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MULTIELEMENT CATHODE RAY TUBE

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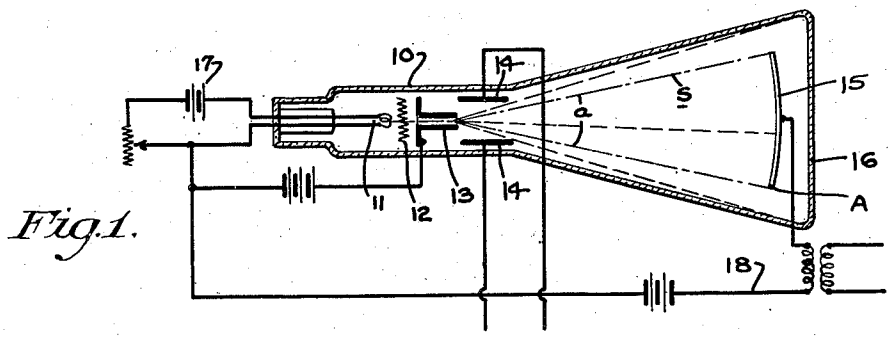

Fig. 1.

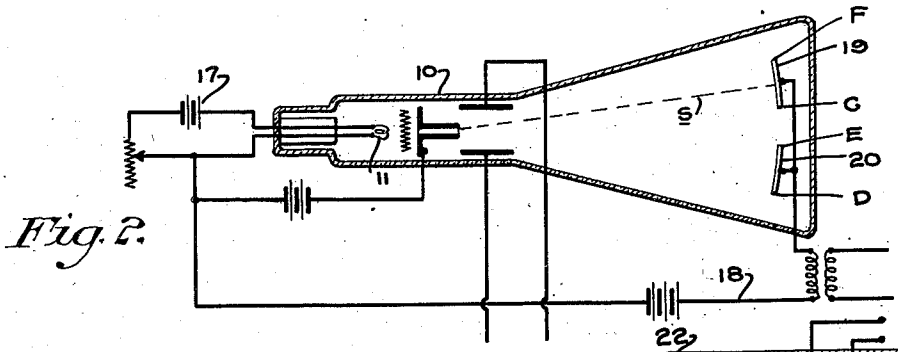

Fig. 2.

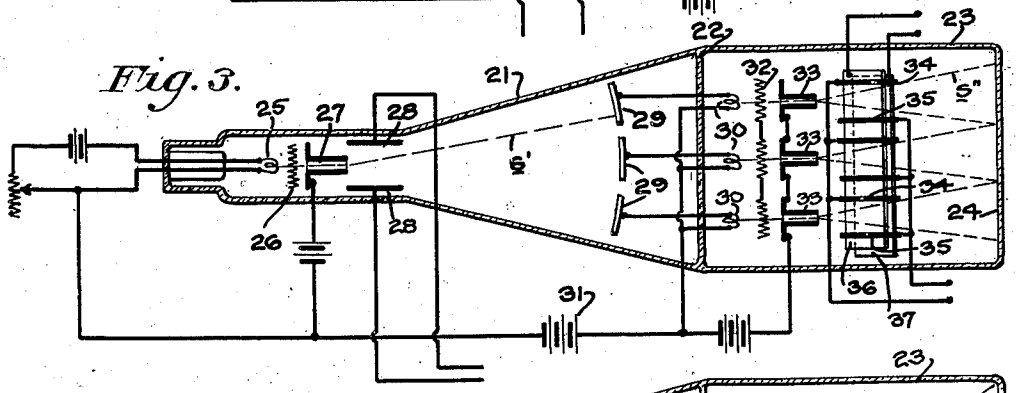

Fig. 3.

