Dec. 26, 1939. K. SCHLESINGER 2,185,132

CATHODE RAY TUBE

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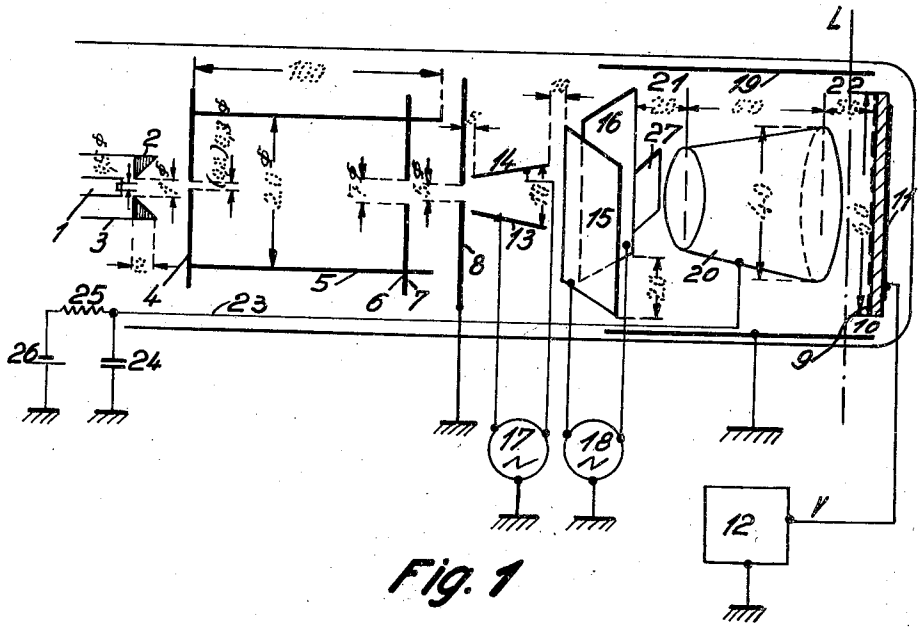

Fig. 1

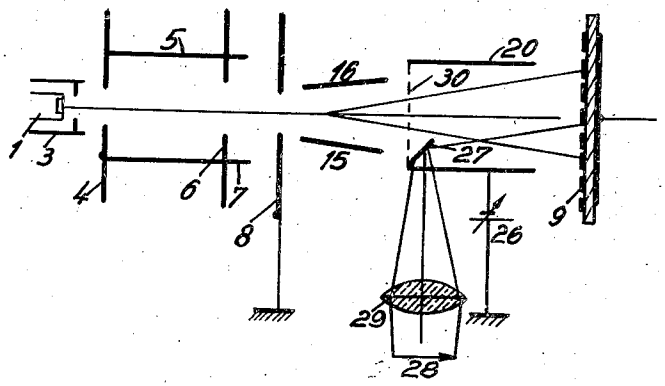

Fig. 2

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CATHODE RAY TUBE

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Application January 6, 1937, Serial No. 119,192
In Germany January 11, 1936

7 Claims. (Cl. 250—153)

The invention relates to an iconoscope in which deflecting plates are provided for applying scanning deflections to a cathode beam.

In describing and explaining the invention, reference will be made to the accompanying drawing,

Fig. 1 of which shows diagrammatically, partly in sectional elevation and partly in perspective, an iconoscope embodying the invention and certain electric devices associated therewith, whereas

Fig. 2 shows diagrammatically in sectional elecation the electrode system of an iconoscope, incorporating a modification.

In Fig. 1, 1 is a hot cathode situated within a control cylinder 3 which, with the assistance of a conical member 2, preliminarily concentrates the ray on to the aperture of a diaphragm 4. The latter terminates a tubular member 5, the upper portion of which, viz., the apertured lid 6 and the edges 7 form in conjunction with an anode 8 a well corrected electrical lens. The aperture in the diaphragm 4 is sharply electron-optically reproduced on the photo-electric mosaic 9, which is disposed on a sheet of mica 10 backed by a signal plate 11, in the manner well known in the art. The signal plate 11 is connected with the amplifier 12 through the line V.

The photo-electric mosaic has an optical image of the object to be televised projected thereonto. In order that this may be done from the side of the tube, i. e. in the drawing, from the side above the plane of the paper, a mirror 27 may be provided as shown, in the manner described in the co-pending patent application Ser. No. 107,669, filed October 26, 1936.

