PUBLISHED
MAY 18, 1943.
BY A. P. C.

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CONTROL CIRCUITS
Filed July 1, 1937

Serial No.
151,347

Fig. 1

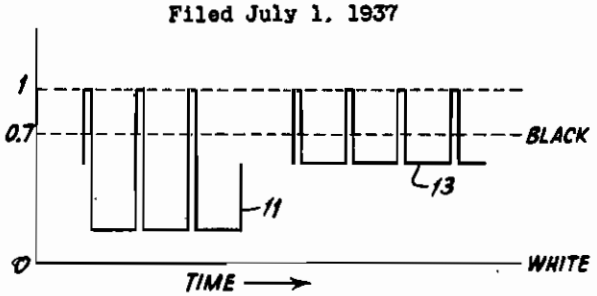

Fig. 2

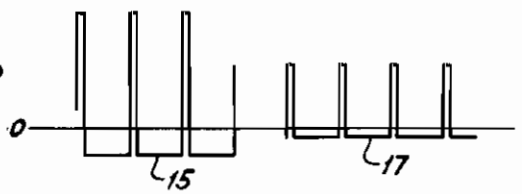

Fig. 3

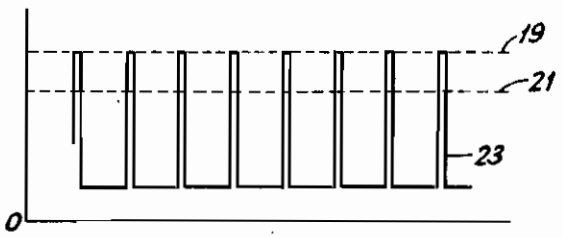

Fig. 4

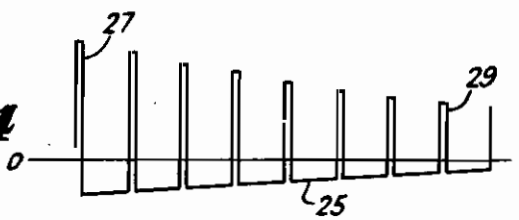

Fig. 6

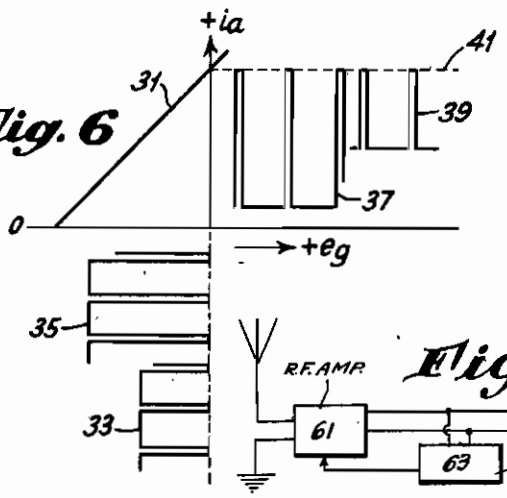

Fig. 5

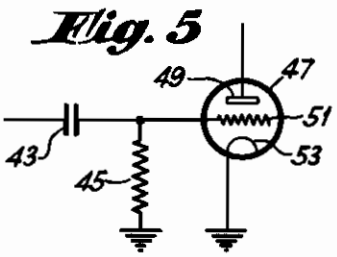

Fig. 7

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Published May 18, 1943

Serial No. 151,347

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CONTROL CIRCUITS

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Application filed July 1, 1937

In the transmission of pictures for television it is known from the earlier art to modulate a carrier wave by the synchronizing impulses beyond a certain fixed amplitude value of the carrier, while the content of the picture, i. e., the video signals proper, are transmitted by reducing the amplitude of the carrier wave below the said fixed value.

The present invention deals with the problem of insuring, in connection with the said transmission method, a fading regulation or volume control at the receiving end. This problem is closely allied to the problem of transmitting the average or mean picture shading value or picture brightness (density) which is indispensable if faithful picture re-creation at the receiving end is required. A number of suggestions have been disclosed in the prior art to reintroduce at the receiving end the average picture brightness and to insure fading regulation or compensation. These earlier methods shall be compared in what follows with the object of the invention by reference to the accompanying drawing.

Referring to Figs. 1 to 4 of the drawing, the horizontal coordinate stands for time and the vertical for the amplitude of the carrier wave, numeral 1 standing for the maximum carrier amplitude, and black for a carrier amplitude of 0.7 approximately, while white corresponds to zero carrier amplitude. Under certain circumstances it may also be expedient to coordinate a small finite carrier amplitude to white picture portions or elements rather than zero amplitude, though this point shall be left out of consideration in the following considerations for the sake of greater simplicity of discussion.

