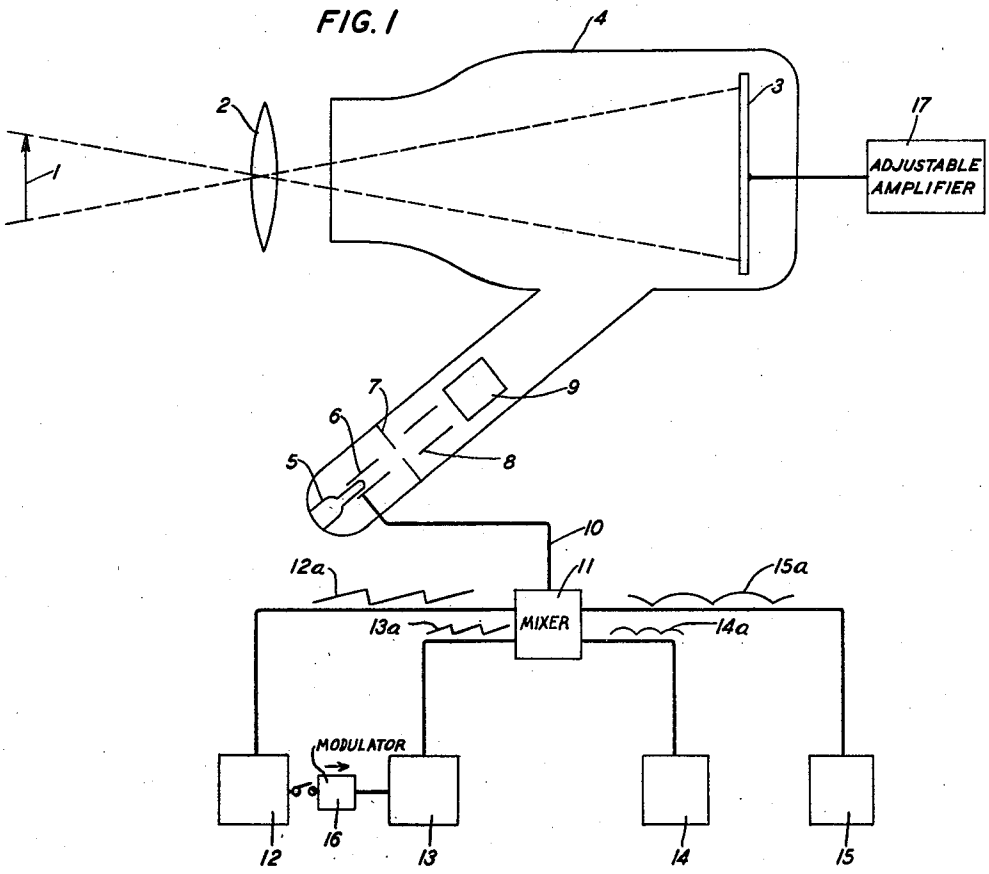
May 15, 1945. R. R. VON FELGEL-FARNHOLZ 2,375,968

BLACK SPOT CORRECTING MEANS

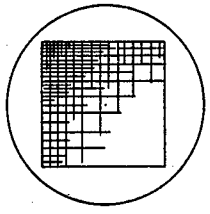
Filed Feb. 12, 1942

FIG. 1



RECTANGLES 12, 13, 14, 15 EACH CONTAINS A GENERATOR, MEANS FOR ADJUSTING AMPLITUDE AND PHASE OF THE GENERATED WAVE, AND A SWITCH IN THE CONNECTION TO MIXER 11.

FIG. 2



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2,375,968

BLACK SPOT CORRECTING MEANS

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Application February 12, 1942, Serial No. 430,569
In Germany August 30, 1940

2 Claims. (Cl. 178—7.2)

My invention relates to television systems and particularly to television systems of the type in which a cathode-ray transmitter tube using the storage effect is employed.

It is well known that, in television transmission systems comprising cathode-ray transmitter tubes using the storage effect, there will occur, in the picture received, visual disturbances which become manifest in an irregular distribution of brightness within the scanned area. This phenomenon of irregular brightness distribution will be particularly distinct in cases when the light-sensitive layer is everywhere illuminated with equal brightness. For example, one corner of the picture may be of a very dark shade, while the corner diagonally opposite may be of a very light shade. This phenomenon is commonly referred to as "black spot."

It is, accordingly, an object of my invention to provide a method of and means for correcting, or otherwise controlling, the shading of a television picture.

It is a further object of my invention to provide an improved method of and an improved means for preventing the transmission of undesired signals from the picture transmitter.

In accordance with the invention, in a cathode-ray transmitter tube serving for the transmission of television programs and the like, the intensity of the electron beam scanning the storage electrode is so controlled that the picture modulation effected by the intensity control will be directly opposite to the picture modulation producing the black spot, so that, at the output of the cathode-ray transmitter tube, a picture signal practically free from disturbing signals is obtained. It is advisable to effect the modulation of the electron beam scanning the storage electrode by means of a perforated diaphragm, preferably the Wehnelt cylinder. For this purpose a modulating potential is admitted to the beam modulating electrode, said potential being advantageously generated by means of signal generators whose output currents are mixed with one another across control elements.

Other objects, features and advantages of my invention will appear from the following description taken in connection with the accompanying drawing, in which:

Figure 1 is a circuit and block diagram of a television transmitter embodying my invention.

Fig. 2 shows the undesired black spot at the television receiver.

