Aug. 13, 1935. D. PRINZ 2,011,260

CATHODE RAY INTENSITY CONTROL SYSTEM

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Fig. 1.

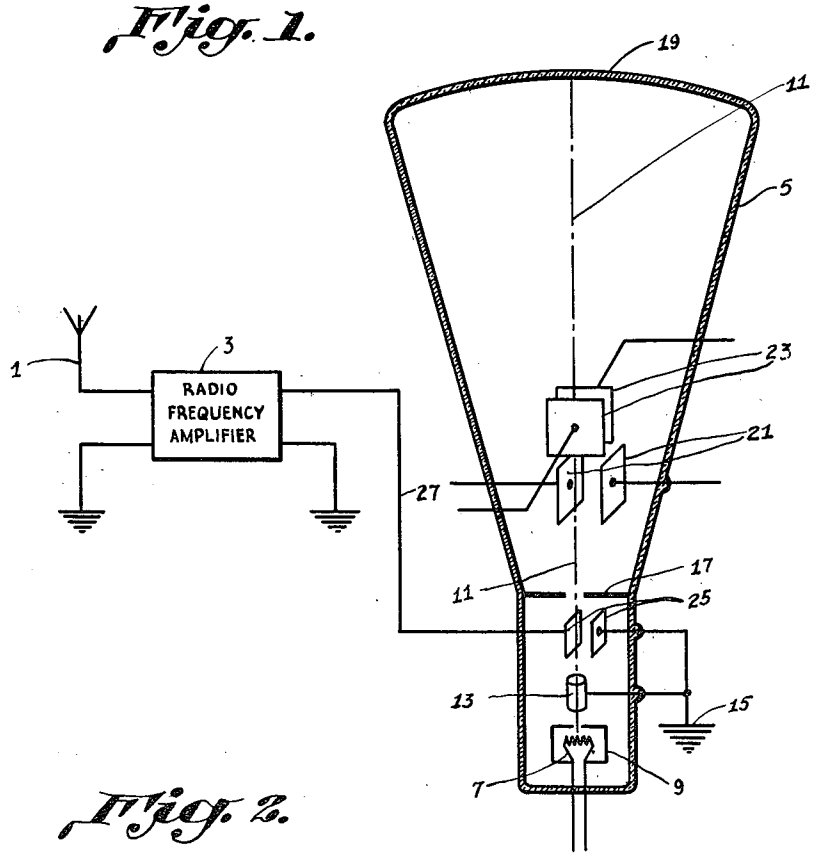
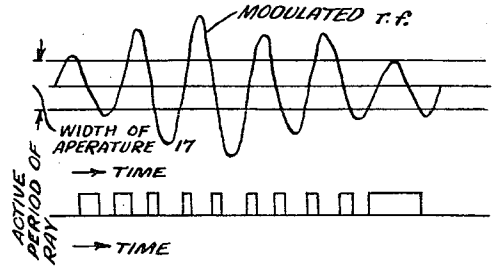


Fig. 2.



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CATHODE RAY INTENSITY CONTROL SYSTEM

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3 Claims. (Cl. 178—6)

The present invention relates to television systems and is directed primarily to the use of cathode ray or Braun tubes for the purpose of rebuilding or reconstructing the electro-optical television image.

It is known to those trained in this art that arrangements of this sort may be attended with the difficulty of varying the brightness or luminosity of the image spot produced upon the fluorescent end wall or screen of the tube by the cathode ray without incidentally varying also the position thereof. To overcome this difficulty, according to the present invention, a hole or aperture diaphragm is mounted between the anode and the control or deflecting electrostatic plates or electromagnetic fields of the Braun or cathode ray tube which will just allow of the passage of the cathode ray, while between the anode and the said apertured diaphragm there is interposed a pair of control plates to which a radio frequency alternating current potential is applied directly from the receiver. As a result, conditions are made so that the cathode ray pencil is able to pass through the apertured diaphragm only during a fraction of a cycle of the radio frequency potential.

