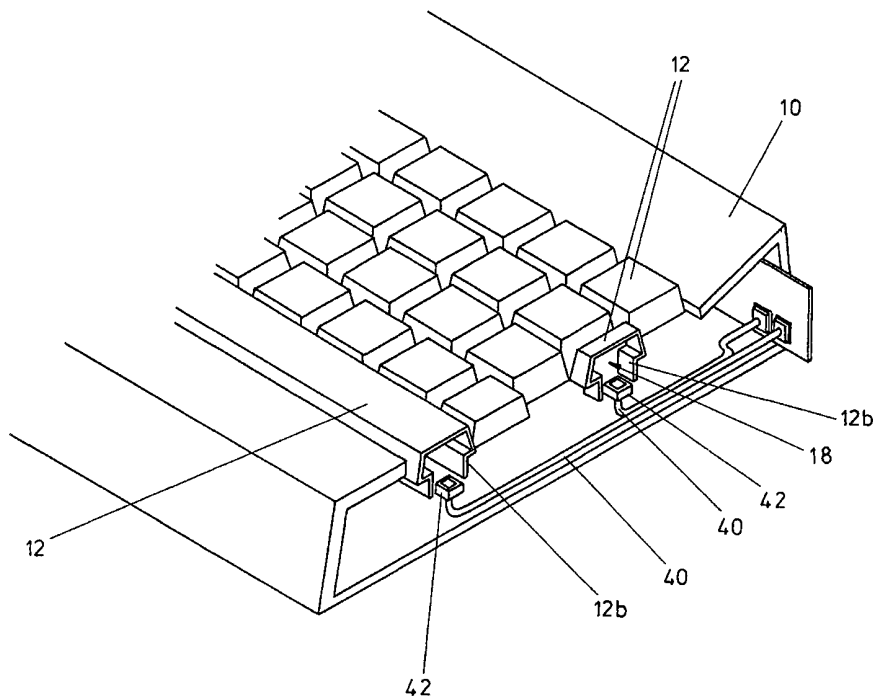




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<p>(21) International Application Number: PCT/GB99/00323 (22) International Filing Date: 1 February 1999 (01.02.99) (30) Priority Data: 9801912.8 30 January 1998 (30.01.98) GB (71)(72) Applicant and Inventor: GRANT, Paul [GB/GB]; Berghaus, Turnberry Avenue, Gourock, Renfrewshire PA19 1JA (GB). (74) Agent: GIBSON, Stewart, Harry; Urquhart-Dykes &amp; Lord, Three Trinity Court, 21-27 Newport Road, Cardiff CF2 1AA (GB).</p>	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>	

(54) Title: RECONFIGURABLE KEYBOARD



(57) Abstract

A keyboard for connection to a host computer includes a plurality of keys (12), each of which is provided with a visual display means (18) arranged to display a plurality of different characters or other indicia in response to instructions provided by the host computer.

### Reconfigurable Keyboard

The present invention relates to a keyboard for use with a computer or other data processing system.

Conventional computer keyboards have a number of keys (typically 102 in a standard PC-compatible keyboard),  
5 corresponding to standard alphanumeric and other characters, special function keys, system control keys etc. The relevant characters and functions are represented by characters and other legends or indicia which are printed or engraved on the top surfaces of the keys. Pressing the keys sends signal to  
10 the computer system to which the keyboard is connected. The computer system interprets these signals and responds accordingly, e.g. by displaying the relevant character on the visual display unit of the system or by performing some other function. The manner in which the signals are interpreted is  
15 determined by software in the computer system, commonly known as the keyboard map.

It is common for a computer to have a number of different keyboard maps which can be selected by the user according to the task at hand. Different keyboard maps  
20 typically relate to different character sets, such as different alphabetic characters used in different languages. The characters on the keys of the keyboard will typically correspond directly to only one of the various keyboard maps available to the user. Accordingly, if a different keyboard  
25 map is selected, it becomes difficult for the user to identify the key corresponding to a particular character or function.

It is an object of the present invention to provide a keyboard in which the indicia displayed on the keys of the keyboard may be altered automatically to suit a variety of  
30 different keyboard maps which may be selected by the user.