Referring to Fig. 1, an optical image of object 1 to be teletransmitted is produced, by means of optical system 2, on storage electrode 3 of a cathode-ray transmitter tube 4 of the type described in an article by V. K. Zworykin published in the January, 1934, issue of the Proceedings of the Institute of Radio Engineers. Within that tube an image of electrical charges is generated, said charges corresponding, in their respective distribution, to the brightness distribution of the scanned object. The charge stored on the storage electrode is taken off by means of an electron beam generated in a gun comprising a cathode 5, a Wehnelt cylinder 6 and a first anode 7. Under the influence of the deflecting voltages supplied to pairs 8 and 9 of deflecting plates the scanning beam is moved line by line across the storage electrode.

The intensity of the scanning beam can be varied by means of electric control signals, which are applied to Wehnelt-cylinder 6.

The electric control signals of suitable form and frequency are fed to the Wehnelt cylinder across line 10, the phase of said signals with respect to the saw-toothed cathode-beam deflecting waves being so chosen and their amplitude so dimensioned that the disturbing spurious signals otherwise resulting at the output of the cathode-ray transmitter tube will be substantially balanced out and disappear for this reason. By means of a mixing device 11 which may serve also for coupling purposes the electric control signal is composed of auxiliary signals. The auxiliary signals are generated by means of signal generators 12, 13, 14, and 15 which generate, e. g., saw-tooth curves of picture frequency according to curve 12*a* and such of line frequency according to curve 13*a* as well as sine-shaped half-waves of line frequency and picture frequency according to curves 14*a* and 15*a*. Furthermore, a variable modulating device 16 has been provided, in order to modulate the amplitude of the saw-tooth oscillations produced by generator 13, in the rhythm of the line frequency (i. e., in proportion to the amplitude of the signals represented in curve 12*a*).

In certain cases, especially when the disturbing signals have a considerable amplitude so that, for compensating the black spot, the electron beam which effects scanning must undergo a relatively high degree of modulation, it is of advantage the gain of at least one stage of the picture modulation amplifier may be varied. The amplification should be controlled independently of the amount of the compensating voltage required at any particular instant. Thus the gradation curve of the picture received will be practically the same at all spots of the scanned area of the

picture and independent of the disturbing signal amplitude which is characteristic for the respective picture spot as well as independent of the modulating voltage amplitude required for compensation.

The causes of the so-called black spot have not been completely explained as yet; probably it is caused by an irregularity of the spatial charge cloud being developed in the surroundings of storage electrode 3. This irregular distribution may result from the gravitational field of the earth and from the leap in potential resulting at the discharge of each of the storage elements. Often, there will arise a disturbance effect as per Fig. 2, i. e., the storage electrode being uniformly illuminated, e. g., the area near the left and the upper edges of the picture surface is being illuminated brighter than the area near the two other edges. For compensating this form of the black spot signals acccording to curves 12*a* and 13*a* are mixed and applied to Wehnelt cylinder 6.

It is well understood by those acquainted with television practice that a saw-tooth wave of line scanning frequency introduced into the transmitted television signal in phase with, or in opposite phase to, the saw-tooth wave used to deflect the cathode beam of a cathode ray receiving tube across the screen will shade the image uniformly from one side to the other, and that the same is true with respect to a saw-tooth wave of field scanning frequency except that the resultant shading will extend from top to bottom of the field. If both shading waves are present the shading will extend diagonally of the field, as shown for example in Fig. 2. When such shadings of the field are present in television transmission it is known that spurious waves of the kind just mentioned are present in the signal current and it is also well known that such spurious wave forms are introduced by television camera tubes of the storage type. To reduce or eliminate such spurious shadings which can be recognized as due to the presence of other simple wave forms, such as half-sine waves, either alone or in combination with other simple wave forms, it has been the practice to synthesize wave forms at the transmitter of the proper shape to produce such shadings and to apply them to the output circuits of the camera tube in opposite phase to the known spurious waves producing the shadings. As the present invention proposes no novel form of apparatus for synthesizing the required wave form, no attempt has been made to show in the drawing any known form of apparatus for generating the different simple wave forms employed or for adjusting their phase and amplitude. For a complete description of suitable apparatus of this kind reference is here made to Principles of Television Engineering, by Donald G. Fink, McGraw-Hill Book Company, Inc., 1940, pages 414 to 418.

What I claim is:

1. In combination, a cathode ray picture transmitter tube comprising means for forming a beam of electrons, a photosensitive target for said beam adapted to have radiations from an object or field of view applied thereto, said target having means associated therewith to produce, when scanned by an electron beam of substantially constant intensity, picture signals and undesired spurious variations which unevenly shade the picture, and means for controlling the intensity of said beam, and means for producing and applying to said controlling means signals of such form and intensity that the formation of said spurious variations is substantially prevented.

2. In combination, a cathode ray picture transmitter tube comprising means for forming a beam of electrons, a photosensitive target for said beam adapted to have radiations from an object or field of view applied thereto, said target having means associated therewith to produce, when scanned by an electron beam of substantially constant intensity, picture signals and undesired spurious variations which unevenly shade the picture, and means for controlling the intensity of the beam, and means for applying to said controlling means signals of such form and intensity that the formation of said spurious variations is substantially prevented, said controlling means comprising a Wehnelt cylinder which serves also to concentrate said beam.

RICHARD RITTER VON FELGEL-FARNHOLZ.

CERTIFICATE OF CORRECTION.

Patent No. 2,375,968. May 15, 1945.

RICHARD RITTER von FELGEL-FARNHOLZ.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 51, for the word "independently" read -- in dependence--; and page 2, first column, line 28, after "image" insert the word --field--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of September, A. D. 1945.

Leslie Frazer

(Seal) First Assistant Commissioner of Patents.