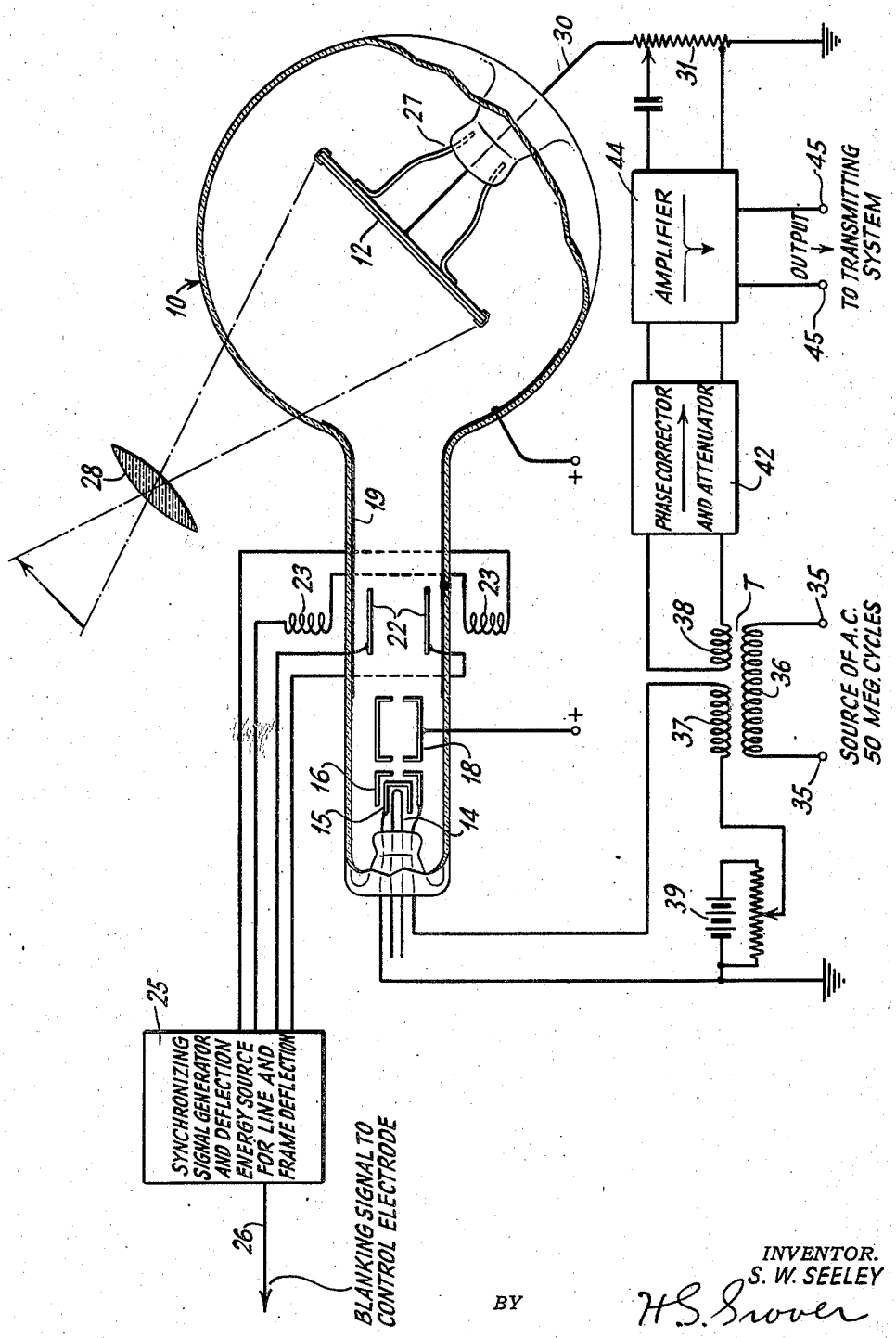
Nov. 12, 1940. S. W. SEELEY 2,220,977

TELEVISION SYSTEM

Filed Dec. 27, 1937



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Patented Nov. 12, 1940 2,220,977

UNITED STATES PATENT OFFICE

2,220,977

TELEVISION SYSTEM

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Application December 27, 1937, Serial No. 181,842

8 Claims. (Cl. 178—7.2)

This invention relates to television systems and more particularly to a new and improved manner in which a television pick-up tube or "Iconoscope" is used.

