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TELEVISION APPARATUS

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Fig. 1

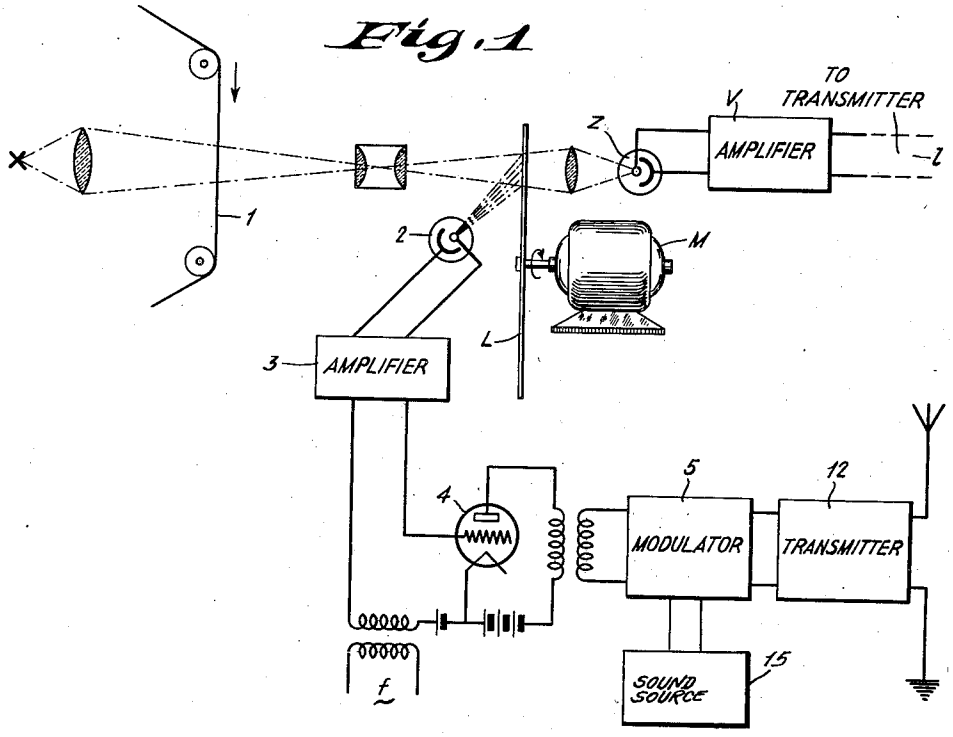
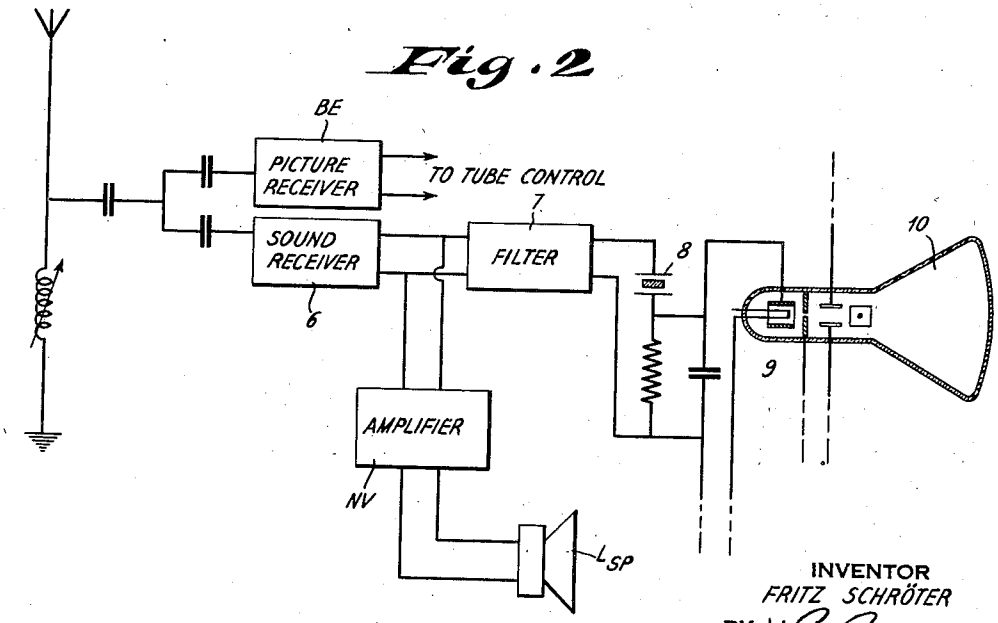


Fig. 2



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TELEVISION APPARATUS

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8 Claims. (Cl. 178—5.6)

The present invention relates to a method and means to regulate the direct current component in television pictures.

