

The invention relates to a display means for alpha-numerical displays, having a display panel, wherein an actuated light source illuminates a bundle of optical fibres, wherein a switching element, which is actuatable via a control line, is inserted into each optical path leading to a display element of a co-ordinate point via an optical fibre, the associated optical path being selectively releasable or blockable by means of said switching element, wherein each co-ordinate point of the display panel includes n optical paths, wherein the optical fibres are each combined to form bundles and are illuminated by separate light sources, and wherein the control lines of the switching elements are actuatable by means of a control unit in order to represent an n-coloured alpha-numerical display, filters being disposed after the light sources or the optical fibres in the latter case.

A display means of this type is proven to be known by EP 0 109 328 A1. In this known display means, an optical fibre or a small group of, for example, three or four optical fibres, which are combined to form a light emergence point and may be illuminated at the input end by a plurality of light sources, extends to each co-ordinate point of the display. Only one display element is obtained in this manner at each co-ordinate point. A disc, which has at least one hole and is rotatable in order to release or shield the single light emergence point, is provided per co-ordinate point. The holes in the disc may be provided with various colour filters. Since the co-ordinate point for generating the light, which point is possibly formed from a plurality of optical fibres and only has one display element, can thus only be released or shielded as a whole, the possible variations of the display are limited.

DE-OS 28 31 174 presents an alternative display means, wherein all of the display elements are combined to form a permanently illuminated bundle of optical fibres. The switching elements, which are actuated in each optical path, are individually actuatable, so that any desired alpha-numerical display may be released by the actuation thereof, only the resolution of the display panel into the display elements defining the possible representations. However, one display in one colour is only ever possible, though the display may include a plurality of partial images. This depends merely on the actuated switching elements and the display elements released thereby.

It is an object of the invention to improve a display means of the initially mentioned type, so that an increase in the possible variations is possible, since such variations are required, for example, for traffic signals on road networks.

This object is achieved, according to the invention, in that each co-ordinate point has n display elements, in that the display elements are disposed in n matrices which are inserted inside one another, in that the bundles of optical fibres are each associated with a respective matrix, and in that the control lines are actuated according to individual matrices so that n alpha-numerical displays are also simultaneously representable.

In such case, the number of the matrices determines the number of the colours in a display. Furthermore, n displays may be represented on the display panel independently of one another when only specific partial areas of the display panel are associated therefor via the actuation of the switching elements.

For such purpose, one embodiment is advantageous and characterised in that a partial control circuit is associated with each matrix of the switching elements, via which circuit each switching element of the matrix is individually actuatable, and in that the partial control circuits are actuatable by the control unit according to the desired displays or partial displays.

If, according to an alternative embodiment, the control commands for the control unit are contained in a programmable memory, the most varied displays may be predetermined and recalled as required and displayed.

For many cases of application, one embodiment is advantageous and characterised in that the memory is actuatable via long-distance lines, and in that control commands for new and/or additional displays are transmittable into the memory. It is only then necessary to proceed in such a manner that the displays are releasable via display-individual display commands which are suppliable to the control unit.

According to one embodiment, the selective release or blocking of an optical path may be effected in that the switching elements are disposed in the optical fibres or on at least one end thereof and vary the wave-length of the waves radiated into the optical fibres.

The structural design of the display panel is so configured, according to one embodiment, that the display panel has a display panel provided with a number of light emergence cones, which number corresponds to the number of the matrices and to the number of the display elements, a carrier plate provided with a corresponding number of bores to accommodate the ends of the optical

fibres, and one respective control tube provided with a switching element which connects a bore in the carrier plate to the associated light emergence cone of the display panel.

The switching elements may also be rotatably mounted valves, which are electrically actuatable by means of a coil. The configuration as a filter for the light-waves is also possible. For such purpose, the transmission characteristics of the filters may be varied magnetically, electrically or thermally. Switching elements, which are configured as liquid crystal, are especially suitable therefor.

