

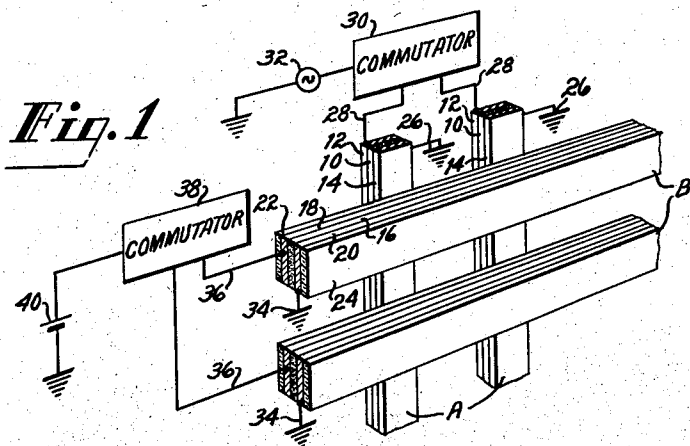
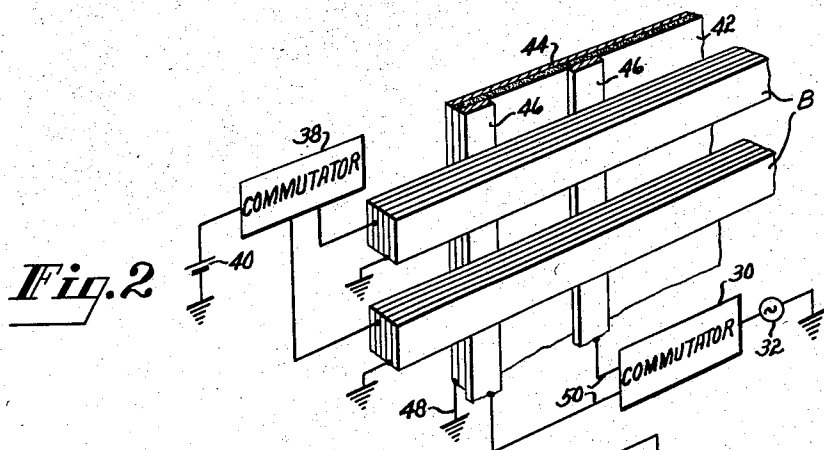
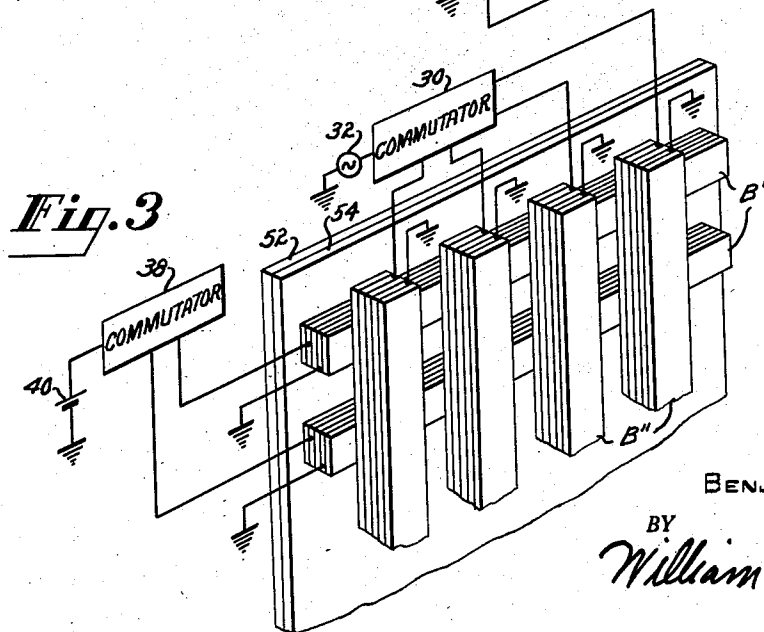
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PICTURE PRODUCING DEVICES

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1

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PICTURE PRODUCING DEVICES

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This invention relates to mural type picture producing devices, and it has for its object to provide a novel and improved device of this type for producing a large area flat television picture without the use of optical projection equipment or cathode ray tubes.

