









## DISPLAY APPARATUS

The subject of this invention is a symbol display device of the type in which a symbol is displayed as a number of discrete points of light against an unilluminated background.

One such known device incorporates a mosaic of electric lamps wired to switches which are selectively operable so that only the lamps pertaining to points on a particular symbol are illuminated to display that symbol. This device is clumsy because the smallest lamps available still require that the device should be quite large. The switching arrangements are also complicated because every lamp is individually switched.

Another known device incorporates light guides terminating at one end in holes in a display plate, the holes being arranged in the shape of symbols. The holes are arranged in straight rows or bars and the light guides from the holes forming each bar are led through a hole in another plate to a lamp placed at that hole. To display a particular numeral, for example, the lamps opposite the light guides corresponding with the appropriate bars are illuminated to display the symbol on the display plate, the appropriate bars lighting up. To avoid too great a tangle of light guides and lamps and make the device reasonably easy to assemble it is customary to display the numerals as what are known as seven bar type numerals. The disadvantages of this type of device are that combinations of switches must be operated to display each symbol and the symbols are highly stylized and unpleasant to look at. For example the numeral seven consists of a horizontal bar at the top and two vertical bars in line one above the other at the extreme right hand side and requires three switches to be operated.

It is an object of the present invention to provide a symbol display device which is easily made and assembled, which can display symbols of pleasing and completely individual shape and which can display each symbol by a single switching operation individual to that symbol.

A symbol display device according to the invention consists of a pile of laminae in which each of particular laminae is formed on one face at least with at least one groove which has a front end terminating at one edge of the lamina and a rear end terminating at another edge of the lamina the laminae being so orientated that the front ends of all the grooves are located at one face constituting the front face of the pile of laminae and are so disposed relatively to one another that they define discrete points on at least one symbol or portion of a symbol to be displayed, and light guides disposed one within each passage formed by a groove in one lamina and the contiguous lamina, each light guide having a front end located at said front face of the pile of laminae and a rear end, all the rear ends of the light guides pertaining to the same symbol or portion of a symbol being grouped in proximity to one another so as to be capable of receiving light from a single common light source.

The front ends of the grooves may be arranged in groups defining discrete points on respective symbols or portions of symbols, all the rear ends of the light guides in the grooves pertaining to the respective symbols or portions of symbols being correspondingly grouped in proximity to one another so as to be capable

of receiving light from single light sources each individual to a respective group.

All the rear ends of the light guides of each group may be disposed in a linear formation so that the light source may conveniently be constituted by a tubular lamp such as that commonly called a festoon lamp. Where each display device is arranged to display several symbols the rear ends of the light guides of the respective groups may be arranged in parallel linear formations. Such an arrangement makes it easy to arrange the tubular lamps for the several groups in a side by side arrangement thus minimizing the space required for the light sources.

Each linear formation of light guide ends may consist of one row or several parallel rows of light guide ends. The most convenient arrangement is that in which the rows of light guide ends are arranged vertically with respect to the symbols they represent.

According to the type of display required all or selected laminae are formed each with one groove or several grooves on one or both sides.

The light guides may be flexible monofilaments or may be bundles of optical fibres or may be formed by the process which is the subject of my co-pending patent application Ser. No. 141,116 filed May 7, 1971.

The device may incorporate a lamp block fitted with holders for receiving lamps constituting the light sources.

Where some of the symbols to be displayed are symmetrical or substantially symmetrical about a vertical axis the rows of light guide ends corresponding with these symbols are preferably located close to the vertical centre line of the pile of laminae so that the light guides on opposite sides of the axis of symmetry of the symbol will have approximately the same length and the points delineating the symbol have approximately the same brightness.

In a device arranged to display optionally one of a number of available symbols it may be necessary for light guides in grooves formed in the same face of the same lamina to cross one another. In this situation as one groove approaches the crossing point with another groove it is made gradually deeper from both sides towards the crossing point and at the crossing point is at least twice its normal depth and the adjacent lamina is formed with ramps of gradually increasing height disposed to fit into the gradually deepening groove in the first mentioned lamina so that the height of the passage formed between the bottom of the groove and the adjacent lamina remains constant throughout its length except at the crossing point where the ramp is interrupted to allow the passage formed by the other groove and the said adjacent lamina to cross over the lower passage.

A practical embodiment of the invention is illustrated in the accompanying drawings in which FIG. 1 is a view looking on the front (display) face of a device arranged to display any one of the numerals 0-9, FIG. 2 is a view looking on the top of the lamina third from the top in FIG. 1, (at the position 2-2 in FIG. 1), showing clearly the light guides which must cross one another and FIG. 3 is a view looking on the underside of the second lamina from the top, (at the position 3-3 in FIG. 1), showing the ramps which fit into the appropriate grooves in the lamina of FIG. 2 to form the crossing points. As the views of FIGS. 2 and 3 are looking in opposite directions one is a mirror image of the other. FIG. 4 shows

two portions 2A and 3A of typical laminae 2 and 3 at the places where two grooves cross one another, the lamina portion 2A being shown raised and swung back from the portion 3A to show the ramps 19 more clearly and FIG. 5 is a sectional elevation through the one groove which passes below the other groove showing how the ramps fit into the lowermost groove to provide a roof which can guide an optical fibre bundle to pass below the uppermost groove.

