March 12, 1940. M. KNOLL 2,193,101

ELECTRODE STRUCTURE

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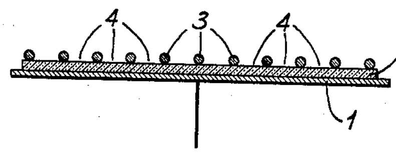

Fig. 1

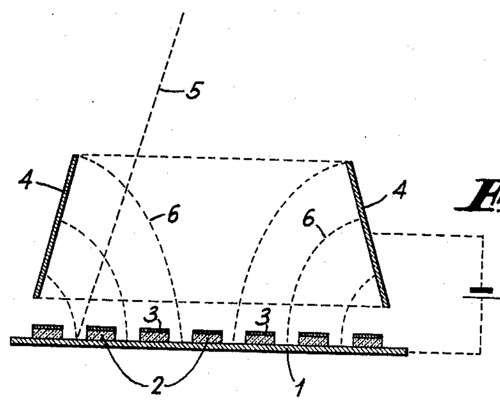

Fig. 2

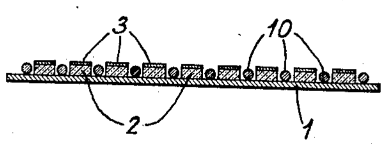

Fig. 3

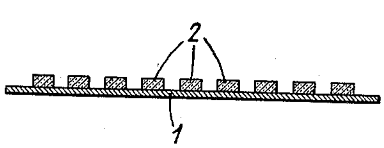

Fig. 4

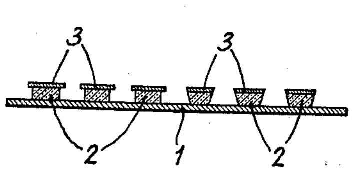

Fig. 5

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ELECTRODE STRUCTURE

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11 Claims. (Cl. 250—27.5)

The present invention relates to cathode ray scanners, particularly for the storage, reproduction and conversion of amplitude modulated signals, e. g. for television purposes. In such arrangements an electrostatic charge image is formed by a suitable method on a screen and the charges composing the electrostatic image are periodically evaluated by cathode ray scanning. The screen on which the charge image is produced consists in the hitherto known or proposed arrangements of either a discontinuous or a continuous surface which is suitable for holding the charges for a certain time and which may or may not be photo-electrically sensitive according to the kind of scanner used.

The invention comes into question for all cathode ray scanners mentioned above, but more particularly for devices of ths kind in which the application and scanning of the charge image are effected from one and the same side of the screen.

In describing the invention, reference will be made to the drawing in which Figure 1 shows schematically in end view an electrode structure for describing the invention, Figure 2 shows diagrammatically one embodiment of the inventon, while Figures 3, 4 and 5 show modifications of the embodiment of the invention shown in Figure 2.

To explain the inventive idea one of the known arrangements will be taken as a basis. Let the screen consist as shown in Fig. 1 of an insulating plate, e. g. a mica plate, 2, on one side of which (scanning side) is arranged a plurality of metallic elements 3 insulated from each other and photo-electrically activated if required. A continuous metal electrode 1 stands opposite them on the other side of the mica plate. The use of such mosaic electrodes has led to disturbances in several respects. These disturbances are partly to be ascribed to the fact that the free parts 4 of the insulating layer between the separate mosaic elements are likewise capable of taking up charges and thus prejudice in an uncontrollable manner the charge image stored on the mosaic elements. The charging of the insulating bridges can occur due to photo-emission, but principally due to cathode ray charging. In the latter case on the impact of primary electrons upon the insulating bridges a different ratio between primary and secondary electron emission will be present from that on the impact of the electrons upon the elements themselves.

A further drawback giving rise to disturbances consists in the following: In the cathode ray scanning of the mosaic elements carrying the charge image secondary electrons are released which are mostly caught by an electrode at rather more positive potential, e. g. the second anode. This process is the actual switching process which makes possible the evaluation of the charges stored on the elements. Now it has been found that the secondary electrons on the impact of the primary ray pass over not only to the electrode mentioned, e. g. the more positive one, but also to the neighbouring mosaic elements which may be, e. g., at a more positive potential. The process is favoured by the fact that the distance to the neighbouring elements is less than to the intercepting electrode mentioned and that the secondary electrons pass out under the most varied angles of direction to the plane of the screen, thus also at very small angles to this plane and in fact with low velocity. Consequently not only electrons are withdrawn from the secondary emission path in any case but the actual charge image of the mosaic elements is also distorted. A further disadvantage of hitherto known mosaic screens consists in that the insulation paths between the elements are in general comparatively short. This is particularly disturbing when the mosaic screen is photo-activated, a deposition of the metals used for the photo-activation occurring on the insulating bridges. With imperfect insulation between the separate elements a deterioration of the actual charge image of course occurs by charge equalisation between the elements.

