

Oct. 31, 1939.

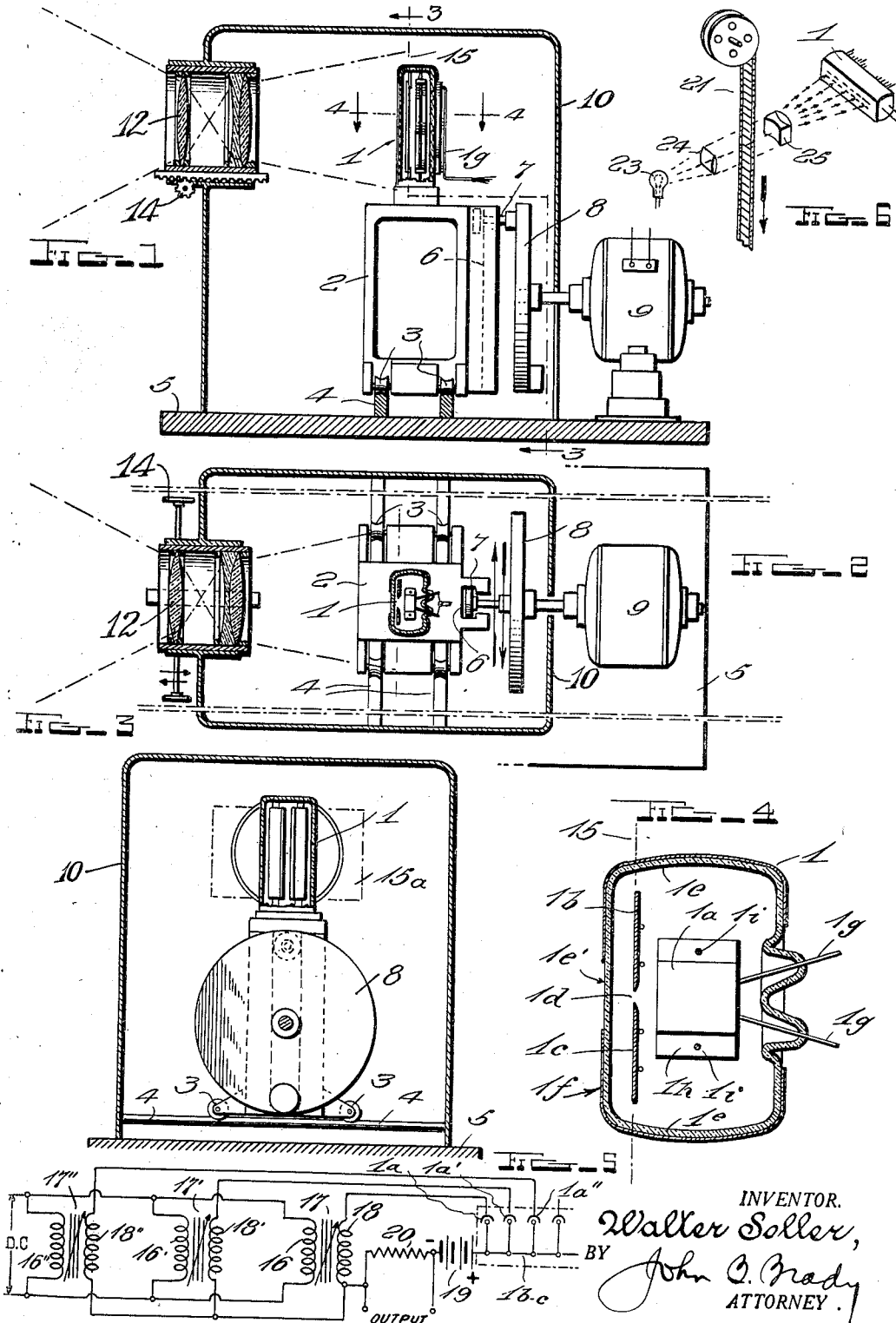
W. SOLLER

2,177,676

TELEVISION SYSTEM AND APPARATUS

Filed Aug. 21, 1937

3 Sheets-Sheet 1



INVENTOR.

Walter Soller,

BY John C. Brady

ATTORNEY.

Oct. 31, 1939.