Under the influence of the light projected onto the mosaic 9, the mutually insulated individual particles thereof emit photo-electrons determined in their number by the local illumination intensity, so that the optical image formed on the mosaic 9 produces an electrical charge image thereon. The electron-image of the aperture in 4 is caused, by a system of two pairs of deflecting plates 13/14, and 15/16, to scan the mosaic 9. A series of electric impulses is thereupon transmitted to the signal plate 11, which correspond in their distribution in time to the geometrical distribution of charges over the mosaic 9. These impulses are the vision signals which are then impressed on amplifier 12 and further disposed of in the manner well known in the art.

Of the deflecting plates 13 and 14 are those for the line scanning and 15 and 16 those for the frame scanning. The advantages of performing the scanning cathode ray deflections by electrostatic plates as compared with magnetic deflection are sufficiently well known. Electrostatic deflection should preferably be effected in the push-pull way, as the image is then rectangular (free from keystone distortion) and sharp at the edges. Accordingly, each pair of plates is shown as being connected with a reverse phase voltage generator, 17 being the generator of rapid relaxation oscillations, 18 that of slow relaxation oscillations, the reverse phase operation being indicated by showing the middles of the generator symbols at a fixed potential, viz., that of ground, to which there is also connected the main anode 8.

Now it was found upon the attempt to operate a tube of the general type illustrated in Fig. 1 that a considerable effect was exerted on the output of amplifier 12 by the deflecting potential at the plates. A closer investigation of these spurious signals led to the conclusion that the rear plates 13, 14 are adequately screened by the front plates 15, 16, so that their fields do not act on the output circuit, provided, though, that all leads disposed at the left-hand side of the line L are passed out in common through the foot of the tube, whilst the amplifier line V is conducted separately to the amplifier input through the top of the tube, that even then, however, and even if operated with reverse phase voltages, the front plates 15, 16 were found to affect the photoemission of 9 to an undesirable extent. Dependent on the condition of oscillation of the front plates the photo-electrons are subjected to different suction voltages. An earthed coating 19 on the wall is not sufficient to eliminate this effect.

According to the invention, there is provided a screening electrode 20 extending in the direction of the ray. This electrode may be a cylinder. Preferably it is of frusto-conical form, its rear and front orifices being selected in accordance with the "cross-sections of the movement of the cathode ray," i. e., with the cross-sections of the pyramid of deflection, so that the cylinder 20 will never be touched by the ray. The distance 21 between the frusto-conical screening member and the front edge of the plates is according to a further feature of the invention, made at least as large as the distance between the plates, so that no distortion of the field and ensuing distortion of the line screen will be caused by the electrostatic field between the frusto-conical member and the plates. The distance 22 between the frusto-conical member and the photo-mosaic 9 is selected to be approximately equal to the height of the screen plate 9. The front orifice of the frusto-conical member is made somewhat

smaller than the photo-plate, which follows as a matter of course if it is assumed that the ray, in its extreme position just avoids touching the frusto-conical member. With this dimensioning the suction field between the frusto-conical screening member 20 and the photo-plate 9 is of equal strength in respect of practically all points of this plate. There may be supplied to the screening member 20 a weakly positive bias or earth potential. The potentiol is supplied by a lead 23, which may also be passed through the base of the tube, but must be by-passed to earth by a steadying condenser 24 of approximately 1 mf., and protected against penetrating oscillations by a series resistance 25. It is preferable to conduct this lead, too, out of the tube separately from the remaining leads serving for deflection and focussing purposes, in order that the screening member be maintained free from capacitative coupling by oscillations within the tube.

It has been found that by means of a screening member of this nature any trace of a penetration of the fields from the plates 15/16 to the photo-mosaic is suppressed, whilst on the other hand an even suction effect on the photo-electrons is obtained. A distortion of the line screen of the cathode ray due to the member 20 was not found to occur with the dimensions stated. The voltage of the biasing battery 26 may be in the order of +100 volts, and is preferably between 0 and +50 volts. The tested iconoscope described operates with a considerable sharpness of the scanning lines, viz. with lines of about 2 mm. in thickness at the screen if the aperture in the diaphragm 4, of which the scanning spot is an electron image, is 3 mm in diameter. The screen has a diameter of approximately 60 mm. so that the screen has room for about 300 lines disposed closely adjacent to each other. An increased fineness of the screen may be obtained simply by reducing the diameter of the aperture in the diaphragm 4 from .3 to .2 mm. The optimum operation was found with about 800 volts anode potential.

Mirror 27 is preferably in metallic connection with the plate 16, and the light from the object to be televised is preferably projected through the screening member 20.

