straight portions in succession.

The systems described above may be used to transmit alternate lines of an image over different channels by displacing the apertures 7 and associated cells 11 from the position midway between cells 10 and 12, or the apertures 6 and 8 and their associated cells 10 and 12 of Fig. 1, or one row of apertures in disc 36 and its associated cell 40 or 41 of Fig. 5, a distance equal to the width of one unit line of the image; similarly displacing by the same amount one series of lamps 21 or 25 relatively to the other and rotating the disc 3 or disc 35 and cylinder 22 at twice the speed hereinbefore specified. Thus, if twenty images per second are to be reproduced, the disc 3 or 35 and cylinder 22 should be rotated twenty times per second.

For single channel operation the disc 3 and cylinder 22 should be driven twenty revolutions per second and the switches 105 and 106 in either channel of the transmitter and receiver, respectively, would be opened. By opening switch 105 as herein shown, the cells 10 and 12 are rendered inoperative, while opening switch 106 serves to disconnect channel 14 from the brush 19 and group of lamps 21. In this case, image currents corresponding to successive elemental areas of the field of view are transmitted over the channel 16 to energize the group of light sources 25, which cooperate with the scanning mechanism, consisting of the cylinder 22 and disc 29, to produce an image.

Figs. 8 and 9 illustrate apparatus which may be substituted for that shown to the left of section line *a-a* and to the right of section line *b-b*.

b—b, respectively, in Fig. 1, to provide a system in which image currents corresponding to elemental areas of different sections of a field of view are repeatedly transmitted over separate channels to respectively energize movable strip light sources which are simultaneously scanned to produce an image of the field of view.

Referring to Fig. 8 there is shown a field of view 56, consisting of two sections *e* and *f*, a lens 57 adapted to produce an image of the field of view in the plane of disc 58 mounted on a shaft 100 adapted to be driven by a motor (not shown).

Associated with the disc 58 is a panel 59 mounted in guideways on a support 60 and adapted to be reciprocated by a cam 61 carried by the shaft 100. Panel 59 is provided with slots 62 and 63 and prisms 64 and 65, respectively associated with the slots.

As shown in Fig. 10, disc 58 has four rows of apertures 66, 67, 68, and 69 which extend through an angle of slightly less than 180° and cooperate in pairs, i. e., 66—68 and 67—69, to constitute reverse spirals. Panel 59 is provided with a bracket 70, carrying a roller 71 which engages the face of the cam, and it is held in engagement therewith by a spring 72. The cam may comprise a rotating element provided with a slot engaged by the roller 71. Rotation of the shaft 100 causes the panel 59 to reciprocate and the disc 58 to rotate, so that as the panel moves down, light from successive elemental areas of successive unit lines of section *e*, from its outer margin to its inner border, passes through the row of apertures 66, slot 62, and prism 64. This prism causes the light passing through slot 62 to be directed to the light sensitive device 73, which is thereby activated to produce a varying current corresponding to the tone values of successive elemental areas of section *e*.

Simultaneously therewith, light from successive elemental areas of section *f*, from its inner border to its outer margin, passes through the apertures 67 and slot 63 and is directed by the prism 65 to the light sensitive device 74, which is thereby activated to produce a current varying in accordance with the tone values of successive elemental areas of section *f*.

When the panel moves upwardly, light from successive elemental areas of the respective sections, from the inner border to the outer margin of section *e* and from the outer margin to the inner border of section *f*, passes through the apertures 68, slot 62 and prism 64 to light sensitive device 73 and through apertures 69, slot 63 and prism 65 to light sensitive device 74. Light sensitive devices 73 and 74 are respectively connected to the amplifiers 13 and 15, and the resultant amplified image currents are respectively transmitted over channels 14 and 16. For each revolution of the disc 58 and reciprocation of the panel 59 the two sections of the image are simultaneously and completely scanned twice. As described above, the optical system, identified as lens 57, preferably operates to project an image which is neither inverted nor transposed in the plane of disc 58.

