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2,733,501

ELECTROSTATIC SHUTTER MOSAIC AND METHOD OF MANUFACTURE

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Fig 1

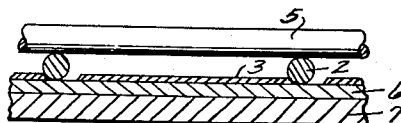
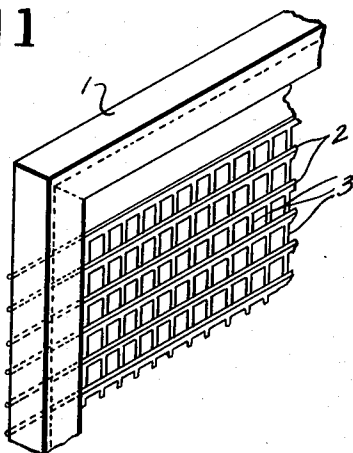


Fig 3

Fig 2

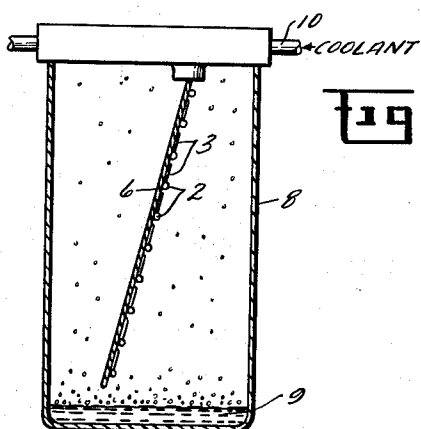
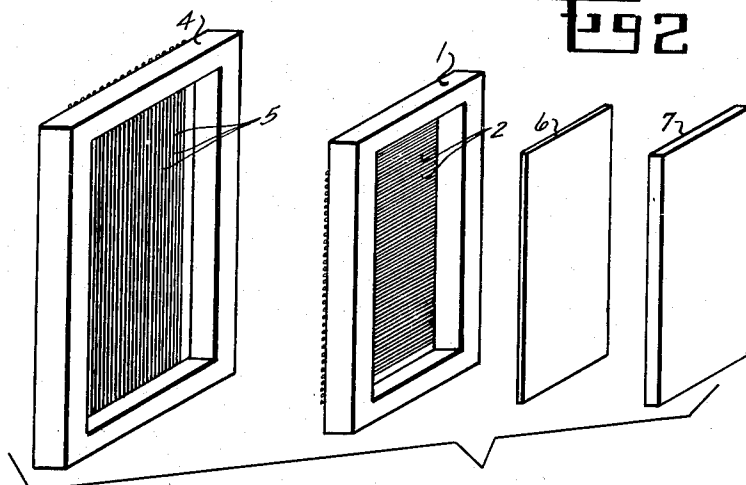


Fig 4

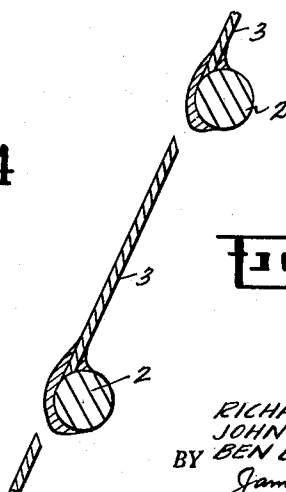


Fig 5

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ELECTROSTATIC SHUTTER MOSAIC AND METHOD OF MANUFACTURE

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1 Claim. (Cl. 29—25.17)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to us of any royalty thereon.

This invention relates to cathode-ray tube mosaics and particularly to mosaics of the electrostatic shutter type for use in cathode-ray tube projection systems.

Such mosaics consist of a multitude of metallic flaps of elemental size attached to a flat substrate. The electron beam of the cathode-ray tube is caused to scan over the mosaic, or else over a transparent dielectric element placed opposite and close to the mosaic, so as to control the charge on or in the vicinity of the flaps. The resulting electrostatic force acting on each flap causes a bending thereof in proportion to the strength of the force. A projection lens system is used to form an image of the mosaic on a projection screen. Two methods of illuminating the mosaic from the projection light source are possible. In one method light is passed through the mosaic with each flap controlling the amount of light passing through the corresponding part of the mosaic to the projection screen as a function of the amount of bending of the flap. In the other method, each elemental flap acts as a small mirror reflecting light from the projection light source into the projection lens in an amount determined by the degree of bending of the particular flap. Projection systems of the above type are described and claimed in the applications of Richard K. Orthuber, Serial Numbers 240,772 and 248,439, filed August 7, 1951, and September 26, 1951, respectively.

