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[11] 3,611,359

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[33] **Italy**

[31] **819878**

[56]

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Assistant Examiner—Michael Slobasky

Attorney—Wenderoth, Lind & Ponack

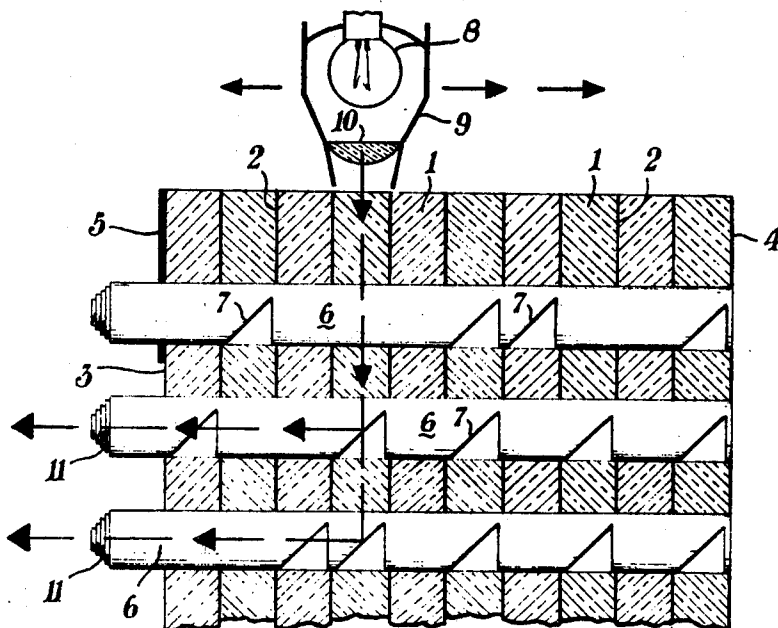
[54] **COMPACT COMPONENT DEVICE FOR THE**
VISIBLE DISPLAY OF LETTERS, DIGITS,
SYMBOLS AND FIGURES
48 Claims, 59 Drawing Figs.

[52] U.S. Cl. **340/380,**
350/96

[51] Int. Cl. **G08b 5/00**

[50] Field of Search **340/300;**
350/96

ABSTRACT: A compact component device for the visible display of letters, digits, symbols and figures characterized in comprising in combination a plurality of transparent plates mounted close to one another, a plurality of transparent rods passing through the pack of said plates through their thickness, one or more luminous sources located along one or more lateral faces of said pack, and means for selectively sending back the light from said sources along said rods, axially, so that the end front surfaces of said rods will form a unit of luminous zones on the front surface of said pack, reproducing the desired visible indication.



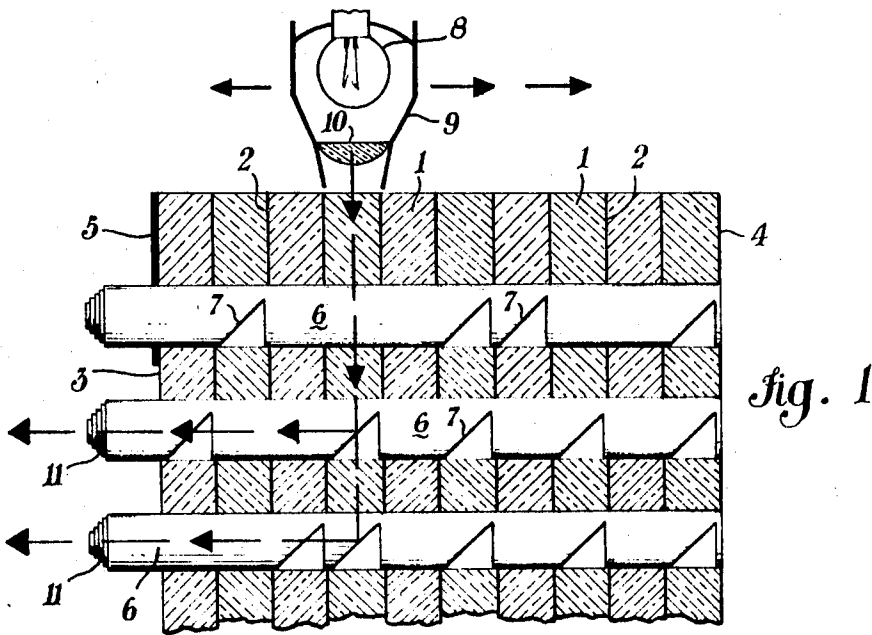


Fig. 1

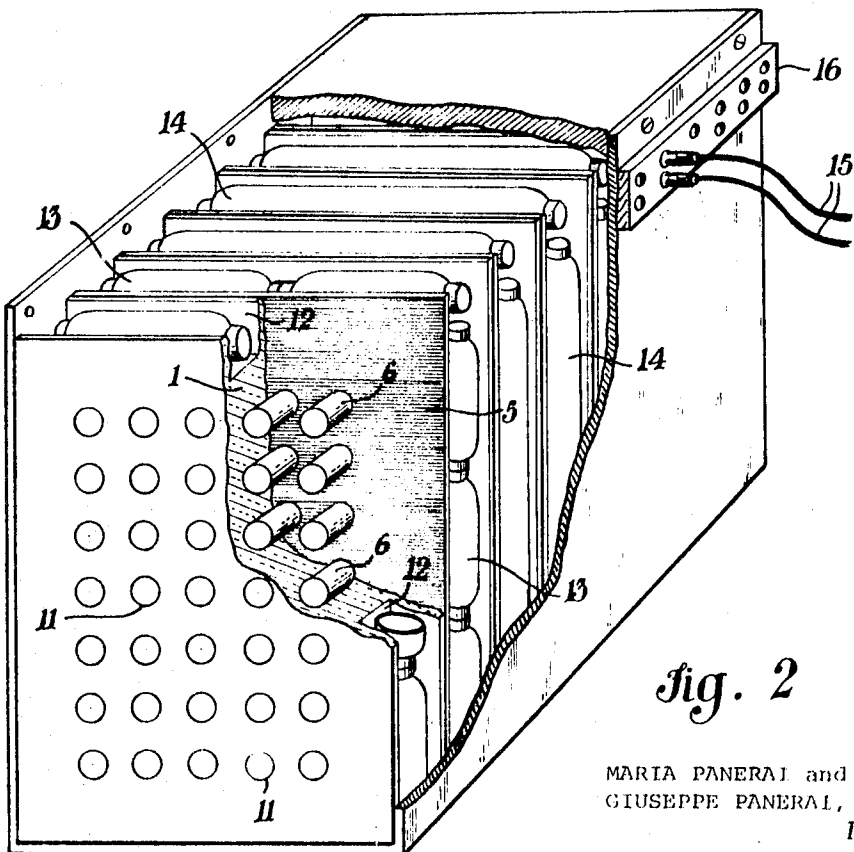


Fig. 2

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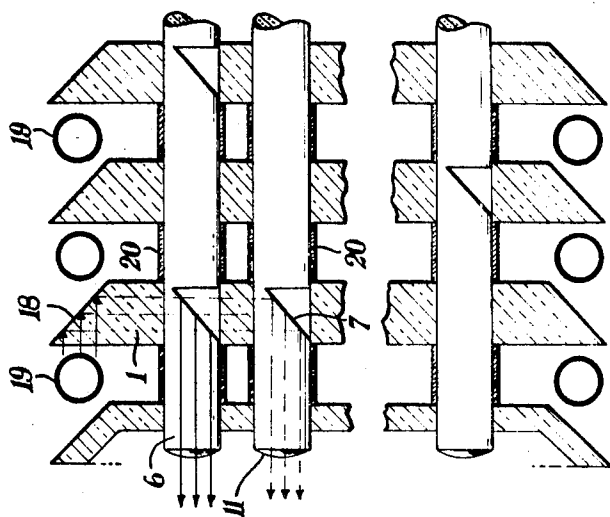


Fig. 5

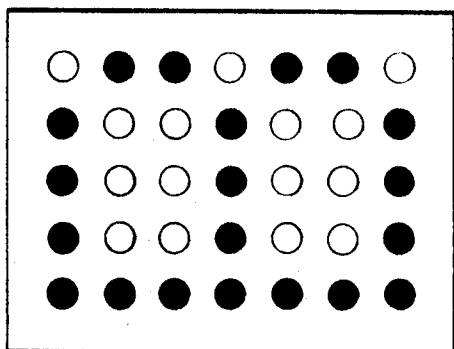
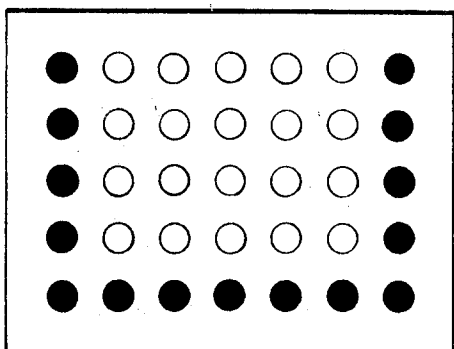


Fig. 6

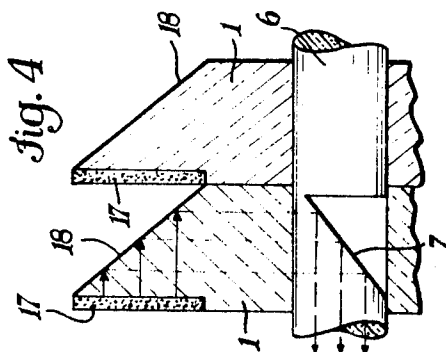


Fig. 4

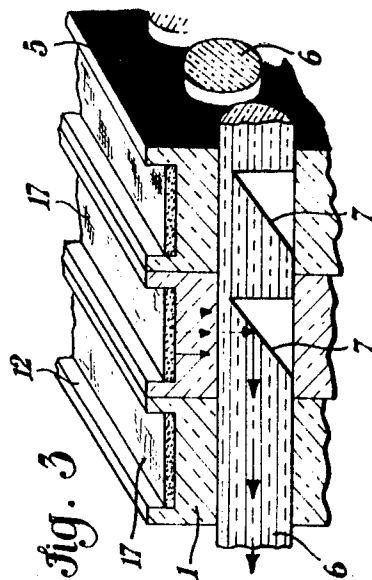


Fig. 3

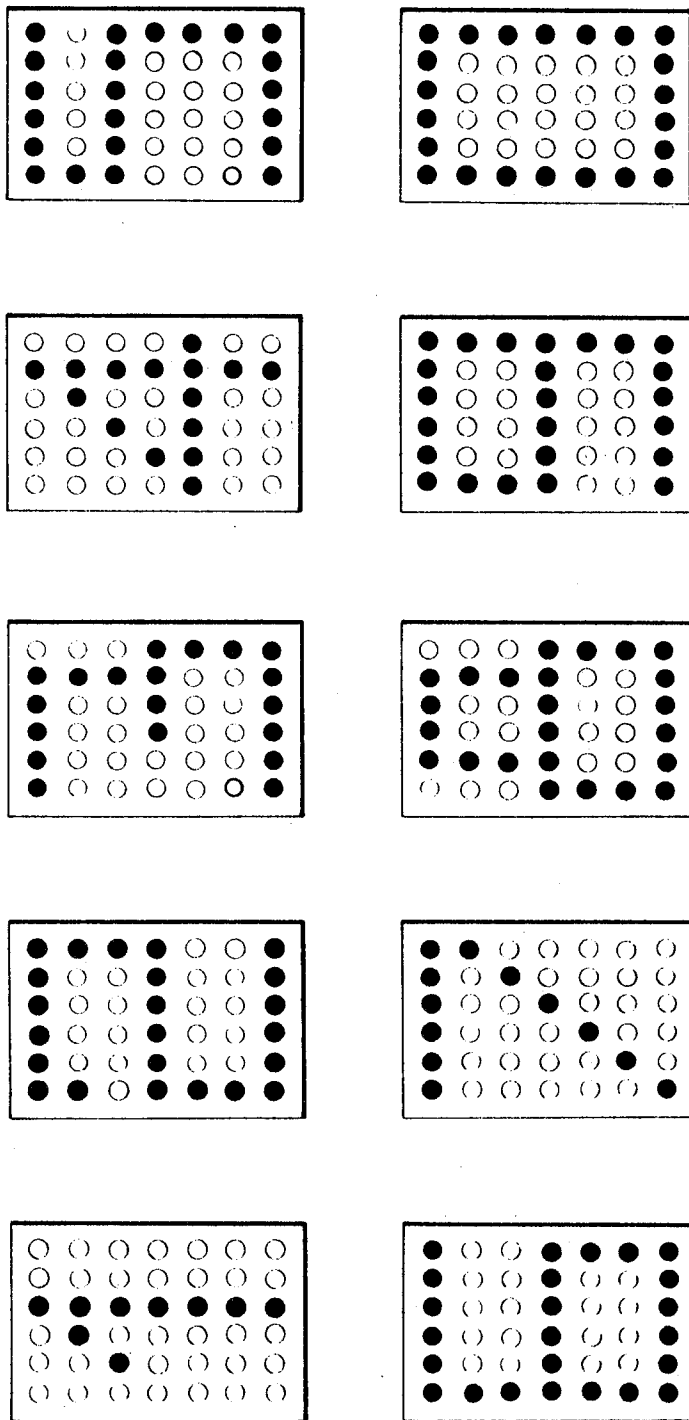
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fig. 7



