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(54) Lighting device with variable pitch

(57) A lighting device with a variable pitch, comprising: a raceway (1) having an elongated U-shaped cross section, internally provided with guides (4) adapted to retain boards (5), each of said boards carrying a plurality of LEDs (6) and to allow a longitudinal translation of said boards along the raceway, a pair of electrically conductive strips (3) being internally provided on the base of said raceway (1), said boards further providing for a pair of electrical contacts (10a) each corresponding to one of said conductive strips (3), whereby an electrical connection is established between each of said pair of strips and each of said pair of contacts at any locations of said boards (5) along said raceway.

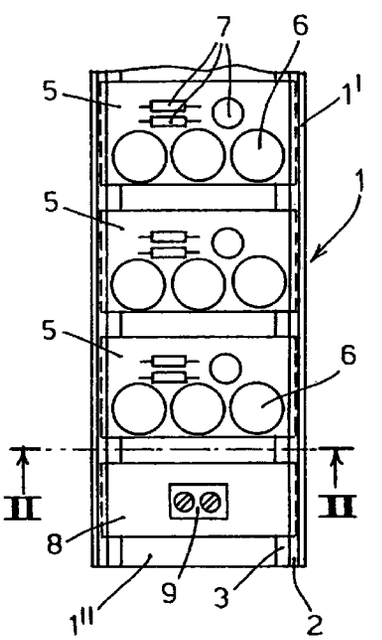

FIG. 1

EP 0 933 589 A2

Description

[0001] The present invention relates to a lighting device with a variable pitch.

[0002] More particularly, the present invention consists of a lighting device comprising a plurality of light sources spaced from each other by a distance that can be changed in a continuous manner.

[0003] Such a device can be advantageously used for backlighting (i.e. indirect lighting) a panel such as the semitransparent surface of pushbutton panels in doorbells, intercommunicating systems or intercoms, road guide posts and other similar devices.

[0004] Under poor lighting conditions, the surfaces carrying alphanumeric characters require an additional light source in order that an observer can read the indications or indicia written thereon.

[0005] The problem of properly backlighting surfaces on which characters and indicia are written has been traditionally solved by locating light sources behind the surfaces to be lightened, i.e. on the side opposite to that of the viewer.

[0006] In the past such light sources consisted of filament lamps but presently the light sources are usefully replaced by lighting devices comprising light emitting diodes or LEDs, both in view of their lower power consumption and their longer useful life when compared with the filament lamps.

[0007] An example of a lighting device realized with LEDs is disclosed in Italian patent Application No. TO97A000008 according to which the semitransparent surfaces are illuminated by a light source comprising a plurality of light emitting diodes or LED arranged in an array.

[0008] A drawback of the known devices resides in the difficulty of their assembling, particularly when they are to be precisely located to register with the semitransparent panels of the users (the residents) in an intercom (doorplate) push button panel.

[0009] Another drawback of the known devices is found in the electric connections for feeding the LEDs. In accordance with the teaching of the above mentioned application, the interconnections between the LEDs are carried out either by means of flexible leads/wires, the ends of which are soldered to a base member on which the LEDs are mounted, or by means of bipolar connectors of the male-female type provided on such mounting bases.

[0010] The drawback of a connection through flexible wires is that the whole device is rendered unserviceable when a section of the flexible connecting wire is detached or broken.

[0011] Furthermore this type of connection only allows a limited freedom to the mutual movements of the members carrying the LEDs.

[0012] On the other hand a connection by means of connectors or plugs has the drawback of preventing any adjustments of the relative distance between the LEDs' mountings.

[0013] It is therefore an object of the present invention to provide a low-cost lighting device with a variable pitch that is easy to be manufactured and is devoid of the prior art drawbacks discussed above.

[0014] According to the present invention such drawbacks are overcome by providing light emitting diodes that are secured on flat carrier elements or boards movable along guides provided in supporting raceways equipped with conductive strips, such strips accomplishing the electrical connection of such supporting boards with the feeding electric line.

[0015] Advantageously, according to the invention, the boards can be precisely positioned along the raceway in correspondence of the semitransparent surfaces to be lightened, for example when assembling the pushbutton panel.

[0016] The supporting raceway can further be provided with reference notches allowing a more precise positioning of the boards carrying the LEDs in correspondence of the characters to be lightened.

[0017] Moreover the supporting raceway can be provided with indentations to positively lock the boards at given locations along the raceway and prevent their sliding, particularly when the raceway is vertically mounted.

