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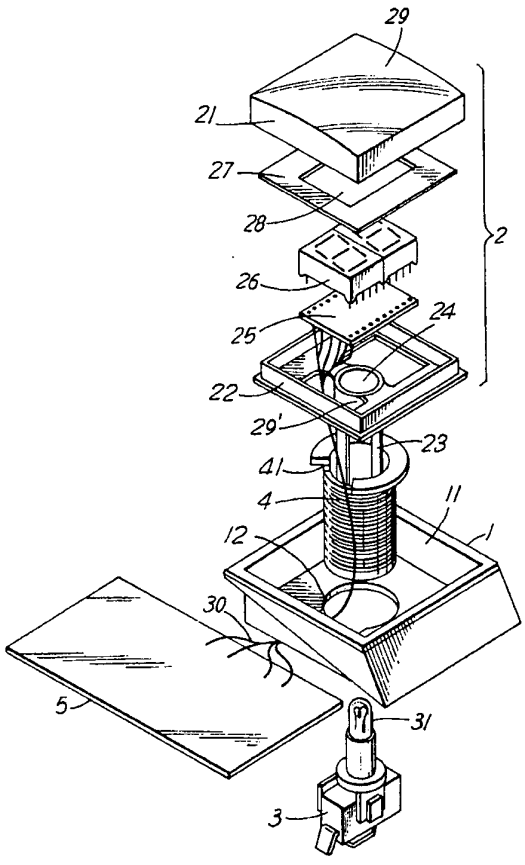
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(54) Title: PUSH-BUTTON SWITCHES

(57) Abstract

A push-button electric switch has a variable display element (26), e.g. a seven-segment LED, housed beneath a transparent front cover of the button member (21). The switch is particularly useful for electric game machines.



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PUSH-BUTTON SWITCHES

This specification relates to push-button switch devices, and to game machines having push-button switches.

It is known for a push-button switch device to incorporate a light on or near the push-button, to indicate (by being off or on) the condition of the switch (e.g. whether it is in the "off" or "on" position).

The present inventors have gone beyond this and perceived that a push-button switch device can be adapted in a new way to help monitor and/or control the electrical and/or electronic system associated with the switch device.

In one broad aspect, we propose a push-button switch device having a movable button member and a variable or programmable electronic display element, adapted to display visually at a display location any of a plurality of characters (e.g. numbers and/or letters), the display element being viewable through or on the button member of the device.

In a more specific aspect, we propose a push-button switch device comprising

a switch body or bezel for securing to a substrate;

a push-button member mounted recriprocably movably on or in the body or bezel;

an electric switch operable by the movement of the push-button member, and

an electronically-controllable variable display

element, adapted to display any of a plurality of characters, and viewable at or through an actuating portion of the push-button member.

The switch body is preferably a housing having a back wall facing a front opening which is occupied by the push-button member, the push-button member defining a front wall spaced from the back wall.

The electronic display element may be visible through a transparency or window of the front wall of the push-button member. It may move with the button or, more preferably, is fixed to the switch body e.g. to a back wall as mentioned above. The electric switch may also be advantageously fixed to or on the body e.g. to a back wall as mentioned above.

This simple and practical proposal enables qualitative advancements over previous button lights. Previous lights have indicated the mere condition of the switch e.g. "on" or "off". The electronic display element in the present proposal, being capable of displaying characters and in particular letters and/or numerals, gives a new order of flexibility and can therefore be connected so as to indicate not merely the condition of the switch, or the condition of the associated system arising from the condition of the switch, but rather a more generalised status of the associated system. The value of indicating such status at the push button resides in the capability of potential influence on that status by use of that push-button.

Thus, a further aspect herein is a machine having an electric/electronic system and at least one push-button device of the type described connected to influence operation of the system by its electrical switch. The electronic display element of the push-button device is connected to a status signal source of the system, to indicate at the push-button one or more characters indicative of and variable in dependence on a status of the system.

A particular embodiment of interest is a game or amusement machine. In these, push-button switches are widely used for player interaction. A "fruit machine" (a game machine having a display of relatively movable reels bearing respective series of symbols), for example, typically has any or all of

(a) a button for initiating play after inserting or winning a game credit;

(b) buttons for "temporarily holding" individual reels of the display, and

(c) buttons for "nudging" (i.e. incrementally advancing) the reels.

In a general aspect herein, a machine as referred to in the previous aspect is a game machine and the push-button switch is for use by a player operating the machine, e.g. for any or all of initiation of, control of, and interaction during, a game routine provided by the electric/electronic system of the machine. The status signal source of the machine indicates, either

continuously or from time to time, a status of the machine and/or game routine.

