

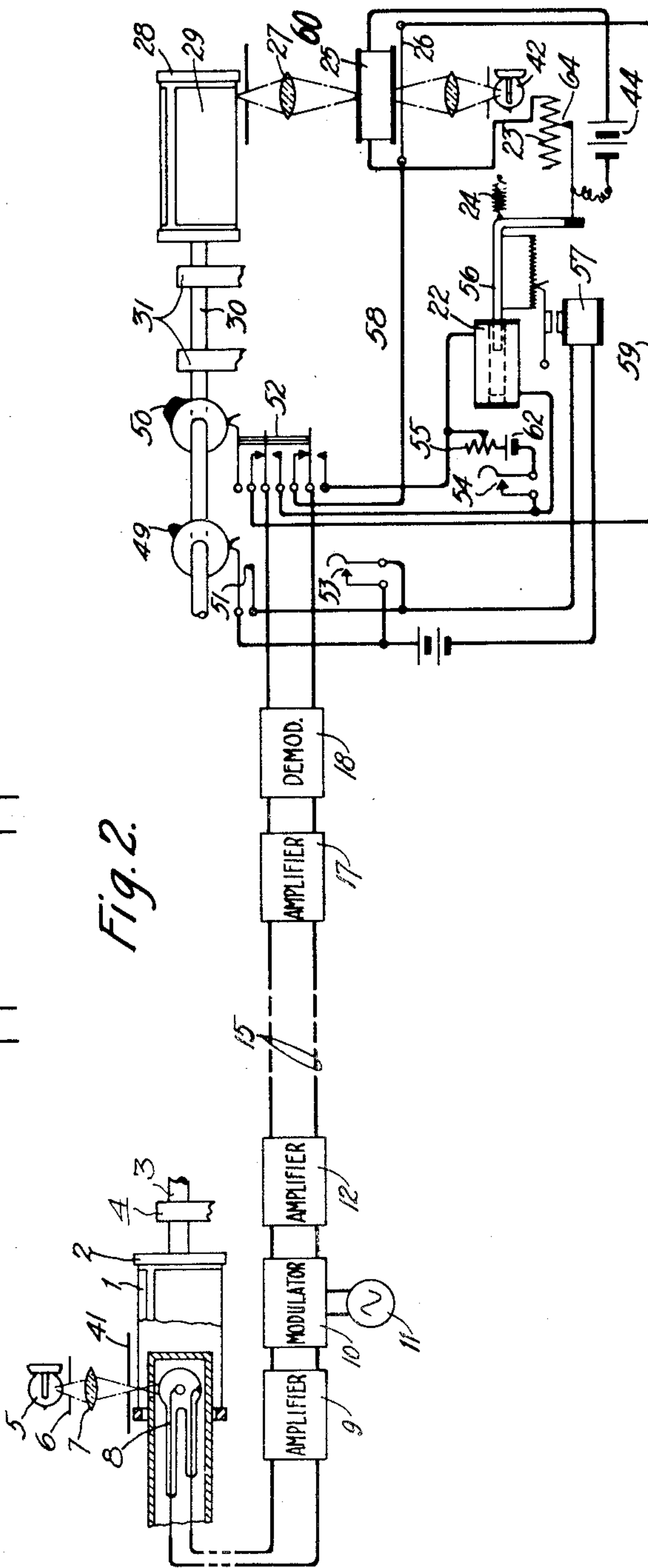
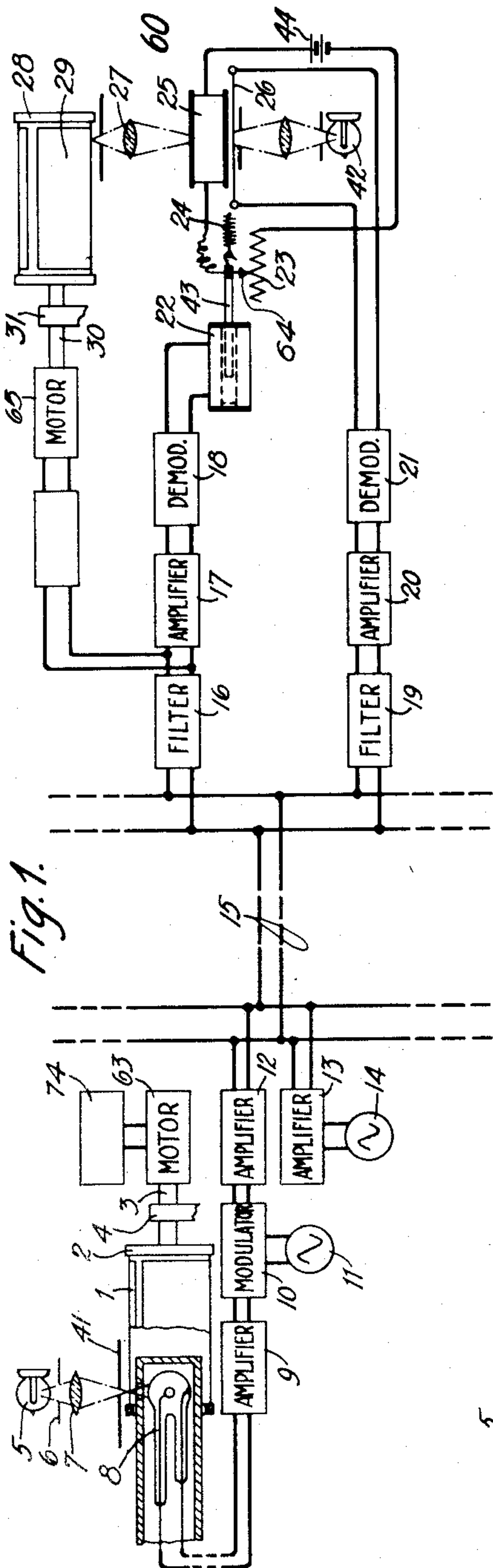
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H. E. IVES