Experience gained of late has shown that in order to insure high-grade television transmission it is highly desirable to control the amplitude of the direct current component of the picture, i. e., the mean brightness of the picture coming in from the transmitter in a faithful manner. This solution should be aimed at particularly for the reason that, without the use of an auxiliary carrier wave for the picture impulses or signals (which, in turn, would inadmissibly widen the frequency band to be transmitted) it would be extremely difficult to so design the radio transmitter equipment that the very slow brightness variations in the form of correspondingly low frequencies could be passed through. However, the frequencies of which some lie away below one cycle per second could, of course, be regarded also as periodically varying fluctuations of the mean brightness. Looking at the matter from this angle care could be taken so that the adjustment of this latter quantity in the receiver apparatus may be automatically effected from the sending end.

The present invention attempts to solve the problem of including in the transmission also the slowly varying value of the direct current component present at any time by the following simple procedure:

The assumption shall be made that in addition to the picture transmission or carrier wave, for the acoustic accompaniment of the television program, there is made available a second carrier wave which besides the voice or music, would be enabled to transmit also the synchronizing frequencies or impulses for the picture screen. Owing to the presence of such a second carrier wave there is a chance to modulate the latter with an auxiliary frequency which may be separated from the musical, vocal or synchronizing frequencies by the aid of electrical filters. The amplitude of such an auxiliary frequency, for the purpose of the present invention is regulated by the optical picture scanner and it corresponds to the magnitude of the direct current component of the picture prevailing at any given instant or the mean brightness or density thereof. In other words, this value must be reascertained continuously by the aid of a distinct photoelectric evaluating means adapted to integrate the luminous density throughout the whole picture area thereby determining the mean or average value thereof, and may be thus utilized in well known manner by the aid of amplifiers for the regulation of the amplitude of the auxiliary frequency modulating the acoustic transmitter.

The device would preferably work in this manner that it responds solely to fluctuations of the brightness lying sufficiently far below the picture frequency (which at the present time can be considered as about 25 cycles per second), whereas all higher frequencies are transmitted by the modulation of the carrier wave of the picture transmitter itself.

The utilization of the auxiliary wave filtered and separated out at the receiving end for the control of the direct current component of the television picture is insured most preferably by the aid of a biasing voltage derived from the amplitude of the auxiliary frequency. The method is particularly simple if recourse is had to a Braun tube as the means to recreate the television picture. In this case the suitably amplified carrier wave is rectified or demodulated and the ensuing audio frequency mixture or spectrum, after separating the carrier frequency therefrom, is fed to a filter chain which is designed to transmit only the auxiliary frequency. The latter is sent through a second rectifier and the residual alternating voltage is eliminated in a filter means, while the slowly varying D. C. voltage which then remains is impressed upon the Wehnelt cylinder or other control electrode of the Braun tube so as to control the intensity of the cathode ray pencil.

The drawing shows schematically an exemplified embodiment of the invention, whereby Fig. 1 represents the transmitter and Fig. 2 the receiver.

Referring first to Fig. 1, numeral 1 denotes the film traveling through the picture scanner of the transmitter apparatus, 2 is a supplementary photocell which takes care of ascertaining the average brightness of the picture, i. e., determination of the direct current component, rather than insuring scanning of the picture properly so-called. The photocell current from the cell 2 amplified in amplifier 3 controls the amplitude of an oscillation generator 4, which may be of any suitable frequency. The said generator 4 is shown as being subject to and designed for separate excitation in that the auxiliary frequency f is fed to its grid from some suitable source. This frequency is supplied to the modulator 5 of the transmitter 12 for the sound carrier wave. The scanning proper of the picture is effected by the aid of the perforated disk L driven by the motor M, the scanning beam being caused to fall through the apertures of the said disk upon the photocell Z with which the photocell amplifier V is con-

nected. The amplified picture current impulses are fed to the picture transmitter by way of the line *l*.