[0018] Additional characteristics and advantages of the invention will be better understood from the following description of an exemplary back-lighting device illustrated in the attached drawings in which:

Figure 1 is a scrap plan view of a device according to the invention;

Figure 2 is a cross section view along lines II-II of Figure 1;

Figure 3 is a perspective view of a supporting board equipped with connecting terminals;

Figure 4a is a bottom view of a LEDs carrying board;

Figure 4b is a bottom view of a board equipped with connecting terminals;

Figure 5 is a scrap plan view of a raceway provided with reference notches;

Figure 6a is a front view of a raceway provided with indentations;

Figure 6b is a perspective view of a raceway provided with indentations.

[0019] Referring to Figures 1 to 3, a backlighting device according to the present invention, comprises a U-shaped elongated housing or raceway 1 of an electrically insulating plastic material.

[0020] Said raceway 1 has two sides or side walls 1' and each side wall is internally provided with an elastic(ally deformable) rib 2 parallel to the longitudinal axis of the raceway, and with a base 1".

[0021] Under each elastic rib 2, an electrically conductive strip 3 is fastened to the base 1" and extends longitudinally along the whole length of the raceway 1.

[0022] Such conductive strips 3 are formed by an adhesive lower layer 3a (made up by a tape sticky on both faces, or by deposing a resin or other known resin system), by an intermediate support 3b of an electrically non conductive plastic material, and by an upper layer 3c of a conductive material that has been deposited over the support 3b, e.g. through known technique used in manufacturing printed circuit boards or by gluing.

[0023] This way, guides 4 allowing the shifting of the boards 5 and 8 along the raceway are defined between the ribs 2 and the conductive strips 3.

[0024] The boards 5 are flat elements of an electrically non conductive material carrying light emitting diodes or LEDs 6, as well as other circuit components 7, such as resistors, diodes and capacitors.

[0025] The boards 8 are of an electrically non conductive material and are equipped with terminals 9 for connecting the device to a feeding line, for example through a pair of electric leads.

[0026] Figures 4a and 4b show electrical connections realized by means of conductive paths 10 deposited over the lower surfaces of the boards 5 and conductive paths 11 deposited over the lower surfaces of the boards 8.

[0027] Both the conductive paths 10 and the conductive paths 11 comprise sections, 10a and 11a respectively, that are parallel to the shift or displacement directions along the raceway 1 of the boards 5 and the boards 8, respectively, and are positioned so as to ensure the electrical contact with the conductive layer 3c of the conductive strips 3.

[0028] Thanks to this type of contact an electric connection with each board 5 and 8 is achieved irrespective of the position of the boards 5 and 8 along the raceway.

[0029] According to the invention it is therefore possible to position a desired number of boards inside the raceway since no permanent electric connections are provided for them.

[0030] In other words, the boards can be easily shifted and/or replaced as desired inside the raceway, and the raceway can be transversally cut at the desired length.

[0031] Figure 5 shows a raceway 1 on the base 1" of which a strip 12 with millimeter marks is provided, e.g. by applying to the base an adhesive tape provided with marks, for improving the precise positioning of the single boards 5 near the correspondent characters to be backlit.

[0032] Figures 6a and 6b show a raceway 1 having a base 1" provided with indentations 13, for example either directly formed on the base 1" or applied by gluing, that are adapted to engage a projection 14 on the lower surface of the boards 5 and 8.

[0033] The engagement between the indentations 13 and the projections 14 forms a sort of ratchet-gear device that maintains the boards 5 or 8 in the desired position and prevents their accidental sliding when in a vertically disposed raceway 1, the pressure applied by the guides 4 onto the boards 5 and 8 is reduced due to thermal expansion, wear or other reasons.

[0034] According to the invention, additional strips of a conductive material can be provided on the base 1" of the raceway, for example when this is required to individually control the light sources provided on the boards.

[0035] Moreover said additional strips can be used to connect and control auxiliary boards carrying for example microphones, loudspeakers, etc., and provided on their lower surfaces with conductive circuits or paths to electrically connect the feeding line with the boards, such circuits being similar to those discussed with reference to Figures 4a and 4b.