The receiver of Fig. 9 is similar to the transmitter shown in Fig. 8, in that it comprises a disc 58', mounted on a shaft 100', a panel 59' slidable in a frame 60' and reciprocated by the cooperative action of cam 61' and spring 72'. Shaft 100' is driven by a motor (not shown) so that the disc 58' operates in synchronism and in phase with the disc 58. A suitable system for

the purpose is disclosed in the above mentioned Stoller patent.

Panel 59' is provided with strip light sources 21 and 25, respectively associated with slots 62' and 63', which are supplied with image currents transmitted over the respective channels 14 and 16. One electrode of source 21 is connected to the amplifier 17 and a similar electrode of source 25 is connected to the amplifier 18, the other electrodes of sources 21 and 25 are connected by a common conductor to the amplifiers 17 and 18.

Disc 58' is provided with four rows of elongated apertures 66', 67', 68' and 69' operating in pairs, i. e., 66'—68' and 67'—69', to constitute reverse spirals. These reverse spirals cooperate with slots 62'—63', in the same manner as apertures 66, 67, 68 and 69 with slots 62 and 63 at the transmitter, to scan sources 21 and 25 respectively, which emit light corresponding in tone values to the successive elemental areas of sections *e* and *f* of the field scanned at the transmitter, whereby an image may be produced and viewed directly by an observer or projected on a screen.

To avoid distortion of the image, caused by the non-uniform motion of the panels 59 and 59', when the direction of motion is reversed, limited angular portions 15 of the discs 58 and 58', 180° apart are not provided with apertures.

At the receiver, as an aid in joining the two sections of the image, without an appreciable break, the slots are divided into two parts, the ends of which are in spiral lines and are so positioned that they define the line of division of the sections. However, a single slot could be used by providing an accurately constructed cam motion and adjusting the moving parts precisely.

While in the plural-channel systems described above, the image field is divided into two sections and two communicating channels are employed, the systems may embody three or more sections and channels.

Since the total light supplied by each source at the receiver is used to illuminate successive elemental areas of separate lines of different sections of the reproduced field of view and a plurality of such sources are simultaneously energized, an extremely bright image will be produced.

The amplifiers may be of any suitable type adapted to repeat current without distortion, but preferably comprise space discharge tubes. They may consist of any number of stages to meet practical requirements.

If it is desired to effect scanning of the subject or field of view at the transmitter by two or more moving beams of light, this may be accomplished by using scanning apparatus which operates as disclosed in U. S. Patent 1,803,700 of applicant issued May 5, 1931, or U. S. Patent 1,786,652 of Hartley, issued December 30, 1930.

What is claimed is:

1. Image producing means comprising a series of strip light sources each corresponding to a unit line of an image field, and means for simultaneously energizing a plurality of said light sources to constitute remotely spaced unit lines of the image and for successively energizing all of said sources.

2. Image producing apparatus comprising a plurality of light sources each corresponding to a unit line of an image field, terminal means for a plurality of image current channels, and means for associating said terminal means simultaneously with a corresponding number of said light sources and for successively associating each

of said terminal means with a different one of said light sources.

3. Image producing apparatus comprising a plurality of strip light sources each corresponding to a unit line of an image field, terminal means for a plurality of image current channels, and means for associating said terminal means simultaneously with a corresponding number of said light sources and for successively associating each of said terminal means with a different one of said light sources.

4. Image producing apparatus comprising a plurality of strip light sources each corresponding to a unit line of an image field, terminal means for a plurality of image current channels, means for distributing image currents from each of said terminal means to respective ones of a group of said light sources, and optical scanning means for rendering effective at each instant the light from a single elemental area of each of said light sources then associated with said terminal means.

5. Image producing means comprising a plurality of strip light sources each corresponding to an elemental line of the receiving field of view, and means for energizing groups of said light sources in succession, all portions of each light source emitting light when the source is energized.

6. Image producing means comprising a plurality of strip light sources each corresponding to a unit line of an image field, means for energizing groups of said sources in succession, and optical scanning means cooperating with said light sources for rendering effective at each instant the light from a single elemental area of each light source then associated with said energizing means.