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fig. 8

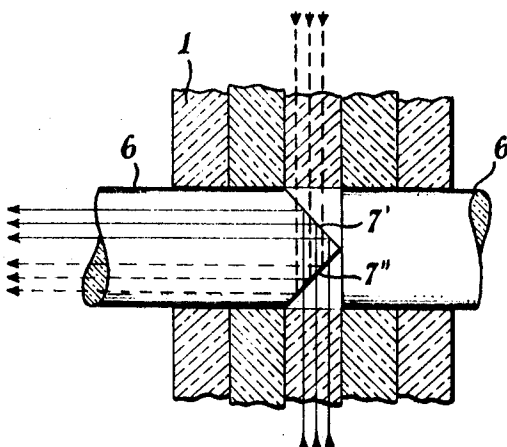
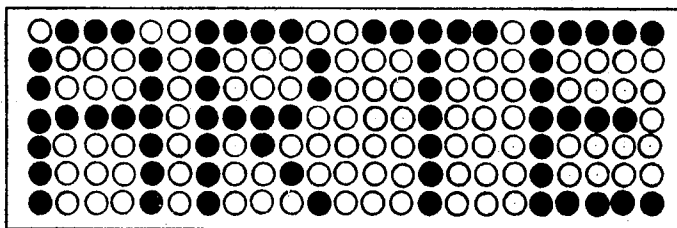
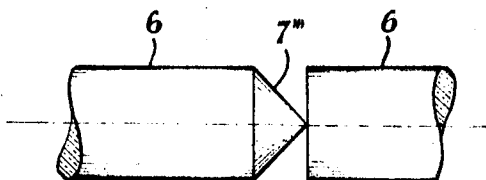


fig. 9

fig. 10



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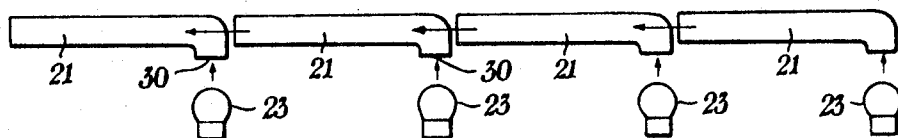
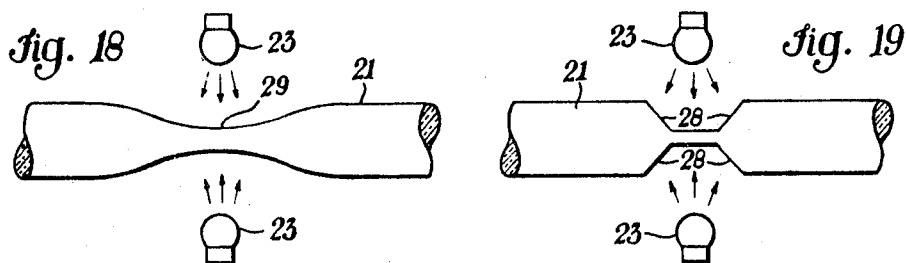
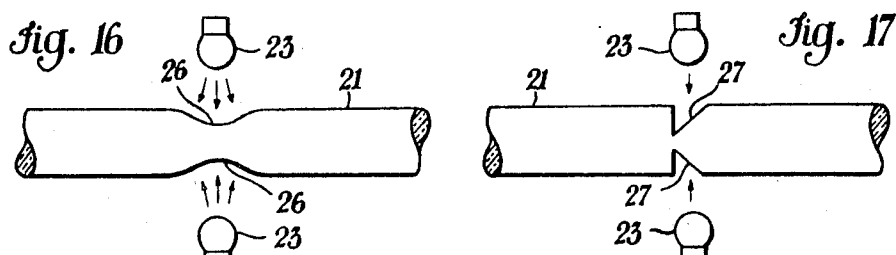
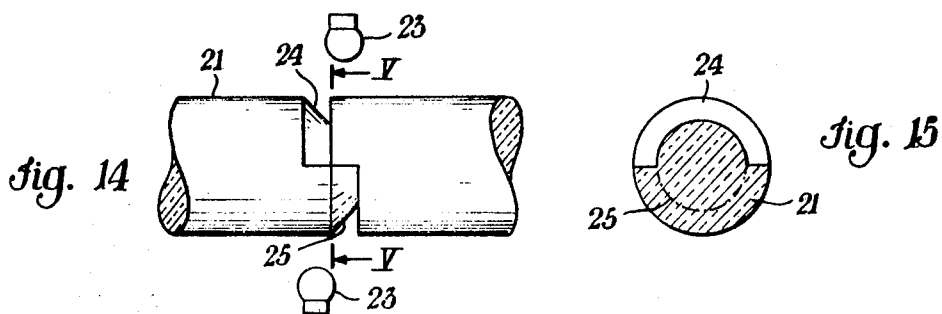
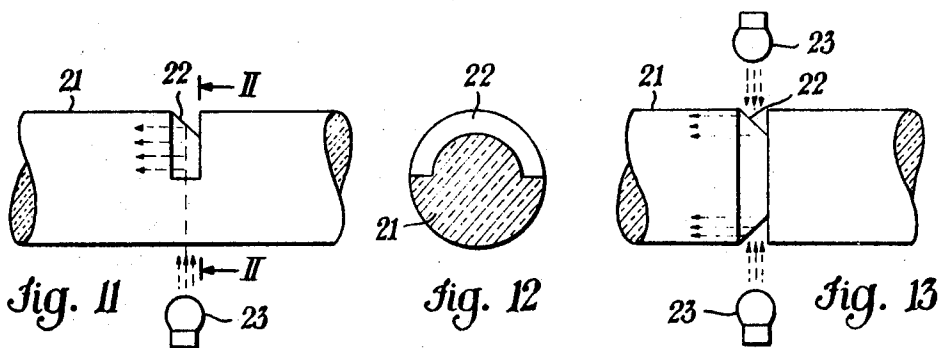
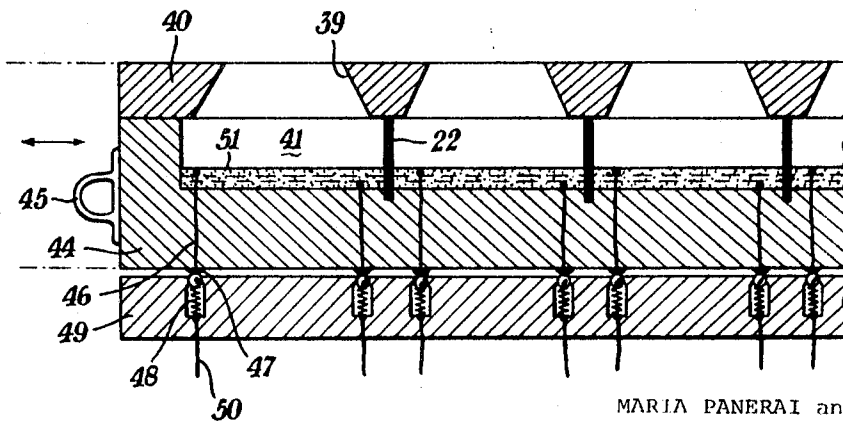
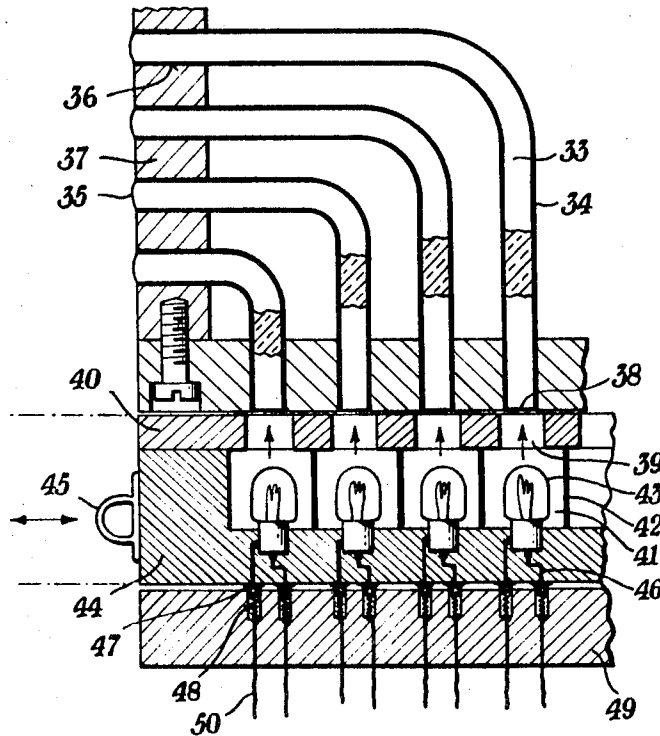
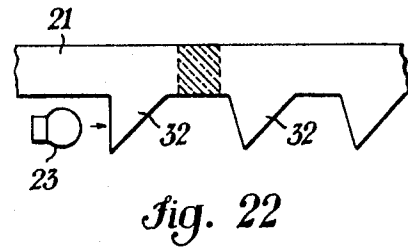
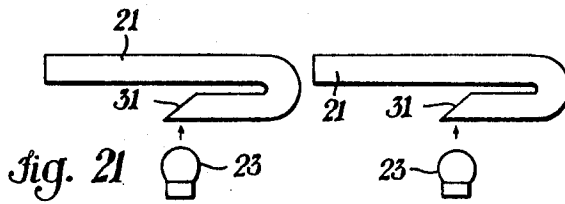


Fig. 20

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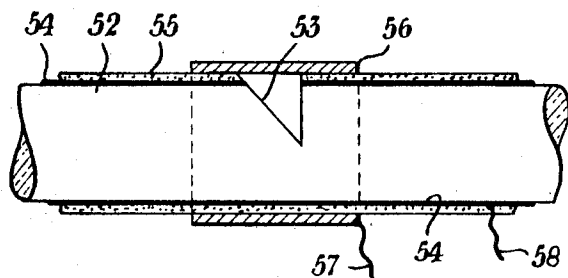


