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ELECTRONIC DEVICE

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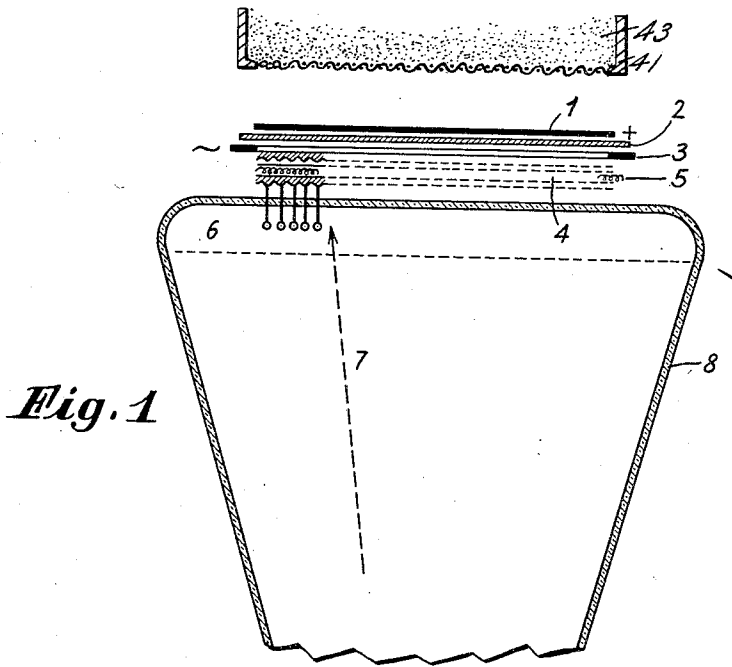


Fig. 1

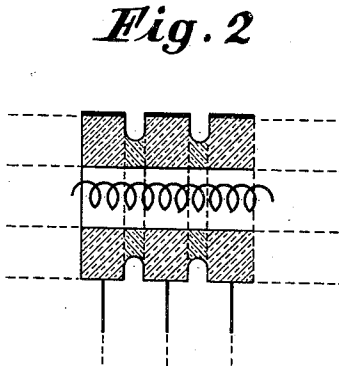


Fig. 2

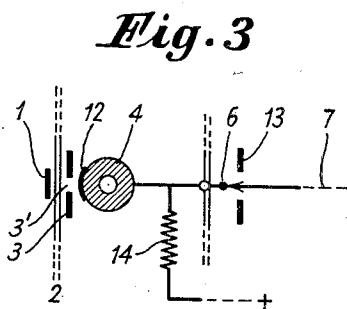


Fig. 3

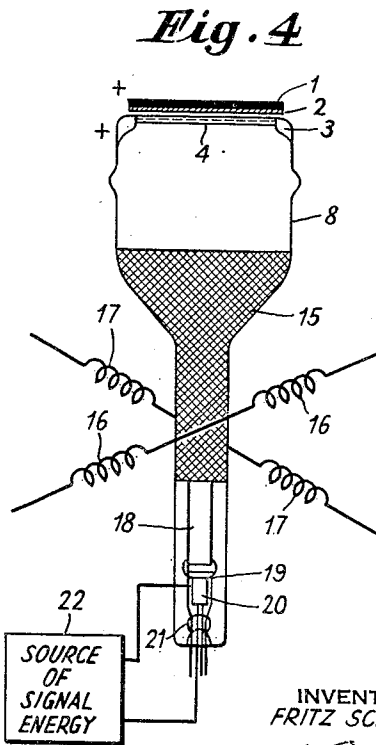


Fig. 4

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ELECTRONIC DEVICE

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9 Claims. (Cl. 178—7.5)

This invention relates to electronic signaling apparatus and in particular to television receiving apparatus wherein an electro-optical record is made as an intermediate step of the final projection of the picture.