7. Television image producing apparatus comprising a plurality of parallel strip light sources each corresponding to a unit line of an image field, a plurality of transmission channels, means for distributing the current received over one channel to a plurality of said light sources one at a time, means for simultaneously distributing the current received over another channel to others of said light sources simultaneously with the said first distribution, and an apertured rotating element cooperating with said light sources for producing the image.

8. Image producing apparatus comprising a plurality of moving strip light sources each corresponding to a unit line of an image field, terminal means for a plurality of image current channels, and means for distributing image currents from each of said terminal means to a group of said light sources.

9. Image producing apparatus comprising a plurality of moving strip light sources each corresponding to a unit line of an image field, terminal means for a plurality of image current channels, means for distributing image currents from each of said terminal means to a group of said light sources, and scanning means cooperating with said light sources.

10. Image producing means comprising a plurality of moving strip light sources each corresponding to an elemental line of the receiving field of view, and means for energizing groups of said light sources in succession, all portions of each light source emitting light when the source is energized.

11. Television image producing apparatus comprising a plurality of parallel moving strip light sources each corresponding to a unit line of an

image field, a plurality of transmission channels, and means for distributing the current received over one channel to a plurality of said light sources one at a time, means for simultaneously distributing the current received over another channel to others of said light sources simultaneously with the said first distribution, and an apertured rotating element cooperating with said light sources for producing the image.

12. Image producing apparatus comprising a movable supporting member, a plurality of strip light sources mounted thereon, and means for supplying different image currents simultaneously to at least two of said sources and to each thereof in succession.

13. Image producing apparatus comprising a rotating cylindrical supporting structure, a plurality of strip light sources mounted thereon, and means for supplying image currents, respectively corresponding to different parts of an image, simultaneously to at least two of said sources and successively to said sources.

14. A scanning apparatus comprising an apertured cylindrical member, and a disc having apertures which register with a plurality of the apertures of the cylindrical member simultaneously thereby producing a plurality of light channels therethrough corresponding to different elemental areas of the field being scanned, and terminal means for a plurality of image current channels, the several terminal means of the several channels being simultaneously operatively associated with the several light channels, respectively.

15. A scanning apparatus comprising a plurality of strip light sources, an apertured member carrying said light sources, and a disc having apertures which register with a plurality of the apertures in said member simultaneously thereby producing a plurality of light channels therethrough corresponding to different elemental areas of a field being scanned, and terminal means for a plurality of image current channels, the several terminal means of the several channels being simultaneously operatively associated with the several light channels, respectively.

16. Image producing means comprising a plurality of movable strip light sources each corresponding to a unit line of an image field, means for simultaneously energizing at least two of said light sources, and means for rendering effective in succession, elemental portions of said energized light sources.

17. Image producing apparatus comprising a plurality of strip light sources, a plurality of terminal means respectively associated with a plurality of image current channels, and means for simultaneously distributing image currents from said terminal means to different light sources constituting a group and successively to different groups of said light sources.

18. Image producing apparatus comprising a supporting structure, a plurality of strip light sources mounted thereon, means for linearly actuating said structure, and an apertured member for simultaneously exposing areas of the respective light sources to constitute elemental areas of an image field.

19. An electro-optical system for scanning a field of view comprising a plurality of image current channels, separate light sensitive means included in said channels respectively, means for causing all portions of the light sensitive means associated with one channel to be operable throughout each complete scanning of said field

and for causing different portions of the light sensitive means associated with another channel to be operable in succession throughout each said scanning.

5 20. An electro-optical system for scanning a field of view comprising a plurality of light sensitive means, and means for rendering said light sensitive means operable simultaneously to scan
10 different parts of said field of view and in succession to respectively scan said different parts during each complete scanning, each said parts comprising a plurality of elemental strips of said field.

15 21. An electro-optical system comprising a transparency, means for moving said transparency, means for illuminating and scanning successive elemental areas of said transparency, and light sensitive devices simultaneously activated by light controlled by elemental areas of
20 different sections of said transparency and successively by the elemental areas of all of said sections.