Fig. 25

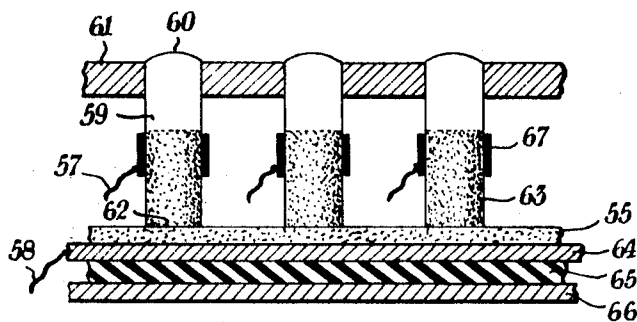


Fig. 26

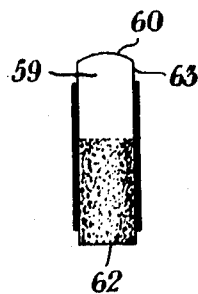


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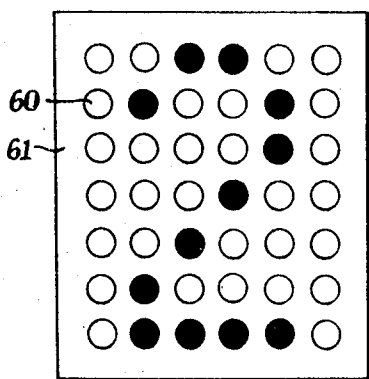


Fig. 28

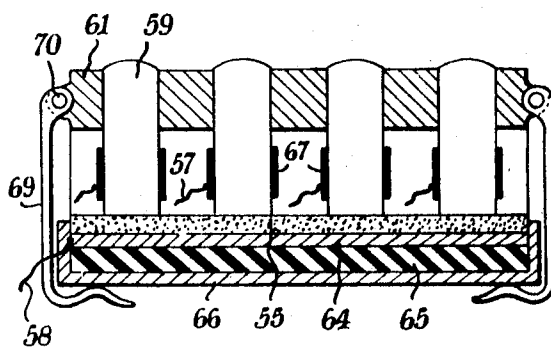


Fig. 29

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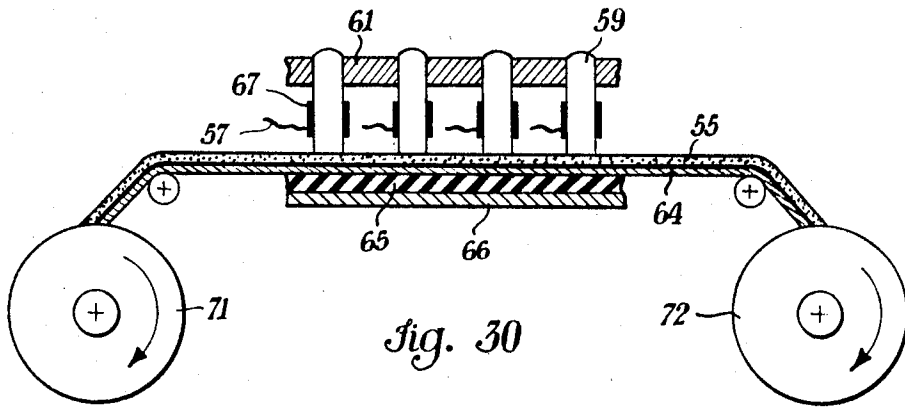


fig. 30

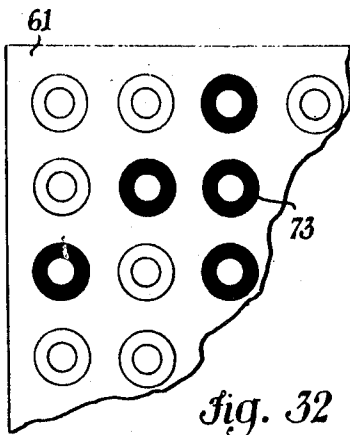


fig. 32

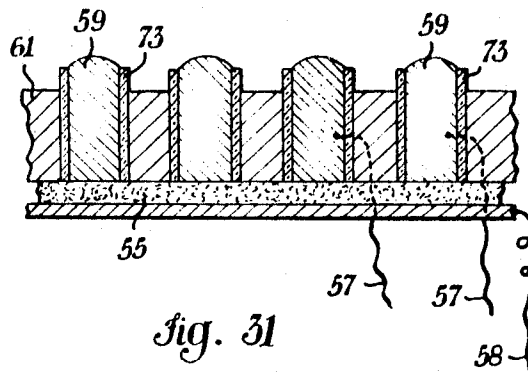


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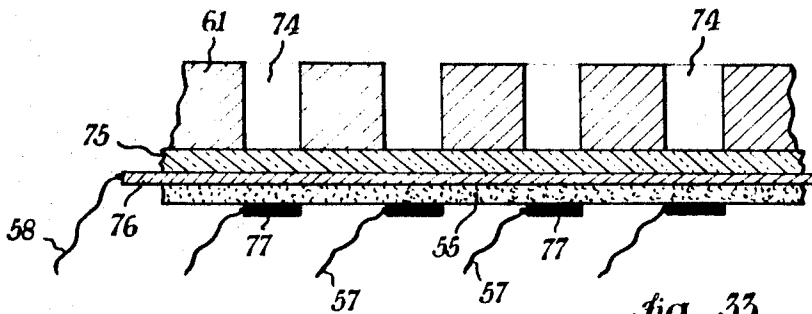