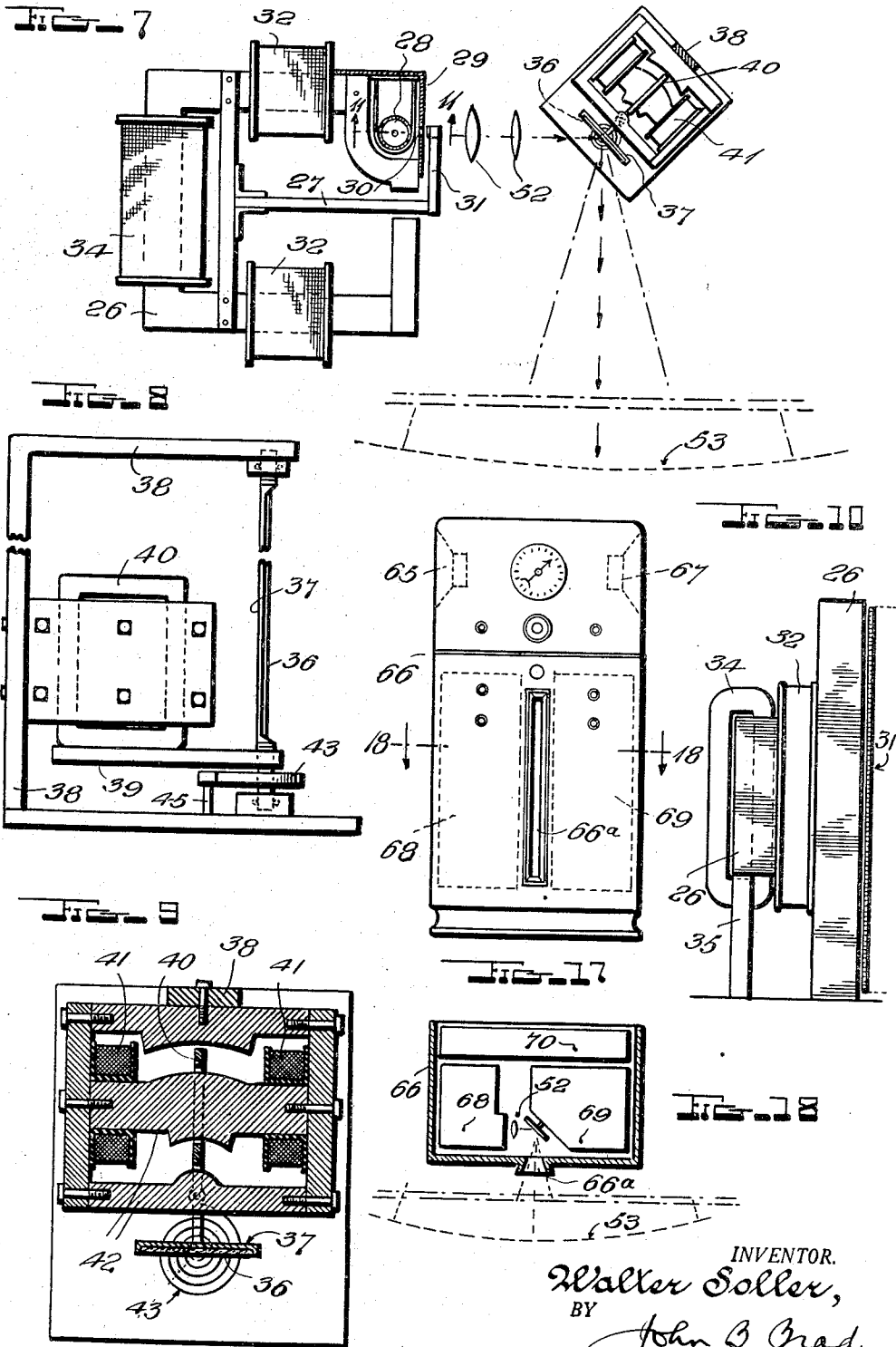
W. SOLLER

2,177,676

TELEVISION SYSTEM AND APPARATUS

Filed Aug. 21, 1937

3 Sheets-Sheet 2



INVENTOR.
Walter Soller,
BY John B Brady
ATTORNEY

Oct. 31, 1939.