P. Selenyi has described in "Elektrotechnische Zeitschrift", vol. 56, No. 35, 1935, on page 961 an electrographic method by means of which there can be recorded a point by point on an insulating carrier through electron charges and subsequent dusting with a powder such as lyco-podium powder. This author furthermore has already pointed to the applicability of this method to intermediate film television reception. To this end, the image made visible through dusting on a transparent or reflecting carrier is recreated on the receiving screen at high enlargement by way of diascopic or epidiasepic projection.

One of the objects of my invention is to provide an improved intermediate film type of television system of the kind proposed by Selenyi.

Another object of my invention is to provide a television apparatus which shall have increased resolution by supplying a substantial increase in the number of elemental areas representative of the picture surface.

A further object of my invention is to provide a simplified intermediate film projection television receiver which shall be easy to operate and have comparatively low initial cost as well as low maintenance cost.

Other and ancillary objects will appear upon consideration of the specification taken in conjunction with the drawing, in which:

Fig. 1 shows one embodiment of my invention;
Fig. 2 shows an electrode structure used in the embodiment shown in Fig. 1;

Fig. 3 shows a circuit scheme; and

Fig. 4 shows another embodiment of my invention.

Selenyi has pointed out that his dusting method would permit the recording of images up to 100,000 elemental areas per second. Since the order of the number of elemental areas in the image lies today already at 50,000 and more for good definition, the limit of recording according to Selenyi's method would be exceeded at 24 images per second. This drawback is now overcome in accordance with this invention by means of parallel connection of several transmission channels in conjunction with storage and amplification effects. A mode of construction according to this invention resides in that the original image be dissected simultaneously into a multiplicity of lines, and at the output of the corre-

sponding number of transmission channels at the receiver a like number of controlled electronic recording systems (in the same arrangement relative to the image frame as in case of the transmitter) are put into action in parallel as to time.

In order that this may be carried out in case of stationary electronic recording systems, it would be necessary to provide a number of systems equal to the number of lines which the image contains in the direction of movement of the intermediate film. Assuming for instance 200 such lines, it would be necessary in a line transversal to the advance of the intermediate film to provide 200 independent stationary recording systems operating simultaneously, past which the film moves continuously and in synchronism with the respective photo-electric evaluation at the transmitter, in order later to be projected on the receiving screen following the dusting in step-like fashion (Maltese cross) or in continuous running (by the use of an image balancing arrangement, for instance Wehler's prism wheel, mirror arrangement according to Mechau). At the transmitter therefore, 200 separate photocells or photo-elements with the same number of adjoining amplifier channels are required or else in place thereof a transformation arrangement which distributes the image modulation gained in the single channel method, true to the image points over 200 channels.

If in view of the structural difficulties in the afore-described multiple arrangement the number of the simultaneously acting transmission channels would be made smaller than the number of divisions along the one or the other image coordinate, i. e. smaller than the number of lines appertaining to the dimension under consideration, there arises the necessity of a rapid relative movement of the intermediate film to the recording means. In view of the apparent mechanical difficulties of such a method this invention envisages the application of moving modulated cathode rays for the image production, whereby these cathode rays produced in the vacuum act directly or indirectly in the free space in order there to produce on the carrier of the image record the locally varying electron charge, over which the fine particles are dusted.

Hereby the intensity control of the cathode ray through the transmitted image modulation as well as the deflection in accordance with one of the two image coordinates takes place in the ordinary way in the cathode ray tube proper.

Figure 1 shows a mode of structure according to the invention relating to a special construction

of the grid-controlled electronic recording system. Between the anode plate 1 and the grid 3 of slot-like construction, there is moved the record carrier which is a transparent, highly insulating film free of emulsion, whereafter it passes through the dusting and projection zone. The film 2 suitably forms an endless loop of sufficient length in whose circular path in back of the projection zone a device for wiping off the dusted powder is inserted. In parallel to the grid slot 3, an indirectly heated cathode is arranged consisting of a tubular ceramic body whose bore contains a heating helix 5. This incandescent cathode whose length corresponds to the image line to be traced on the film 2, instead of having a smooth surface has a roughened surface provided thereon such as shown greatly enlarged in Figure 2 as part of the longitudinal section through 4. The cathode may for example consist of alternate rings of metal separated by smaller diameter insulators to give the raised surfaces 9, 10, 11 which are covered with a conducting material and separated from each other by insulating intermediate spaces. In this manner the cathode is subdivided into a plurality of electrically independent emission zones corresponding to the line. According to Figure 1 and Figure 3 these emission zones are connected across conducting leads to a corresponding number of contacts 6 arranged in the interior of the cathode ray tube 8. The connections are inserted through and held by the glass wall. They come in contact in succession with the cathode ray 7 modulated and moving along the line and produced in the tube 8, and these connection lines owing to suitable preparation of their surfaces are charged negatively. The lycopodium powder 43 in the sieve 41 may then be dusted over the insulating medium.