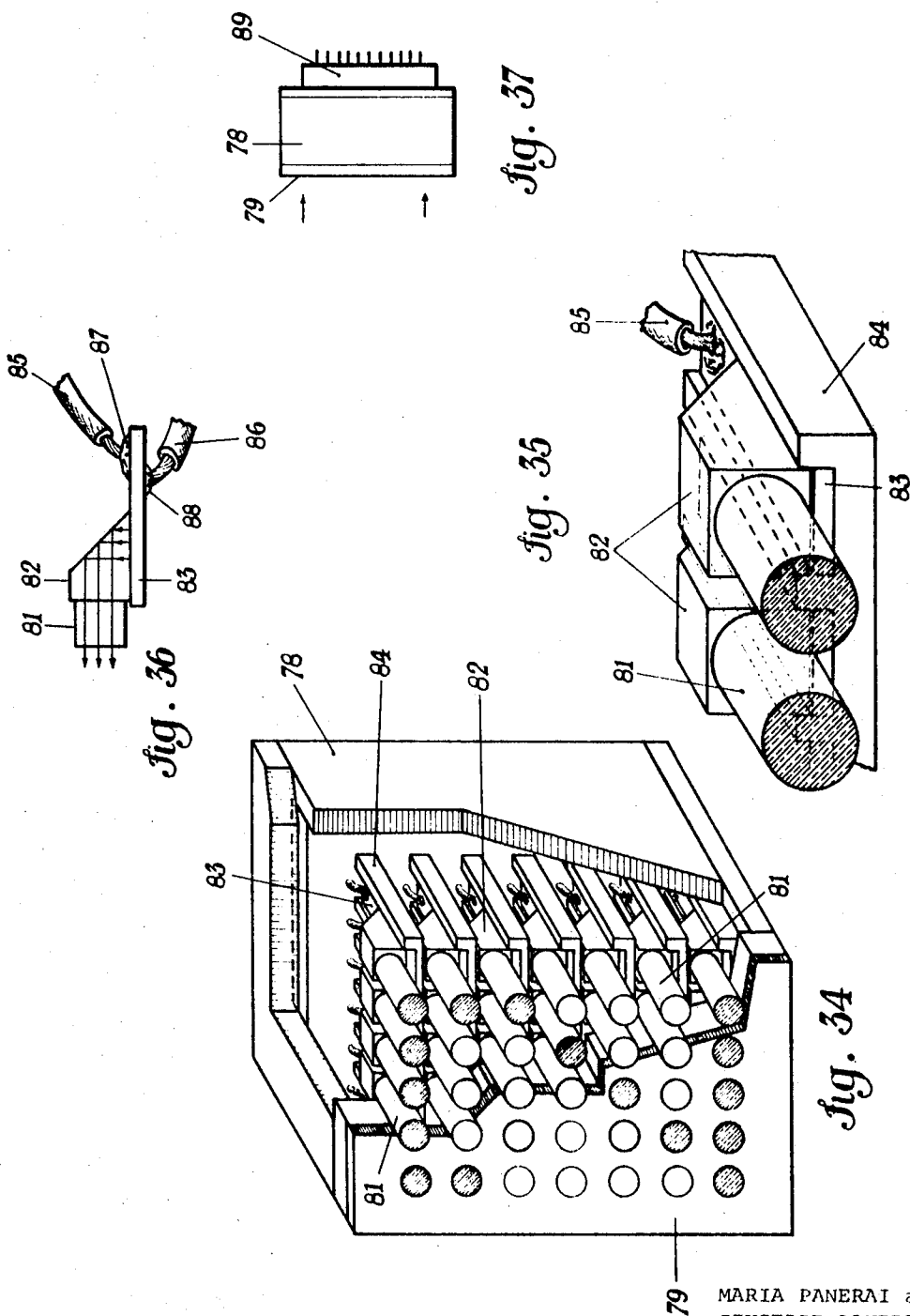
fig. 33

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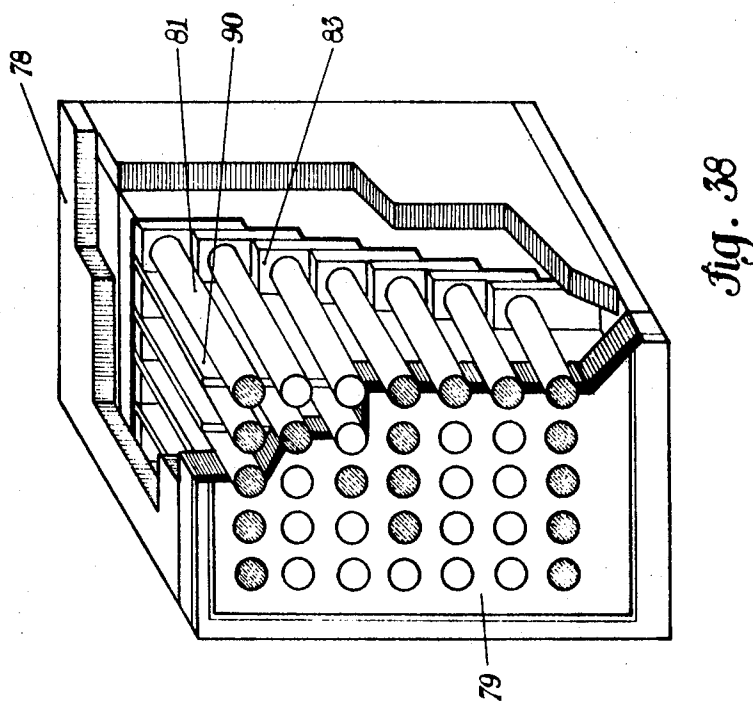
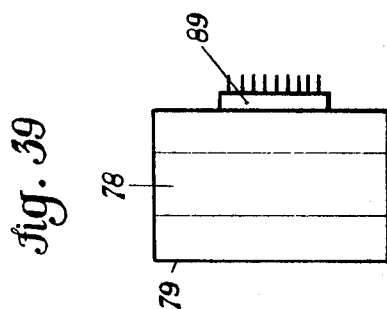
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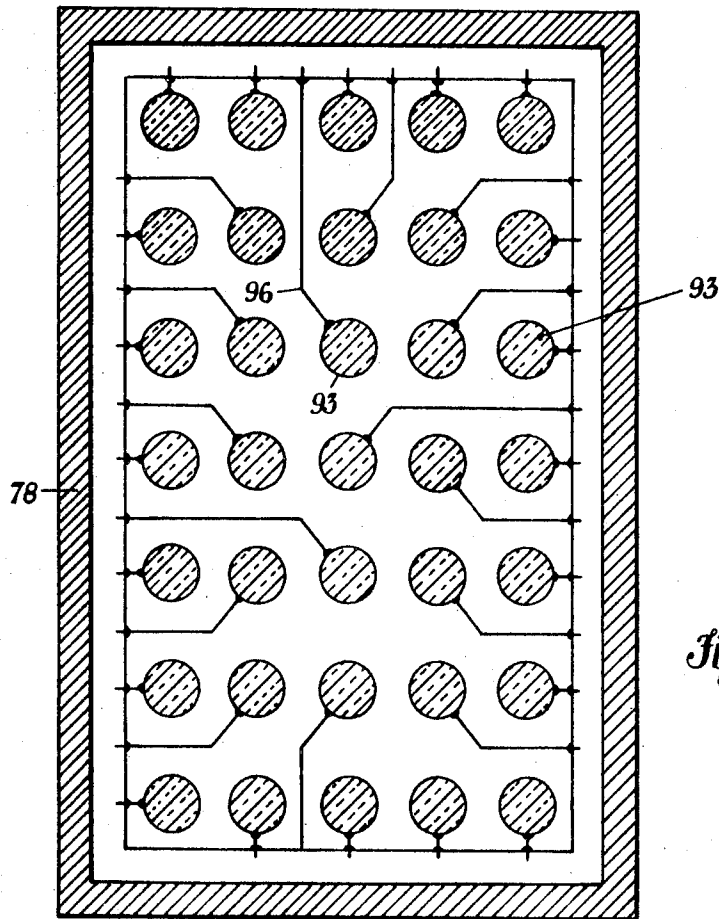
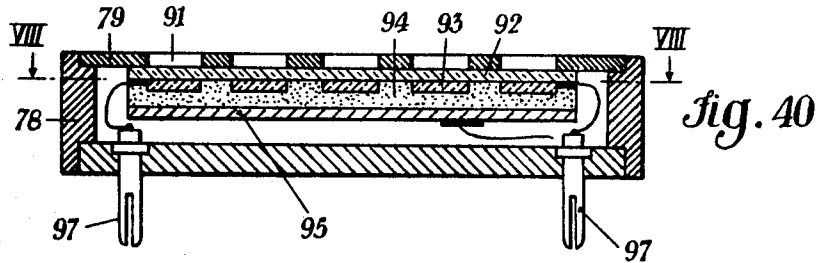
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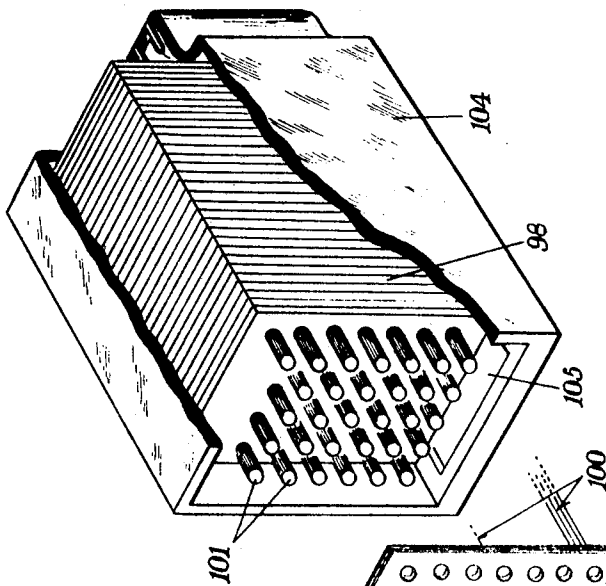


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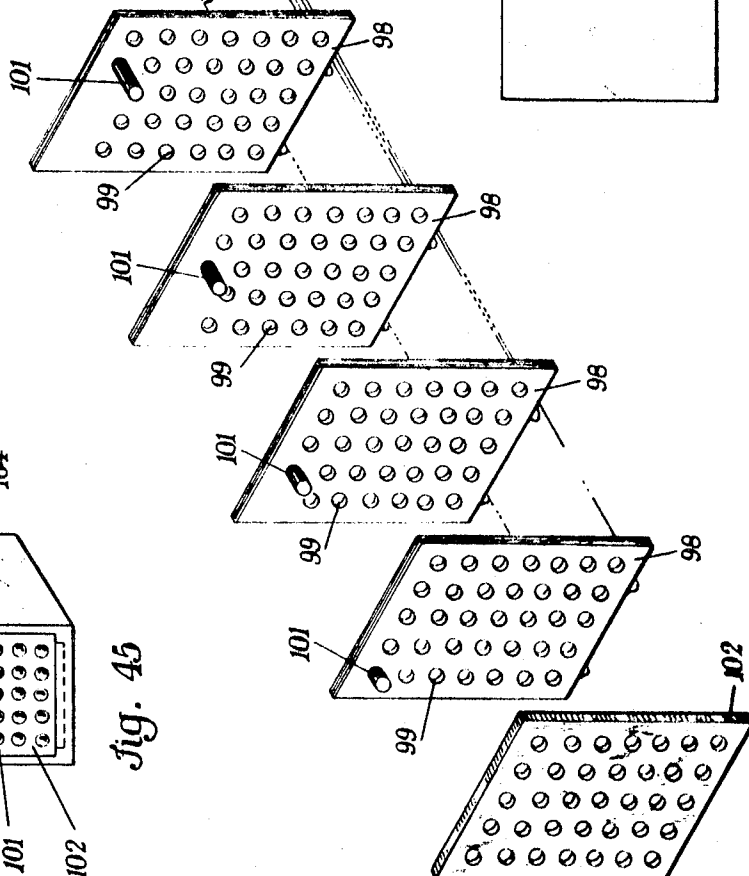
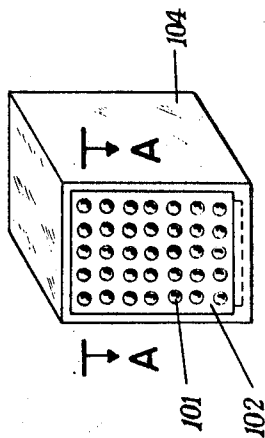


Fig. 43

Fig. 45

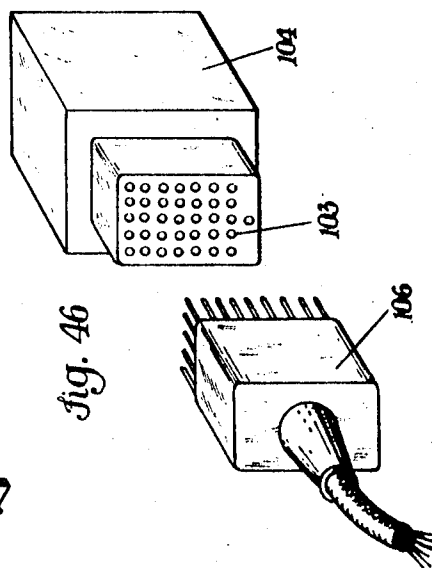
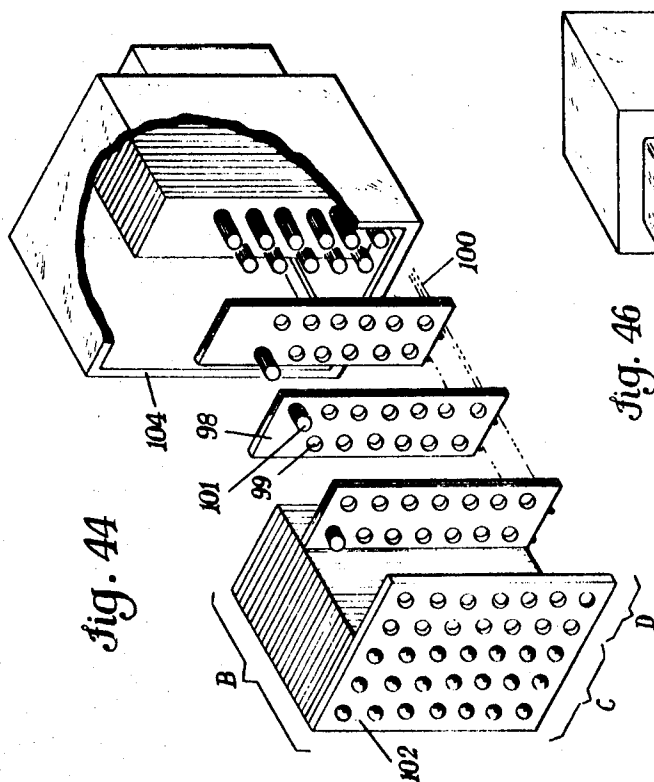
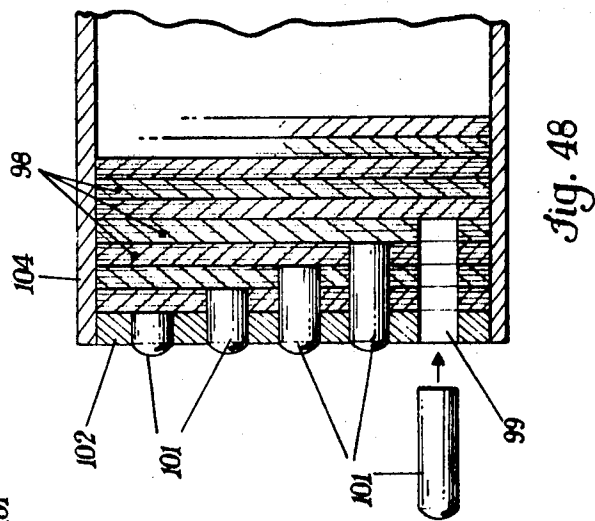
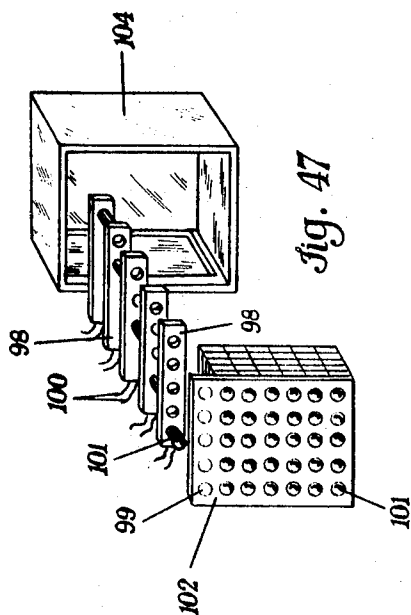


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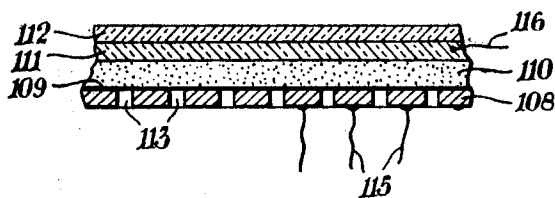


Fig. 49

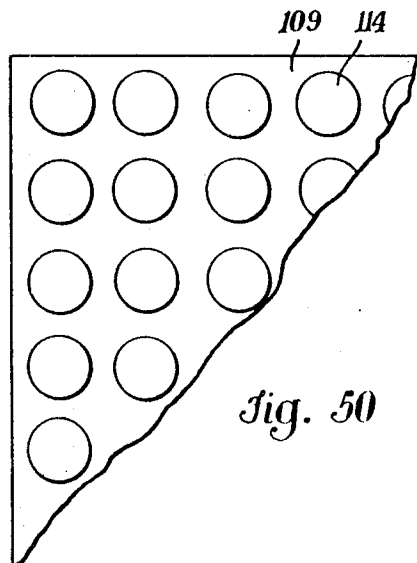


Fig. 50

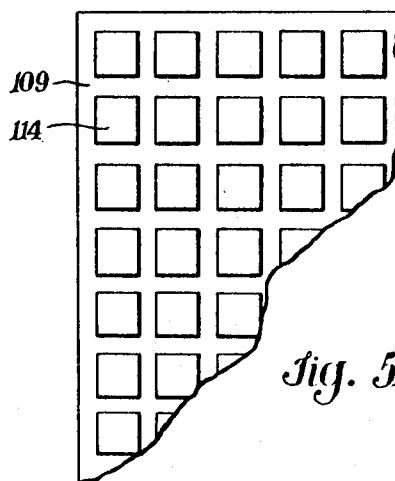


Fig. 51

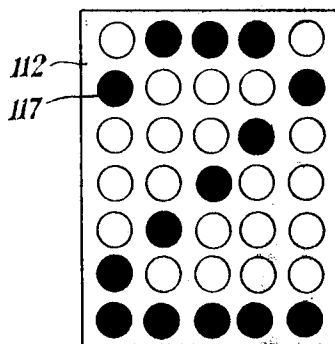


Fig. 52

Fig. 53

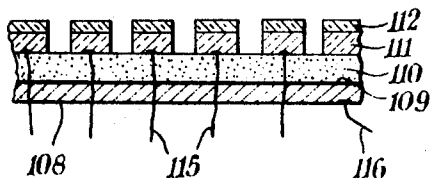
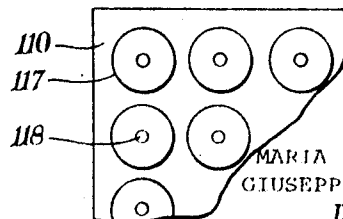