In accordance with the invention there is provided a keyboard for connection to a data processing system, the keyboard including a plurality of keys, each of said keys including visual display means arranged to display a plurality  
35 of different characters or other indicia in response to instructions provided by said data processing system.

Preferably each said visual display means comprises a matrix of pixels.

Preferably each said matrix of pixels is formed by a matrix of fibre optic elements.

5 Preferably each said visual display means is formed by the ends of a group of optical fibres, arranged as a matrix and directed onto the underside of a respective key.

Preferably the fibre optic elements of each matrix are illuminated by a light source means via programmable light gate  
10 means comprising an array of optical switches.

Preferably the programmable light gate means is controlled by interface means arranged for connection to a host computer.

Preferably said fibre optic elements are optically  
15 coupled to said light source by means of a fibre optic highway having an input end adjacent said light gate means, said light source being located on the opposite side of said light gate means from said input end of said fibre optic highway.

Preferably said light gate means comprises a  
20 transmissive LCD panel.

Preferably said light source comprises at least one semiconductor laser device.

Alternatively, a light-emitting display (e.g. a flat panel display) is provided for illuminating the groups of  
25 optical fibres, the light-emitting display being controlled by interface means arranged for connection to the host data processing system.

It will be appreciated that the interface means may be intelligent such that, on power up, the keyboard functions in  
30 a standard mode, but then responds to instructions generated when specific application software is running, to change the display on the keys of the keyboard.

In an alternative embodiment, the keyboard may include a selecting means which is manually or otherwise operable to  
35 determine which of the available characters or other indicia are displayed by the visual display means of the keys of the keyboard.

An embodiment of the present invention will now be described by way of example only and with reference to the

accompanying drawings, in which:

FIGURE 1 is a schematic block diagram illustrating an embodiment of a keyboard in accordance with the invention;

FIGURE 2 is a view of the keyboard, broken away to  
5 illustrate details of construction;

FIGURE 3 is a section through one of the keys of the keyboard;

FIGURE 4 is a top plan view of the key shown in Figure  
3;

10 FIGURE 5 is a schematic plan view illustrating the configuration of a base portion of the keyboard of Figure 1;

FIGURE 6 is a schematic block diagram illustrating an illuminator unit forming part of the keyboard of Figure 1; and

15 FIGURES 7 and 8 are schematic diagrams illustrating the configuration and operation of a light gate forming part of the illuminator unit of Figure 6.

Referring now to the drawings, Figure 1 illustrates schematically the major parts of one embodiment of a keyboard in accordance with the invention. The keyboard comprises a  
20 housing 10 in which are mounted a plurality of keys 12. The keys 12 may correspond in number and general arrangement to those of conventional keyboards, although in Figure 1 only a single key is illustrated. The keyboard further includes an interface unit 14, by means of which the keyboard is connected  
25 to the host computer. Each key 12 has an electrical switch 16 associated therewith, such switches 16 being connected to the interface unit 14. Each key 12 acts as a switch which is closed when the key is depressed. The interface unit 14 detects the operation of the keys and sends appropriate signals  
30 to the host computer (not shown), in the same manner as in conventional keyboards.

In accordance with the invention, each of the keys 12 includes a visual display means 18 arranged for displaying a selected character or other indicia via the top surface of the  
35 key. In this embodiment of the invention, the visual display means 18 of each key comprises a matrix (suitably a 5x7 matrix) formed by the ends of a corresponding number of optical fibres and directed towards the underside of the key itself. The keyboard further includes an illuminator unit 20 including a

light source means 22 and a light gate means 24, which control the illumination of the fibre optic matrices of each key. The illuminator unit 20 is controlled by the host computer, via the interface unit 14. Light passing through the light gate 24 is  
5 guided to the respective pixels of the display means 18 of the various keys 12 by means of a fibre optic "highway" 26.

Referring to Figures 2 to 4, the ends of the optical fibres of each group e.g. 40 are secured within a rectangular, frame-shaped mount 42 positioned underneath the respective key  
10 12, with the ends of the optical fibres of the group arranged as a 5x7 matrix and directed upwardly. The key 12 comprises a case having a reduced-thickness, translucent top 12a and a depending skirt 12b: the key 12 is arranged for vertical displacement relative to fixed support structure 10a of the  
15 keyboard base, means (not shown) being provided for biasing the key upwards to the position shown in Figure 3. When the key is depressed against this bias, the skirt 12b of the key passes downwardly around the periphery of the mount 42: a proximity detector 44 is fixed to an outer edge of the mount  
20 42 to respond to depression of the key, the proximity detector 44 being connected to the interface unit 14 and the arrangement providing the above-mentioned switch 16. It will be appreciated that the light rays R emerging from the ends of the optical fibres pass upwardly to strike the underside of the top  
25 12a of the key, so providing an illuminated display on the top surface of the key.