PICTURE TRANSMISSION

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PICTURE TRANSMISSION.

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This invention relates to picture transmitting and receiving systems and more especially to method and means for compensating for variations in the energy level of a transmission line utilized in such systems.

In those types of picture transmission systems where gradations of shades of the elemental areas of a reproducing film are determined by means of received carrier currents, it is necessary if uniformity of like shades is to be maintained throughout the picture that the reproducing apparatus be unaffected by changes in the transmission characteristics of the system. Such changes may be produced by a variety of conditions which are not controllable directly, such for example as changes in atmospheric conditions, temperature conditions and the like. In systems for transmission by wire these external changes result in a lowering or raising of the transmission level of the line and corresponding changes in the elemental areas of the picture which should be of like degree of shade.

The principal object of this invention therefore is to improve picture transmission systems by incorporating therein novel means to compensate for changes in energy level of a transmitting medium.

One feature of the invention has reference to a picture transmission system wherein the picture reproducing means is unaffected by changes in the attenuation of the received picture currents.

Another feature of the invention relates to a light control device at a receiving station, said device being controlled jointly by received picture currents and by a special compensating current transmitted to the receiving station.

The term "light" as used herein includes not only radiations within the visible spectrum, but also radiations having wave lengths above and below those of the visible spectrum.

It is to be understood that the terms used herein both in the specification and claims do not limit this invention to the production of a picture record at the receiver from a picture record at the transmitter. The invention is equally applicable to systems, for example, in which a transitory image is produced at the receiver as in certain forms of television systems.

The drawing which illustrates a number of ways of practising the invention consists of

two figures. Fig. 1 shows in schematic form a picture transmission system comprising a sending station and a receiving station and employing two channels, one a picture current channel and the other a compensating current channel. Fig. 2 shows schematically a system similar to that shown in Fig. 1 but with a single channel used for both picture currents and compensating currents.

The invention as herein set forth is particularly well adapted to be used in a picture transmitting and receiving system of the general character described and claimed in the patent of J. W. Horton, H. E. Ives, M. B. Long, No. 1,606,227, issued Nov. 9, 1926. Reference may be had to said application for a description of the organization and a description of the method of operation of apparatus which is disclosed in the present application in a comparatively general manner. In the main, such a system comprises a transparent drum 2 mounted on shaft 3 which rotates in threaded bearing 4. By means of a motor 63, controlled by synchronizing apparatus 74, shaft 3 is rotated and as a result of the threaded portion of shaft 3, drum 2 is rotated and simultaneously moved transversely. The picture film 1 is so mounted on drum 2 that there is a portion of the drum exposed between the picture edges. The part of the revolution of drum 2 during which the drum is so exposed is termed the "under-lap" period. Light from a source 5 is focused, by means of a suitable optical system represented by the lens 7, upon the film 1, the size of the elemental area of the film which is exposed being determined by an adjustable baffle plate 41. The light rays after passing through the picture film and the transparent drum impinge upon the active element of the photoelectric cell 8.