In the drawings, 1 to 12 denote the laminae which form the pile 13 constituting the display device. 14 denotes grooves formed in the laminae to hold light guides 15. The numerals marked in the grooves shown in FIG. 1 denote the particular numeral formed by illumination of all the light guides in the grooves bearing the same numeral. To show what is meant the grooves forming the numeral 2 have been blacked in. 16 denotes a lamp block supporting festoon lamps 17. These lamps are shown in end view and the numeral marked on each lamp indicates the numeral displayed on the front face of the device when that lamp is illuminated. The portions 18 of certain grooves 14 as shown in FIGS. 2, 4 and 5 (shaded in FIG. 2) denote the sections where these particular grooves become deeper as they approach the crossing point with other grooves. 19 (FIGS. 3, 4 and 5) denotes ramps located to coincide with the portions 18 when the lamina 2 is applied to the lamina 3. The ramps 19 are interrupted at 20 to provide gaps which coincide with the crossing points to allow the light guides in the other grooves to cross over the light guides in the deeper grooves.

In practice, when a particular one of the lamps 17 is illuminated light from the lamp passes into the rear ends of all the light guides terminating at that lamp and passes along these light guides to the front ends at the front face of the pile of laminae. As the front ends of the light guides at the front face of the pile define points on a particular symbol, the particular symbol is shown on the device. In the embodiment illustrated which indicates in FIG. 1 the numeral 2 as being displayed this would come about by illuminating the lamp numbered 2 in FIG. 2.

The device according to the invention is compact, particularly as a result of using tubular lamps, it is easily constructed in large quantities because the laminae can be easily moulded and also easily assembled and a light guide inserted into one end of the passage formed by the groove in one lamina and the face of the adjacent lamina is automatically guided to the other end of the passage even where it has to cross over or under another light guide. Alternatively, the method of forming light guides which is the subject of my co-pending patent application Ser. No. 141,116, filed May 7, 1971, may be used. This method is particularly applicable to the display device of the present invention. Another advantage of the present invention is that the symbols to be displayed can be of pleasing shape because the points used to define each symbol can be exclusive to that symbol so that the symbol need not be stylized in any way. Still another advantage of the display device

of the invention is that a simple switching operation individual to the symbol to be displayed and operating a single lamp is effective to display the symbol.

What is claimed is:

1. A symbol display device comprising a pile of laminae in which each of a plurality of selected laminae is formed on at least one face with a groove which has a front end terminating at one edge of said selected lamina and a rear end terminating at another edge of said selected lamina, the laminae being so orientated that the front ends of all the grooves are at one face of the pile of laminae constituting the display face of the display device, and are so disposed relative to each other that they define discrete points on at least one symbol or portion of a symbol to be displayed, the lamina adjacent the face of each selected lamina having a groove therein cooperating with that groove to define a passage, a light guide being located in each passage, each light guide having a front end located at said front face of the pile of lamina and a rear end, all the rear ends of the light guides pertaining to the same symbol or portion of a symbol being grouped in proximity to one another so as to be capable of receiving light from a single common light source.

2. A display device as claimed in claim 1 in which the front ends of the grooves are arranged in groups defining discrete points on respective symbols or portions of symbols, all the rear ends of the light guides in the grooves pertaining to the respective symbols or portions of symbols being correspondingly grouped in proximity to one another so as to be capable of receiving light from single light sources, each individual to a respective group.

3. A device as claimed in claim 1 in which all the rear ends of the light guides of each group are disposed in a linear formation.

4. A device as claimed in claim 3 incorporating a light source for each group of light guide rear ends constituted by a tubular lamp.

5. A device as claimed in claim 4 incorporating a lamp block fitted with lamp holders for receiving tubular lamps, one for each group of light guide rear ends.

6. A device as claimed in claim 1 in which two light guides contained in individual grooves in the same face of the same lamina cross one another at a crossing point, the groove containing the light guide which is to pass under the other light guide being formed to become gradually deeper as it approaches said crossing point from both sides and at said crossing point is at least twice its normal depth and the contiguous lamina is formed with ramps of gradually increasing height disposed to fit into said gradually deepening groove in the first-mentioned lamina so that the height of the passage formed between the bottom of said gradually deepening groove and said contiguous lamina remains constant throughout its length except at said crossing point where the ramp is interrupted to provide a continuity of the groove containing the light guide which is uppermost at said crossing point.

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