Another object of the invention is to provide a mural type television picture scanning device comprising an array of parallel light-emitting strips and a second array of parallel light-gate strips arranged at right-angles thereto, which requires only two lead wires for each strip rather than for each picture element as heretofore, thus not only effecting important economies in construction and assembly but also eliminating the possibility of electrostatic coupling between wires and consequent distortion of the picture.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

In the prior art, picture scanning devices of the above type require at least one wire lead to each element of the picture. This type of construction is difficult to make where the picture comprises a large number of elements.

Another type of prior art device employs separate arrays of horizontal and vertical conductors between which picture elements are defined. A picture element is energized by the application of voltages to a selected horizontal and a selected vertical conductor. However, the leads to the individual horizontal and vertical conductors are electrically connected and the applied voltages appear on conductors other than the intended ones. Poor picture contrast and high dissipation of input energy result in such devices.

According to the present invention, separate horizontal and vertical elements or strips are provided which are electrically isolated from each other and only two wires are required for each horizontal and vertical strip rather than for each picture element. One set of strips, either the horizontal or vertical, comprises the light producing portion of the device, and the other set of strips constitutes, in effect, gates for controlling the amount of light emitted by the said light producers.

The separate horizontal and vertical strips may be variously constituted, as hereinafter more fully described. In a preferred embodiment disclosed herein for purposes of illustration, the light producing elements are the vertical strips and are shown as electroluminescent cells which include a layer of electroluminescent phosphor material between a pair of conductive strips at least one of which is transparent. The horizontal gate members as shown herein may be either Donal type liquid suspension valves or they may be composed of strips of electro-optical material such as zinc sulfide. In the Donal type gate a liquid cell carrying a multiplicity of flat conductive platelets is oriented between a pair of conductive transparent plates. When a field is applied between the plates, the conductive platelets are lined up to allow light to pass through with the degree of alignment and the amount of light passed being proportional to the applied field. Similarly, the light output from the electrolumi-

2

nescent cells depends on the field applied between the conductive strips.

In the operation of the device of the present invention, one lead to each electroluminescent cell is grounded and the other is connected to a commutator. Each of the gates has one lead grounded and the other connected to another commutator. A signal modulated voltage source is also coupled to one of the sets of strips. The commutator connected to the vertical strips is operated at picture horizontal scanning frequency, and the commutator connected to the horizontal strips is operated at typical vertical switching frequency. Thus during the time when any one horizontal element is energized, the vertical elements are energized successively so that individual picture elements produce a light output which depends in intensity on the signal applied at that instant from the modulated signal source.

Another embodiment of the invention includes a large area steady light source which is not modulated and separate arrays of horizontal and vertical light gates or valves disposed in front of the light source. With the proper switching operation as described above, and the application of video signals to one of the arrays, the light passed as a result of the cooperative action of the arrays of gates is in the form of a visible picture.

The invention is described more in detail in connection with the accompanying single sheet of drawings, in which:

Fig. 1 is a diagrammatic perspective view of a mural type picture producing device embodying the present invention;

Fig. 2 is a similar view illustrating a first modification of the invention; and,

Fig. 3 is a similar view illustrating a second modification of the invention.

The mural type picture producing device illustrated in Fig. 1 comprises a multiplicity of substantially coplanar vertical light-emitting strips A mounted in back of a multiplicity of co-planar horizontal light gate strips B. The said strips are all electrically isolated from each other. The strips or elements A and B are preferably of small width and the strips A are closely spaced and the strips B are closely spaced so that the area defined by any two crossed A and B strips is of the order of the desired area of a picture element.