For example, if the switch is a game-initiator button for starting a play, the display element might display the number of game credits available. Other uses are e.g. as "hold" or "nudge" buttons for a reels game in which case the element may display whether or not a "hold" or some other feature is available at a given button, or a number of "nudges" available. An alternative use is as a stake-adjusting button for a gambling game, the current value of the stake being indicated at the display. Where a single button may have plural functions, e.g. hold and nudge, the display element may show a character denoting the function currently controlled by and provided at that push button.

The status signal source will comprise means for deriving from the system, and outputting to the display element, the necessary signal information indicative of the status. By appropriate logic connections, the same display element may receive at different times signals indicative of more than one type of status parameter.

The changeable element is preferably an LED or LCD display. The characters shown may be selected from numbers, letters, or other suitable meaningful symbols. Multi-segment displays or dot-matrix displays may be suitable, according to the information to be shown. A seven-segment alpha-numeric format, associated with binary-coded-decimal logic, is suitable.

The display element is preferably viewable through a

transparency of the push-button e.g. a transparent cover cap, to protect it.

In one preferred version, a printed circuit board is comprised in a back wall of the housing of the device. The display element can be mounted on and connected by this, as may be also the electric switch (typically a microswitch).

A light may be provided to illuminate the button member from behind. Such a feature is already known e.g. in game machines. The button member front may incorporate artwork and/or colouring, and this may be provided as a transparency which is thereby backlit.

It is particularly preferred to provide one or more partitions, e.g. by means of a button insert, by which a space illuminated by a backlight, e.g. a conventional light bulb, is separated from a space having the display element.

A backlight, or plural backlights which may be operable independently from one another e.g. to indicate system status, or to light captions adjacent the display element, may conveniently be mounted on a printed circuit board as mentioned above.

A printed circuit board as mentioned above, incorporated in the push-button switch device, may carry logic circuitry for converting a status signal from the system into a display signal adapted for the display element.

Embodiments of the invention are now described with

reference to the accompanying drawings, in which

Figure 1 shows a first embodiment of push-button switch assembly in exploded perspective;

Figure 2 shows a game machine;

Figure 3 is a plan view of a second embodiment of push-button switch assembly;

Figure 4 is an enlarged top perspective view of an interior cavity of the second embodiment, with the push-button member removed;

Figure 5 is a perspective view from beneath showing the switch body of the second embodiment;

Figure 6 is an exploded top perspective view showing parts of the push-button member of the second embodiment, and

Figure 7 is a bottom perspective view showing the assembled push-button member of the second embodiment.

With reference to Fig. 1, a push-button switch suitable for a game machine comprises essentially a fixed bezel 1 and a movable push-button 2 mountable therein for reciprocating movement. The button 2 is of a flat rectangular shape, and seats substantially within a rectangular cavity 11 of the bezel 1. It consists essentially of a capsule formed by a transparent or translucent top cap or lens cap 21 fitting onto a plunger base 22 which is fast with conventional microswitch components 23, and has a central circular hole 24 for admitting the electric bulb 31 of a conventional switchable backlight 3. Housed in the rectangular cavity

formed by the cap and base 21,22 are a printed wiring board 25, a double seven-segment numeric LED display 26 for connection to the terminals of the wiring board 25, and a flat plastics "legend plate" 27, of translucent plastics, having a central rectangular aperture 28.

In the assembled button 2, a plastics transparency having information and/or coloured designs printed thereon is trapped between the legend plate 27 and the flat top window of the cap 21, in a generally conventional way. The LED display 26, connected to the wiring board 25, projects through the central aperture 28 of the legend plate 27 to adjacent the cap 21. Wiring from the board 25 leaves the button 2 through a wiring hole 29' in the plunger base 22, and passes to below the substrate (not shown) through a cutaway portion 41 of a screw body 4 used to assemble the bezel 1 down onto the substrate, and a corresponding cutaway 12 of the bezel 1 itself. Fig. 1 shows the wiring leading to a PCB 5 having signal terminals 30 to control the LED display 26.

It will be appreciated that numeric/alpha numeric displays are not the only possibility; alternative display elements could provide a graphic effect.

Fig. 2 shows an amusement machine of the "fruit machine" type, with a cabinet 6 having a movable reels display 7, credit insertion means 8, actuating button 9 and hold/nudge buttons 10. The actuating button 9 is constructed in accordance with Fig. 1. The other mentioned components may be conventional, and their

construction need not be described here. The LEDs of the actuating button 9 are wired to a PCB of the main machine processor, which among other things stores the number of credits available to the player. This information is output and displayed numerically through the transparent top of the push-button, as seen in the Figure.