22. The method of controlling a bank of light emitting elements each corresponding to a unit
25 line of an image field to produce a television image which comprises causing light to be directed in succession from portions of the elements constituting said bank corresponding to elemental areas of the image so as to set up
30 parallel line series of elemental areas of the entire image, and simultaneously causing light to be similarly emitted from other portions of the elements constituting said bank in succession to simultaneously set up a second parallel line series
35 of elemental areas of the entire image, the two elemental areas which are being simultaneously set up at any instant being separated from each other by a distance many times the greatest dimension of an elemental area.

40 23. The method of controlling a bank of lamps each corresponding to a unit line of an image field to produce a television image which comprises causing light to be directed in succession from portions of said lamp bank corresponding
45 to elemental areas of the image so as to set up parallel line series of elemental areas of the entire image, and simultaneously causing light to be emitted from other portions of the lamp bank in succession to simultaneously set up a
50 second parallel line series of elemental areas of the entire image, the two elemental areas which are being simultaneously set up at any instant being separated from each other by a distance many times the greatest dimension of an elemental area.

55 24. The method of controlling a bank of lamps each corresponding to a unit line of an image field to produce a television image which comprises causing light to be directed in succession
60 from portions of said lamp bank corresponding to elemental areas of the image so as to set up parallel line series of elemental areas of the entire image, and simultaneously causing light to be emitted from other portions of the lamp
65 bank in succession to simultaneously set up a second parallel line series of elemental areas of the entire image, the two elemental areas which are being simultaneously set up at any instant being separated from each other by a distance
70 many times the greatest dimension of an elemental area, and repeating said process in time intervals substantially equal to the period of persistence of vision.

75 25. Image producing apparatus comprising a plurality of strip light sources each correspond-

ing to a unit line of an image field, terminal means for a plurality of image current channels, means for simultaneously distributing image currents from said terminal means respectively to
5 a like number of said light sources and successively to different light sources, and optical scanning means for rendering effective at each instant the light from a single elemental area of each of said light sources then associated with said terminal means.

10 26. Image producing means comprising strip light sources each corresponding to an elemental line of the receiving field of view, and means for energizing a plurality of said light sources simultaneously to constitute a group and for substituting
15 others of said light sources one at a time and in succession to constitute different groups.

27. Image producing means comprising strip light sources each corresponding to a unit line
20 of an image field, means for energizing a plurality of said light sources simultaneously to constitute a group and for substituting others of said light sources one at a time and in succession to constitute different groups, and optical scanning
25 means for rendering effective at each instant the light from a single elemental area of each said light source then associated with said energizing means.

28. Television image producing apparatus comprising a plurality of strip light sources, a plurality
30 of transmission channels, means for distributing the current received over one channel to a plurality of said light sources one at a time, means for simultaneously distributing the current received over another channel to others of
35 said light sources simultaneously with the first distribution, an apertured element, and means for rotating said apertured element with respect to said light sources for producing the image.

29. Image producing apparatus comprising a
40 plurality of moving strip light sources each corresponding to a unit line of an image field, a plurality of terminal means respectively associated with a plurality of image current channels, and means for simultaneously distributing image
45 currents from said terminal means to different light sources constituting a group and successively to different groups of said light sources.

30. Image producing apparatus comprising a plurality of moving strip light sources, terminal
50 means for a plurality of image current channels, means for distributing image currents from each said terminal means to a different series of said light sources, scanning means, and means for moving said scanning means with respect to said
55 light sources.

31. Image producing means comprising a plurality of moving strip light sources each corresponding
60 to an elemental line of the receiving field of view, means for energizing groups of said light sources in succession, all portions of each light source emitting light when the source is energized, scanning means, and means for moving said scanning means with respect to said
65 light sources.

32. Television image producing apparatus comprising a plurality of parallel moving strip light
70 sources, a plurality of transmission channels, and means for distributing the current received over one channel to a plurality of said light sources one at a time, means for simultaneously distributing the current received over another channel to others of said light sources simultaneously with said first distribution, an apertured element, and means for moving said apertured element with
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respect to said light sources for producing the image.