Fig. 54



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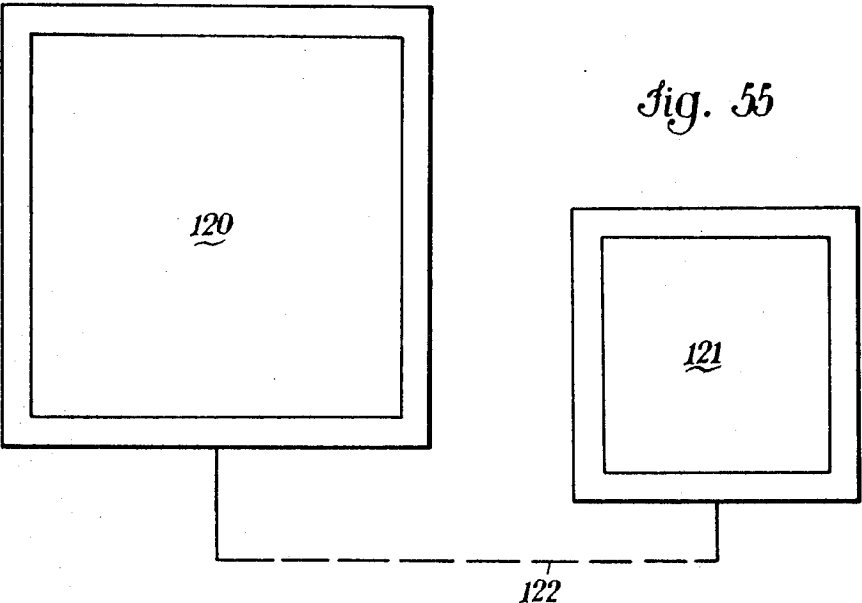


Fig. 55

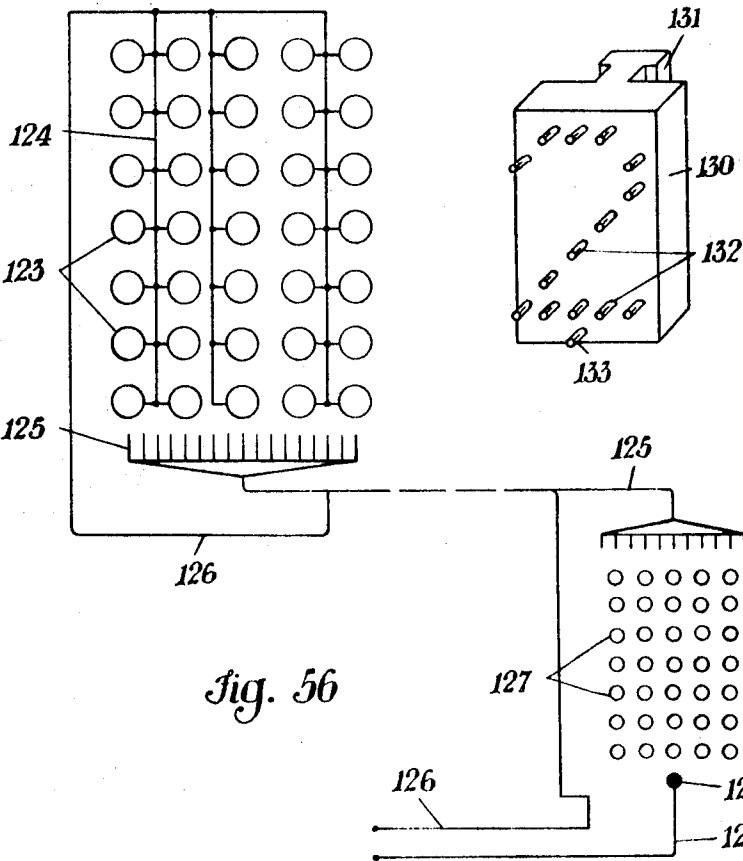


Fig. 56

Fig. 57

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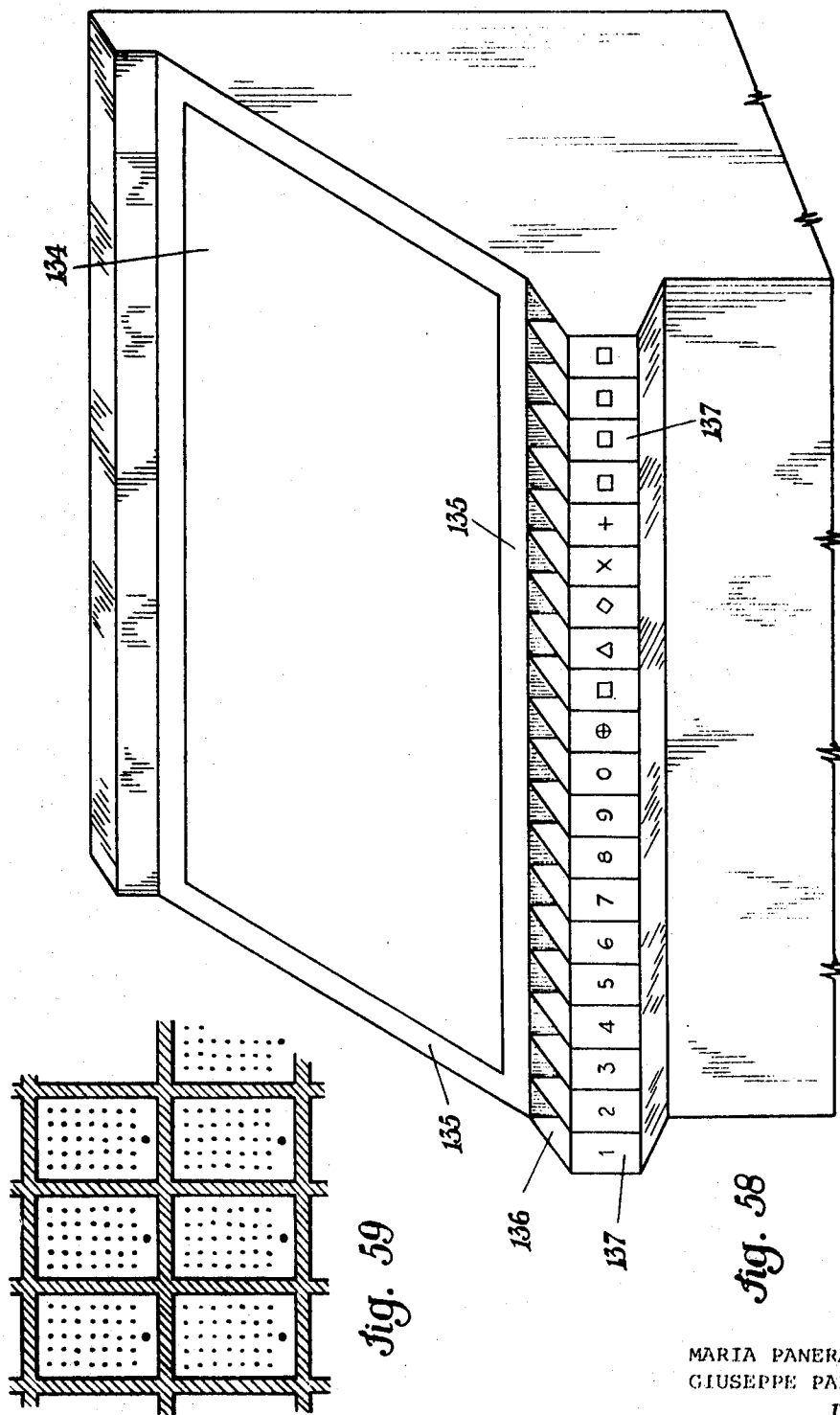


fig. 59

fig. 58

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COMPACT COMPONENT DEVICE FOR THE VISIBLE DISPLAY OF LETTERS, DIGITS, SYMBOLS AND FIGURES

The present invention relates to a compact component device for the visible display of letters, digits, symbols and figures.

In very numerous fields of the art there is the need of supplying a luminous indication or display, having an either fixed or variable composition. In some cases, such as for instance the dials of electronic equipments, display panels, operative boards, etc., is it necessary to have a multiplicity of luminous signals contained in a rather restricted space. In the case of the advertising or informative luminous displays, where the problem of the dimensions is relatively less important, it occurs, however, the inconvenience of being compelled to have recourse to circuits and components very cumbersome, expensive and subject to frequent damages.

The purpose of this invention is that of embodying a device of the related kind, consisting of compact components (i.e. having minimum dimensions), having a simple constructive plan, a very high luminous yield, suitable to supply a large band of visible indications, having whatever sizes and colors with a power consumption remarkably lower than that of the known systems.

According to this invention, a device is provided including in combination, a plurality of transparent plates packed with one another, a plurality of transparent rods passing through the pack of said plates, through their thickness, one or more luminous sources located along one or more lateral faces of said pack, and means for returning selectively the light of said sources axialwise along the said rods so that the terminal surfaces of said bars will form a unit of luminous zones on the head surface of said pack, reproducing the desired visible indication.

In a first embodiment of this invention, said means for selectively returning the light consist of prismatic notches, provided along the rods in prefixed positions, so that by said plates will be returned by said prisms along the axis of the rods themselves, in order to form the preselected visible indication.

In a second embodiment of this invention, said means for the selective return of the light consist of two prismatic notches, opposite and symmetrical, which receive the light from two directions, or from a conical notch.

Always according to this invention, the light source or the light sources will move at will along the lateral faces of the block or pack of transparent plates, in order to send selectively a light beam to the plate corresponding to the selected indication.

According to a further embodiment of this invention each of said plates is provided along its contour one or more light sources, destined to be energized selectively to obtain on the front terminal surface of the rods the associated luminous indication.

In a variant, said means for the selective return of the light consist of prismatic notches, having a nonrelevant depth, provided in the lateral surface of the rods, perpendicularly to the optical axis and extending through one part or the entire contour of the rods themselves. Said notches can be also provided in two half circles and axially staggered with respect to one another.

The depth of the various notches can be differentiated so as to avoid the possible screening effects with respect to the light rays which will be transmitted along the rods.

In another embodiment the means for the selective return of the light consist of a local restriction of a cross-sectional area of the rod, obtained so as not to change the optical features of the material in the restricted cross-sectional area zone. Said restriction can be also obtained by symmetrical imprints obtained by deformation or by stretching.

In a further variant, the rods consist of segments of transparent material, located in prosecution with one another each having one bent at 90° so that the surface of said end will be presented towards the associated light source. The end of each segment can be also U-bent through a short length, and ending

by a beveled portion forming a prism destined to feel and return the light of the associated source.

In another variant, suitable for rods the cross section of which is not circular, the light-returning means consist of elementary prisms, bodily obtained on one or more side faces of the rod, and faced towards the respective light sources.