Claims

1. A backlighting device comprising: a U-shaped elongated raceway (1) internally provided with guides (4) adapted to retain boards (5), each of said boards carrying a plurality of LEDs (6), and to allow a longitudinal translation of said boards along the raceway, a pair of electrically conductive strips (3) being internally provided on the base of said raceway (1), said boards further providing for a pair of electrical contacts (10a) each corresponding to one of said conductive strips (3), whereby an electrical connection is established between each of said pair of strips and each of said pair of contacts at any locations of said boards (5) along said raceway.

2. A device as claimed in claim 1, wherein said guides (4) are formed by elastic ribs (2) on the inner side walls (1') of the raceway (1), and are adapted to keep said boards (5) pressed against said conductive strips (3).

3. A device as claimed in claim 1, wherein said conductive strips (3) are internally fastened to the base of said raceway (1) by gluing.

4. A device as claimed in claim 1, further comprising a movable board (8) equipped with terminals (9) electrically connected to a pair of electric contacts (11a) each corresponding to one of said conductive strips (3), whereby an electrical connection is established between each of said pair of strips (3) and each of said pair of contacts (11a) at any locations of said boards (8) along said raceway.

5. A device as claimed in any of the preceding claims, wherein said raceways (1) comprises a strip with

millimeter marks (12) for a precise positioning of the boards (5,8) along the raceway at a prefixed distance.

6. A device as claimed in any of the preceding claims, wherein the base (1") of said raceway (1) is internally provided with indentations (13) adapted to engage a projection (14) on the lower surface of each board (5,8).