The present invention offers means and methods for removing the disadvantages mentioned. Further advantages provided by the invention will be dealt with hereinafter.

According to the invention the mosaic elements of the screen are so arranged on a continuous metallic support (signal electrode) that the scanning ray also touches the metallic support between the elements. The mosaic elements can then consist of metallic structures individually insulated from the metallic support or of semi-conductors or of insulating bodies.

An embodiment of a mosaic screen according to the invention is shown in Fig. 2. On a metallic plate 1 are located metallic structures 3 separated by the insulating layers 2. 4 denotes an interception electrode for taking up the secondary electrons released in the scanning by the cathode ray. The following advantages will at once be noted in the embodiment shown:

Any charging such as occurs in the known arrangement according to Fig. 1 between the mosaic elements is excluded, since the cathode ray impinges between the elements on the metallic electrode 1 which is to be regarded as standing at a fixed potential in relation to the electrode 4. Further it will be understood from the figure that any passing over of the secondary electrons released from one of the elements 3 to neighbouring elements is made far more difficult because the lines of force 6 pass through from the interception electrode 4 direct to the signal electrode 1. Then the field strength between the interception electrode 4 and the uncovered parts of the signal electrode 1 is in general greater than between 4 and the mosaic elements 3. The passing through of the lines of force to the electrode 1 gives at the same time the advantage of a uniform definite field strength distribution between every point of the mosaic screen and the interception electrode and consequently the advantage of a uniform and effective drawing off of the secondary electrons from every point of the screen. If on the other hand there is as in Fig. 1 between the signal electrode 1 and the interception electrode 4 a continuous insulating layer, the field strength between these electrodes will be perceptibly influenced in an uncontrollable manner by the charge of the insulating layer or of the elements located thereupon. The manufacture of the screen shown diagrammatically in Fig. 2 can be effected in the most varied ways. The following method illustrated in Fig. 3 may be mentioned for example:

On a metallic support 1, e. g. of aluminum or magnesium, a fine meshed auxiliary grid 10 is first applied. This grid can either be laid on or produced by printing, spraying, vaporising or atomising some suitable material. It is desirable, however, that after the subsequent application of the necessary substances on the parts of the metallic support 1 left free by the grid that it should be possible in some way or other to remove the grid again. On the parts of the metallic support left free by the grid there are applied in sequence an insulating coating 2 /:e. g. by partial surface oxidation of the metal layer or by application of a suitable metal (Mg) and subsequent oxidation (MgO):/, a metallic coating 3 (e. g. of silver) and upon this a photo-electrically active layer. After completion of this process the auxiliary grid 10 is removed in a suitable way.

Instead of mosaic screens of the above described kind, it is possible to use as illustrated in Fig. 4 exclusively insulating or semi-conducting bodies 2 on the metallic support 1. If insulating or semi-conducting bodies are in question, which—with the use of short waved light, if required—exhibit a photo-electric effect, the possibility is provided of using these bodies also for photo-electrically effective mosaic screens, e. g. for iconoscopes. If the bodies exhibit no photo-electric effect their use is possible, e. g. in cathode ray scanners in which a non-photoactive mosaic screen is arranged separately from a photo-layer. In each case the type mosaic screen shown diagrammatically in Fig. 4 provides in addition to the advantages described above, e. g. with the use of semi-conducting elements, the advantage in particular of faithful maintenance of the charge image once produced during a longer period of time than should be the case with the use of unchequered insulating or semi-conducting layers. The chequering here prevents any diffusion of the image transmitted, which is observed on such screens and which is to be ascribed to a certain equalisation of differing charges in the direction of the surface.