Figure 5 is a schematic illustration of the base of the keyboard housing 10. The illuminator unit 20 is in optical communication with the fibre optic highway 26. The light gate  
30 24 suitably comprises an array of optical switches, the number of switches in the array corresponding in number to the total number of pixels in the display matrices 18 of all the keys 12 of the keyboard (3579 for a 102 key keyboard with 5x7 pixel display). The light gate 24 is interposed between the light  
35 source 22 and the fibre optic highway 26, as illustrated in Figure 6. The operation of the optical switches of the light gate 24 thus controls the illumination of the individual pixels of the keytop displays 18.

The light gate 24 may suitably comprise a small

transmissive type LCD (liquid crystal display) panel 30 (Figure 7). Each pixel of the LCD panel 30 acts as an optical switch as described above. The optical channels at the input end of the fibre optic highway 26 are aligned with the pixels of the LCD panel 30, on the opposite side of the panel 30 from the light source 22.

The light source 22 may be of any type capable of illuminating the LCD panel 30 so as to provide adequate brightness of the illuminated keytop pixels. The light source preferably comprises one or more low power semiconductor laser devices in view of light losses within the system, e.g. within the light gate 24. Figure 8 shows one channel 32 of the fibre optic highway 24 aligned with a light source 34 on the opposite side of the LCD panel 30.

The interface unit 14 serves two purposes. Firstly, it provides the conventional interface by which the keyboard is connected to the host computer. Secondly, it provides the interface between the keytop display means 18 and the host computer.

In use, then, when a particular keyboard map (or equivalent) is selected on the host computer, the computer communicates with the keyboard via the interface unit 14 so as to program the light gate 24. The optical switches of the light gate are switched on or off as appropriate, such that the display means 18 of the respective keys 12 are configured to display appropriate characters or other indicia. The indicia displayed by the keys 12 are thus reconfigured to correspond with the selected keyboard map.

The example described above provides a monochrome keyboard display. With modification of the illuminator unit 20 it would be possible for the keyboard display to include a plurality of different colours. In particular, a light-emitting display (e.g. a flat panel display) may be provided to pass light into the fibre optic highway, the light-emitting display being controlled by the interface unit 14.

The invention is applicable to general purpose QWERTY keyboards for general purpose computers. It is also applicable for more specialised application, including:

- (a) educational applications where keys could be

configured to suit particular software and to prompt students;

(b) in retail EPOS (electronic point of sale) units where keys could be configured to represent different products;

(c) in process control in manufacturing industries;

(d) in command and control systems;

(e) in the automotive and aerospace industries where control switches or the like may have multiple functions;

(f) in medical electronics.

Claims

- 1) A keyboard for connection to a data processing system, the keyboard including a plurality of keys, each of said keys including visual display means arranged to display a plurality  
5 of different characters or other indicia in response to instructions provided by said data processing system.
- 2) A keyboard as claimed in claim 1, in which each said visual display means comprises a matrix of pixels.
- 3) A keyboard as claimed in claim 2, in which each said  
10 matrix is formed by a matrix of fibre optic elements.
- 4) A keyboard as claimed in claim 3, in which each said visual display means is formed by the ends of a group of optical fibres, arranged as a matrix and directed onto the underside of a respective key.
- 15 5) A keyboard as claimed in claim 3 or 4, in which the fibre optic elements of each matrix are illuminated by a light source means via programmable light gate means comprising an array of optical switches.
- 6) A keyboard as claimed in claim 5, in which said  
20 programmable light gate means is controlled by interface means arranged for connection to said data processing system.
- 7) A keyboard as claimed in any one of claims 1 to 4, comprising a programmable light-emitting display for illuminating said groups of optical fibres.
- 25 8) A keyboard for connection to a data processing system, the keyboard including a plurality of keys, each of said keys including visual display means arranged to display a plurality of different characters or other indicia, and means for controlling said visual display means and being selectively  
30 operable to determine which of said characters or other indicia are displayed by said visual display means.