In the receiver **6** which receives the wave modulated with the sound, synchronizing and auxiliary frequencies, after having passed through an input amplifier and demodulator, the auxiliary frequency is separated out of the audio frequency spectrum or mixture which is fed by way of a branch amplifier NV to the loudspeaker L*sp*, by the aid of the filter **7** and is rectified by a standard rectifier tube or a dry (electrolytic) rectifier **8**. The ensuing filtered direct current voltage is superposed in the proper sense upon the negatively biased control electrode **9** of the cathode ray picture receiver tube **10**, there being simultaneously supplied to the said electrode the picture modulation impulses furnished from the picture receiver BE.

Squaring of the amplitude possibly produced during rectification of the auxiliary frequency, if the characteristic of the detector in question should happen to deviate too far from the linear shape, might vitiate the brightness of the direct current component. In this case a suitable biasing correction must then be introduced at the sending end designed to vitiate the functional relationship between the direct current component of the brightness. It will then be necessary to use a suitable pre-distortion at the sending end which will shape the functional relationship between the direct current component of the brightness and the amplitude of the auxiliary frequency in such a way that above the rectifier device **8** of the receiver which is here concerned, proper dependence of the mean luminous density of the television picture upon the original picture will be assured.

If upon the acoustic carrier wave, in addition to the sound program, also synchronizing frequencies or impulses for the picture screen or plate are transmitted, then the frequency of the picture change, it being assumed for this present consideration that picture frequency is 25 cycles per second, may be infraposed in reference to the music or vocal frequency band inasmuch as the latter can be cut off below the 50 cycles per second mark. The rhythm-making period of the line change, on the other hand, may be accommodated only above the upper limit of the acoustic frequency band; in other words, this band might then have to be cut-off to such an extent that the synchronizing frequency may be filtered out to a satisfactory degree. However, it is preferred to raise the frequency difference by prior doubling or multiplication of the effective line frequency followed by a corresponding demultiplication in the receiver, or else the line frequency is first superposed upon an auxiliary carrier wave to be demodulated at the receiving end and chosen adequately high, with the consequence that the identical result is obtained. In all of these instances it is feasible inside the scope of this invention to avoid the necessity of using a further auxiliary wave for the transmission of the direct current component of the picture to thus transmit the variations in the average brightness to the receiving apparatus, simply by that the amplitude of one of the very synchronizing frequencies or the auxiliary carrier thereof is varied and by that these amplitude changes are evaluated in the receiver apparatus.

For the purpose of perfect picture synchronization, in other words, for undisturbed deflection of the spot of the Braun tube, it will be suitable in this connection to provide limiting means for the purpose to stabilize the intensity and the phase of the impulses fed into the "entrainment" devices of the relaxation wave means, in spite of such variations of amplitude as may occur.

If the auxiliary frequency for the regulation of the mean picture brightness of the receiver is transmitted by virtue and way of amplitude modulation of the sound carrier wave, then a modulation interval suited therefor must be reserved inside which the percentage of modulation varies as a function of the direct current component of the picture. It is not easy in this connection to preclude the risk of over-modulations within the modulation interval, and this is liable to conduce to disturbing interferences. To obviate this difficulty, the basic idea of the invention is modified in such a way that the auxiliary frequency is varied in its frequency rather than in its amplitude. For this object there must then be set aside a certain frequency band, while the amplitude is kept constant. The photoelectric current of the cell **2** (Fig. 1) will then act upon the frequency rather than the amplitude of generator **4** by the use of ways and means well known in the prior art. However, the percentage modulation of the sound carrier wave with this variable auxiliary frequency remains the same. For the re-conversion of frequency variations into amplitude variations at the receiving end there are also used ways and means known in the earlier art, for instance, a tuned circuit whose current amplitude to be rectified varies with the frequency.