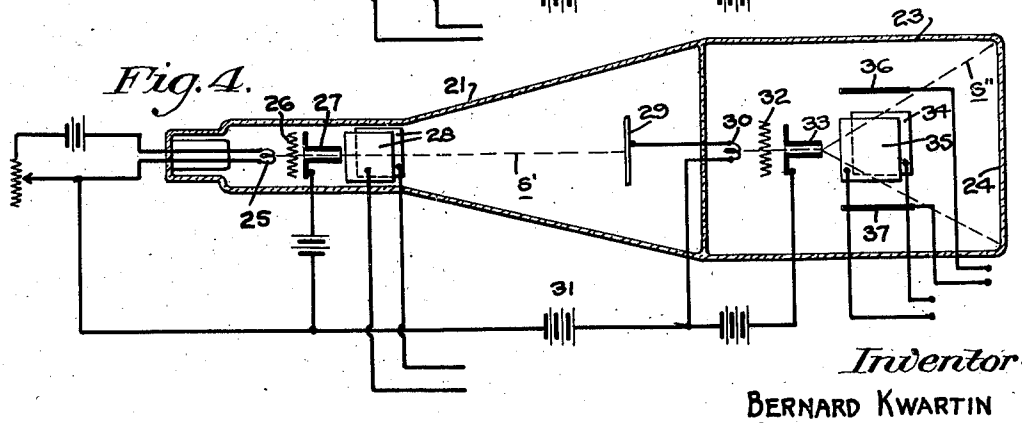

Fig. 4.

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MULTIELEMENT CATHODE RAY TUBE

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Application May 12, 1931, Serial No. 536,808

5 Claims. (Cl. 250—27.5)

This invention relates to apparatus for receiving light pictures and more particularly to improvements in electronic receivers such as are employed for receiving light pictures which have been transmitted from a remote point by either wire or radio.

Heretofore and prior to this invention it has been proposed and various attempts have been made in electronic receivers which function more or less in accordance with the principles of the Braun tube. These tubes are all characterized in that one end thereof is provided with a fluorescent screen or target the visible fluorescence of which may be varied in accordance with the variations in intensity of the electronic stream which is set up in the tube. Considerable difficulty, however, has been encountered in the use of this tube due to the fact that it has not been possible to enlarge the size of the target or screen upon which the light images appear without causing the latter to be considerably distorted.

It is among the principal objects of the present invention to provide a multiple-element electronic tube which makes possible the facsimile reproduction of transmitted light pictures upon a screen which is considerably larger than any of those which have been employed heretofore.

A further object of the invention is the provision of an electronic receiver wherein a plurality of thermionic cathodes are employed for producing a corresponding number of electron streams each of which latter is adapted to scan a predetermined portion of a considerably enlarged fluorescent screen or target.

A still further object of the invention is the provision in an electronic receiver of a plurality of thermionic cathodes each of which is individually capable of producing its own electron stream, these cathodes being selectively energized in predetermined order by means of an electronic interrupter forming part of the receiver.

Still another and important object of this invention is the provision of an electronic interrupter which is capable of interrupting an electric circuit at frequencies of very high order, the interrupter being designed to interrupt the circuit two or more times for each oscillation of the electronic stream.

Other objects of the invention will appear more fully hereinafter.

It will be understood that the invention consists substantially in the combination, construction, location and relative arrangement of parts, as well as in the method of employing the same, in the facsimile reproduction of transmitted light pictures and as a high frequency interrupter independently of its use as a television receiver, all as will appear more fully hereinafter, as shown in the accompanying drawing, and as finally pointed out in the appended claims. In the accompanying drawing, which illustrates certain preferred embodiments of the present invention:—

Figure 1 is a diagrammatic illustration of an electronic interrupter constructed in accordance with and embodying the principles of the present invention;

Figure 2 is a diagrammatic illustration of an electronic interrupter which is capable of interrupting an electric circuit at a greater frequency for each cycle of applied current than that shown in Figure 1;

Figure 3 is a diagrammatic illustration of an electronic receiver constructed in accordance with and embodying the principles of the present invention; and

Figure 4 is a diagrammatic illustration of the receiver when viewed at right angles to Figure 3.