In the transmission of pictures by television it has been customary to use a pick-up tube of the cathode ray type which includes a light sensitive mosaic upon which the light image to be transmitted is projected. A cathode ray beam is caused to systematically scan the surface of the mosaic in order to produce a series of signals which are representative of the light and dark portions of the picture projected on the mosaic.

In using a cathode ray pick-up tube or "Iconoscope" it has been customary to cause the mosaic to be scanned by a cathode ray beam of continuous intensity. Means have, in particular instances, been provided whereby the intensity of the beam may be controlled for various reasons, but such control has been more a matter of manual adjustment and manipulation. In such systems, some difficulty has been experienced in the transmission of the signals derived from the mosaic or signal plate when an area of considerable size on the mosaic is illuminated with uniform light intensity. When a sizeable area which is uniformly lighted is scanned, the signals produced by the television transmitter tube are continuous and are maintained at a substantially uniform level and have little or no alternating current component. Inasmuch as the alternating current components of the signal variations are considerably more easily transmitted than are the direct current components, the presence of the direct current components (or signals of uniform amplitude) are somewhat annoying and as a result are sometimes amplified and controlled independently of the alternating current components.

The present invention utilizes a system whereby the direct current component of the signal series derived from the mosaic of the television transmitter tube is eliminated, and all signals are alternating in character regardless of whether the particular portion scanned is uniformly or uniformly illuminated.

It is therefore a purpose of the present invention to provide means whereby the series of signals derived from the signal plate of the photosensitive mosaic of a television pick-up tube are always alternating or pulsating in character.

A further purpose of the present invention resides in the provision of means whereby signals derived from uniformly lighted areas on a photosensitive mosaic are broken up into a series of signals having a pre-determined alternating current component, the amplitudes of which are determined by the intensity of illumination of the particular area.

A still further purpose of the present invention resides in the provision of means whereby the cathode ray beam which is produced in the television pick-up tube for the purpose of scanning the photo-sensitive mosaic is modulated at a very high frequency in order that the intensity of the beam may be varied from a pre-determined minimum to a pre-determined maximum.

A still further purpose of the present invention resides in the provision of means whereby a source of alternating potential may be applied to the control electrode of a cathode ray beam in a television pick-up tube for the purpose of modulating the beam at the particular frequency.

Still another purpose of the present invention resides in the provision of means whereby a corresponding alternating potential may be applied to the output circuit of the television pick-up tube in such a phase relationship that the output of the tube will be reduced to substantially zero at such times when the cathode ray beam is traversing an area on the photo-sensitive mosaic which is not illuminated.

A still further purpose of the present invention resides in the provision of means whereby the percentage or amount of the beam modulation frequency that appears in the output of the television pick-up tube may be varied from substantially zero to a maximum, the percentage or amount at any particular instant being determined by the value of light which is projected upon the particular portion of the photo-sensitive mosaic which is being scanned at that particular instant.

Other purposes and advantages of the present system will become apparent to those skilled in the art from a reading of the following specification and claims, particularly in connection with the single figure of the drawing, wherein a system is shown which illustrates one embodiment of the present invention.

Referring to the figure, a cathode ray television pick-up tube or "Iconoscope" 10 is shown, at one end of which is positioned a gun structure for producing a cathode ray beam, and at the other end is positioned a photo-sensitive mosaic 12 upon which the light image to be transmitted is projected, and from which the series of signals representative of the light image are derived.

Specific outline of the construction and operation of the pick-up tube are believed to be un-

necessary since its operation is well known to those skilled in the art and since a clear and concise description of the operation of the tube may be had by referring to a patent to V. K. Zworykin #2,021,907 of November 26, 1935.

The gun structure includes a heater element 14, a cathode or electron emitter 15, and a control electrode or grid 16. In order that the electrons which are emitted from the electron emitting element 15 may be accelerated in the direction of the mosaic, a first anode 18 and a second anode 19 are provided. These anodes are of course maintained at appropriate positive potentials. The cathode ray beam is brought to focus upon the photo-sensitive mosaic, because of the presence of the electrostatic field which is produced by the first and second anodes, as well as by other elements of the tube. The manner in which a cathode ray beam may be focused to a small elementary area is described and discussed in the patents to P. E. L. Chevallier #2,021,252 and #2,021,253 of November 19, 1935 as well as in the patent to R. H. George #2,086,546 of July 13, 1937.