The application of the individual insulating bodies to the metallic support can be effected as was already mentioned in the description of Fig. 3 with the use of an auxiliary grid applied in some way or other and partial transformation of the metallic support into an insulating or semi-conducting layer. On the other hand the insulating or semi-conducting bodies can also be applied with or without the use of an auxiliary grid by spraying, atomising or vaporising. Further, instead of insulating or semi-conducting elements metallic particles also can be used which are coated over their surface with a very thin insulating or semi-conducting layer. Superficially oxidised aluminum powder for instance is suitable for this purpose. Such bodies have in contrast to pure insulating or semi-conducting bodies the advantage of a good electron conductivity in the interior and thus may prevent the remanence effects occuring with the former on rapid change of the contents of the image.

It should be observed that in the mosaic screens according to the invention in contrast to known arrangements (cf. Fig. 1), the free surface of the insulation path no longer runs parallel to the plane of the screen but substantially perpendicular to it as is clear for instance from Fig. 2. The result of this is that the individual mosaic elements can be placed very close together without dispensing with the quality of the insulation, in fact even with better insulation than in the known arrangements. This is equivalent to increasing the fineness of the mosaic screen, or to increasing the light sensitivity. With the free surface of the insulating path not running parallel to the plane of the screen it is also possible to achieve the result that the insulating path seen from the scanning side lies more or less in the "shadow" of the mosaic elements or of the parts of the insulating or semi-conducting bodies located nearest the cathode. This effect can be further supported by having the part of each mosaic element lying nearest the cathode projecting in the manner shown in Fig. 5. This step can be undertaken on elements of the kind shown in Fig. 2 and Fig. 4. In an arrangement according to Fig. 5 the insulating path is protected from the impact of cathode rays as well as from impact of any substances such as metallic ones deposited from the direction of the cathode, and entirely satisfactory insulation is ensured.

I claim:

1. The steps in the method of preparing a mosaic electrode which comprises depositing minute isolated particles of insulating material upon a continuous metallic base and photo-sensitizing a portion of the exposed area of the particles of the insulating material, said area being at least as large as the area of contact between particles and said base.

2. The steps in the method of preparing a mosaic electrode which comprises positioning a mesh upon a continuous metallic base, depositing insulating material upon the base through the interstices of the mesh, photo-sensitizing the deposited insulating material, and removing the mesh subsequent to the photo-sensitizing of the material.

3. The steps in the method of preparing a mosaic electrode which comprises positioning a

mesh upon a continuous metallic base, depositing insulating material upon the base through the interstices of the mesh, depositing a photo-sensitive layer upon the insulating material through the interstices of said mesh, and removing the mesh subsequent to the deposition of the photo-sensitive layer.

4. The steps in the method of preparing a mosaic electrode upon a metallic support which comprises depositing minute isolated particles of insulating material upon the metallic support, said particles having an area in contact with the base less than the area of an opposite face of said particles, and depositing a photo-sensitive layer upon said opposite face.

5. The steps in the method of preparing a mosaic electrode upon a metallic support which comprises depositing minute isolated frustro-conical particles of insulating material, said particles having their smaller base in contact with the metallic support, and photo-sensitizing the larger base of the deposited particles.

6. The steps in the method of preparing a mosaic electrode upon a metallic support which comprises depositing minute isolated particles of insulating material upon the metallic support and depositing a photo-sensitive layer upon a portion of the exposed surface of the particles, said deposited photo-sensitive layer having a greater area than the exposed area of the deposited particles.

7. A mosaic electrode comprising a continuous metallic base, a plurality of minute isolated particles of insulating material deposited upon the base, and a photo-sensitive surface deposited upon a portion of the exposed area of said particles, said portion being at least as large as the area of contact between particles and base.

8. A mosaic electrode comprising a continuous metallic base, a plurality of minute isolated particles of aluminum oxide deposited upon the metallic base, and a photo-sensitive surface supported upon a portion of the exposed area of the particles of aluminum oxide, said portion being at least as large as the area of contact between the particles and the base.

9. A mosaic electrode comprising a metallic base, a plurality of minute isolated particles of cuprous oxide deposited upon the metallic base, and a photo-sensitive surface supported upon the particles of cuprous oxide.

10. A mosaic electrode comprising a metallic support, a plurality of minute frustro-conical isolated particles of insulating material deposited upon the metallic support, said particles having the smaller of its two bases in contact with the metallic support, and a photo-sensitive layer supported on the larger base of the particles.

11. A mosaic electrode comprising a metallic support, a plurality of minute isolated particles of insulating material deposited according to a predetermined pattern upon the metallic support, and a photo-sensitive layer supported from the particles, said photo-sensitive layer having a greater area than the area of contact of the layer and particles.

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