Inasmuch as the speed at which the ray moves past the apertured diaphragm is proportional to the amplitude of the radio frequency, it follows that the time for which the ray has a chance to pass through the diaphragm is inversely proportional to the amplitude of the radio frequency energy. The same thing holds true of the brightness of the spot upon the fluorescent screen since the spot brilliance is proportional to the length of time during which the cathode ray pencil impinges upon the fluorescent end wall or screen of the tube.

Since the cathode ray passes through the apertured diaphragm just during a time when the deflecting radio frequency potential passes substantially through zero, it will be seen that the electrons issuing from the source at that particular instant are entirely uninfluenced so that they will be deviated by the control plates of the Braun tube in just the same manner as if the radio frequency potential were not present at all. As a matter of fact, the position of the spot will not be affected during this particular period of variation of the brightness thereof.

If the transmission of the television picture is effected by the aid of radio frequency oscillations, then the incoming radio frequency oscillations, preferably amplified to some extent at least, without prior rectification, may be fed directly to the auxiliary control plates of the cathode ray or Braun tube.

Modulation of the transmitter should be effected in such a way that the radiated radio frequency energy is inversely proportional to the brightness of the picture point or unit to be transmitted.

It is known in the art that the luminosity of the light spot produced upon the fluorescent end wall of a cathode ray or Braun tube may be varied by slightly deviating the cathode ray pencil passing through the diaphragm out of its normal position or path, so that only a part of the electrons is able to pass through the aperture of the diaphragm. In an arrangement of this sort, however, the cross-section of the pencil of cathode rays must be perfectly homogeneous in order that a state of proportionality may be secured between luminosity and deflection. This difficulty has been avoided in the present arrangement, for the sole point to be satisfied is that the entire cathode ray should pass across the diaphragm.

Other novel features and advantages of the present invention will become apparent and suggest themselves from a reading of this specification and claims in connection with the accompanying drawing, wherein the single figure illustrates in diagrammatic manner one form of system for reconstructing electro-optical images using the above suggested form of image intensity control.

Referring now to the accompanying drawing, wherein Fig. 1 represents schematically a system according to the present invention, and wherein Fig. 2 plots the modulated radio frequency received signal amplitude against time and indicates the width of the aperture in the diaphragm, and also wherein the active period of the ray pencil upon the fluorescent screen is indicated in the same time relationship as the modulated radio frequency signal, signals originating at a transmitting point are picked up at the receiving station by any appropriate type of antenna or signal collector 1 and transferred therefrom to a radio frequency amplifier 3. For the purpose of reconstructing an electro-optical image representation of the received image signals, a cathode ray or Braun tube 5 is provided. Within one end portion of the tube 5 is a cathode 7, which may be either the heated or the cold type, appropriately shielded by a shielding element 9. The cathode ray 11 which is emitted from the cathode 7 is then projected longitudinally of the tube through the anode element 13, which is appropriately

grounded at 15, and the diaphragm element 17 provided with a central aperture 18 toward the fluorescent end wall 19 of the tube.

Image spots which are produced by the cathode ray bombardment of the fluorescent material coating the inner surface of the end wall 19 may be viewed upon the tube end wall. In order to cause the produced cathode ray to trace a two dimensional path, pairs of deflecting plates 21 and 23 are provided. These deflecting plates are supplied with suitable electric potentials so arranged as to cause the cathode ray beam to traverse the screen in two directions, for example, the plates 21 may cause a rapid traversal from left to right to represent horizontal image points and the plates 23 may cause a slower motion of the cathode ray along a path at right angles to the deflection path produced by the plates 21. This deflecting field may be of the well-known saw-tooth type, so that there is a relatively slow traversal in one direction and practically an instantaneous return in order that the image is reproduced always in one direction.