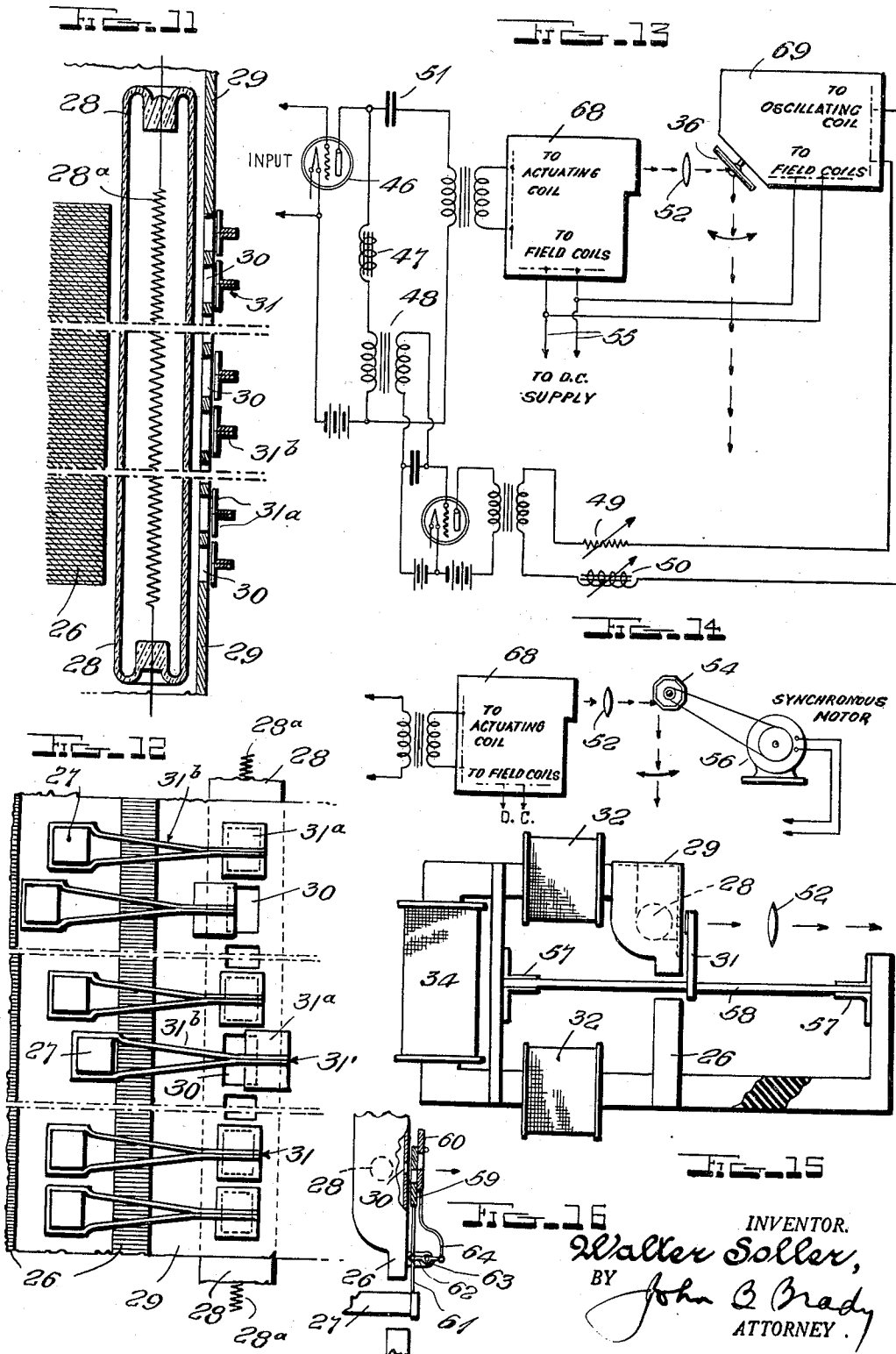
W. SOLLER

2,177,676

TELEVISION SYSTEM AND APPARATUS

Filed Aug. 21, 1937

3 Sheets-Sheet 3



INVENTOR.
Walter Soller,
BY John B. Brady
ATTORNEY.

UNITED STATES PATENT OFFICE

2,177,676

TELEVISION SYSTEM AND APPARATUS

Walter Soller, Cincinnati, Ohio, assignor of one-half to William H. Woodin, Jr., Tucson, Ariz.

Application August 21, 1937, Serial No. 160,332

17 Claims. (Cl. 178—7.6)

My invention relates broadly to television systems and more particularly to a system for transmitting and reproducing images by employing scanning devices functioning in one dimension only.

One of the objects of my invention is to provide a simplified construction of television transmitting and receiving apparatus employing scanning means deflected in one dimension only across the object to be televised.

Another object of my invention is to provide a simplified construction of photosensitive scanning means having a plurality of individual photoelectric elements operative in combination to view simultaneously a linear portion of the object to be televised, the object being scanned solely in a direction substantially normal to the linear portion simultaneously viewed.

A further object of my invention is to provide an electrical circuit arrangement and means for simultaneously modulating a plurality of sub-carrier currents by the light intensity on a plurality of points in an object scanned, each sub-carrier current bearing modulations of a linear portion of the object in the direction of scanning of the object by a linear scanning element extending normal to the direction of scanning.

Still another object of my invention is to provide a simplified arrangement of television receiving means for cooperation with the type of transmitter described, and wherein a plurality of vibratory light shutters are operated by electromechanical selective devices actuated by the currents of sub-carrier frequency in the received wave.

A still further object of my invention is to provide means at the receiver, cooperative with a beam of light comprising a plurality of rays of varying intensity, for deflecting such beam of light across a screen in synchronism with scanning means at the transmitter.