33. Image producing means comprising a plurality of movable strip light sources, means for simultaneously energizing at least two of said light sources, scanning means, and means for moving said scanning means relatively to said light sources to simultaneously expose successive portions of said energized light sources.

34. Image producing apparatus comprising a plurality of strip light sources, means for moving said light sources across a field of view, a scanning means having a plurality of sets of light directing means lying along different parallel spirals respectively, and means actuating said scanning means for causing said sets of light directing means to move relatively to said light sources for respectively scanning them to produce an image.

35. An image producing apparatus comprising strip light sources moving in one direction across a field of view, scanning means having a plurality of sets of optical apertures lying along different parallel spirals respectively, and means actuating said scanning means for moving said sets of apertures in another direction across said field of view to respectively scan said movable strip light sources for producing an image.

36. An electro-optical system for scanning a field of view comprising a plurality of independent image current transmission channels, a rotating scanning element provided with a plurality of light focussing means to produce a series of moving images of a field of view, the path of each image being laterally displaced from that of a preceding image, and a plurality of apertures so placed that at any given instant during a scanning period one of said moving images will fall upon a number of apertures equal to the number of channels, and means to associate one of said channels with a plurality of said apertures which are not simultaneously receiving light from said images.

37. The method of scanning a field of view for electro-optical image production which comprises associating a plurality of light sensitive means with a plurality of image current transmission channels, respectively, rendering said light sensitive means operable in accordance with the simultaneous scanning of different parts of said field of view, and rendering said light sensitive means operable in succession in accordance with the scanning of said light different parts during each complete scanning.

38. A method of scanning a field of view which comprises producing a time-series of electrical impulses by scanning one portion of a field of view, producing another time-series of electrical impulses by scanning another portion of said field of view simultaneously with the scanning of said first portion, continuing the production of said first time-series of impulses by later scanning said other portion, and continuing the production of said second time-series of impulses by scanning said first portion simultaneously with said later scanning of said other portion, and utilizing said first time-series of

impulses independently of said second time-series of impulses in the production of an image.

39. An electro-optical system for scanning a field of view comprising a plurality of independent image current transmission channels, a plurality of light apertures in a stationary opaque screen equal in number to twice the number of independent channels less one, said apertures being linearly arranged and equally spaced from each other, light sensitive material associated with each channel and energized by light from said apertures to produce image currents, means to produce a succession of images of said field of view each moving at right angles to said linearly arranged apertures and the path of each being displaced laterally from that of the preceding image, means to energize one channel by light received from the middle aperture, and means to energize another channel by light received from two apertures which are separated by a number of apertures equal to one less than the number of channels.

40. An image producing apparatus comprising a cylindrical member having apertures adapted to define unit lines of an image field, light sources respectively supplied with different image current variations for simultaneously illuminating a plurality of said apertures, and means for scanning said simultaneously illuminated apertures.

41. An image producing apparatus comprising a cylindrical member having apertures adapted to define unit lines of an image field, light sources simultaneously supplied with image variations respectively representative of different unit lines of an image for illuminating a plurality of said apertures, and means for scanning the simultaneously illuminated apertures.

42. An image producing apparatus comprising a cylindrical member having apertures adapted to define unit lines of an image field, light sources, carried by said member and supplied with different image current variations, for simultaneously illuminating a plurality of said apertures, and means for scanning said simultaneously illuminated apertures.

43. An image producing apparatus comprising a cylindrical member having apertures adapted to define unit lines of an image field, a plurality of light sources, a plurality of image current channels, means for supplying image variations from the respective channels to different ones of said light sources, respectively, for simultaneously illuminating a plurality of said apertures, and means for scanning said simultaneously illuminated apertures.

44. An electro-optical system comprising a transparency, means for moving said transparency, means for illuminating and scanning successive elemental areas of said transparency, and light sensitive devices each equal in length to a unit line of the image and simultaneously activated by light controlled by elemental areas of different sections of said transparency and successively by the elemental areas of all of said sections.

FRANK GRAY.