In a mosaic of the above described type it is desirable that the flap size be as small as possible, that the ratio of total flap area to total mosaic area be as high as possible and, in cases where the flaps act as reflectors, that the flap surfaces be as flat as possible. It is the object of the invention to provide a mosaic meeting the above requirements together with a method of manufacture therefor.

The mosaic and manufacturing method will be described more fully in connection with the accompanying drawings in which:

Fig. 1 shows a small portion of a complete mosaic considerably enlarged;

Fig. 2 shows a suitable mask assembly;

Fig. 3 illustrates the method of depositing the flap material on a removable plastic sheet;

Fig. 4 shows the method of removing the plastic sheet; and

Fig. 5 shows an enlarged cross-sectional view of the mosaic.

Referring to Fig. 1, the mosaic consists of a rectangular frame 1 across which are stretched a large number of closely spaced parallel wires 2. Each of the wires carries a plurality of small thin flaps 3 each attached to the wire

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along one edge so that it may be readily bent from its rest position by the application of an electrostatic force thereto. The flaps are spaced as closely as possible and preferably aligned vertically as well as horizontally. The length of a flap is made sufficient to substantially fill the space between adjacent wires and in their rest positions the flaps lie in a plane parallel to the plane of the wires. The entire mosaic therefore consists of a multitude of minute flaps supported on a substrate of parallel wires.

The first step in the manufacture of a mosaic such as shown in Fig. 1 is shown in Fig. 2. The substrate consisting of frame 1 and parallel wires 2, is placed inside another frame 4 carrying parallel wires 5 which are at right angles to wires 2. A thin sheet 6 of easily soluble material such as cellulose-acetate or cellulose nitrate is placed inside the frame 1 against the wires 2. The sheet may be held in place by backing plate 7.

When the elements of Fig. 2 are assembled as described the relative positions of the parts are as shown in Fig. 3. A vapor beam of a suitable flap material, such as aluminum, is then directed toward the sheet 6 through the crossed wire mask formed by the systems of wires 2 and 5. This results in small rectangular areas of flap material being formed on the sheet 6 beneath each rectangular opening in the mask. If the beam is directed normally to wires 2 but at an acute angle relative to sheet 6 each rectangular area of flap material will touch the adjacent wire 2 along one edge and be separated from the adjacent wire 2 along the opposite edge, as shown in Fig. 3.

After the flaps 3 have been deposited on the sheet 6 in the above manner the wires 5 and the backing plate 7 are removed. The frame 1, without disturbing the sheet 6, is placed in a container 8 filled with saturated vapor of a solvent 9 for the plastic sheet 6, such as acetone. The frame 1 is positioned within the container so that the wires 2 are horizontal, the plane of sheet 6 approximately vertical and the edges of the flaps which are in contact with their neighboring wires 2 are beneath the free edges. The frame 1, wires 2 and sheet 6 are connected to a cooling line 10 so that solvent condenses on the sheet 6 in small drops. The drops of solvent dissolve the plastic sheet and the resulting droplets of the solution, flowing downward, collect at the lower edge of the flap. After the sheet 6 is completely dissolved the mosaic may be allowed to rise in temperature and the resulting evaporation of the remaining solvent will leave sufficient plastic material at the lower edge of the flaps to reinforce the connection between the flaps and wires 2 as shown in Fig. 5.

We claim:

A method of manufacturing an electrostatic shutter mosaic consisting of a frame having a rectangular opening across which are stretched a plurality of fine closely spaced parallel supporting wires each carrying a plurality of minute juxtaposed metallic flaps; said method comprising the steps of placing a thin sheet of dissolvable material over and in contact with said supporting wires; placing a second set of fine closely spaced parallel wires over and at right angles to said parallel supporting wires and on the opposite side thereof from said sheet; depositing small substantially rectangular areas of flap material on said sheet, with one edge of each of said areas in contact with one of said supporting wires, by condensation from a vapor beam of the flap material directed toward and at an acute angle to said sheet through the mask formed by said wires; supporting said frame, supporting wires, sheet and deposited areas of flap material in a saturated vapor of a solvent for said sheet with said supporting wires hori-

zontal, said sheet substantially vertical, and the edges of said areas of flap material that contact said supporting wires downward; reducing the temperature of said sheet whereby solvent condenses thereon and dissolves said sheet and droplets of the resulting solution flow downward 5 to said supporting wires; and evaporating said solution to leave a residue of the sheet material to reinforce the bonds between edges of the flaps and said supporting wires.

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