Still another object of my invention is to provide means for transmitting images from photographic motion picture film by viewing the film across its width simultaneously by a plurality of light sensitive elements arranged linearly, the film being scanned by relative motion of the film and the light sensitive elements in a direction along the length of the film, which may be effected by moving the film at constant speed across a linear viewing aperture.

A still further object of my invention is to provide translating means in a television receiver operative by a complex current comprising a plurality of separately modulated currents of different frequencies, the translating means providing frequency separation and light modulation simultaneously in the same structure.

A further object of my invention is to provide a television system requiring a relatively narrow frequency band by virtue of electromechanical, selectively responsive tuned vibrating elements.

Other and further objects of my invention reside in the structure and arrangements of television apparatus hereinafter fully described with reference to the accompanying drawings in which:

Figure 1 is a side elevation partly in section of the television camera apparatus of my invention; Fig. 2 is a plan view thereof with parts in section; Fig. 3 is a vertical sectional view thereof taken on line 3—3 in Fig. 1; Fig. 4 is a horizontal section on an enlarged scale, taken on line 4—4 in Fig. 1 through the photoelectric device employed in my invention; Fig. 5 is a schematic diagram of the circuit connections of the modulating system of my invention; Fig. 6 is a diagrammatic showing of the adaptability of the system of my invention to the transmission of images from photographic motion picture film; Fig. 7 is a plan view of receiving apparatus cooperative in the television system of my invention, showing the arrangement of reciprocity or oscillating synchronizing means and frequency selective and translating means; Fig. 8 is an elevation on an enlarged scale of the oscillating mirror support and actuating means; Fig. 9 is a horizontal sectional view thereof on line 9—9 in Fig. 8; Fig. 10 is a full elevation on a smaller scale of the frequency selective and translating means, showing especially the foreshortened core structure for mounting the field and the actuating coils; Fig. 11 is an enlarged detail view in section on line 11—11 in Fig. 7; Fig. 12 is a front elevation on an enlarged scale of the shutter mechanism, which is shown also in Figs. 7 and 11; Fig. 13 is a schematic diagram of the circuit arrangement in the receiving system of my invention; Fig. 14 diagrammatically illustrates a modified form of synchronizing device which may be employed with the scanning arrangement of Fig. 6; Fig. 15 illustrates a modified form of the structure shown in Fig. 7, particularly adapted for the selection of higher sub-carrier frequencies; Fig. 16 is a detailed view of a modified form of shutter mechanism; Fig. 17 is a front view of a radio and television receiver cabinet showing the relation of the apparatus of my invention; and Fig. 18 is a horizontal sectional view at line 18—18 in Fig. 17 illustrating the apparatus of Fig. 7 within the cabinet.

My invention employs mechanical scanning apparatus broadly of the type operating in one dimension and scanning the object in linear elements. The subdivision of the linear elements into substantially point units is effected by a special construction of photoelectric device comprising a stack of photosensitive elements each individually insulated and connected with a sub-carrier channel in the system. A common anode is employed in the photoelectric device, cooperating with all the photosensitive elements. The effect of scanning apparatus of this type is a division of the image into "lines" along only one dimension, the vision in the other dimension being blended in accordance with the smoothness of operation of the scanning mechanism.

The number of lines which may be accommodated in the system of my invention is adaptable to the degree of precision desired. A transmitter employing upwards of 500 lines along the subdivided dimension may serve receivers of different capacities up to the maximum number of lines provided at the transmitter. Receivers of less than maximum capacity may be designed to reproduce the entire image transmitted but with a sacrifice of clarity by selecting for reproduction only certain ones of the lines transmitted. Other receivers of less than maximum capacity may be designed to reproduce the central portion only of the image, with full clarity, which will be satisfactory inasmuch as the principal action in the view generally occurs in the central portion thereof.

Referring to the drawings in more detail, Figs. 1-3 illustrate an arrangement employing a multiple photoelectric device 1, mounted on a reciprocatory carriage 2, which is mounted by means of rollers 3, on rails 4, disposed crosswise of the supporting structure indicated generally at 5. The carriage 2 as shown is adapted to be driven through a Scotch yoke mechanism, comprising a slot 6, in the carriage 2, and an eccentric drive member 7 mounted on a flywheel 8, driven by synchronous motor 9. It will be understood that any suitable reciprocatory drive mechanism may be employed for moving the photoelectric device 1 in lieu of the Scotch yoke mechanism shown.

A casing 10 is mounted on the base structure 5 and encloses the reciprocatory photoelectric assembly. An optical lens system 12 is mounted in the forepart of the casing 10 and provided with adjusting means 14 for focusing an image of the object to be televised in the plane indicated at 15. The photoelectric device 1, as seen more clearly in Fig. 4 comprises a series of conductive laminations 1a having the forward edges thereof photosensitive. Disposed in front of the photosensitive assembly, formed by the photosensitive edges of the conductive laminations, is an anode structure comprising two elongated plate members 1b and 1c arranged with a vertically extending narrow slit 1d separating the two members. This slit 1d constitutes the scanning slit of the apparatus and the plane 15 of the image focused by lens system 12 coincides with the reciprocatory path of the slit 1d, as indicated clearly in Fig. 4. The portion of the image in the plane 15, scanned by the slit 1d, is indicated in Fig. 3 at 15a which defines the frame of the image transmitted.