As a result of the rotation and transverse movement of drum 2, the film 1 is scanned in a continuous helical path and the amount of light reaching cell 8 varies in accordance with the changes in the shade characteristics of the successive exposed elements. The current thus generated in photoelectric cell 8 is amplified by means of amplifier 9 and the output circuit of this amplifier is connected with the oscillator modulator 10, 11. Before reaching the transmission line 15, however, the picture currents are again amplified by means of terminal amplifier 12. A second source of oscillations 14, is provided for the purpose

of synchronizing and compensating for changes in the transmission level of line 15 as will appear hereinafter. The frequency of the current from source 14 is preferably of
 5 a different order from that generated by the source 11 in order to reduce inter-modulation between the picture and control currents.

At the receiving station the picture currents after passing through the high-pass
 10 filter 19 are amplified by the device 20 and de-modulated by the device 21. The de-modulated currents then pass through the string 26 of light valve 60. The amount of
 15 light from source 42 passing through the light valve is determined not only by the amplitude of the currents from de-modulator 21, but also by the strength of the field produced by the winding 25 of the light valve. Accord-
 20 ingly the control currents from source 14, after passing through the low-pass filter 16, the amplifier 17, and de-modulator 18, energize the winding of the solenoid 22. The
 25 plunger 43 is adapted to be attracted by solenoid 22 and carries at its outer end a sliding contact 64 which cooperates with resistance 23 to vary the current through the winding 25 of the light valve.

It will be noted that the position of sliding contact 64 is determined by the tension of
 30 spring 24 and the amplitude of the current from de-modulator 18, the amplitude of the de-modulated current being a function of the attenuation of the received carrier currents. In a similar manner the current through the
 35 light valve string 26 is also a function of the transmission characteristics of line 15. Accordingly when the received picture currents are more than normally attenuated, the current flowing through the string 26 corre-
 40 sponding to a given shade of the picture element being transmitted, is reduced. By means of sliding contact 64, however, the strength of the the field winding 25 is increased in a sufficient proportion to overcome
 45 the decrease of current through string 26.

Let it be assumed that a standard condition of line 15 exists and that a given shade of the picture element such as black is being
 50 transmitted. In this case, for the transmission of black the amplitude of the received picture carrier is maximum and the light valve opening is also maximum. This is taken care of by adjusting the tension of
 55 spring 24 to include a predetermined value of resistance 23 in series with winding 25. Should the received carriers, both picture and control, be reduced in amplitude due to a lowering of the transmission level, then the
 60 current through the light valve string 26 is correspondingly reduced, as well as the current through solenoid 22. Under tension of spring 24, contact 64 moves to the right and reduces the value of the resistance in series with winding 25. Thus for a given degree
 65 of shade to be recorded, the reduction of the

current through the light valve string is compensated for by an increase of current through the field winding 25. As may be gathered from an inspection of Fig. 1 the re-
 70 ceived control carrier passed by filter 16 may be utilized to synchronize the motor 65 in the manner described in detail in the application of Horton, Ives, Long to which reference has already been made.

Fig. 2 shows schematically a picture trans-
 75 mission system similar to that shown in Fig. 1 but with a single channel used for both picture currents and compensating currents. Referring to Fig. 2, apparatus corresponding to similar apparatus shown in Fig. 1 bear
 80 the same numerical designations. In this case, however, the source of carrier current 11 serves both for picture currents and control currents. During the part of the revolution of the sending drum 2, that picture
 85 film 1 is exposed to the light from source 5, the output of cell 8 is varied by the picture characteristics and is then amplified by amplifier 9. The amplified picture currents, by
 90 means of device 10, cause the carrier current from source 11 to be modulated accordingly. At the receiving station shown in the right
 95 of Fig. 2, the carrier currents are amplified by device 17 and demodulated by device 18. The output of demodulator 18 is connected by means of contacts of switch 52 and conduc-
 100 tors 58 and 59 to the light valve string 26. String 26 therefore responds to the demodulated currents to vary the amount of light reaching the receiving film 29. It is to be
 105 noted that during the picture transmission period of each revolution of drum 28, switches 51 and 52 are in the position shown in the drawing. During the underlap period
 110 respectively to operate the same. Cam 50 is so positioned on the shaft 30 as to operate switch 52 slightly in advance of the operation of switch 51. Switch 52 when operated transfers the demodulated carrier current to
 115 the winding of magnet 22. Magnet 22 is, therefore, energized to an extent depending upon the transmission level of the line 15. A short interval later cam 49 operates switch 51 to close an obvious energizing circuit for
 120 magnet 57. Magnet 57 when so energized withdraws its armature from engagement with the toothed portion of plunger 56, whereupon said plunger is free to assume a position determined by the resultant of the
 125 energization of magnet 22 and the tension of spring 24. Switch 51 is only momentarily closed and when said switch is reopened magnet 57 is deenergized and its armature engages the plunger 56 to hold the same in its
 130 adjusted position.