Having now described the invention, what is claimed and desired to secure by Letters Patent is the following:

1. In a sound and television system wherein is provided a transmitter for the sound signal and a separate transmitter for the television signal, the method of transmitting controlling background brightness signals comprising the steps of producing electrical signal energy proportional to the average brightness value of substantially the complete subject to be electro-optically represented and modulating the sound transmitter by said produced signal energy.

2. In a sound and television system wherein is provided a transmitter for the sound signal and a separate transmitter for the television signal, the method of transmitting controlling background brightness signals comprising the steps of producing electrical signal energy proportional to the average brightness value of substantially the complete subject to be electro-optically represented, producing electrical signal energy representative of the sound energy desired to be transmitted, and simultaneously modulating the sound transmitter by both of said produced signal energies.

3. In a television system wherein is provided means for producing electro-optical images of the subject, the method of transmitting controlling background brightness signals comprising the steps of scanning elemental light areas of the subject, sequentially converting the brightness values of said scanned areas into proportional electric signals, simultaneously producing electrical signals representative of the average brightness value of said completely scanned subject, developing an electrical carrier current, modulating the developed carrier by the proportional electric signals, developing a second electrical carrier current, and modulating said second developed carrier by the produced electric signals

representative of the average brightness of the completely scanned subject.

4. The method of producing signals for controlling the electro-optical representation of a subject, which comprises scanning a subject to produce electrical signals representing varying values of lights and shadows on the several elemental areas thereof, transmitting the produced signals, photoelectrically producing signals representing the average value of lights and shadows of substantially the entire area of the subject scanned, converting sound signal energy into electrical signals, transmitting over an independent transmission channel simultaneously with the transmission of the produced signals representative of the light and shadows of the elemental areas of the subject the combined sound signal energy and the signals representing the average value of light and shadow of substantially the entire subject so as to provide signal energy for controlling, at the point of reception of the electro-optical image signals, the production level of the signals representing the light and shadows of the elemental areas of the subject.

5. The method of controlling background brightness in electro-optical image reproducing systems, which comprises the steps of producing electric signal energy proportional to the elemental light area densities of the subject to be represented, simultaneously producing an electric signal proportional to the average density of substantially the complete subject, producing an electrical carrier current, modulating said produced carrier current by the first of said produced signals, producing a second electrical carrier current, modulating said second produced carrier current by the second of said produced signals, transmitting both of said modulated carrier currents, receiving both of said carrier currents, separately demodulating each of said modulated carrier currents to produce signal energy representing the elemental light areas of the subject and signal energy of the average density of the subject, producing an electro-optical representation of the subject by the signals proportional to the elemental light area densities, and controlling the background brightness of the produced representation by the signal proportional to the average density of the subject.

6. In a television system, wherein electrical signal energy representative of the background brightness of an image to be transmitted modulates the same carrier wave as modulated by the electrical energy representative of the sound energy, the method of background brightness control comprising the steps of demodulating the carrier modulated by both the signal energy representative of the background brightness and by the electrical energy representative of the sound energy, separating the demodulated background brightness signal energy from the demodulated sound signal energy, rectifying the background brightness signal energy, electro-optically producing separately image representations upon a viewing plane, and controlling the background brightness of the electro-optical image representation by the said rectified energy.

7. A television receiver comprising two separate receivers, one of said receivers being adapted to receive electro-optical image signals and the other of said receivers being adapted to receive both background brightness control signal energy and sound signal energy, means for developing an electro-optical image from the electro-optical signal energy, means for separating the background brightness control signal energy from the sound signal energy, and means for controlling the background brightness of the produced electro-optical image by the said separated background control signal energy.

8. A system for electro-optically representing a subject comprising means for illuminating the said subject, means for scanning elemental light areas of said subject, means for converting elemental light area brightness values into proportional electrical energy, means for amplifying said electrical energy, means for transmitting said amplified energy, means for simultaneously producing electrical energy representing the average brightness value of substantially the entire scanned subject, means for amplifying said last named electrical energy, means for producing electrical energy representative of sound energy, means for simultaneously modulating a transmitter by both the electrical energy representative of the average brightness value of the entire scanned subject and the electrical energy representative of the sound energy, and means for transmitting the simultaneously modulated transmitter energy.

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