Referring again to Fig. 4, the photosensitive and anode assemblies are supported within an envelope 1e, having a plane transparent portion 1e', in front of the slit 1d, and the remainder of the surface thereof rendered opaque by a coating 1f. Connections are made to the conductive,

photosensitive laminations 1a, in staggered arrangement by conductors 1g passing through the wall of the envelope 1e. Connections to the anode structure are made in a similar manner, as will be understood. Intermediate the conductive laminations 1a are arranged insulating laminations of mica or like material. The conductive and insulating laminations are supported between end plates 1h and clamped by bolts 1i.

Fig. 5 indicates schematically an arrangement of modulating system employing the multiple frequency mechanical alternator device shown in my copending application Serial Number 733,300, filed June 30, 1934 for Television system. Coils 16, 16', 16''..., are energized by direct current to produce magnetic fields in the core structures 17, 17', 17''.... The reluctance of the magnetic circuits is mechanically varied at different frequencies so that alternating currents of different frequencies are induced in the coils 18, 18', 18''.... The photosensitive elements 1a, 1a', 1a''..., are connected respectively with one terminal of the coils 18, 18', 18''..., and the anode structure is connected through a source of potential 19, and a load resistance 20 in common with the other terminals of coils 18, 18', 18''.... Output terminals are connected across the resistance 20, as shown, the current therethrough being a complex current having as components the modulated sub-carrier currents from the several coils 18, 18', 18''..., and photosensitive elements 1a, 1a', 1a''....

Fig. 6 illustrates an arrangement for the use of photographic motion picture film as the source of images to be transmitted. The film indicated at 21 is arranged so that its direction of motion is normal to the axis of the photoelectric device 1. Light rays from a source 23 are paralleled by lens 24 and passed through the film 21, and thence through a spreading lens arrangement 25 so as to embrace the longitudinal dimension of the photoelectric device 1 and the series of photosensitive elements therein, as indicated. Reciprocatory movement of the photoelectric device 1, either vertically, or horizontally hereinbefore described, is necessary when the film is moved intermittently, in which case, the intermittent movement of the film should be synchronized at the transmitter with the scanning period. However, it is possible to transmit from the film by running it at a constant speed relative to a stationary photoelectric device 1. In this arrangement however, rotary synchronous means must be provided at the receiver, as will be hereinafter more fully set forth.

Fig. 7 illustrates an arrangement of translating apparatus which may be employed in conjunction with the transmitter hereinbefore described with respect to Figs. 1-5. The apparatus comprises a laminated magnetic core structure 26, with opposite poles thereof embracing a series of magnetic vibratile tuned reeds indicated generally at 27. One pole of the core structure is recessed as at 26a to provide a mounting for an elongated tubular lamp 28 having a filament 28a or other means producing luminescence within the lamp for a space corresponding in length to the poles of the core 26, as shown more clearly in Fig. 11. The lamp 28 is shielded by a covering member 29 having a series of apertures 30 aligned with the lamp 28. These apertures 30 are individually closed by shutter devices, indicated generally at 31, connected with the tuned vibratile reeds 27.

Mounted on the core structure 26 are a pair of

coils 32 fed with direct current from a suitable source of supply for magnetizing and creating a magnetic field of optimum flux density; and also mounted on the core structure is an actuating coil 34 fed with the complex current which resulted from the modulation at the transmitter of a plurality of sub-carrier currents of different frequencies. In operation, the tuned vibratile reeds 27 individually respond to the magnetic effect of the subcarrier currents of corresponding frequency, and are disposed in amplitudes proportional to the amplitude modulations of the corresponding sub-carrier currents.

As indicated in Fig. 12, the shutter devices 31 when displaced uncover the apertures 30 in varying degrees, permitting light in varying intensities to be observed. The effect of such operation is the production of a heterouminuous beam of light formed of individual rays of varying intensity disposed in linear relation. Each shutter device 31 is formed of a single piece of die-cut sheet metal having wings bent to provide a shutter portion 31a and a supporting portion 31b offering minimum obstruction to light when the shutter is displaced to positions as indicated by shutter 31' in Fig. 12. The supporting portion 31b is fixed to a reed by soldering or brazing, or in any suitable manner.

As illustrated in Fig. 10, the portion of the core structure 26 on which coils 32 and 34 are mounted is foreshortened to facilitate construction and design, while the pole portions of the core are of a length necessary to embrace all of the tuned vibratile reeds. A support 35 is provided under the foreshortened portion of the core structure 26.