The invention is explained more fully with reference to embodiments illustrated in the drawings. In the drawings:

Fig. 1 illustrates a display panel having optical fibres and light sources for representing alpha-numerical displays;

Fig. 2 illustrates the end of an optical fibre;

Fig. 3 is a partial cross-sectional view through an optical path taken along the line III-III of Fig. 1;

Fig. 4 is a partial cross-sectional view through an optical path taken along the line III-III of Fig. 1, showing a differently configured switching element; and

Fig. 5 is a circuit diagram for actuating a display panel having four matrices which are inserted inside one another.

Fig. 1 illustrates a portion of a display means

10 for alpha-numerical displays. The display may be represented on the display panel 12 by the selection or combinations of individual display elements. The display panel 12 has two matrices of display elements 23, which matrices are inserted inside one another. The display elements 23, associated with the first matrix, are illuminated by a first optical fibre bundle 25, namely via the filter 24 of the light source 20, which is a halogen lamp. The optical fibres of this optical fibre bundle 25 extend, for example, to all of the display elements 23 of the odd-numbered lines of the display panel 12. The optical fibres 14, 16 and 18 of the optical fibre bundle 26 then extend to all of the display elements 23 of the even-numbered lines of the display panel 12. The light source 22 is responsible for illuminating the second optical fibre bundle 26. The control unit 27 is responsible for controlling the switching elements accommodated in the display panel 12 via lines 28, which extend to the switching elements, as is also shown.

In this embodiment, the display panel 12 may represent two-colour displays. However, it is within the scope of the invention to divide the display elements 23 of the display panel 12 also into more than two matrices and to provide a corresponding number of optical fibre bundles and light sources. Since each co-ordinate point of the display panel then contains one display element per matrix, all of the optical fibre bundles are identical. Different filters may be associated with the light sources.

The end of the optical fibre bundle 25, illustrated in Fig. 2, is received by the socket 30 and may be covered by means of a filter clamping bush 33. This filter clamping bush 33 accommodates a colour filter

31 and a heat protection filter 32. The colour filter 31 is hereby retained directly in front of the light admitting area of the optical fibre bundle 25.

In conjunction with Figs. 3 and 4, moreover, Fig. 1 shows that the display panel 12 has a front display panel 41 and a rear carrier plate 40, the ends of the optical fibres 14 in the bores 52 and 54 respectively being connectable to a respective control tube 42, which is disposed between the display panel 41 and the carrier plate 40. The control tube 42 accommodates the switching element 43 or 43' respectively.

In Fig. 3, the element 43 is a filter for electromagnetic waves, the transmission characteristics of which are thermally, magnetically or electrically variable. In such case, it is particularly advantageous for the switching element 43 to be liquid crystal. The electromagnetic wave, which passes the optical fibre 14, has the wave-length λ_1 , while the wave emitted from the emergence cone 44 has a wave-length λ_2 . By applying a specific voltage to the switching element 43, its filtering properties may be appropriately affected, so that the switching element is only penetrable for the specific wave-length which is generated by the associated light source.

In Fig. 4, the switching element 43' comprises a valve 60, which is pivotable about a rotary axis 61. The switching element 43' is controllable by a magnetic field produced by the coil 50, which is actuatable by the control unit 27.

Fig. 5 is a circuit diagram for a display panel 12 having four matrices M1 to M4, which are inserted inside one another. Each co-ordinate point 21 of the

display panel 12 has four display elements and, in consequence, four switching elements 43.1 to 43.4 also. The display panel 12 should have $x=1$ to $x=k$ lines and $y=1$ to $y=l$ columns, so that $k.l$ co-ordinate points, each having four switching elements 43.1 to 43.4, are required.