In another embodiment of this invention, the device includes an array of flexible light pipes, each having one end inserted in a front plate, and the other end faced to a cell containing one or more light sources, which are selectively energized in order to form, on said front plate the desired light display. The unit of the cells with their associated light sources (either incandescent or electroluminescent) is carried by a glidable frame, provided with sliding contacts for connecting the various control circuits, and easily dismountable for quickly effecting the necessary checking, maintenance, and replacement of the light sources.

The prismatic notches provided in the transparent material rods can be surrounded by a ring of electroluminescent material, which is selectively energized by the operative circuits so as to illuminate said notches and send back the light to the front plate, in order to have a multiplicity of luminous zones forming the desired display.

In another embodiment there is an array of transparent pins, the head ends of which passes through the display front plate and the side and bottom surface is rendered conductive by a transparent layer, with said bottom resting on a layer of electroluminescent material, which will be energized selectively in order to obtain the formation of desired luminous zones. The energizing circuits of the electroluminescent material layer include an opaque conductor layer, contacting said electroluminescent material, and a set of single conductors connected to the side conducting transparent surface of the pins through a metal ring. Said metal ring can advantageously consist of a conductive sleeve with an internal reflecting surface, surrounding the lateral surface of each pin.

In order to ensure the contact of the bottom surface of the various pins with the electroluminescent layer, an elastic layer is provided, resting in said conductive opaque layer thrust and pushed towards it by a rigid plate. In order to render easily rechargeable the electroluminescent layer with its associated conductive support, said rigid plate is elastically thrust by snap disengageable springs.

Alternatively, the layer of electroluminescent with its associated conductive support, are embodied in the form of a flexible tape coming from a bobbin, which is periodically displaced after the removal of the elastic pressure urging said tape against the bottom of the pins.

In another embodiment, said pins are made of conductive opaque material, and are surrounded by a sleeve of transparent material. In this case, there is a plurality of luminous annular zones, corresponding to the zones where said electroluminescent layer is locally energized.

In a further embodiment, the panel is provided with a set of holes, through which it will be possible to see the corresponding luminous zones of the electroluminescent material, selectively activated by conductors having any shape and size, located below said electroluminescent layer.

In a further variant, a device is provided including in combination an array of transparent parallel rods, contained within a case and the front end of which is located in the visible plane or face of said casing, while the rear end is associated to a prism which receives the light from a horizontal electroluminescent plate.

In another embodiment, said rods have differentiated lengths, and their rear ends receive directly the light from electroluminescent vertical plates, partially overlapped on one another.

In another variant, the casing has its front face provided with an array of holes, behind which is located an electroluminescent panel, comprising a bottom conductor layer, an electroluminescent material layer, and a set of conductive transparent zones, capable of being selectively energized, and

located in register with said holes. The formation of luminous information will be obtained by energizing the electroluminescent layer in register with said transparent conductive zones, when the current is fed to said conductive zones according to an arrangement corresponding to the desired signal.

In another different embodiment, the device includes in combination a set of electroluminescent panels, closely standing and selectively energizable, located inside of a casing, and an array of transparent rods, perpendicularly located with respect to said panels, each of said rods having its front end appearing on a display plane, while the rear end of the rod rests on one of said panels, so that on said plane a number of luminous points will be observed, corresponding to the various energized panels.

In a further embodiment, a panel is provided including in combination, a multiplicity of metal zones, independent from one another, each carrying a conductor, a ceramic dielectric protective continuous layer covering the unit of said zones, a layer of electroluminescent phosphor superposed to said protective layer, a continuous transparent conductive layer to which is fastened a common electric conductor, and a front dielectric transparent protective layer, forming the display face of the panel.

By selectively closing the circuits leading to said metal zones, the energizing of the corresponding zones of the phosphor layer will be obtained, whereby on the display of the panel a set of luminous points or zones, forming in their unit the desired indication.

Still according to this invention a process is provided for manufacturing the above disclosed panel, including the stages of: predisposing a continuous metal layer provided with a protective ceramic dielectric coating, superposing to said coating orderly, a layer of electroluminescent material, a transparent conductive layer and a protective transparent dielectric layer, removing by either electronical or mechanical or chemical means determined zones of said base metal layer so as to obtain a multiplicity of separate and independent zones, connecting said zones to a corresponding set of electric conductors for a selective energization, and connecting said transparent conductive continuous layer to a common conductor.

Still according to this invention, a device is provided allowing the quick and exact energization of a multiplicity of circuits according to a prefixed order, variable at will, in order to obtain on a luminous point board, a corresponding visible indication.

This device includes in combination: a multiplicity of female connection members, located on a control board reproducing the luminous point panel, and a set of male connection members, consisting of a socket provided with an array of contact jacks arranged to a predetermined design and suitable to energize the corresponding circuits of the panel due to the insertion into said female connection members in order to obtain on said panel a set of luminous points forming the desired indication.

Still according to the present invention, said control board is provided with a number of female connection members equaling that of the luminous points of the display panel, and said luminous points and said female members are grouped in zones (cells) ordered according to horizontal lines and vertical columns. In each of said zones of the board a male connection member can be applied the contact jacks of which will establish the formation of the set of luminous points forming the desired indication in the corresponding cell of the display panel.

This invention will be now described with reference to the attached drawings showing by way of nonlimitative example, a number of preferred embodiments of the invention itself.

In the drawings:

FIG. 1 is a diagrammatical representation, in cross-sectional view, of the device;

FIG. 2 is a partially cross-sectional perspective view of a different embodiment of the device of FIG. 1;

FIGS. 3, 4 and 5 show some detail views of the various illumination systems;

FIG. 6 shows two examples of letteral display;

FIG. 7 shows a set of digital displays;

FIG. 8 shows an indication including more letters;

FIGS. 9 and 10 show two further kinds of elements for returning the light;

FIG. 11 shows the detail of one rod, in partial side elevation;

FIG. 12 is a cross-sectional view taken along the plane II—II of FIG. 1;

FIGS. 13 and 14 show two views similar to FIG. 11, concerning two different embodiments;

FIG. 15 is a cross-sectional view taken along the plane V—V of FIG. 14;

FIGS. 16 to 22 diagrammatically show a set of different embodiments of the rod of FIG. 11;

FIG. 23 shows diagrammatically a further embodiment of the device according to the present invention, in vertical sectional view;

FIG. 24 shows a detail of the device of FIG. 23, in an enlarged scale;

FIG. 25 shows a cross-sectional view of a transparent rod with luminous collar;

FIG. 26 diagrammatically shows a cross-sectional of a view of a further embodiment;

FIG. 27 shows a different embodiment of the luminous pins of FIG. 26;

FIG. 28 diagrammatically shows the front view of the panel of FIG. 26;

FIGS. 29 and 30 show two different embodiments of the device of FIG. 26;

FIG. 31 shows a cross-sectional view of a further embodiment;

FIG. 32 is a partial front view of the panel of FIG. 31;

FIG. 33 shows a sectional view, taken along a vertical plane of a further embodiment;

FIG. 34 is a partially sectional perspective view of another panel according to this invention;

FIGS. 35 and 36 show a constructional detail;

FIG. 37 is a diagrammatical side elevation;

FIG. 38 is a view similar to FIG. 34 and showing another embodiment;

FIG. 39 is a view similar to FIG. 37;

FIG. 40 is a cross-sectional view of another embodiment;

FIG. 41 is a cross-sectional view taken along the plane VIII—VIII of FIG. 40;

FIG. 42 is perspective view, with some elements in exploded view, of another embodiment in perspective view;

FIG. 43 is a partially cross-sectional side elevational view;

FIG. 44 is a view similar to FIG. 42 showing a different embodiment of the device;

FIG. 45 is a perspective view of the device of FIG. 42;

FIG. 46 is a rear view;

FIG. 47 is a perspective view of a variant of the device of FIG. 42;

FIG. 48 is a cross-sectional view taken along the plane A—A of FIG. 45;

FIG. 49 shows a vertical sectional view of another panel according to this invention;

FIG. 50 is a partial rear elevational view of the panel of FIG. 49;

FIG. 51 shows a variant of FIG. 50;

FIG. 52 shows a front view of the panel;

FIGS. 53 and 54 show a variant to the FIGS. 49 and 50;

FIG. 55 diagrammatically shows a control unit for digital panels;

FIG. 56 is a detail view showing the connections between one zone or "cell" of the control board;

FIG. 57 shows the detail of a male connecting member;

FIG. 58 shows the detail of the control boards with the receiving recesses of the male connecting members;

FIG. 59 is a detail view of the control board of FIG. 58.

With reference to FIG. 1, this invention provides a set of transparent plates 1, packed along their faces 2 so as to form a pack which extends from the front or display face 3 to the rear face 4. On the front face 3 and on the separating faces 2 an opaque material-coating layer 5 can be provided.

The pack of plates 1 is passed through by a set of rods 6, also made of transparent material, provided with prismatic notches 7 located according to the conformation of the visual display to be obtained. In other words, the notches 7 form in the plane of each plate 1, one letter, digit, symbol or sign to be obtained; therefore, the device of FIG. 1 lends to production of a number of indications equaling the number of plates. In FIG. 1 10 plates 1 have been shown, being however understood that their number can change within limits rather broad.

Along one or more sides of the pack of plates 1, a light source 8 movable towards the two directions shown by the arrows, is located, and said source consists of one or more incandescent of fluorescent or luminescent, and so on, elements. The light source 8 is contained in a recess 9 provided with an optical condenser 10, if the case may be, and serves the function of sending a light beam having a thickness substantially equal to the thickness of one plate 1.

The operation is as follows: the light beam coming from the light source or sources 8 passes through the transparent plate 1 and the rods 6 along the path as shown by the arrows, will be sent back by the prismatic notches 7 axialwise along the rods, emerging from the front end surfaces 11 in the form of luminous zones either white or colored, having the desired location. In FIGS. 6 and 7 some digital or letteral indications have been shown by way of example, while in FIG. 8 a group of luminous indications suitable to form a word, has been shown. It is evident that according to the number of the plates 1 and of the rods 6 it will be possible to obtain from a single compact pack or from more blocks sequentially located, one wording, one number or any figure.

As shown in FIG. 1, the terminal surfaces 11 of the rods 6 can be conveniently shaped with concentric steps, in order to afford a good visibility even under a visual angle somewhat displaced with respect to the front observation of the front or display face 3, being however understood that the surfaces 11 can be lens-shaped or flat-shaped; also the front end of the rods can slightly project out from the plane 3 (as in FIG. 1) or it can be at level of said plane, or also be somewhat embedded.

In the variant shown in FIG. 2 each plate 1 is provided with a peripheral recess 12 wherein is located a set of light sources 13 or a single source 14 for each side of the plate. The sources 13 and 14 are fed by the conductors 15 leading to the terminal board 16. In this case, the luminous indications are obtained by selectively switching on said sources.

In FIG. 3, the light sources are embodied by an electroluminescent layer 17, while in FIG. 4 the light of the electroluminescent layers 17 is returned by a total reflection prismatic surface 18, provided along the edge of the plate 1.

In the variant of FIG. 5, the light sources consist of tubular elements 19 interposed between the plates 1. The latter, in this case, will be spaced apart by means of opaque sleeves 20 serving the purpose of preventing the possible luminous interferences.

Instead of the prismatic notches 7 it is possible to use also returning surfaces consisting of two prismatic surfaces 7' and 7'' symmetrical and opposite (FIG. 9) which receive the light from two reverse directions, or (FIG. 10) the return of the luminous rights can be obtained also by a conical surface 7'''.

For simplicity of showing, the cross-sectional shape of the rods 6 is circular, being however understood that said rods can have also a quadrangular or polygonal cross-sectional shape.