Figs. 8 and 9 illustrate in more detail the oscillating mirror structure adapted to be synchronized with the reciprocation of the photoelectric device 1, at the transmitter. The apparatus comprises an elongated mirror, 36 of a length adapted to correspond to that of the lamp 28, mounted in a support 37 pivoted at its upper and lower ends in antifricition bearings mounted in a frame structure 38. Actuating means for oscillating the mirror, as shown particularly in Fig. 9 consist of an arm 39 extending from the support 37, and mounting an actuating oscillating coil 40, which is disposed in a constant magnetic field provided by field coils 41 and fixed core structure 42. The oscillating coil is fed with synchronizing current from the television receiver and operates within a limited arc. Adjacent the lower pivot of the support 37, I provide a spiral spring device 43 fixed to the support 37 and a pin 45 connected with the frame structure 38. The spiral spring 43 is so constructed with respect to the mass of the oscillating assembly, including supports 37 and 39, mirror 36 and coil 40, that the combination constitutes a torsional pendulum oscillating at substantially the frequency of the scanning operation at the transmitter. Thus, the synchronizing current fed to the coil 40 need only be of such magnitude as to maintain synchronism and overcome friction in the oscillating assembly.

The general arrangement of the circuit connections in the receiving system of my invention is shown in Fig. 13, wherein the demodulated radio frequency energy comprising synchronizing and modulated sub-carrier components, is impressed on the grid circuit of a final amplifier tube 46. In the anode circuit of the tube, a selective path is provided through a choke coil 47 and a transformer 48, having a tuned secondary, to

separate the current of synchronous frequency which is then further amplified if necessary, and fed to the oscillating coil 40 of the reconstructing apparatus. Amplitude and phase adjusting means are provided at 49 and 50, respectively, in the synchronizing circuit. Also, in the anode circuit of tube 46, I provide a path, including low frequency blocking condenser 51 for excluding synchronizing currents of scanning frequency, by which the complex current comprising modulated sub-carrier currents is impressed on the actuating coil 34 of the translating apparatus. Connections to the field coils of the translating and reconstructing apparatus are indicated at 55.

As shown in Fig. 7 and further indicated in Fig. 13, light rays passing through apertures 30 are directed through focusing lens means as at 52 and reflected by mirror 36 onto a screen 53, which is placed at a predetermined distance from the mirror. It will be understood that the vertical dimension of the image is determined by the height of the elongated lamp 28 and the series of shutters 31, whereas the width is dependent upon the arc of oscillation of the mirror 36 and the distance to the screen 53.

Referring to the transmitting arrangement indicated in Fig. 6 and the conditions for transmitting from a constantly driven film, Fig. 14 illustrates the modified form of receiver required to reconstruct the image thus transmitted. In place of the oscillatory mirror 36, a rotary mirror 54 is provided and arranged to be driven by a synchronous motor 56, maintained in synchronism with the film driving means at the transmitter. It will be understood that the mirror 36 deflects the beam of light rays from lamp 28 across the screen 53 once for each "frame" of the motion picture film. Also, it will be further understood that in the conventional arrangement such reconstruction will be in a vertical direction, in differentiation from the horizontal oscillatory deflections. The arrangement as described in connection with Fig. 6 contemplates this vertical scanning arrangement, but it is to be understood that when the film is run intermittently, the directional relation of the photoelectric device 1 and the film may be altered so that each "frame" in the film is scanned crosswise while stationary and intermittent movement of the film is synchronized with the scanning operation. Under these conditions the preferred oscillatory mirror reconstructing apparatus is employed as hereinbefore described.

The modified form of translating apparatus shown in Fig. 15 is adaptable for the support of vibratile reeds tuned for higher frequencies of vibration. The relatively more rigid construction provides a support 57 at both ends of reeds 58, which although longer than the reeds 27 are designed for higher frequencies of vibration. Shutters 31 are affixed to the reeds 58 as hereinbefore described and the modified structure is otherwise similar to that shown in Fig. 7. Tuned vibratile reeds are provided to cover a substantial audio or super-audio frequency band and it is intended therefore that the reeds be constructed and mounted in such manner as to vibrate at the required frequencies. It may be that in some instances magnetic wires may be found more adaptable for higher frequencies of vibration, in which case the modified form shown in Fig. 15 may be employed with a fixed support for the wires at one side and individual tuning means at the other. The reeds or wires are adapted to vibrate at their fundamental frequency whereby

the point at which the shutters are fixed vibrates with the maximum amplitude for any condition.