Since the manner of producing the deflecting fields forms no part of the present invention, no specific form is shown, but it is understood that any well known type of means to produce deflecting fields may be used. For these two deflecting fields, it should be understood that the lower of the two deflecting frequencies, that is the frequency causing the slow motion, should be of a frequency equal to the number of picture repetitions per second. Therefore, this lower frequency may, for example, be of a value varying between 16 and 24 cycles per second and the higher of the two frequencies will be a value equal to the lower frequency multiplied by the number of picture lines forming each reproduced image, so that the higher frequency, for example, may vary, assuming a 100 line picture is being constructed, from 1600 cycles per second to 2400 cycles per second, depending upon the number of complete pictures per second which are to be reproduced. In any case, however, it is to be understood that these values are merely suggested as suitable but are not in any sense intended to be limiting.

Also, while electrostatic ray deflection within the tube for position control has been shown, it is likewise possible to substitute for the electrostatic deflection electromagnetic deflecting fields which, if desired, may be external to the tube, and also to substitute external electrostatic deflecting fields.

In order to produce modulation of the resulting light spot produced by the bombardment of the fluorescent end wall 19 of the tube 5 by the cathode ray 11, an auxiliary pair of plates 25 has been provided. One of these plates is connected to ground at 15, for example, and the other plate is connected with the radio frequency amplifier circuit by means of a suitable conductor 27, so that the amplified radio frequency oscillations received by the collecting means 1 may be impressed directly upon the intensity controlling deflecting plates 25. As was above set forth, this arrangement will produce a control of the intensity of the resulting light spots upon the fluorescent screen, since the time during which the cathode ray stream 11 is able to pass through the diaphragm 17 in its passage toward the fluorescent end wall 19 of the tube is proportional to the amplitude of the supplied radio frequency energy and the brilliance of the spot upon the fluorescent screen is, in turn, proportional to the time during which the cathode ray impinges thereon.

Other modifications of this invention to produce a suitable intensity control of the resulting electro-optical image produced upon the fluorescent end wall of the tube are, of course, obvious to anyone skilled in the art to which the invention relates, and therefore the invention herein disclosed is to be considered in its broad sense as covering all forms of intensity control which fall fairly within the spirit and scope of the present disclosure, as defined by the hereinafter appended claims.

Having now described my invention, what I claim and desire to secure by Letters Patent is the following:

1. In a television system embodying a cathode ray tube and a set of auxiliary deflecting plates arranged to control the passage of the cathode ray through a diaphragm toward the fluorescent screen, the method of reproducing television signals which comprises generating a cathode ray and projecting the generated ray toward the fluorescent end wall of the tube for producing luminous spots thereon, producing a position controlled deflection of the resulting spots along a pair of paths transverse to each other at appropriate speed rates, and supplying to the intensity controlling deflecting plates radio frequency potentials to control in accordance with the amplitude of the supplied potentials the time of passage of the cathode ray through the diaphragm to impinge upon successive elemental sections of the screen.

2. In a television receiving system comprising the combination of a cathode ray tube provided with a fluorescent end wall adapted to produce light spots upon the bombardment thereof by cathode rays, the method of intensity control which comprises limiting the normal period during which the cathode rays impinge upon the fluorescent end wall to produce light spots within the cathode ray tube, and varying the said normal effective time period of impact of said rays by influencing the cathode ray in its passage toward the fluorescent screen with an amplitude varying radio frequency field proportional in amplitude to fluctuating intensities of light and shadow to be represented.

3. In a television system, a cathode ray tube having a fluorescent end wall, an apertured diaphragm within the tube, a pair of signal actuated deflecting plates arranged to control the passage of the cathode ray through the aperture toward the fluorescent end wall, means for producing a plurality of transverse electric fields within the tube to cause the light spots produced from the cathode ray acting upon the fluorescent material to trace upon the end wall of the tube a pair of paths at right angles to each other at appropriate speed rates, and means for supplying to the signal actuated deflecting plates amplitude modulated radio frequency potentials of sufficient amplitude to cause the cathode ray to overshoot the edges of the aperture in amounts varying with the modulation thereof and thereby varying the time duration of passage of the cathode ray through the aperture to vary the resultant spot brilliance upon the fluorescent end wall proportional to the time duration of impact of the cathode ray.

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