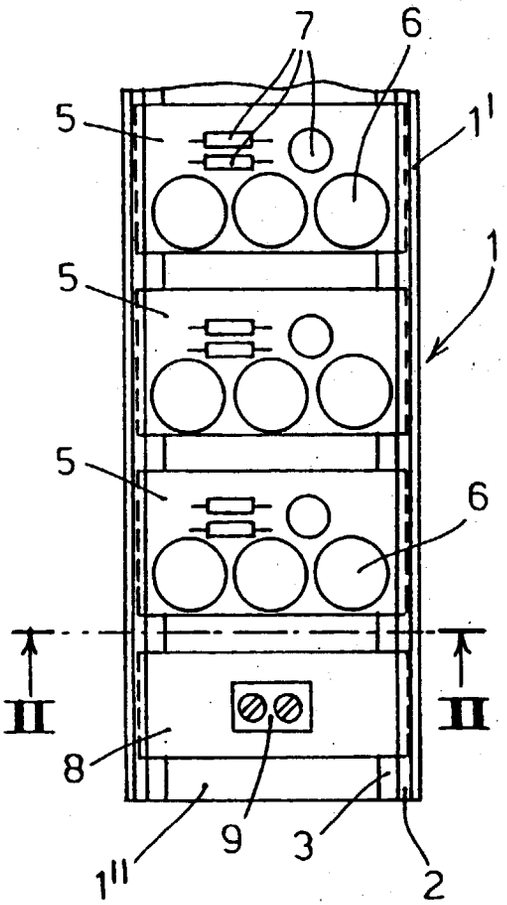

FIG. 1

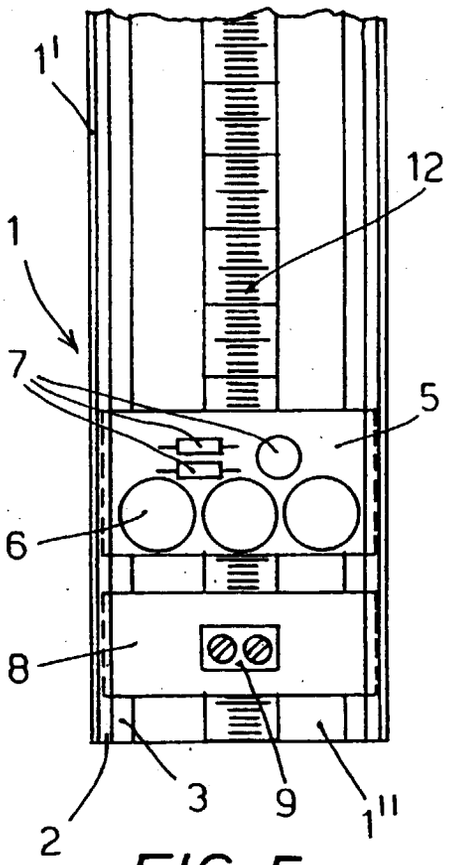

FIG. 5

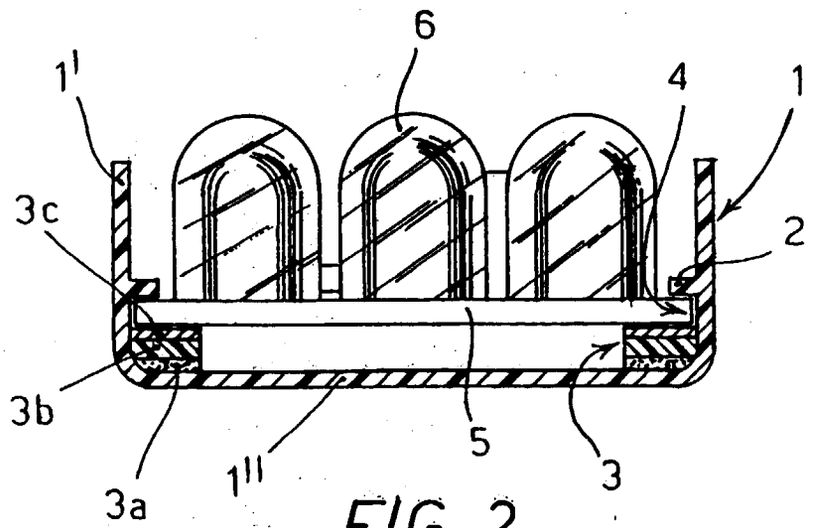

FIG. 2

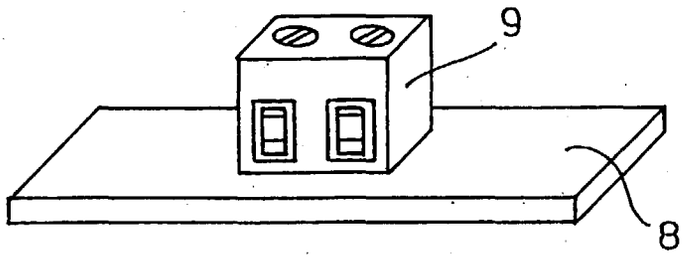

FIG. 3