In Figure 3 there is shown the circuit scheme. The cathode 4 shown in enlarged cross section is provided with an oxide layer 12 emitting electrons said layer being disposed on the side facing the grid 3 or slot shaped orifice 3' of the grid and also facing the film 2. The oxide covers the metallic carrier ring surrounding the entire circumference of the cathode and which is in connection with a constant current source at the inner contact 6 of the cathode ray tube 8 as well as across the resistor 14. Element 13 designates an anode with slot-shaped orifice provided in the cathode ray tube, and in back of which the line of the contacts 6 is arranged. The potential of the current source connected with 12 across 14 is slightly more positive than that at which grid 3 is maintained constant. Consequently, in the absence of the cathode ray, the grid 3 produces a blocking effect across the entire length of the cathode 4, so that no electrons can arrive at the film 2. If however, the modulated cathode ray 7 moved along the line of the contacts 6 supplies the cathode elements with less negative charge. The field of the anode 1 grips in a corresponding degree through upon the charged emission zones of the cathode 4 and from there is caused a transit of electrons to the carrier of the record 2, which transit is controlled in accordance with quantity of charge. The emission of each cathode element into a region of negative potential relative to the grid by proper choice of the radiation conditions, of the size of the resistor 14 and of the capacity of the charged part, continues up to the time at which the cathode ray returns to the same place, i. e., it last approximately throughout the duration of an image line.

Since during this time the film 2 has advanced by the width of an image line, there will be obtained on the carrier 2 a sufficient spacial electron charge, so that it is possible to produce charges on the film even in case of a very large number of image points. The recording frequency becomes equal to the image line frequency, and hence is essentially reduced as compared with the image point frequency. It is also possible to modify this method; thus instead of subdividing the cathode 4 in Figure 1, to subdivide the grid 3 and to connect its elements with the contact line 6 in the ray tube. In this case a positive or negative image record would be obtained in accordance as to whether the ray 7 at the electrodes 6 has a factor of the secondary emission that is greater or smaller than 2. However, in this case it would be difficult to eliminate the errors caused by the control of the contact potential at the individual elements of the grid and by the varying activation thereof.

Figure 4 shows another embodiment of the invention. Element 1 again signifies an anode arranged in back of the film 2 as seen from the side of the cathode ray, and which is maintained at a still higher positive potential than the last acceleration anode in the cathode ray tube proper. The tube 8 is designed as Lenard tube, thus containing a window 4 for the exit of the cathode ray, and consisting of a thin foil of light metal. If beryllium is chosen for said foil the passage of the electron ray into the open can already be achieved with an acceleration potential of about 20,000 volts. If the film 2 is placed closely in front of the Lenard window 4, and if the field between 4 and 1 still produces a highly accelerating action upon the electrons passing into the open, there can be obtained on 2 a very high electron charge fluctuating along the image line with the variation in the brightness. The carrier of the foil 4 is a metal piece 3 fused to the glass tube 8 in accordance with a known method, and which has a hollow space for circulating cooling water.