Plunger 56 has attached thereto a sliding contact 64 which cooperates with resistance 23 to determine the current flow through the winding of field magnet 25. Since the posi-

tion of the sliding arm is a function of the amplitude of the received carrier, which in turn is determined by the transmission level of line 15, the amount of light passed by valve 50 is also a function of this transmission level. Furthermore, the compensating effect of resistance 23 is in inverse proportion with respect to the changes in attenuation of the received carrier.

For the purpose of adjusting the receiving apparatus to correspond to a standard condition of line 15, prior to the reception of pictures, key 54 is operated, and current from battery 62 flowing through winding 22 is adjusted by means of rheostat 55 to a value corresponding to the amplitude of the unmodulated carrier when line 15 is in a standard condition. When the current has been so adjusted, key 53 is temporarily closed to release the armature of magnet 57 from engagement with plunger 56. Sliding contact 64 therefore assumes a position which is determined by the energization of magnet 22 and the retractile effort of spring 24, thus giving a predetermined current flow through the winding 25 of the light valve. Key 53 is then restored, allowing the armature of magnet 57 to reengage plunger 56 to hold the same in its adjusted position. Key 54 may now be restored and the receiving apparatus is in readiness to reproduce the picture.

In my copending application, Serial No. 51,309, filed August 20, 1925, I have disclosed and claimed broadly compensating means controlled by variations in the energy level as applied to a picture transmission system.

What is claimed is:

1. In a picture transmission system, the method of maintaining uniform reproduction which comprises producing two mutually reacting magnetic fields to control the passage of light rays, controlling one of said fields by received picture currents and controlling the other field in accordance with the transmission characteristics of the system.

2. In a picture transmission system, a sending station, a receiving station, a transmission line interconnecting said stations, means for sending picture currents over said line, means for sending control currents over said line, an element having a picture reproducing surface at said receiving station and a source of light therefor and means controlled by the received picture and control currents for producing mutually reactive magnetic fields to control the amount of light reaching said surface from said source.

3. In a picture transmission system, a sending station, a receiving station, a transmission line interconnecting said station, means for sending over said line currents modulated in accordance with picture characteristics, means for sending test currents over said line, a source of light, an element having a picture reproducing surface and an electromagnetic

control device at said receiving station, a field winding for said device, means for energizing said field winding under control of said test currents, and means for applying said picture currents to said device to control the amount of light reaching said surface from said source.

4. In a picture transmission system, the combination of a sending station, a receiving station, a light valve at said receiving station having a field winding and a movable shutter element, means for transmitting from said sending station to said receiving station currents to vary the energization of said field winding, and means for transmitting currents from said sending station to said receiving station to control said shutter element.

5. In a picture transmission system, the combination of a transmission line, a sending station, a receiving station, a light valve at said receiving station comprising a field winding and a movable shutter element, a variable resistance in circuit with said field winding, means for transmitting from said sending station to said receiving station currents to control the amount of said resistance in circuit with said field winding in proportion to the energy level of said line, and means for sending picture currents to control said shutter elements.

6. In a picture transmission system, the combination of a transmission line, an element having a picture reproducing surface and a source of light therefor, means for sending picture currents over said line, means for sending control currents over said line, an electromagnetic light valve comprising a field winding and a movable element, means for adjusting the current through said winding in accordance with the transmitted control currents, and means for applying the picture currents to said movable element.

7. In a picture transmission system, the combination of a transmission line, means for sending picture currents over said line, means for sending other currents over said line, and a light valve comprising a field winding adapted to be energized in accordance with the amplitude of said other currents and a movable element to be energized in accordance with said picture currents.

8. In a picture transmission system, a sending station, a receiving station, a transmission line, means for generating a carrier current, means for modulating said current in accordance with picture characteristics and a light valve comprising a field winding and a movable element, both said winding and said element adapted to be energized under control of said carrier current.

In witness whereof, I hereunto subscribe my name this 21st day of December A. D., 1925.

HERBERT E. IVES.