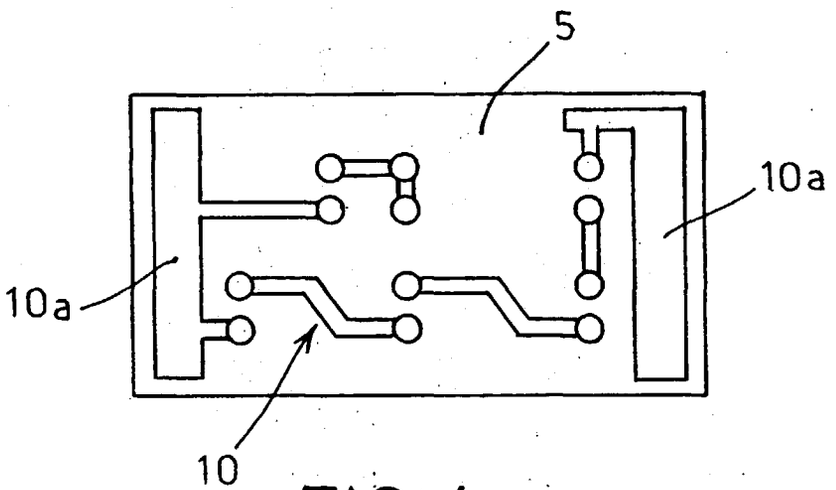

FIG. 4a

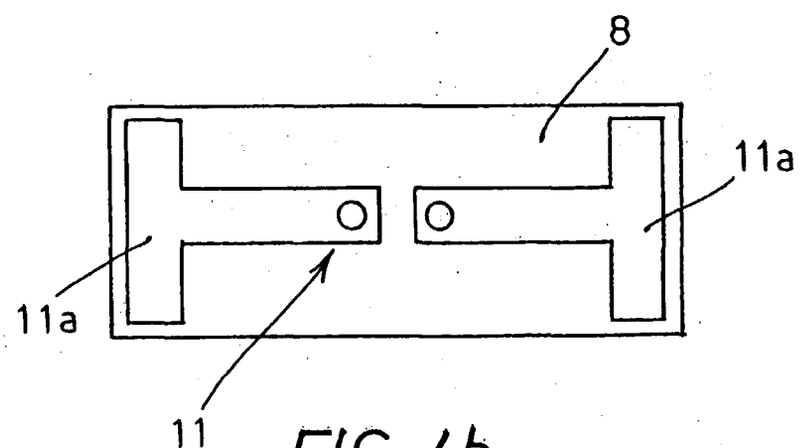

FIG. 4b

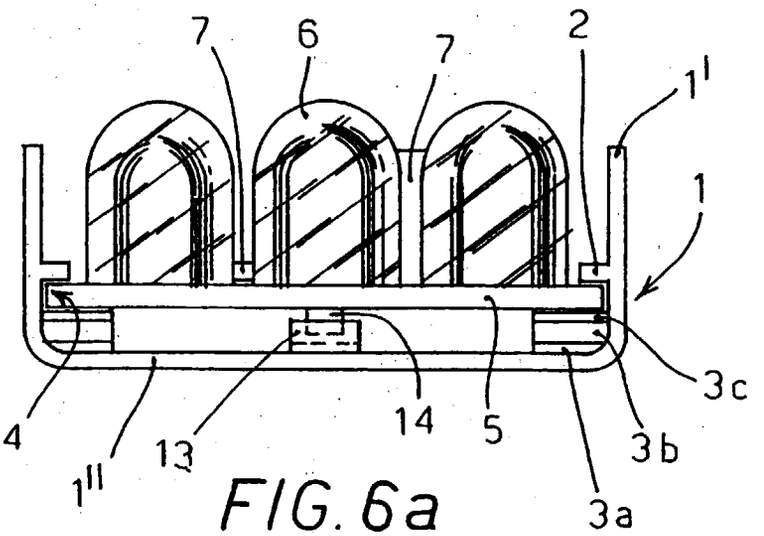

FIG. 6a

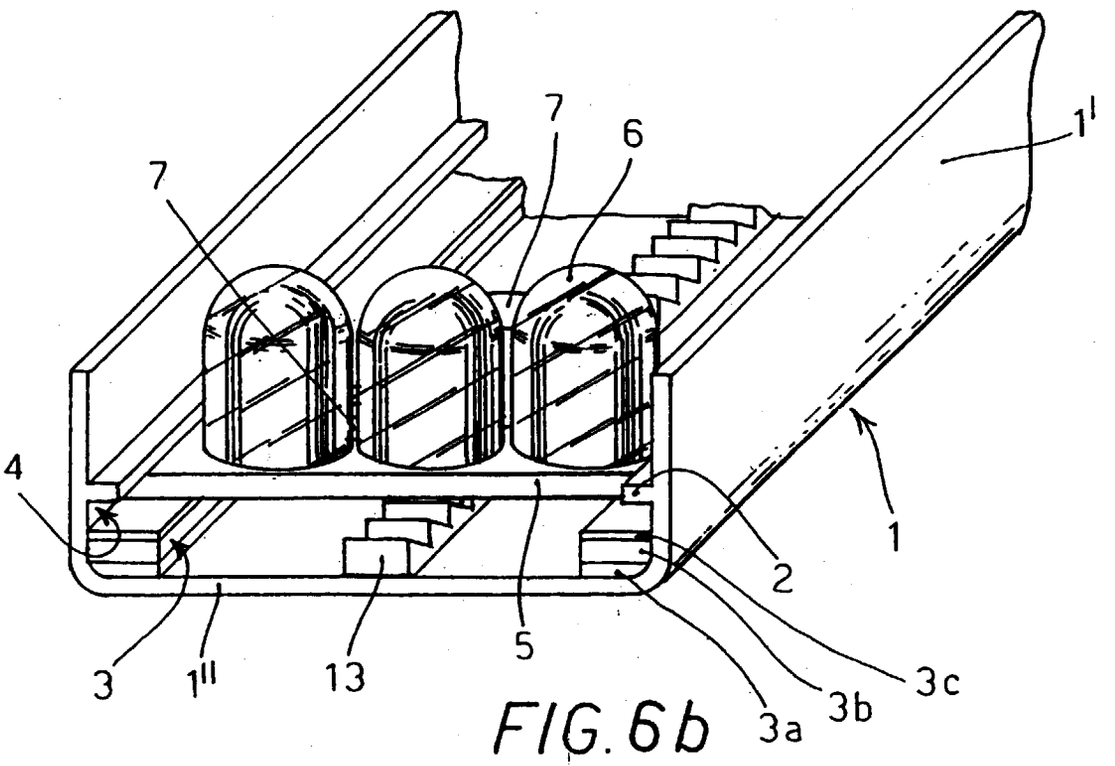

FIG. 6b