Referring to Fig. 1, the shape of the envelope is represented for a number of lines of picture for which a comparatively great mean brightness exists, while on the right-hand side is indicated the shape of the envelope for a few lines characterized by less average brightness. Also for the sake of simplicity, the distribution of brightness or shading values within the various picture lines or strips (scanning lines) has been assumed to be constant, both in this figure as well as in the following ones.

If the potential obtained at the receiving end by means of rectification of a carrier wave modulated in a way as shown in Fig. 1 is further amplified in an A. F. amplifier, the mean brightness which represents a d. c. component of the A. F. is lost seeing that for practical reasons it is necessary to employ what is known as an a. c. amplifier, that is to say, an amplifier which comprises capacitive or inductive coupling means between the various stages thereof. What thus results at the output end of the a. c. amplifier is a voltage wave having a shape as shown in Fig. 2. Methods and circuit organizations have been disclosed in the earlier art which have the aim and purpose to re-introduce the lost average picture brightness. This is accomplishable, for instance, by impressing the potential Fig. 2 in such a way upon the circuit arrangement Fig. 5 that the synchronizing impulses at the control grid of the tube are in the positive sense. The time-constant of condenser 10 and resistance 11 is high in contrast to the period of the impulses so that the condenser 10 which is charged up by the grid current of the tube is unable to become discharged in the interval between two impulses. But when the impulse amplitude decreases, in other words, when at the control grid of the tube in Fig. 5 a potential of a shape as shown in Fig. 2 is supplied, the condenser 10 is discharged to such a point where, at each crest value of a synchronizing impulse, a grid current will start to flow, and thus, in each instance, will initiate a new small charge of the condenser 10.

The discharge of condenser 10 from the value corresponding to a high average brightness or shading value to that corresponding to a small mean value, to be sure, proceeds very slowly; but it will be remembered that also the mean brightness, as a general rule, does not change suddenly and abruptly, with the result that the incoming and recreated image will fairly closely follow the original also as regards the changes of the average brightness.

These conditions are shown in more detail by the aid of the plate current-grid voltage characteristic of the tube. The zero line of the voltage wave Fig. 2 becomes shifted because of the fluctuations in the charge of the condenser 10 at the control grid of the tube; hence, the shape of the plate current again reflects the mean picture brightness. As can be seen from Fig. 6, the form of the plate current perfectly agrees with Fig. 1.

The circuit arrangement as here described for the reintroduction of the mean brightness is an instance of the so-called A. F. crest or peak measurement; in fact, also all other circuit organizations that have been disclosed in the prior art for the purpose of reintroducing the mean brightness may be regarded to fall in the same class.

It has also been suggested in the art to provide ways and means adapted to insure fading

compensation or V. C. in connection with television or video signals as in Fig. 1, at the receiving end. As a result of fading, from an envelope of the kind shown in Fig. 3 for the sending end, there results an A. F. potential having a shape as shown in Fig. 4. To be sure, by A. F. peak measurement at the receiving end it is feasible to insure fading compensation, but only on the condition that the mean picture brightness or shading value stays constant and stable throughout the entire transmission or program.

For it will be understood that, so far as the receiver apparatus is concerned, there is no chance to ascertain by means of measurement whether a reduction in the amplitude of the synchronizing impulses is ascribable and due to a reduction in the mean picture brightness (right-hand side in Fig. 2) or to more marked fading. The requirement to reintroduce the mean picture brightness into the A. F. at the receiver end together with the demand to insure fading compensation in the A. F. energy coming in at the receiver, are therefore contradictory. In other words, mean picture brightness will be reintroducible only if the transmission channel is free from fading, while, on the other hand, V. C. or fading compensation will be accomplishable only if the mean brightness of the picture points is stable.

Now, according to this invention a circuit organization is suggested which permits to secure fading compensation in connection with a modulation method of the kind illustrated in Fig. 1 while yet reproducing the variations of the mean brightness in the incoming picture. For this purpose, contradistinct to the A. F. peak measuring method mentioned above, recourse is had to an R. F. peak measurement. What is meant by that is that the synchronizing impulses in the form of R. F. energy are fed to a device which furnishes a voltage which will be a function of the impulse amplitude coming in at the receiving end. This, for instance, is attainable by impressing the amplified RF potential upon a biased diode so that the plate current of the diode will furnish a measure and criterion for the amplitude of the carrier alternations constituting the synchronizing impulse. As will be seen, it is thus feasible, by the aid of the drop of potential caused by the plate current of the diode, to act upon the grid biasing potential of one or of several tubes of the RF amplifier in a way well known in the art.

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