Referring now to the drawing and more particularly to Figures 1 and 2 thereof, the electronic interrupter, designated generally by the reference numeral 10, essentially comprises a Braun tube preferably of the type having a thermionic cathode 11, a control element 12, an anode 13 and a pair of plates 14—14 for deflecting the electronic stream *s* in a horizontal plane. In the form of tube shown in Figure 1, a metallic plate 15 is suitably supported within the tube adjacent the outer enlarged end 16 thereof. It will be observed that this electrically conductive plate 15, which may be in the form of a slightly arcuated strip intersecting the plane of oscillation of the electronic stream *s*, is arranged with the opposite ends thereof terminating short of the opposed side walls of the tube.

The thermionic cathode 11 is energized in any suitable manner, as by a source of potential 17 to produce the electron stream *s*, which latter passes through the tubular anode 13 and toward the plate 15. The oscillatory movement of the stream *s* is controlled by an electrostatic field established between the plates 14—14, these plates being respectively connected to the terminals of a suitable oscillator (not shown) of any desired frequency. By proportioning the plate 15 such that the angle *a* is less than the angle through which the electronic stream *s* oscillates, it will be observed that for each oscillation of the electronic stream the circuit 18 will be interrupted

twice, the first interruption when the stream *s* leaves the plate at the point A. Attention is here directed to the fact that during the interval the electronic stream *s* is confined within the limits of the angle *a* it serves to complete the circuit 18, the plate 15 serving as one terminal of this circuit and the thermionic cathode 11 as the other.

In Figure 2, a modified arrangement of electronic interrupter is shown wherein a pair of electrical conductive plates 19 and 20 are employed instead of the single plate 15 of Figure 1. Where two such plates 19 and 20 are employed, the circuit 18 is interrupted four times for each oscillation of the electronic stream *s*, the first interruption occurring when the stream *s* leaves the plate 19 at C, the second when it leaves the plate 20 at D, the third when it leaves the plate 20 at E, and the fourth when it leaves the plate 19 at F. It will be understood of course that by still further multiplying the number of electrical conductive plates, a corresponding increase may be had in the number of interruptions for each cycle of current applied to the deflecting plates 14—14. It will also be understood that instead of employing an electrostatic field for effecting an oscillatory movement of the electronic stream *s*, the same effect may be obtained by means of an electromagnetic field established through the use of a pair of opposed electro-magnets the energy for which is supplied by the oscillator.

Referring now to Figures 3 and 4, it will be observed that the electronic interrupter of the character just described has been incorporated as an element of an electronic receiver such as may be used in connection with the facsimile reproduction of transmitted light pictures. This electronic receiver comprises a Braun tube 21 to the outer and enlarged end 22 of which is secured an auxiliary axially extending tube 23 the outer end of which is provided with a fluorescent screen or target 24. The portion 21 of the receiver is again preferably of the type having a thermionic cathode 25, a control element 26, an anode 27, and a pair of plates 28—28 for deflecting the horizontal streams *s'* in a horizontal plane. Suitably mounted within the interior of the portion 21 of the receiver and adjacent the intermediate wall 22 thereof are a plurality of electrically conductive plates 29. In the particular instance shown, three such plates 29 are employed, the several plates being electrically independent of each other. Suitably arranged within the interior of the portion 23 of the receiver and immediately adjacent the intermediate wall 22 thereof are a plurality of thermionic cathodes 30, one terminal of each of which is respectively connected to one of the plates 29. The opposite terminals of these cathodes are electrically connected together and to the thermionic cathode 25 through a suitable source of supply 31.

It will be observed as the electronic stream *s'* oscillates in a horizontal plane under the influence of the horizontal deflecting plates 28—28, the several secondary thermionic cathodes 30 are selectively energized in a predetermined order depending upon which of the plates 29 the electronic stream *s'* is in contact with. The secondary cathodes 30 are uniformly spaced horizontally of the rear end of the portion 23 of the receiver and are each provided with a suitable control element 32 and an anode 33. In addition, each secondary cathode is provided with a pair of horizontal deflecting plates 34—35 for controlling the horizontal deflection of the electronic stream *s''*, which emanates from the cathode 30. It will be understood of course that as each of these secondary thermionic cathodes 30 is energized an electronic stream *s''* is produced the outer end of which is adapted to strike the fluorescent stream or target 24. The several sets of horizontal deflecting plates 34—35 are connected in parallel and are adapted to be energized by a suitable oscillator (not shown).