The $k.l$ switching elements of the matrices M1 to M4 are individually actuatable via partial control circuits 27.1 to 27.4, so that each partial control circuit must have $k.l$ control lines extending to the associated switching elements. Each matrix M1 to M4 may be individually actuated in this manner. A co-ordinate actuation of the switching elements is not possible, since a plurality of switching elements of various lines and columns also have to be actuated, depending on the display. The control unit 27 may recall various control commands from the programmable memory 29, when it is actuated for a specific display, and transfers this display via the partial control circuits 27.1 to 27.4 to the switching elements of the matrices M1 to M4. It is easily possible, via long-distance lines for example, to input new and/or additional control commands for additional or other displays into the programmable memory 29 and to display such by appropriate display commands via the control unit 27. Since each co-ordinate point 21 of the display panel 12 is actuatable via each matrix M1 to M4, a display means is provided which permits displays of up to four colours to be represented. In such case, of course, it is also possible to use fewer colours for the display. This depends solely on the control commands, stored in the memory 29, for a specific display. Any desired matrices may of course be used for a display. The control unit 27 provides the greatest possible variations in conjunction with the programmable memory 29. The display is only defined by the

resolution which is provided by the display elements 23, accommodated in a co-ordinate point 21, and the number of the co-ordinate points k.1 on the display panel 12.



CLAIMS

1. Display means for alpha-numerical displays, having a display panel (12), wherein an actuated light source illuminates a bundle (25, 26) of optical fibres (14, 16, 18), wherein a switching element (43, 43'; 43.1 to 43.4), which is actuatable via a control line (1 to k.1), is inserted into each optical path leading to a display element (23) of a co-ordinate point (21) via an optical fibre, the associated optical path being selectively releasable or blockable by means of said switching element, wherein each co-ordinate point (21) of the display panel (12) includes n optical paths, wherein the optical fibres (14, 16, 18) are each combined to form bundles (25, 26) and are illuminated by separate light sources (20, 22), and wherein the control lines (1 to k.1) of the switching elements (43, 43'; 43.1 to 43.4) are actuatable by means of a control unit (27) in order to represent an n-coloured alpha-numerical display, filters (24, 31) being disposed after the light sources (20, 22) or the optical fibres (14) in the latter case, characterised in that each co-ordinate point (21) has n display elements (23), in that the display elements (23) are disposed in n matrices (M1 to M4) which are inserted inside one another, in that the bundles (25, 26) of optical fibres (14, 16, 18) are each associated with a respective matrix (M1 to M4), and in that the control lines are actuated according to individual matrices so that n alpha-numerical displays are also simultaneously representable.

2. Display means according to claim 1, characterised in that a partial control circuit (27.1 to 27.4) is associated with each matrix (M1 to M4) of the switching elements (43, 43'; 43.1 to 43.4), via which circuit each switching element of the matrix (M1 to M4) is individually actuatable, and in that the partial



control circuits (27.1 to 27.4) are actuatable by the control unit (27) according to the desired displays or partial displays.

3. Display means according to claim 2, characterised in that the control commands for the control unit (27) are contained in a programmable memory (29).

4. Display means according to claim 3, characterised in that the memory (29) is actuatable via long-distance lines, and in that control commands for new and/or additional displays are transmittable into the memory (29).

5. Display means according to one of claims 1 to 4, characterised in that the displays are releasable via display-individual display commands which are suppliable to the control unit (27).

6. Display means according to one of claims 1 to 5, characterised in that the switching elements (43, 43'; 43.1 to 43.4) are disposed in the optical fibres (14, 16, 18) or on at least one end (52, 54) thereof and vary the wave-length (λ) of the waves radiated into the optical fibres (14, 16, 18).

7. Display means according to one of claims 1 to 6, characterised in that the display panel (12) has a display panel (41) provided with a number of light emergence cones (44), which number corresponds to the number (n) of the matrices (M1 to M4) and to the number (k.1) of the display elements (23), a carrier plate (40) provided with a corresponding number of bores (52, 54)



to accommodate the ends of the optical fibres (14, 16, 18), and one respective control tube (42) provided with a switching element (43, 43') which connects a bore in the carrier plate (40) to the associated light emergence cone (44) of the display panel (41).

8. Display means according to one of claims 1 to 7, characterised in that the switching elements (43') are rotatably mounted valves (60), which are electrically actuatable by means of a coil (50).

9. Display means according to one of claims 1 to 7, characterised in that the switching elements (43) are filters for the light-waves, the transmission characteristics of which are magnetically, electrically or thermally variable.

10. Display means according to claim 9, characterised in that the switching elements (43) are liquid crystal.