In Fig. 2, which illustrates a tested modified form of an iconoscope embodying the invention, like members are given the same references as in Fig. 1. The electrode 20 is shown cylinder shaped. The diameter of the cylinder in the case of a given length, which should be as great as possible, is fixed quite definitely by the shown extremum positions of the deflected cathode ray. In the tested case the length of the cylinder amounted to 50 mm. with 35 mm. diameter, the size of the mosaic screen being 50 x 50 mm., and the length of the oscillating part of the ray amounting to 100 mm. The deflecting mirror 27 was disposed, as far as possible, towards the rear of the cylinder, where it did not intersect the passage of the rays.

By 28 the object of transmission is indicated, by 29 the optical system projecting an image of 28 onto the iconoscope.

The screening electrode 20 may, according to a further feature of the invention, be completed by a wire net as shown by 30, arranged in accordance with the copending patent application numbered 119,194, filed January 6, 1937.

It is specifically remarked that in the above there have been described particular forms of embodiment of the general idea of the invention, and that the stated measures may be employed and claimed both in combination as well as singly.

I claim:

1. A cathode ray tube comprising a photo-electrically sensitive electrode structure, means for producing a cathode beam directed onto said structure, electrostatic cathode ray deflecting means for causing the part of said beam disposed between a point of its path and said structure to oscillate laterally about the stated point so that said beam sweeps over said structure, and an extended conductor mounted between said deflecting means and said structure and surrounding at least half of the mentioned part of the path of said beam to screen said structure from said deflecting means.

2. A cathode ray tube comprising an envelope having a base portion and enclosing a photo-electrically sensitive electrode structure, a large capacity counterplate to said structure, a photo-anode mounted in operative relationship to said structure, electrodes for producing a cathode beam, further electrodes for applying scanning deflections to said beam and an extended conductor mounted between said further electrodes and said structure, said conductor being extended in the direction from said further electrodes to said structure to screen said structure from said further electrodes, a lead connected to each of said electrodes, all of said leads being taken through said base portion, further leads connected to said counterplate and to said photo-anode, said further leads being separately fused through said envelope.

3. A cathode ray tube comprising a photo-electrically sensitive electrode structure, means for producing a cathode beam directed onto said structure, electrostatic cathode ray deflecting means for causing the part of said beam disposed between a point of its path and said structure to oscillate laterally about the stated point so that said beam sweeps over said structure, and an extended hollow-cylinder-shaped conductor mounted between said deflecting means and said structure and surrounding at least half of the mentioned part of the path of said beam to screen said structure from said deflecting means.

4. A cathode ray tube comprising a photo-electrically sensitive electrode structure, means for producing a cathode beam directed onto said structure, electrostatic cathode ray deflecting means for causing the part of said beam disposed between a point of its path and said structure to oscillate laterally about the stated point so that said beam sweeps over said structure, and an extended conductor of hollow-frusto-conical shape mounted between said deflecting means and said structure and surrounding at least half of the mentioned part of the path of said beam to screen said structure from said deflecting means.

5. In a cathode ray tube having an insulating wall and comprising a photo-electrically sensitive electrode structure, means for producing a cathode beam directed onto said structure, and electro-static cathode ray deflecting means for causing the part of said beam disposed between a point of its path and said structure to oscillate laterally about the stated point so that said beam sweeps over said structure, the combination comprising an extended conductor mounted between said deflecting means and said structure and surrounding at least half of the mentioned part

of the path of said beam to screen said structure from said deflecting means, and a metallic coating on the inside of said insulating wall.

6. In a cathode ray tube having an insulating wall and comprising a photo-electrically sensitive electrode structure, means for producing a cathode beam directed onto said structure, and electrostatic cathode ray deflecting means for causing the part of said beam disposed between a point of its path and said structure to oscillate laterally about the stated point so that said beam sweeps over said structure, the combination comprising an extended conductor mounted between said deflecting means and said structure and surrounding at least half of the mentioned part of the path of said beam to screen said structure from said deflecting means, a metallic coating on the inside of said insulating wall, and a lead connected to said coating and taken through said wall to the outside of said cathode ray tube.

7. A cathode ray tube comprising a photo-electrically sensitive electrode structure, means for producing a cathode beam directed onto said structure, electrostatic cathode ray deflecting means for causing the part of said beam disposed between a point of its path and said structure to oscillate laterally about the stated point so that said beam sweeps over said structure, an extended conductor mounted between said deflecting means and said structure and surrounding at least half of the mentioned part of the path of said beam to screen said structure from said deflecting means, and a wire net at said conductor for improving its screening effect.

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