Element 15 designates an inner conducting layer serving at the same time as acceleration anode, 16 and 17 are crossed coil pairs for the magnetic deflection of the cathode ray in the direction of the image and line, 18 is the first anode, 19 is the control electrode for the intensity modulation, 20 is the shielded cathode system, and element 21 is the lead-in of the electrode connections. In order to increase the life of the Lenard's foil under the action of the outer air pressure, it is preferred to mount the same on a plate having a small longitudinal slot. In this case the operation would be carried out only with a single line movement of the cathode ray along this slot, while the line alternation of the recording is effected by continuous advance of the film 2. In this case, it is obvious that one of the deflection coil pairs 16, 17 can be dispensed with, while the image alternation is synchronized with the advance movement of the film.

Having now described my invention, what I claim is:

1. The steps in the method of producing charges on an insulating medium in air comprising developing a plurality of elemental thermionic electron emitting sources, directing the electrons emitted from the sources through air toward the insulating medium, producing a focused beams of electrons, and controlling the intensity of the directed electrons in accordance with the produced beam.

2. The steps in the method of producing charges on an insulating medium in air comprising developing a plurality of elemental thermionic electron emitting sources, directing the electrons emitted from the sources through air toward the insulating medium, producing a focused beam of electrons, controlling the intensity of the produced beam and controlling the intensity of the directed electrons in accordance with the produced controlled beam.

3. The steps in the method of producing charges on an insulating medium in air comprising developing a plurality of elemental thermionic electron emitting sources, directing the electrons emitted from the sources through air toward the insulating medium, producing a focused beam of electrons, controlling the intensity of the produced beam, deflecting the controlled beam, and controlling the intensity of the directed electrons in accordance with the deflected controlled beam.

4. The steps in the method of producing charges on an insulating medium in air comprising developing a plurality of elemental thermionic electron emitting sources, directing the electrons emitted from the sources through air toward the insulating medium, producing a focused beam of electrons, controlling the intensity of the produced beam, sequentially actuating each of the plurality of developed sources by the controlled beam, and controlling the intensity of the directed electrons in accordance with the actuation of the developed sources by the produced beam.

5. The method of producing charges on an insulating medium in air representative of the intensity of illumination of elemental areas of an image to be produced comprising the steps of developing a plurality of elemental thermionic electron emitting sources, directing the electrons emitted from the sources through air toward the insulating medium, producing a focused beam of electrons, developing a source of electrical impulses representative of the image to be produced, controlling the intensity of the produced beam in accordance with the developed electrical impulses, and controlling the intensity of the directed electrons in accordance with intensity of the controlled produced beam.

6. The method of producing a record on an insulating medium in air representative of an electrically transmitted image which comprises

the steps of developing a plurality of elemental thermionic electron emitting sources, directing the electrons emitted from the sources through air toward the insulating medium, producing a focused beam of electrons, developing a source of electrical impulses representative of the image to be produced, controlling the intensity of the produced beam in accordance with the developed electrical impulses, controlling the intensity of the directed electrons in accordance with intensity of the controlled produced beam, and subsequently dusting dielectric particles over the insulating medium.

7. In combination, an insulating medium, a flat electrode, an apertured electrode, means for positioning the insulating medium between the two said electrodes, a plurality of elemental thermionic electron emitting sources positioned adjacent the apertured electrode, a cathode ray tube comprising means for developing and controlling a cathode ray, and means to control the intensity of emission of electrons from the electron sources by the intensity of the cathode ray.

8. In combination, an insulating medium, a flat electrode, an apertured electrode means for positioning the insulating medium between the two said electrodes, a plurality of elemental thermionic electron emitting sources positioned adjacent the apertured electrode, a cathode ray tube positioned in register with said sources comprising means for producing and controlling a concentrated cathode ray, means to control the intensity of emission of electrons from the electron sources by the intensity of the cathode ray, and means to direct the emitted electrons through air upon the insulating medium.

9. In combination, an insulating medium, a flat electrode, an apertured electrode, means for positioning the insulating medium between the two said electrodes, a plurality of elemental thermionic electron emitting sources positioned adjacent the apertured electrode, a cathode ray tube positioned in register with said sources comprising means for producing and controlling a concentrated cathode ray, a source of electrical signalling energy, means to control the cathode ray intensity in accordance with the electrical signals, and means to direct the electrons emitted from the sources through air upon the insulating medium.

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