The photo-sensitive mosaic is of the type wherein a plurality of elementary and insulated photo-electric surfaces are provided, each surface acting as a separate and distinct photo-electric cell. The mosaic may be constructed in any manner such as, for example, the manner and method shown and described in the patents to S. F. Essig #2,062,122 of November 24, 1936 and #2,065,570 of December 29, 1936.

In order that the cathode ray beam may be deflected in two directions for the purpose of scanning the photo-sensitive mosaic, deflection means are provided. In the figure shown a pair of plates 22 are provided for deflecting the cathode ray beam in a vertical direction and a pair of electro-magnetic coils 23 are provided for deflecting the cathode ray beam in a horizontal direction. The deflecting voltages for the deflecting means are derived from any appropriate source represented by the rectangle 25 and the wave form of the potentials is in general of a saw-tooth or modified saw-tooth formation. The synchronizing signals which are transmitted with the picture image are also derived from the source of deflection voltage as is also the blanking signal for the control electrode 16 which serves the purpose of extinguishing the cathode ray beam during the time it is returned for another traversal of the photo-sensitive mosaic.

In order that the cathode ray beam may be modulated and rapidly varied in intensity, a source of alternating current of a frequency, for example, of 50 megacycles per second is connected to the terminals 35, the modulating frequency is then applied to the primary winding 36 of the transformer T, the secondary 37 of which is connected to the control electrode of the cathode ray tube. A source of potential 39 is included in the connection in order that the control electrode may be biased to a proper potential and if desired means may be provided whereby the degree of bias may be varied as well as additional means whereby the extent or amplitude of the modulated potential induced in the secondary winding 37 may be varied. Because of this application of the source of alternating current to the control electrode, the cathode ray beam is caused to be varied in intensity at a rate determined by the frequency of the alternating current applied, with the result that areas which are illuminated at the same intensity are broken up into small elementary areas each of which liberates a signal impulse in accordance with the intensity of the illumination over the area in question.

When all or a portion of the photo-sensitive mosaic is dark, it is desired that there be no output from the pick-up tube and in order to reduce the alternating current component as produced by the modulating voltage a phase corrector or phase shifter and attenuator 42 is provided. This network may be of any appropriate construction, as for example, that shown in the patent to M. S. Crosby #2,065,565 of December 29, 1936 and the current for the phase corrector 42 is derived from a secondary winding 38 of the transformer T. The signals which are derived from the photo-sensitive mosaic 12 as a result of the scanning operation are carried from the pick-up tube by way of the conductor 30 and are applied to a resistor element 31. The potential drop across the resistance 31 is then utilized to supply an amplifier with energy whereby the signals derived from the photo-sensitive mosaic may be amplified for subsequent modulation and transmission. After the modulating frequency has been shifted in phase relationship by the device 42, these potentials are then applied to the amplifier 44, their application being at such phase relationship and at such voltage that when the mosaic is dark no potential will appear in the output 45 of the amplifier 44. This adjustment may be readily made and maintained and the output of the amplifier 44 will be reduced to substantially zero under dark conditions of the mosaic, since the number of secondary electrons leaving the mosaic during the scanning of an unlighted portion thereof are equivalent to the number of electrons which reach the mosaic by way of the primary electron stream, i. e., the cathode ray beam.

From the above, therefore, it may be seen that a new and improved system has been devised for use in connection with a television pick-up tube whereby the direct current component of the output of such a tube is eliminated and is replaced by alternating current signals, the intensity of which are a direct function of the light intensity projected upon the corresponding portion of the photo-sensitive mosaic. By using such a system it may be seen that all of the signal current derived from the pick-up tube is alternating in character and this series of signals may be readily amplified and modulated for transmission over a television network.

It is to be understood that, although electrostatic and electro-magnetic deflection means are shown in connection with the disclosure, any other appropriate deflection means may be used, either entirely electro-static or entirely electro-magnetic.

It is to be further understood that any appropriate light sensitive mosaic may be used and that any amplifying and modulation system may be used. An example of an amplifying system is shown in the patent to J. P. Smith #2,045,315 of June 23, 1936 and in the patent to A. C. Stocker #2,045,316 of June 23, 1936. Other appropirate amplifying and modulating systems may, however, be used in their stead. It is also to be understood that any appropriate deflecting potential generating means may be used since the invention herein disclosed is not concerned primarily with the specific means whereby the deflection is brought about.