The vertical light-emitting strips A comprise electroluminescent cells consisting of a layer 10 of electroluminescent phosphor material between a pair of conductive strips 12 and 14, with at least the strips 14 which are closest to the gates B, being transparent. The phosphor material may be copper activated zinc sulfide in a suitable transparent plastic binder such as ethylcellulose. The conductive strips may be of tin oxide, tin chloride, gold, or the like deposited on glass plates (not shown). Electroluminescent cells emit light when an alternating electric field is applied across them. The light-emitting strips may alternatively consist of an array of parallel gas discharge tubes producing light either from the gas discharge directly or with the aid of phosphor in the gas tubes as used in fluorescent tubes. A further alternative arrangement would consist of parallel tungsten filament wires for producing the light.

The horizontal light gate strips B may each consist of a layer of electro-optical material 16, such as zinc sulfide, sandwiched between transparent conducting electrodes 18 and 20, which may be of the same type as the strips 12 and 14, and a pair of light polarizing filters 22 and 24 which are 90° out of phase. Without the polarizing effect of the zinc sulfide layer, light transmitted through the filter 22 would not pass through the filter 24. However, the zinc sulfide has the property of rotating the plane of polarization of polarized light passing through

it when an electric field is applied across it in the direction of the light transmission. The degree of polarization due to the zinc sulfide is proportional to the magnitude of the electric field. Thus, light passes through the filter 24 in an amount depending on the electric field across the zinc sulfide layer.

An alternative form of light gate strip consists of an elongated cell containing a liquid suspension of plate-like particles as described by J. S. Donal and D. B. Langmuir in *Proc. I. R. E.*, 31, pp. 208-213, 1943. Still another form of light gate strip consists of elongated Kerr cells sandwiched between polarizing filters and with a field applied in a direction perpendicular to that of the light transmission.

In one operative arrangement as illustrated in Fig. 1, a lead 26 is connected to each conductive strip 14 of each light-emitting strip A and to a source of reference potential such as ground. A lead 28 is connected to each conductive strip 12, to a commutator 30 and to one terminal of a signal modulated voltage source the other terminal of which is grounded. The modulating signal may be a video signal or the like. Each of the light gates B has one lead 34 from the conductive electrode 20 to ground and another lead 36 from the conductive electrode 18 to a commutator 38 and to a suitable voltage source such as a battery 40.

The commutator 30 is operated at picture horizontal scanning frequency, and the commutator 38 is operated at the required vertical switching frequency. In operation, one of the light gate strips B is made light transmitting for the scanning time of one horizontal line (all other light gate strips B held at cut-off). During this time, each of the light-emitting strips A is sequentially switched on and caused to emit light instantaneously. In this manner one line of picture information is reproduced. By switching open the next gate strip B a new line of picture information can be presented by again sequentially switching on the light-emitting strips A. Since the light intensity of any picture element may be controlled by either the instantaneous power applied to the light-emitting strips A or to the light gate strips B (determining the degree to which the light gate strip is made light transmitting at any instant) the video signal may be applied to either set of strips simultaneously with the switching power to produce a half-tone picture. The scanning described above may also be accomplished by applying power to a single light-emitting strip for a line time and during this period sequentially switching open the light gate strips.

Fig. 2 illustrates a modification of the invention in which the light-emitting means comprises a single panel 42 of electroluminescent phosphor on a single conductive plate 44 with separate transparent conductive strips 46 on the free surface of the phosphor layer. In this embodiment of the invention, the plate 44 is grounded by a lead 48 while the conducting strips 46 are connected to the commutator 30 by leads 50 and to the signal modulated source 32. The light gate strips may be constructed, and connected to commutator 38 and battery 40 in the manner previously described in connection with Fig. 1.

Fig. 3 illustrates a modification of the invention in which the light-emitting means is a single large-area panel 52 which emits light through at least one large-area surface. The panel 52 is a steady light source and may be of the incandescent type or any other suitable type. Horizontal and vertical arrays of light gate strips B' and B'', respectively, are disposed in front of the light-emitting surface of the panel 52 and these may be of the type described above and shown as B in Fig. 1. The portions of the light-emitting surface which are not masked by the strips B' and B'' are provided with an opaque coating 54 of black paint or the like or are otherwise masked to prevent spurious light emission from the device.