Fig. 16 illustrates a modified form of shutter arrangement which comprises a pair of apertured plates 59 and 60 superimposed over the aperture 30 with the apertures therein normally out of alignment and closed. The plate 59 is supported by rod 61 fixed to a tuned vibratile reed 27 and pivotally connected with one end of a crank member 62 supported on a rod 63, which may extend the length of the core structure 26 for supporting each crank member. The plate 60 is mounted on rod 64 pivotally connected with the other end of the crank member 62. In operation, when the reed 27 is displaced upwardly, as seen in Fig. 16, plate 59 is moved upwardly and plate 60 downwardly, bringing the apertures therein in alignment opposite aperture 30 and lamp 28. The degree of opening through the apertures in the plates 59 and 60 is proportional to the deflection of the reed 27.

In Figs. 17 and 18 I have indicated the manner in which the television receiving apparatus of my invention, shown in Fig. 7, is mounted in a cabinet structure, 66, in combination with a radio receiver. In the upper portion of the cabinet I provide a radio receiver with sound reproducing means indicated at 65 and 67. In the lower portion of the cabinet 66 are mounted the means 69, with the focusing lens 52, which may be adjustable, as shown more clearly in Fig. 18. A power supply unit is included at 70. The oscillating mirror 36 is disposed adjacent the front of the cabinet and an elongated opening 66a is provided in the cabinet in alignment with the mirror, through which the beam of light from lamp 23, within the apparatus at 68 is reflected. The screen 53 is provided on an opposite wall of the room, the required distance from the receiver. Adjustable lens 52 permits limited variation of the distance. A receiver accommodating 480 lines and allowing one-sixteenth inch height for each shutter requires a lamp, lens and mirror approximately thirty inches in height, and a corresponding height of aperture 66a in the cabinet. Such a receiver produces an image approximately thirty by fifty inches at a distance of about ten feet with an angle of oscillation of about twenty-five degrees.

While I have described my invention in certain preferred embodiments, I desire it understood that modifications may be made and that I intend no limitations upon my invention except as may be imposed by the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In a television system, in combination, means for unidirectionally scanning an object to be televised by simultaneously modulating a plurality of sub-carrier currents of different frequencies by the light intensity on a corresponding plurality of linearly disposed points in the object; and means for reproducing an image of the object televised comprising a source of light, means individually responsive to the sub-carrier currents and so constructed and arranged with respect to said source of light that light from said source is varied in intensity in accordance with the modulation of said sub-carrier currents, means for deflecting the light from said source in synchronism with said scanning means, and a screen disposed in the path of the deflected light.

2. In a television system, in combination, means for unidirectionally scanning an object to

having a plurality of photosensitive elements disposed in linear relation, and means for moving said device in a reciprocatory path for scanning an object to be televised, the light intensity on each of said photosensitive elements being employed to modulate a separate sub-carrier current; and means for reproducing an image of the object televised comprising a source of light, means individually responsive to the sub-carrier currents and so constructed and arranged with respect to said source of light that light from said source is varied in intensity in accordance with the modulation of said sub-carrier currents, means for deflecting the light from said source in synchronism with said scanning means, and a screen disposed in the path of the deflected light.

3. In a television system, in combination, means for unidirectionally scanning motion picture film having a series of images to be televised comprising a photo-electric device having a plurality of photosensitive elements disposed in linear relation parallel with the width of said film, and means for moving said film at a constant speed with respect to said photoelectric device, the light intensity on each of said photosensitive elements being employed to modulate a separate sub-carrier current; and means for reproducing the images televised comprising a source of light, means individually responsive to the sub-carrier currents and so constructed and arranged with respect to said source of light that light from said source is varied in intensity in accordance with the modulation of said sub-carrier currents, means for deflecting the light from said source in synchronism with said scanning means, and a screen disposed in the path of the deflected light.

4. The combination defined in claim 3 with the last said means comprising a rotatable mirror device so constructed and arranged that light from said source is deflected in a predetermined arc in synchronism with the scanning of each image on said film.

5. In a television system, in combination, means for unidirectionally scanning motion picture film having a series of images to be televised comprising means for intermittently driving said film, a photoelectric device having a plurality of photosensitive elements disposed in linear relation, and means for moving said device in a reciprocatory path in synchronism with the intermittent movement of said film for scanning each image thereon, the light intensity on each of said photosensitive elements being employed to modulate a separate sub-carrier current; and means for reproducing the images televised comprising a source of light, means individually responsive to the sub-carrier currents and so constructed and arranged with respect to said source of light that light from said source is varied in intensity in accordance with the modulation of said sub-carrier currents, means for deflecting the light from said source in synchronism with said scanning means, and a screen disposed in the path of the deflected light.

6. The combination defined in claim 5 with the last said means comprising an oscillatory mirror device so constructed and arranged that light from said source is deflected in a predetermined arc in synchronism with the reciprocation of said photoelectric device and the intermittent movement of said film.