In FIGS. 11 and 12, the numeral reference 21 denotes the transparent rod, having an indefinite length, with a circular cross-sectional shape. The means for the selective return of the light, coming from one or more sources 23, can consist of a little deep prismatic notch 22 extending through one half circumference of the rod itself, as shown in FIG. 12, or throughout the circumference, as shown in FIG. 13.

FIGS. 14 and 15 have two semicircumferential prismatic notches 24 and 25, slightly staggered axialwise, while in FIG. 16, the return means of the light coming from the sources 23 consist of two symmetrical imprints 26 obtained by locally deforming the rod 21 producing no variation of the optical features of the material forming the rod itself. Said imprints can be embodied in the shape of prismatic notches 27 (FIG. 17) or of biprismatic notches 28 (FIG. 19). In FIG. 18 a gradual restriction of the cross-sectional area 29 is shown, obtained by hot stretching.

In FIG. 20, the rod 21 for the transmission of the light, is subdivided into various segments aligned along the optical axis. Each segment is provided with one end 30 bent at right angle, and turned towards the light source 23.

In FIG. 21 the end of each segment 21 is U-bent and is provided with a prismatic terminal face 31 which is hit by the light coming from the associated source 13. All embodiments shown in FIGS. 16 to 21 can be embodied with transparent rods having a circular or prismatic cross-sectional shape (triangular, quadrangular, polygonal, etc.).

In case of rods the cross-sectional shape of which is not circular, also the variant of FIG. 22 can be adopted, consisting of a prism 32 bodily obtained in the material forming the rod 21, on one or more side faces.

It is to be noted that for sake or simplicity of showing, the light sources 23 have been shown diagrammatically under the form of a lamp, being however understood that the light source can also be of another kind, for instance an electroluminescent zone.

Another embodiment of the device according to this invention is shown in FIG. 23; in this case, the light-transmitting elements consists of an array of flexible light pipes 33, coated with an opaque layer 34.

The light pipes 33 have one end 35 inserted into the holes 36 of the front plate 37 (forming the luminous display panel), while the other end 38 is faced to the holes 39 provided through the plate 40.

The holes 39 are located in exact register with an array of cells 41 separate by partitions 42 and containing the light sources 43.

In order to enable quick and easy operations for checking and replacing the light sources 43, the insulating support 44 of said sources and the plate 40 form an extractable drawer as shown in dotted line in FIG. 23, by a handle or the like 45.

In order to allow said drawer to be extracted, the conductors 46 of the sources 34 end by the sliding contacts 47, faced to the lower surface of the insulating support 44 and cooperating with the respective spring contacts 48 carried by the stationary insulating support 49.

The contacts 48 are connected to the feeding conductors 50 leading to the operative circuits which will not be described as they are not part of this invention.

The operation is similar to the already described one; the operative controls will switch on the sources 43 according to the desired sequences, and on the surface of the front plate 37 a multiplicity of luminous points will be obtained forming the desired visible display.

It is to be noted, in this connection, that each cell 41 two or more light sources 43 can be located, with various colors if the case may be, in order to obtain the luminous display on the front plate 37 in various colors.

The embodiment of FIG. 23 lends also to its embodiment rigid rods of transparent material, bent as shown in the figure.

As shown in FIG. 24 instead of the cited pointlike light sources, it is possible to locate within the cells 44 little electroluminescent panels 51.

In this case, the holes 39 of the plate 40 can have conveniently a conical shape, in order to receive entirely the amount of light emitted by the panels 51.

With reference to FIG. 25, the numeral reference 52 denotes the rod transparent material, provided with a set of prismatic notches 53, which partially or entirely extend on the side surface of the rod, as aforesaid.

The lateral surface of the rod 52 is coated with a thin transparent conductive layer 54, and thereon a layer 55 of electroluminescent is applied.

In register with each prismatic notch 53 a conductive ring 56 is provided, connected by means of the insulated conductive wire 57 to the operative circuit. The other conductor 58 is electrically connected to the layer 54. When the circuit leading to the conductors 57 and 58 will be closed, a luminous ring will surround the zone of the prismatic notch 53. The light emitted by said ring is returned by the prism 53 and is visible by the head of the rod.

In FIG. 26 an array of pins 59 is shown, said pins being made of transparent material, having their head ends 60 projecting through the front plate 61, and the bottom 62 resting on the electroluminescent layer 55. The bottom 62 and the side surface 63 of each pin are coated with a thin transparent conductive layer.

The electroluminescent layer 55 rests on an opaque conductive layer 64 and is elastically pushed against the bottom 62 of the pins by a yieldable layer 65 interposed between the conductor 64 and a rigid plate 66. The operative circuit is connected by the wires 57 and 58 leading to a collar 67 which engages the conductive transparent side surface 63 and to the layer 64 forming the common conductor, respectively. When the circuit of the conductors 57 and 58 will be closed, at the base of each pin 59 the local energizing of the electroluminescent layer 55 will be obtained. Of course said selective energizing is embodied so as to have on the front plate 61 (FIG. 28) the luminous desired device. Instead of the collars 67 (FIG. 27) it is possible to provide conveniently the sleeves 68 having a thin thickness, entirely or partially surrounding the lateral surface 63 of the pins 59 and having a reflecting internal surface, in order to best guide the light coming from the electroluminescent layer 55.

In order to render easy the possible replacement of the layer 55, the rigid plate 66 can be shaped as shown in FIG. 29 and thrust against the elastic pad 65 by the snap springs 69 hinged in 70. Alternatively (FIG. 30) the electroluminescent layer 55 and the conductor 64 can be embodied in the form of a flexible tape, elastically pressed against the pins 59 and fed by a bobbin 71. Periodically, at will, the aforesaid tape will be advanced, and the fresh part of which unwinds from the bobbin 71, while the exhausted portion is wound on the collecting bobbin 72. In this case, the operative circuit is connected to the conductor 64 by a sliding contact of a known type.

In the different embodiment of FIG. 31, the pins 59 are made of opaque conductive material, and are surrounded by the sleeves 73 made of transparent material. When the circuit of the conductors 57 and 58 will be closed, the local energizing of the electroluminescent layer 55 at the base of the pins 59. Thus luminous points or zones visible through the transparent sleeves 73 will be formed giving the desired showing (FIG. 32). It is evident that a similar result will be obtained with the pins 59 opaque or nonconductive and with the sleeves 73 of transparent material rendered conductive.

In FIG. 33 the front plate 61, is provided with the holes 74 and rests on a transparent 75 there is a transparent conductive layer 76, the layer of electroluminescent phosphor 55 and an array of single conductors 77 applied in alignment with the holes 74 and having any shape. The local energizing of the layer 55 by the conductors 57 and 58 determines a multiplicity of luminous zones, which can be seen through holes 74 and forming the desired display.

In the embodiment shown in FIGS. 34 to 36, the numeral reference 78 denotes the casing, carrying the front plate 79 through which pass the front ends of the transparent rods 81. At the other end the rods 81 are provided with a prismatic body 82 applied to the rod or obtained bodily therewith, resting on a plate 83 made of electroluminescent material, supported by the support 84.

Each electroluminescent plate 83 is connected to a pair of conductors 85 and 86 by any suitable system, for instance by

two welding drops 87 and 88 applied to the upper luminous face and to the base surface of the plate 83. As shown in FIG. 36, the light emitted by the plate 83 is sent back by the prismatic body 82 and moves axially through the rod 81 up to the front plate 79. This return system for the light from a horizontal plane (plate 83) to the cylindrical body of the rod allows panels having front sizes extremely reduced to be obtained without having recourse to point like light sources.

The lower conductor 86 of each plate forms the common conductor, and therefore it can be connected to the similar conductor of all other elements of the panel, while the upper conductor 85 is destined to be energized selectively by the operative circuits, in order to have on the display face 79 the desired luminous indication.

The unit of the conductors 85 as seen in FIG. 37 can form a quick connection element 89 which can be easily inserted on a socket connected to the operative circuits.

In the different embodiment of FIG. 38 the transparent rods 81 have differentiated lengths, and receive directly the light from the electroluminescent plates 83 located perpendicularly with respect to the axes of the rods themselves. Also in this case, there is a common feeding conductor, connected to the conductive zones of the plates 83 which result in contact with one another, and a set of selective energization conductors, associated to the single plates and forming the quick connection element 89 of FIG. 39. In order to avoid the possible luminous interferences, the vertical columns of rods 81 are separated by opaque insulating diaphragms 90. FIGS. 40 and 41 show another variant, also suitable to embody luminous panels having minimum dimensions. In this case, the front plate 79 is provided with a set of holes 91 and inside the casing 78 are located, orderly, a transparent protective and insulating plate 92 with a set of conductive transparent zones 93 located in axial alignment with the holes 91, a layer of electroluminescent material 94 and a bottom conductive layer 95. The latter forms the common conductor, while the conductors having a selective operation consist in this case of the wire elements 96, associated to the transparent conductive zones 93, independent from one another, and connected to the plugs 97 for their connection to the operative circuits. The latter cause the selective lighting of the various zones 93 according to an arrangement suitable to reproduce the desired luminous indication. The front opaque plate 79 has the function of hiding the selective conductors 96 and the holes 91 of said plate serve the function of supplying a net contour about the various luminous zones obtained due to energization of the surfaces 93.

With reference to FIGS. 42, 43, 45 and 48, the numeral reference 98 denotes a set of electroluminescent panels which can be selectively energized by the conductors 100. Said panels are provided with a set of holes 99 through which pass the transparent pins or rods 101, located perpendicularly with respect to the plane of said panels. The pins 101 have their front ends passing through the front plate 102 forming the display face, or observation board of the unit. As shown by the drawings, particularly by FIGS. 42 and 48, the rear end of each pin rests on a corresponding associated panel 71 after having passed through the holes 99 of the various preceding panels, so that the various pins have differentiated lengths, according to the distance from the concerned panel and the display plate 102.

The entire unit is located in a casing 104, provided with the recess 105 destined to receive the conductors 100 feeding the various panels. Said conductors 100 lead to several connectors or female recesses 103 (see also FIGS. 43 and 46) into which are inserted the corresponding plugs carried by the connector 106 connecting the device to its associated operative circuits. The operation is similar to that of the various devices hereinbefore disclosed, when the various panels 98 will be semiactively energized, a multiplicity of luminous points will be obtained on the front plate 102, reproducing the visible desired indication.

In the different embodiment shown in FIG. 44, the unit of the panels 98, the total depth of which has been denoted by B, is subdivided into two groups C and D, the first of which includes three columns of pins 101, while the second group carries two columns of pins. Likewise, in FIG. 47, the panels 98 are subdivided into horizontal lines; thus five panels 98 horizontally arranged are obtained for each corresponding line of five pins 101, while the second group carries two columns of pins. Likewise, in FIG. 47, the Of course, it would be possible to provide for a subdivision in vertical columns obtaining thus, in case of FIG. 47, seven vertically arranged panels, for each column of seven pins 101.

With reference to FIG. 49, the numeral reference 108 denotes a continuous metal conductor, provided with a dielectric protective layer 109 of ceramic material ("flus"). On the dielectric material 109 there is a layer of electroluminescent material 110, consisting preferably of ceramized phosphor, i.e. a homogeneous paste of phosphor and ceramic powder. To said electroluminescent layer 110 are orderly superposed a transparent conductive layer 111 and a transparent dielectric protective layer 112 which forms the display face of the panel.

By chemical way, or by mechanical way or by electronic way or by other means, from the metal layer 108 will be removed the zones 113 through the full thickness, so as to obtain a multiplicity of plates 114 independent from one another (FIGS. 50 and 51) having the desired shape (circular, quadrangular, etc.). On said plate or metal zone 114 a filament conductor 115, selectively energized, will be fastened, while the transparent conductive layer 111 will be connected to the common conductor 116, leading to a suitable source of electric power.

When the circuit including the conductor 116 and a certain number of conductors 114 will be closed, a set of points or luminous zones 117 FIG. 52) will be obtained, reproducing the desired indication.