The processor of the machine has an error mode. Should the machine malfunction, the processor self-diagnoses, as far as possible, the nature of the problem and sends an appropriate error code e.g. "E5" or the like, to be displayed on the button 9. This is helpful to a person maintaining or repairing the machine. It will be understood that other information could be displayed (e.g. again through this single push-button) if the machine is switched, e.g. by service personnel, to other modes of non-play operation.

In other embodiments, push-buttons 10 for reel control could also have corresponding displays e.g. to indicate a number of "nudges" available, or the like.

Figs. 3 to 7 show a second embodiment. As before, a generally rectangular push-button member 102 is mounted in a corresponding rectangular front opening of a bezel 101. The bezel 101 is to rest against the front surface of a machine console (not shown), with a rectangular housing 105 attached to the bezel 101 being recessed down into the console.

The mounting of the button member 102 is by means of integral rear and front lugs 85,86 (see Figs. 6 and 7);

the rear lugs 85 engage in corresponding rear notches 109 in the rear wall 107 of the housing 105 while the front lugs 86 engage in vertically-extended front slots 110 in the front wall 108 of the housing. The narrow rear slots 109 hold the rear of the button member 102 to act as a pivot, while the front lugs 86 can ride up and down in the front slots 110 for the button to reciprocate.

The housing 105 forms a rectangular cavity of plastics material. Integrally formed with its underfloor 106 is a screw-threaded tube 113, conventional as such, for securing the device into a machine housing by conventional means (not shown), also a socket boss incorporating a multi-pin electrical connection socket 114 (see Fig. 5).

Within the cavity (Fig. 4) a printed circuit board (PCB) 104 is inserted, trapped under rear wall lugs 112 at its rear end and screwed down to the underfloor 106 at its front by screws 116.

An LED display chip 140 is connected to and fixed on the PCB 104. Here, the chip 140 is a standard seven-segment LED for showing alpha-numeric characters, and is positioned substantially centrally on the PCB. An electrical microswitch 142 is fixed on and wired to the PCB to one side of the LED chip 140. The movable armature 143 of the microswitch projects upwardly, and is urged upwardly by an internal spring (not shown) of the microswitch. Above and below the LED chip 140, standard illumination bulbs 131,132 are positioned. In this

embodiment they are stuck to the PCB by an adhesive pad and their terminals connect to the PCB electrically. Figs. 6 and 7 show the structure of the push-button member. A rectangular cover cap 121 of translucent plastics (which may be coloured) is sized to fit closely into the front opening of the bezel 101. Its front plate 129 is continuous. A flexible polymeric sheet ("legend plate") 127 fits into the cover cap behind its front surface. In this embodiment, the legend plate 127 is a sheet of coloured plastics, printed to define a central window 128 of unmodified translucency, flanking regions 125 which are opaque, and top and bottom regions 123 which are colour-modified and bear text captions (here "NUDGE" and "BANK").

A partition insert 122 snaps into the cover cap 121 to hold the legend plate 127 in position. The insert 122 has side members 122 which engage the cover cap side walls, and transverse partition walls 82 aligned with the boundaries between the colour-modified translucent areas 123,124 of the legend plate 122. A switch presser boss 83, with a rubber cushion disc 84 stuck to its underside (see Fig. 7) is formed integrally as an inward projection from one of the side members 81. The relationship of these parts in the assembled push-button 102 can be seen in Fig. 7.

With the button assembled onto the housing, the lugs 85,86 engage as described previously, the legend plate window 128 is positioned over the LED chip 140, the

colour-modified translucent regions 123,124 are superimposed over respective ones of the illumination bulbs 131,132, and the partition walls 82 of the button insert separate the internal housing space so that the illumination of the bulbs 131,132 does not interfere with the LED display. The presser boss 83 engages the armature 143 of the microswitch 142, so that pressing the button member 102 operates the microswitch; the microswitch's internal spring keeps the button member 102 up unless pressed, i.e. the lugs 86 at the top of the slots 110.

The rear surface of the PCB 104 carries logic circuitry, conventional as such, for providing a binary-coded decimal input into the display element 140. This is different from the first embodiment, where the logic circuitry was all provided away from the push-button device as part of the machine processor.

The multi-pin logic socket 114 co-operates with a corresponding multi-plug from the machine processor, to provide separate electric connections for the microswitch 142, the logic circuitry for the display element 140, and the respective bulbs 131,132.

CLAIMS:

1. A push-button switch assembly comprising

a switch body;

a push-button member mounted reciprocably movably on the switch body;

an electrical switch operable by the movement of the push-button member relative to the switch body, and

an electronic display element programmable to display any of a plurality of different characters, and visible on or through the push-button member.

2. A push-button switch assembly according to claim 1 in which

the switch body comprises a housing having a back wall and a front opening;

the push-button member is mounted to occupy the front opening of the housing, and has a front wall spaced from the back wall of the housing, and

the electronic display element is visible through a transparency of the front wall of the push-button member.