Other modifications may be made in the pres-

ent invention without departing from the spirit and scope thereof and it is desired that any and all such modifications may be considered as within the purview of the present invention except as limited by the hereinafter appended claims.

I claim:

1. In the art of television transmission, the method of operation which comprises developing a cathode ray and directing the same at a screen structure, deflecting the ray to cause the same to scan an area of said structure to develop picture signals, simultaneously and continuously varying the intensity of the developed ray over a given range and at a radio frequency, and superimposing a component of said frequency upon the developed picture signals in substantially reverse phase relationship.

2. In the art of television transmission, the method of operation which comprises developing a cathode ray and directing the same at a screen structure, deflecting the ray to cause the same to scan an area of said structure to develop picture signals, simultaneously and continuously varying the intensity of the developed ray over a given range and at a radio frequency, reversing the phase of the frequency, and superimposing the phase reversed frequency upon the developed picture signals whereby the developed picture signals will be reduced to substantially zero intensity when a dark portion of the screen structure is scanned.

3. In the art of television transmission, the method of operation which comprises developing a cathode ray and directing the same at a screen structure, deflecting the ray to cause the same to scan an area of said structure to develop picture signals, simultaneously and continuously varying the intensity of the developed ray over a given range and at a radio frequency, displacing the phase of the frequency substantially 180 degrees, and superimposing the frequency so displaced upon the developed picture signals whereby the developed picture signals will be reduced to substantially zero intensity when a dark portion of the screen structure is scanned.

4. In a television transmission system, a cathode ray tube for developing picture signals, said tube being provided with a photo-sensitive screen structure and with an electron gun for developing and directing a ray of electrons at said structure, said gun being provided with a control electrode for controlling the intensity of the ray, means for generating an electrical wave of radio frequency, means for coupling said generating means to said control electrode, means connected to said generating means for reversing the phase of the generated frequency, and means for superimposing the frequency of reversed phase upon the developed picture signals whereby picture signals corresponding to black will be reduced to substantially zero.

5. In a television transmission system, a cathode ray tube for developing picture signals, said tube being provided with a photo-sensitive screen structure and with an electron gun for developing and directing a ray of electrons at said structure, said gun being provided with a control electrode for controlling the intensity of the ray, an output circuit connected to said screen structure, means for generating an electrical wave of radio frequency, means for connecting said generating means to said control electrode to vary the intensity of the ray, and means including a phase altering device for connecting said generating means to said output circuit whereby the intensity of the picture signals corresponding to a dark screen will be reduced to substantially zero.

6. In a television transmission system, a cathode ray tube for developing picture signals, said tube being provided with a photo-sensitive screen structure and with an electron gun for developing and directing a ray of electrons at said structure, said gun being provided with a control electrode for controlling the intensity of the ray, an output circuit connected to said screen structure, means for generating an electrical wave of radio frequency, means for connecting said generating means to said control electrode to vary the intensity of the ray, means for producing a phase displacement of substantially 180 degrees connected to said generating means, and means for connecting said phase displacing means to said output circuit whereby the developed picture signals will be reduced to substantially zero intensity when a dark portion of the screen structure is scanned.

7. In a television transmission system, a cathode ray tube for developing picture signals, said tube being provided with a photo-sensitive screen structure and with an electron gun for developing and directing a beam of electrons at said structure, said gun being provided with a control electrode for controlling the intensity of the beam, an output circuit connected to said screen structure, means for generating an electrical wave of radio frequency, means for coupling said generating means to said control electrode to modulate the beam at the frequency generated, and means for coupling said generating means to said output circuit, said means including a phase shifting device and an attenuator whereby the developed picture signals will be reduced to substantially zero intensity when a dark portion of the scren structure is scanned.

8. In a television transmission system, a cathode ray tube for developing picture signals, said tube being provided with a photo-sensitive screen structure and with an electron gun for developing and directing a beam of electrons at said structure, said gun being provided with a control electrode for controlling the intensity of the beam, an output circuit connected to said screen structure, two sources of electrical energy of identical radio frequency but displaced substantially 180 degrees in phase relationship, means for applying the energy from one of the sources to the said control electrode for modulating the beam of electrons, and means for applying the energy from the other source to the said output circuit.

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