In FIGS. 53 and 54 a variant to the above described embodiment is illustrated: in this case the base metal layer 108 will remain intact and the zones intersecting the entire thickness of the layers 111 or 112 will be removed. The wire conductors 115 suitably coated with insulating material, will be fastened to the single plates or independent zones of the transparent conductive layer 111, while the common conductor 116 will be in this case connected to the continuous metal layer 108. The operation is similar to that as previously described (FIG. 54) with the sole difference consisting of the presence of a little opaque pointlike zone 118 at the center of the luminous zone 117, due to the conductor segment 115 passing through the electroluminescent layer 110.

FIGS. 55 to 59 show a control unit for any type of luminous panel, particularly for the previously described panels.

With reference to FIG. 55 the numeral reference 120 denotes the display board consisting of a multiplicity of luminous points and the reference 121 relates to the control board including a multiplicity of female connecting elements corresponding to said luminous points, connected thereto by a group of conductors shown at 122.

The display board 120 is subdivided (FIG. 56) in zones or cells either rectangular or square, each of which includes a certain number of luminous points 123. For instance, in case of FIG. 56, each cell of the board 120 is provided with 35 luminous points 123, connected to each other by the conductors 124 and carrying the single conductors 125. The conductors 124 are connected to the return conductor 126, while the single conductors 125 are individually connected to the bushings or recesses 127 located on the control board in exactly corresponding positions, so as to reproduce the related cell. An independent recess 128 is connected to the common conductor 129 which, together with said return conductor 126 leads to the feeding line.

In order to obtain on the display board 120 and specifically in the cell of FIG. 56 any luminous signal, for instance the digit "2" the male connector shown in FIG. 57 will be inserted into the corresponding zone of the control board, carrying a socket

130 provided with a handle 131 and with a set of jacks 132 parallel connected to one another.

When the jacks 132 will be inserted into the corresponding bushings 127 of the control board, the selective energizing of the luminous points of the cell will be obtained so as to obtain therein the desired indication. As shown in FIG. 57, the male element has an independent jack 133 destined to become inserted into the recess 128 of the common conductor 129.

The above, is valid of course for any cell of the display board and for the corresponding zones of the control board. The latter can take the shape diagrammatically shown in FIG. 58 including a bookstand 134 whereon is reproduced in scale the luminous board, provided with edges 135 graduated in cartesian coordinates for the quick and exact search of the various zones, as shown in detail in FIG. 59.

The male conductive elements, can be suitably contained in a casing 136 containing the reference pointers 137 concerning the various numbers, letters and symbols represented by said connectors.

The present invention has been described in certain preferred embodiments, being however understood that constructive changes might be practically adopted without departing from the scope of the present industrial privilege.

We claim:

1. A device for the visible display of letters, digits, symbols and figures, comprising in combination a plurality of transparent plates mounted adjacent one another to form a pack, a plurality of transparent rods passing through said pack in their thickness direction, one or more luminous sources located along at least one lateral face of said pack to illuminate the corresponding plate and means for selectively reflecting the light from said sources axially along said rods, so that the end front surfaces of said rods will form a unit of luminous zones on the front surface of said pack, reproducing the desired visible indication.

2. A device as claimed in claim 1, wherein said selective reflecting means for the light comprises prismatic notches provided along the rods in prefixed positions whereby a light beam, perpendicular to the axis of the rods, guided by said plates, will be reflected at least by one of said prismatic notches along the axes of the rods themselves, in order to supply the selected visible display.

3. A device as claimed in claim 2, wherein said means for selectively reflecting the light comprise two prismatic opposite and symmetrical notches, which receive the light from two opposite directions.

4. A device as claimed in claim 1 wherein said means for the selective reflecting the light comprise a notch having a conical shape.

5. A device as claimed in claim 1, wherein said luminous source is movable along the lateral faces of said pack to selectively send a light beam to the plate corresponding to the selected indication.

6. A device as claimed in claim 1, wherein each of said plates is provided along at least one lateral side thereof with at least one luminous source to be energized selectively in order to have on the front end surface of the rods a luminous indication.

7. A device as claimed in claim 6, wherein said luminous sources are arranged within recesses provided along the edges of said plates.

8. A device as claimed in claim 1, wherein said light source is a lamp selected from a group consisting of incandescence, luminescence and electroluminescence lamp types.

9. A device as claimed in claim 1, wherein said light source is a layer of electroluminescent material.

10. A device as claimed in claim 9, wherein said layer of electroluminescent material is applied along the edge of each plate, in a position adjacent to a prismatic surface in the thickness of the plate itself.

11. A device as claimed in claim 2, wherein said light sources are interposed between said plates adjacent said prismatic notches, said plates being spaced apart by means of

opaque sleeves, surrounding the corresponding zones of the rods.

12. A device as claimed in claim 1, wherein said selective reflecting means for the light comprise prismatic notches having a slight depth in the side surface of said rods, perpendicularly with respect to the optical axis, and extending at least partially about the contour of the cross section of said rods.

13. A device as claimed in claim 12, wherein said notches are provided on two half-circumferences axialwise staggered with respect to one another.

14. A device as claimed in claim 1, wherein said rods are subdivided into sections located in alignment with one another, and each having one end bent perpendicularly with respect to the optical axis, so that the head surface of said end will be facing towards the associated light source.

15. A device as claimed in claim 14, wherein the end of each segment is U bent through a short portion, and ends with a face forming a prism destined to reflect the light of the associated source.

16. A device as claimed in claim 1, wherein said rods comprise an array of flexible light pipes, each having one end inserted through a front plate and the other end faced circuits, a cell containing one or more light sources, selectively energized in order to form, on said front plate, the desired luminous indication.

17. A device as claimed in claim 16, wherein said cells with their associated light sources is carried by a slidable frame, provided with sliding contacts for the connection with the control circuits, and easily removable for checking and replacing the light source.

18. A device as claimed in claim 16, wherein in each cell are contained at least two light sources, having various colors, in order to obtain on the front plate a colored luminous display according to various colors.

19. A device as claimed in claim 1, wherein said light source consists of an electroluminescent plate.

20. A device as claimed in claim 12, wherein the prismatic notches provided on the transparent material rods are surrounded by a ring of electroluminescent material to be energized selectively by the operative circuits, for selectively illuminating said notches and for reflecting the light to the front end of the rods.

21. A device as claimed in claim 20, wherein a layer of electroluminescent material is contained between a transparent conductive coating applied to the lateral surface of the rod, and a conductive sleeve surrounding the zone of each prismatic notch.

22. A device as set forth in claim 1 comprising a multiplicity of female connection elements located on a control board reproducing the luminous point panel, and a set of male connectors, consisting of a socket provided with a set of contact jacks located according to a prefixed design, suitable to energize the corresponding circuits of the panel due to insertion into said female connectors in order to obtain on said panel a set of luminous points forming the desired indication.

23. A device as claimed in claim 22, characterized in that said control board is provided with a number of female connector members equaling the number of the luminous points of the display panel.

24. A device as claimed in claim 23, characterized in that the display board is subdivided into zones or "cells" each of which includes a plurality of luminous points, orderly located in lines and columns, and the control board is subdivided into a corresponding number of zones, into each of which a male connector element can be inserted.

25. A device as claimed in claim 24, characterized in that said control board is provided with Cartesian references suitable to allow the immediate and easy individuation of the various corresponding cells on the luminous panel, and is provided with a set of cases provided with references and destined to contain said male connectors.

26. A device as claimed in claim 1, characterized in comprising an array of pins of transparent material having their

head end passing through the display front plate, and the lateral and rear surfaces rendered conductive by a transparent layer, said rear end resting on a layer electroluminescent material, which will be selectively energized in order to obtain the formation of the desired luminous zones.

27. A device as claimed in claim 1, characterized in that the means for the selective energization of said electroluminescent layer include an opaque conductive layer, located below said electroluminescent layer, and a set of single conductors connected to the conductive lateral surface of the associated pin, through a metal ring.

28. A device as claimed in claim 27, characterized in that said metal ring consists of a conductive sleeve with a reflecting surface, which entirely or partially surrounds the lateral surface of the pin.

29. A device as claimed in claim 28, characterized in that said electroluminescent layer is pressed against the rear end of the pins by an elastic layer, interposed between said opaque conductive layer and an outer rigid plate.

30. A device as claimed in claim 29, characterized in that said outer plate is elastically urged by one or more snap springs, in order to render said electroluminescent layer and its associated opaque conductor, easily rechargeable.

31. A device as claimed in claim 3, characterized in that the electroluminescent layer with its associated continuous opaque conductive support is embodied in form of a flexible tape, which is elastically pressured against the rear end of said pins, and can be moved periodically under a control, from feeding bobbin to a collecting bobbin for the exhausted tape.

32. A device as claimed in claim 31, characterized in that said pins are made of opaque conductive material, and are surrounded by sleeves of transparent material.

33. A device as claimed in claim 31, characterized in that said front plate is provided with a set of holes communicating with a diffuser transparent layer resting on a transparent conductor, below which are arranged a layer of electroluminescent material and a set of single conductors which can be selectively energized and are located in alignment with said holes.

34. A device as claimed in claim 33, characterized in comprising in combination a set of parallel transparent rods, contained within a casing and the front end of which is located in the front plane or display face of said casing, while each of their rear ends is associated to a prism receiving the light from an electroluminescent horizontal plate.

35. A device as claimed in claim 34, characterized in that said electroluminescent plates are fed by a common conductor and by a selectively energized conductor associated to each single plate and ending to a quick connection element with the operative circuits.

36. A device as claimed in claim 35, characterized in that said rods have a differentiated length and their rear ends receive directly the light from a set of electroluminescent vertical plates, partially superposed to one another.

37. A device as claimed in claim 36, characterized in that the casing has a front plate with an array of holes, behind which is located an electroluminescent panel including a bottom conductive layer, a layer of electroluminescent layer and a set of selectively energizable transparent zones, located in register with said holes.

38. A device as claimed in claim 37, characterized in that said transparent conductive zones are carried by a transparent insulating plate, interposed between the apertured front plate and the layer of electroluminescent material.

39. A device as claimed in claim 38, characterized in that the selective operation conductors are connected to said single transparent conductive zones, while the common conductor leads to said bottom conductive layer.

40. A device as claimed in claim 39, characterized in that said conductors lead to a quick connection element connected to the operative circuits.

41. A device as claimed in claim 40, characterized in comprising a set of electroluminescent panels close mounted to

one another, selectively energizable and located inside of a casing, and an array of transparent rods, located perpendicularly to said panels, each of said rods having its front end appearing on a display plane, and its rear end resting on one of said panels, so that on said plane a set of luminous points will be observed, corresponding to the various energized panels.

42. A device as claimed in claim 41, characterized in that each rod or transparent pin passes through a hole provided in the set of preceding panels.

43. A device as claimed in claim 42, characterized in that the front ends of the pins appear through a set of holes provided through a front plate forming the display plate.

44. A device as claimed in claim 43, characterized in that the unit of the panels and pins is contained within a casing provided frontally with said display plate and provided at its other end with a terminal unit connecting the feeding conductors of the various panels to the operative circuits.

45. A device as claimed in claim 44, characterized in that the unit of the panels is subdivided into horizontal stripes and

vertical columns, each of which carries the set of associated pins.

46. A device as claimed in claim 45, characterized in comprising in combination a multiplicity of metal zones independent from one another, each provided with a conductor, a continuous protective dielectric ceramic layer covering the unit of said zones, a layer of electroluminescent material superposed to said protective layer, a continuous transparent conductive layer to which an electric common conductor is fastened and a front dielectric protective layer, forming the display face of the panel.

47. A device as claimed in claim 46, characterized in that said ceramic protective dielectric layer is bodily embodied with the independent metal zones.

48. A device as claimed in claim 47, characterized in that said electroluminescent material consists of a homogeneous paste of finely subdivided phosphor and power of ceramic material.

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