In addition to the horizontal deflecting plates 34—35, the receiver is provided with a pair of vertical deflecting plates 36—37 for effecting a vertical deflection of the electronic stream *s''*. It will thus be understood that the movement of each electronic stream *s''* is controlled by electrostatic fields applied to the plates 34—35 and the plates 36—37. It will also be observed that due to the provision of a plurality of thermionic cathodes each of which is adapted to produce its own electronic stream *s''*, it becomes possible to scan a much larger screen than has been possible heretofore with the result that a larger facsimile of the transmitted picture is obtained.

It will be understood of course that each of the electronic streams *s''* is designed to scan a predetermined section of the screen 24 and that in the particular illustration shown three such streams are employed to scan one horizontal line of the screen. It is the electronic interrupter which governs, controls and maintains the precise operating relation between the several electronic streams *s''* and which prevents any possibility of overlap therebetween in a horizontal direction. The vertical deflecting plates 36—37 operate to commonly affect the several electron streams *s''* independently of the action of the interrupter and in the same manner as they ordinarily affect the electron stream which is produced in the usual single element receiver.

While in the illustrated arrangement, the portions 21 and 23 of the receiver are shown as being integrally united to constitute a single unit, it will be understood that they may be formed as separate units adapted to be electrically connected together.

While it is preferable to employ electrostatic fields for effecting the horizontal and vertical deflection of the electronic streams *s'* and *s''*, it will be understood of course that electromagnetic fields may be employed with good effect for this purpose. Other advantages and modifications may also be made from time to time without departing from the real spirit or general principles of the invention and it is accordingly intended to claim the same broadly, as well as specifically, as indicated by the appended claims.

What is claimed as new and useful is:—

1. A cathode ray tube for television systems including a plurality of secondary thermionic cathodes energizable from a single source of energy and each of which is individually capable of producing its own electron beam, an accelerating electrode for each of said cathodes, an electronic interrupter interposed between said source of energy and said cathodes operative to successively energize the latter in predetermined order, a primary cathode for producing a beam capable of electrically connecting said energy source and said interrupter, and electrically energized beam-deflecting means for causing the beam produced by each of said cathodes to oscillate in a given plane and at a predetermined frequency.

2. A cathode ray tube for television systems including a plurality of secondary thermionic cathodes energizable from a single source of energy

and each of which is individually capable of producing its own electron beam, an accelerating electrode for each of said cathodes, an electronic interrupter interposed between said source of energy and said cathodes operative to successively energize the latter in predetermined order, a primary cathode for producing a beam capable of electrically connecting said energy source and said interrupter, and electrically energized beam-deflecting means for causing a vertical deflection of the beams produced thereby.

3. A cathode ray tube for television systems including a plurality of secondary thermionic cathodes energizable from a single source of energy and each of which is individually capable of producing its own electron beam, an accelerating electrode for each of said cathodes, an electronic interrupter interposed between said source of energy and said cathodes operative to successively energize the latter in predetermined order, a primary cathode for producing a beam capable of electrically connecting said energy source and said interrupter, and electrically energized beam-deflecting means for causing a two-dimensional deflection of each beam respectively produced.

4. A cathode ray tube for television systems and the like including a plurality of laterally spaced secondary thermionic cathodes, said cathodes being adapted for selective energization whereby to produce separate electron beams, an accelerating electrode for each of said cathodes, a primary thermionic cathode for effecting the successive energization of said secondary cathodes, and a plurality of pairs of deflecting plates for respectively effecting oscillation of the several beams in the plane common to said cathodes, the angular displacement of each beam being such that the beams supplement one another in scanning adjoining portions of a fluorescent screen or target.

5. A cathode ray tube for television systems including a plurality of secondary thermionic cathodes energizable from a single source of energy and each of which is individually capable of producing its own electron beam, an accelerating electrode for each of said cathodes, and an electronic interrupter including a single primary thermionic cathode and a coacting anode for generating an electronic beam and a pair of deflectors for effecting the oscillation of said beam whereby the latter completes the energizing circuit to each of said secondary cathodes in predetermined order.

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