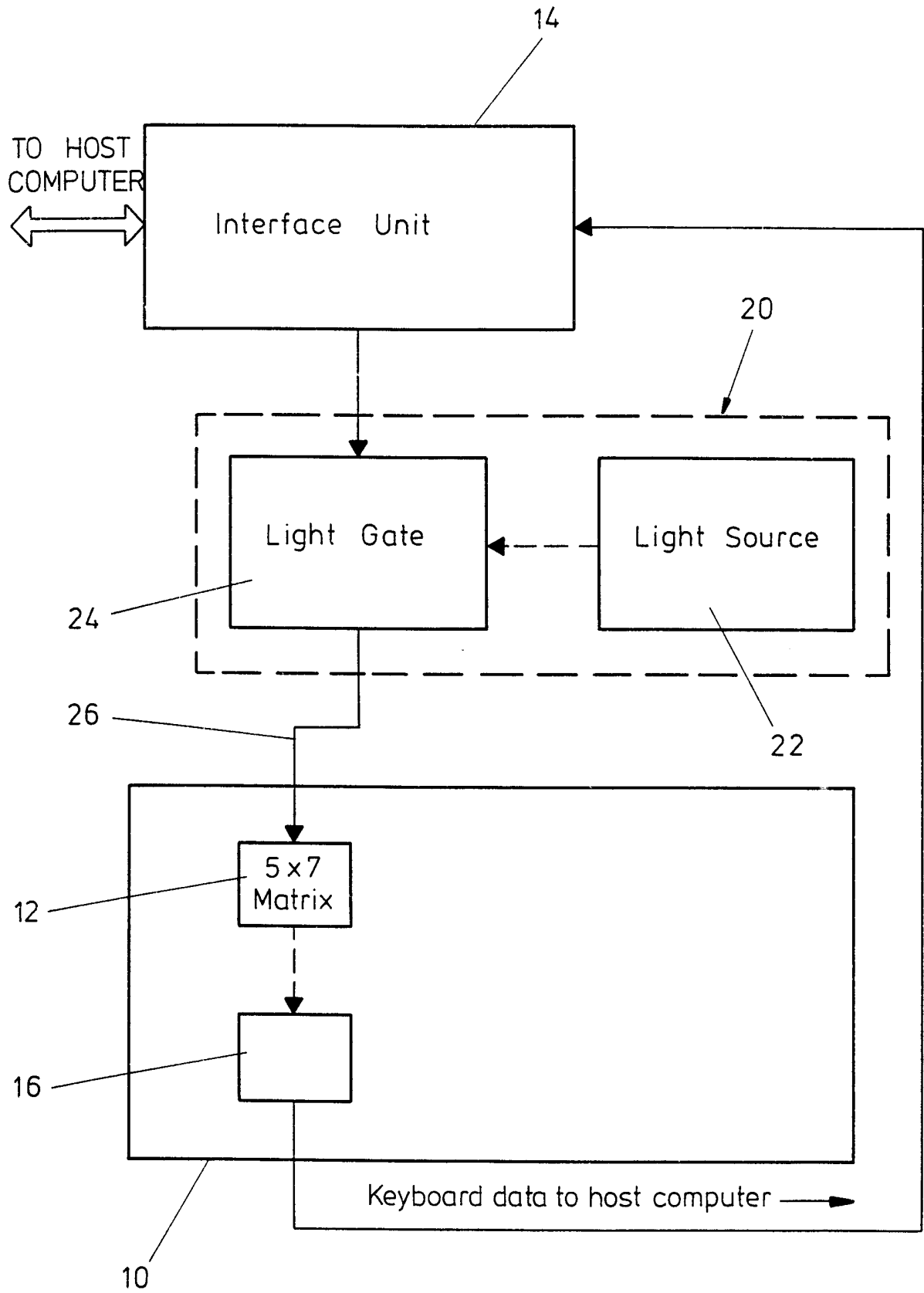


FIG. 1

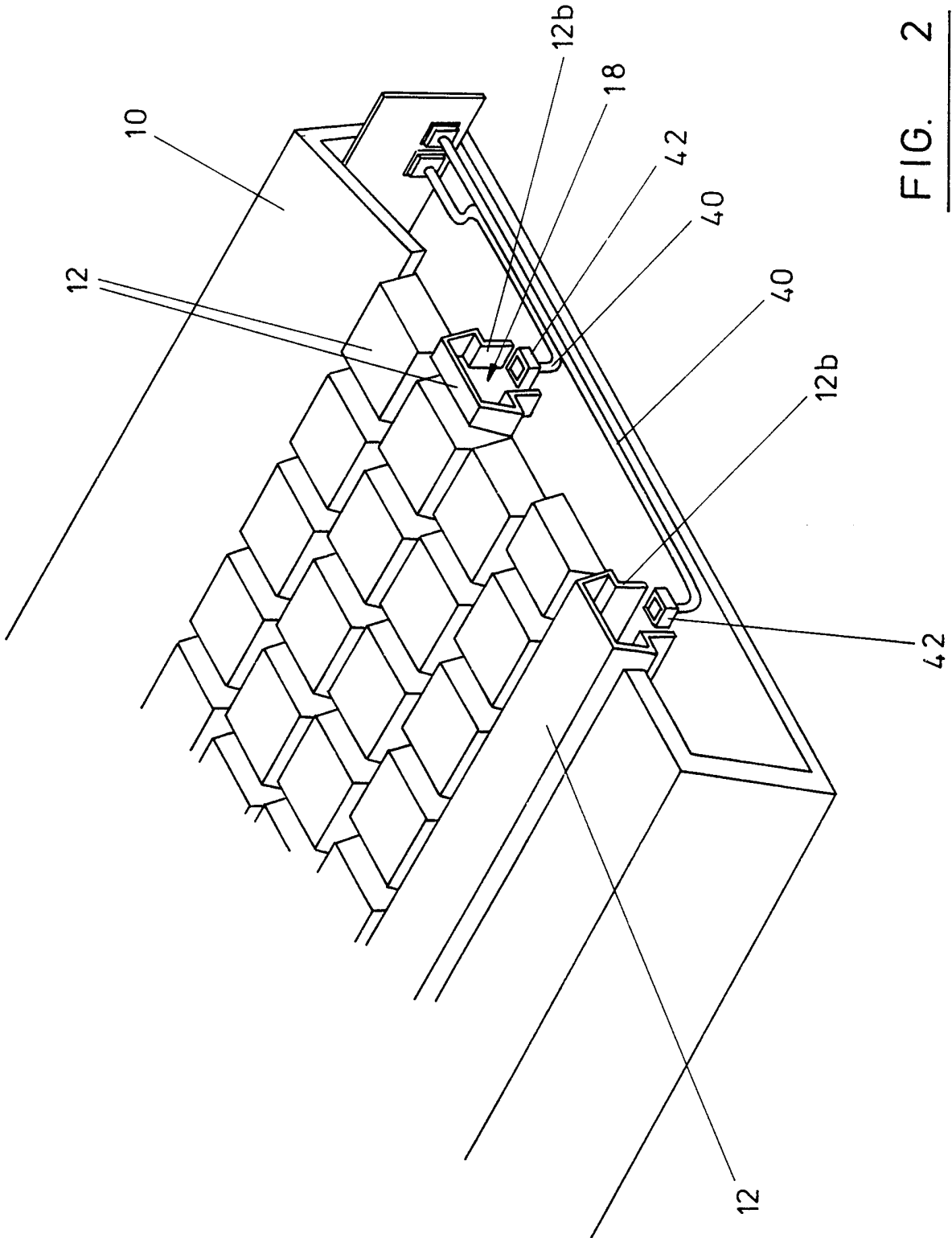


FIG. 2

-3/5-

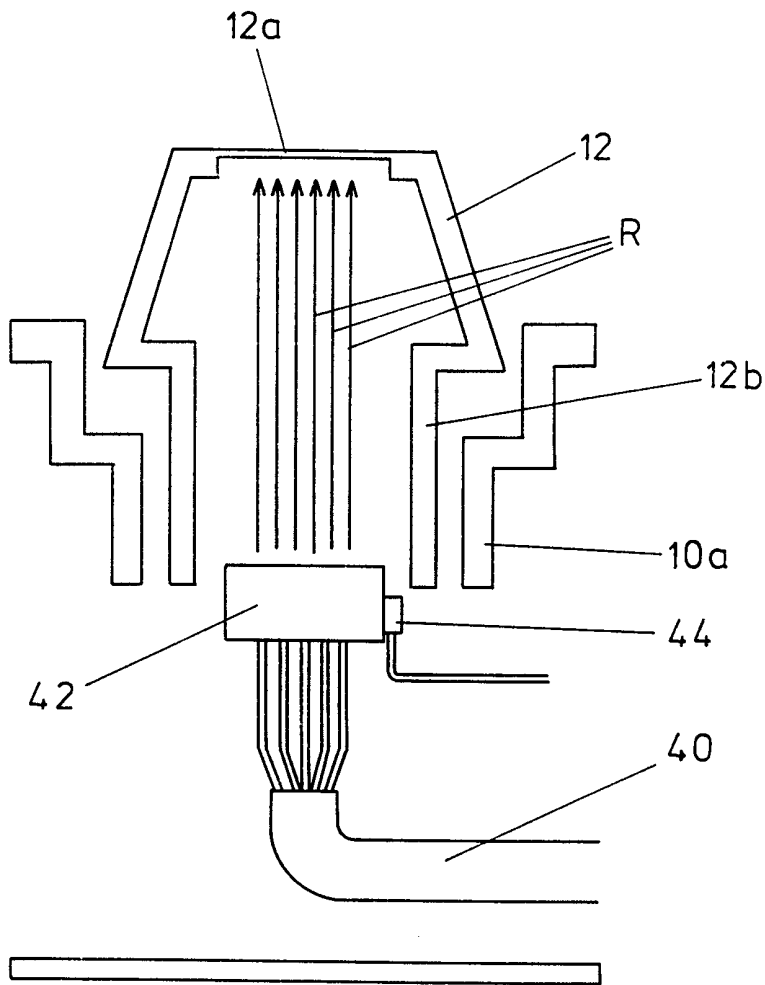


FIG. 3

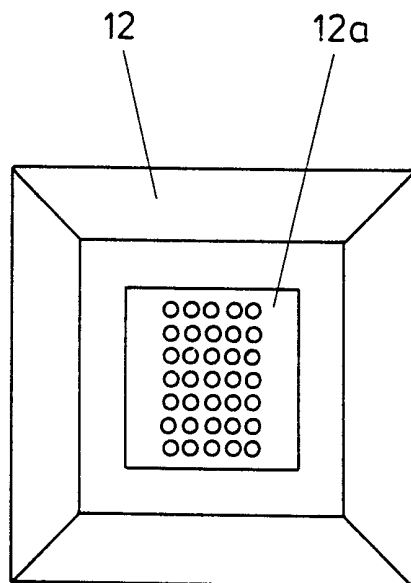


FIG. 4

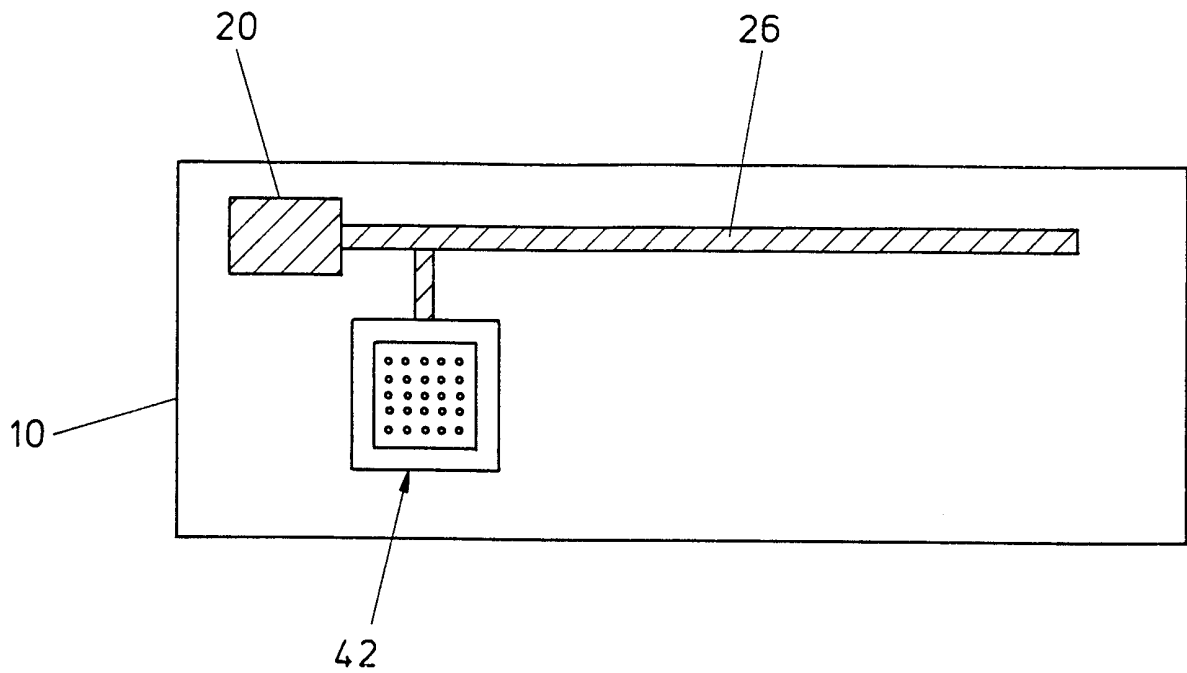


FIG. 5

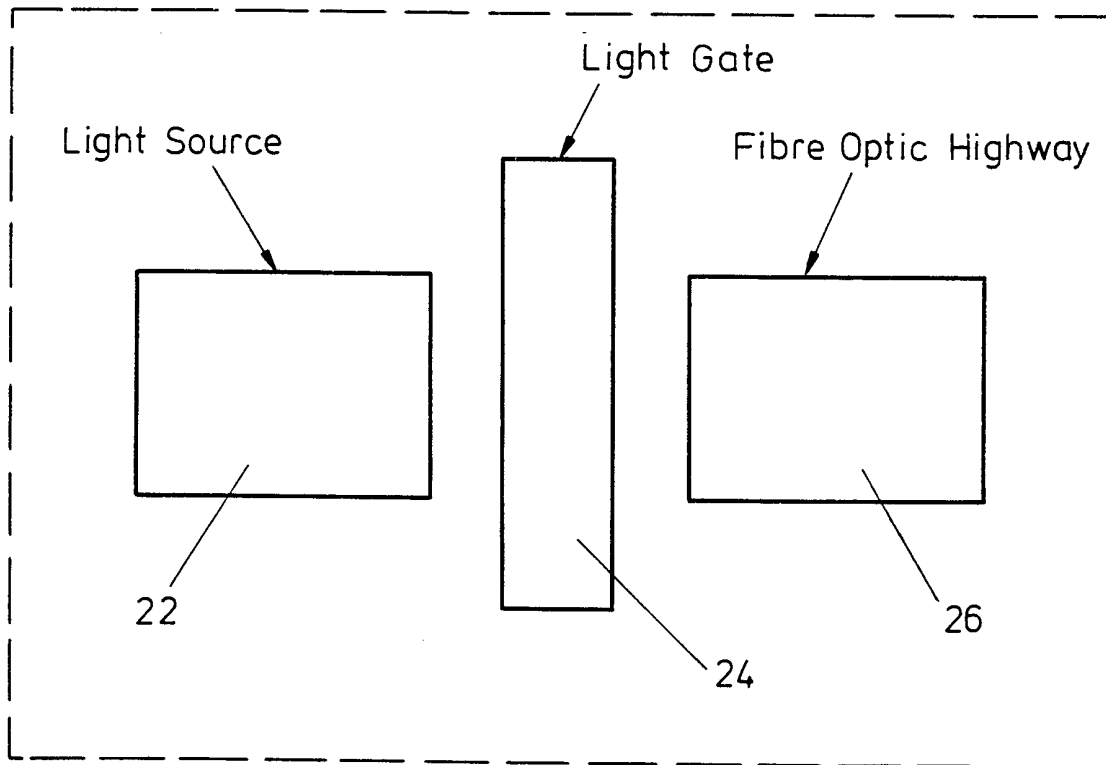


FIG. 6

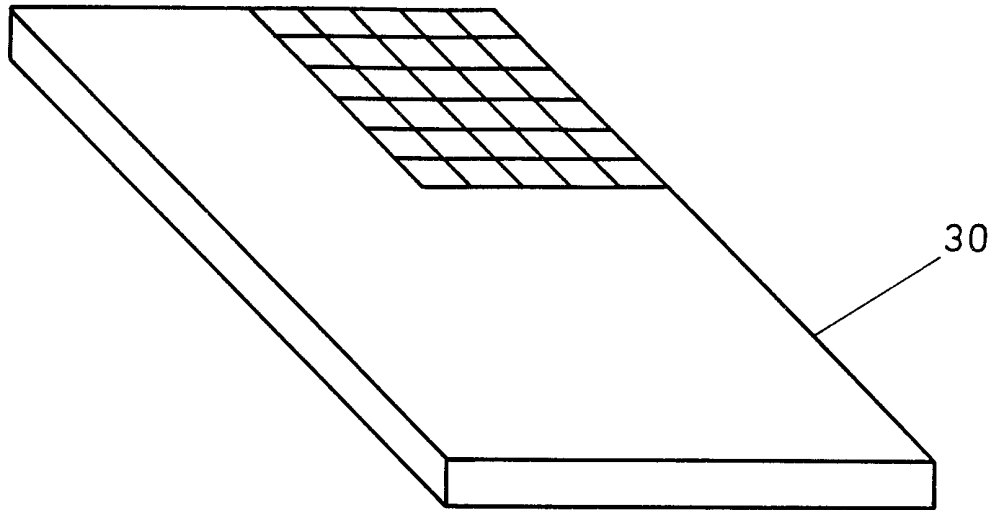


FIG. 7

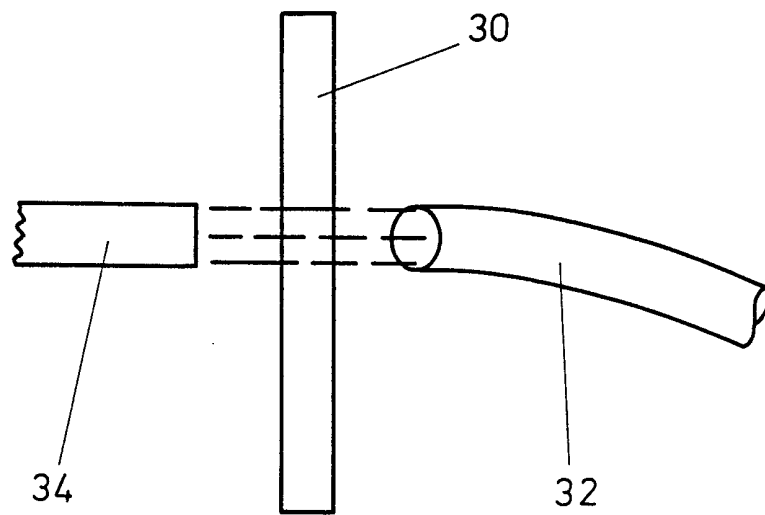


FIG. 8

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/00323

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 6 G06F3/023

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ANONYMOUS: "Keyboard With Optically Changeable Key Symbols" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 26, no. 9, February 1984, pages 4582-4583, XP002103170 New York, US see the whole document ---	1-8
X	ANONYMOUS: "Changeable Character Display Keyboard. September 1979." IBM TECHNICAL DISCLOSURE BULLETIN, vol. 22, no. 4, September 1979, pages 1368-1371, XP002103171 New York, US see the whole document ---	1-6,8
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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

° Special categories of cited documents :

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- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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- "&" document member of the same patent family

Date of the actual completion of the international search

20 May 1999

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# INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 99/00323
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 015, no. 462 (P-1279), 22 November 1991 & JP 03 196323 A (NEC SHIZUOKA LTD), 27 August 1991 see abstract -----	1,2,8
X	EP 0 221 698 A (OLIVETTI & CO SPA) 13 May 1987 see abstract; claims 1,3 -----	1,2,8

# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/GB 99/00323

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0221698 A	13-05-1987	DE 3688175 A	06-05-1993
		JP 62098420 A	07-05-1987
		US 4897651 A	30-01-1990

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