7. The combination defined in claim 2 with

the last said means comprising an oscillatory mirror device so constructed and arranged that light from said source is deflected in a predetermined arc in synchronism with the reciprocation of said photoelectric device.

8. In a television system, means for unidirectionally scanning an object to be televised comprising a photoelectric device having a plurality of photosensitive elements disposed in linear relation, and means for moving said device in a reciprocatory path for scanning the object, including a carriage for said device having rollers, rails engaged by said rollers, and reciprocating motor means connected with said carriage.

9. In a television system, a photoelectric device for unidirectionally scanning an object to be televised comprising an envelope, a plurality of photosensitive cathode elements disposed in linear relation within said envelope, an anode structure comprising a pair of plate members co-extensive with said cathode elements and disposed with adjacent longitudinal edges thereof separated so as to form a slit adapted to pass a beam of light to said photosensitive cathode elements, said envelope being transparent in the portion thereof adjacent said slit, and connections from each of said cathode elements and said anode structure extending through said envelope, said photoelectric device being adapted to scan an object by relative movement thereof with respect to said object in a direction normal to the photosensitive elements in said linear relation, the light intensity on each of said photosensitive elements being employed to modulate a separate sub-carrier current.

10. In a television system, means for reproducing an image of an object televised from a complex current including a plurality of modulated sub-carrier currents of different frequency, comprising translating means including means individually responsive to the sub-carrier currents for producing a heteroluminous beam of light formed of individual rays of light corresponding in number to and varying in intensity respectively with said modulated currents, reconstructing means including means for deflecting said beam in accordance with a predetermined scanning operation, and a screen disposed in the path of the deflected beam.

11. In a television system, means for reproducing an image of an object televised from a complex current including a plurality of modulated sub-carrier currents of different frequency, comprising an elongated light source, a cover therefor having a series of linearly disposed apertures corresponding in number to said modulated currents, individual closure members for the apertures in said cover, and means including a corresponding plurality of tuned vibratile members individually responsive to said modulated currents for actuating said closure members in varying amplitudes dependent upon the modulations of the respective modulated current, whereby a heteroluminous beam of light is produced, means for deflecting said beam in accordance with a predetermined scanning operation, and a screen disposed in the path of the deflected beam.

12. In a television system, means for reproducing an image of an object televised, as set forth in claim 11 and wherein said closure member actuating means includes a magnetic core structure having an actuating coil mounted thereon and energized by the complex current, said tuned

vibratile members being magnetic and disposed with respect to said core structure for actuation by the magnetic field produced by the complex current in said actuating coil, each of said tuned vibratile members being individually responsive to the component of corresponding frequency in the complex magnetic field.

13. In a television system, means for reproducing an image of an object televised, as set forth in claim 11 and wherein closure member actuating means includes a substantially U-shaped core structure having elongated pole pieces and an actuating coil energized by the complex current, and means for mounting said tuned vibratile members by one end thereof with the opposite end disposed between said pole pieces, said tuned vibratile members being magnetic and adapted to be individually responsive to the component of corresponding frequency in the complex magnetic field produced by said complex current.

14. In a television system, means for reproducing an image of an object televised, as set forth in claim 11 and wherein said closure member actuating means includes a substantially U-shaped core structure having elongated pole pieces and an actuating coil energized by the complex current, and means for mounting said tuned vibrating members at opposite ends thereof with the middle portions thereof disposed between said pole pieces, said tuned vibratile members being magnetic and adapted to be individually responsive to the component of corresponding frequency in the complex magnetic field produced by said complex current.

15. In a television system of the type described, employing an elongated lamp as a source of light for reproducing an image, in combination therewith a plurality of linearly disposed shutter members each comprising a strip member folded substantially upon itself and having a wing portion at each extremity bent so as to lie in a single plane and constituting the shutter portion of the member, the folded portion of the member having actuating means connected therewith for controlling the operation of said shutter portion.

16. In a television system of the type described, employing an elongated lamp as a source of light for reproducing an image, in combination therewith a plurality of linearly disposed shutter devices each comprising a pair of apertured plate members normally disposed with the apertures therein closed by overlapping portions of the plate members, a pivoted crank member, a pair of rod members connected with said plate members respectively and with opposite ends of said crank member, one of said rod members having actuating means connected therewith, said plate members being adapted to move in opposite directions whereby the apertures therein move into alignment for effecting the operation of said shutter device.

17. In a television receiving system of the type described, employing an elongated lamp as a source of light for reproducing an image, and synchronized means for deflecting a heteroluminous beam of light from said lamp, in combination therewith a cabinet structure housing said means and having an elongated flared opening therein for permitting the deflected beam to be directed to a predetermined distance outside said cabinet structure, said distance being in proportion to the length of said elongated opening.

WALTER SOLLER.