In this embodiment of the invention, the visible image is produced in essentially the same way as in Fig. 1 with the light transmission from each picture element being

determined by the switching and interaction of the light gate strips due to the voltages applied thereto.

What is claimed is:

1. Mural type picture producing apparatus comprising means including a group of elongated parallel substantially co-planar electrically energizable members for producing a bar of light extending along each member, a group of elongated parallel substantially co-planar electrically controllable light gate members each extending transversely across said members and defining therewith a multiplicity of picture elements, and circuit means for selectively energizing a particular one of said members throughout its length and simultaneously opening a particular one of said light gate members throughout its length.

2. Mural type picture producing apparatus comprising two superimposed groups of parallel elongated electrically isolated members having the members of one group arranged perpendicular to those of the other group and defining a multiplicity of picture elements at the points where said members cross, the members of one group being light-emissive throughout their length and the members of the other group constituting elongated gates controlling the passage of light from said light-emissive members, means including a switching device having a single circuit connection with each of said light-emissive members, and means including a signal source and a second switching device having a single circuit connection with each of said gate members for sequentially opening said gate members.

3. A mural type picture producing device according to claim 2, in which each of said light-emissive members comprises a layer of electroluminescent material between a pair of conductive strips at least one of which is transparent, and in which each of said light-emissive members has one conductive strip grounded and the other conductive strip connected by a single lead to said first-mentioned switching device.

4. A mural type picture producing device comprising, in combination, a first group of closely spaced parallel electrically conductive strip members extending in a first direction, a second group of closely spaced parallel electrically conductive strip members spaced from the strip members of said first group and extending in a direction having at least a component normal to said first direction, electrically energizable light-emitting means co-operating individually with each of the strip members of one of said groups to produce bars of light along said strip members, electrically controllable light valve means co-operating individually with each of the strip members of the other of said groups, and means including a commutator for selectively energizing an individual strip member of one of said groups simultaneously with an individual strip member of the other of said groups.

5. A mural type picture producing device according to claim 4, in which said strip members of said first group are perpendicular to said strip members of said second group.

6. A mural type picture producing device comprising, in combination, a first series of pairs of electrically conductive elongated strip members, at least one of said strip members being optically transparent, elongated electrically energizable light-emitting means sandwiched between the strip members of each pair, a second series of pairs of electrically conductive elongated strip members all formed of optically transparent material and extending transversely of said first series of pairs of strip members adjacent to said optically transparent ones thereof, and elongated electrically controllable light valve means sandwiched between the strip members of said second pair for individually controlling the transmitted light emitted from a predetermined longitudinal portion of a plurality of said light-emitting means.

7. A mural type picture producing device comprising,

5

in combination, electrically energizable light-emitting means, a series of elongated transparent electrically conductive strip members extending across said light-emitting means for selectively causing the emission of light individually from an elongated portion thereof adjacent to one of said strip members, a series of pairs of elongated transparent electrically conductive strip members extending transversely of said first-named series of strip members, and a plurality of elongated electrically controllable light valve means each individually sandwiched between one of said pairs of strip members.

8. A mural type picture producing device comprising means including a group of elongated parallel substantially co-planar electrically energizable members for producing a bar of light extending along each member, and a group of elongated parallel substantially co-planar electrically controllable light gate members each extending transversely across said members and defining therewith a multiplicity of picture elements.

6

9. A mural type picture producing apparatus comprising a large area light-emitting panel, a first group of elongated parallel substantially co-planar electrically controllable light gate members in front of and spaced from said panel, and a second group of elongated parallel substantially co-planar electrically controllable light gate members each extending transversely across said first light gate members and defining therewith a multiplicity of picture elements.

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