3. A push-button switch assembly according to claim 1 or claim 2 in which the electronic display element is a multi-segment LED or LCD element.

4. A push-button switch assembly according to any one of the preceding claims, comprising a back light for

illuminating the push-button member from behind.

5. A push-button switch assembly according to claim 4 having an internal partition wall for separating the display element from the illumination of the back light.

6. A game machine comprising an electronic/electric game system and at least one push-button switch assembly according to any one of claims 1 to 5 for influencing the operation of the game system, the electric switch of the switch assembly being connected to influence the operation of the game system and the display element of the switch assembly being connected to a status signal source of the game system to indicate a status of the game system.

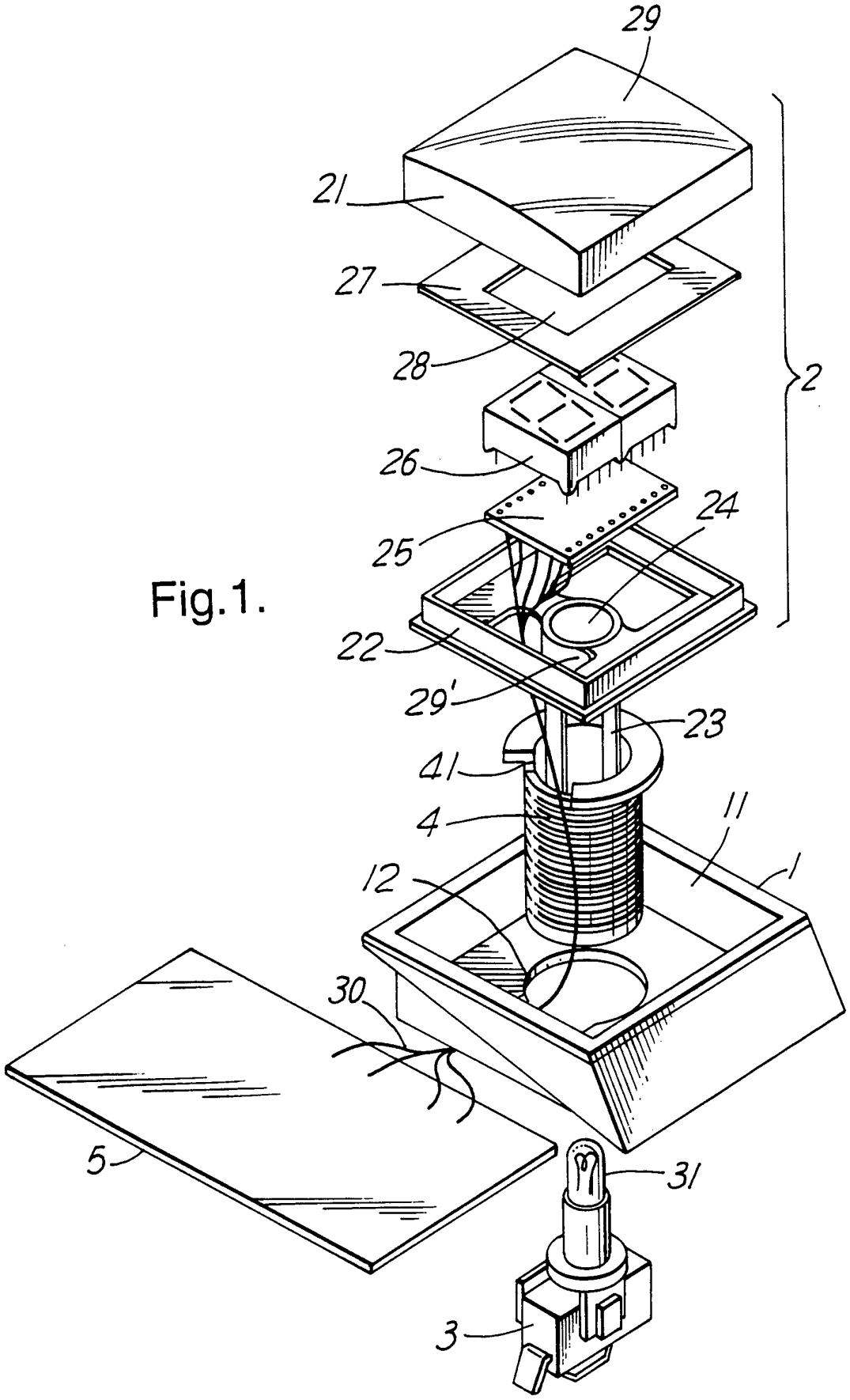


Fig.1.

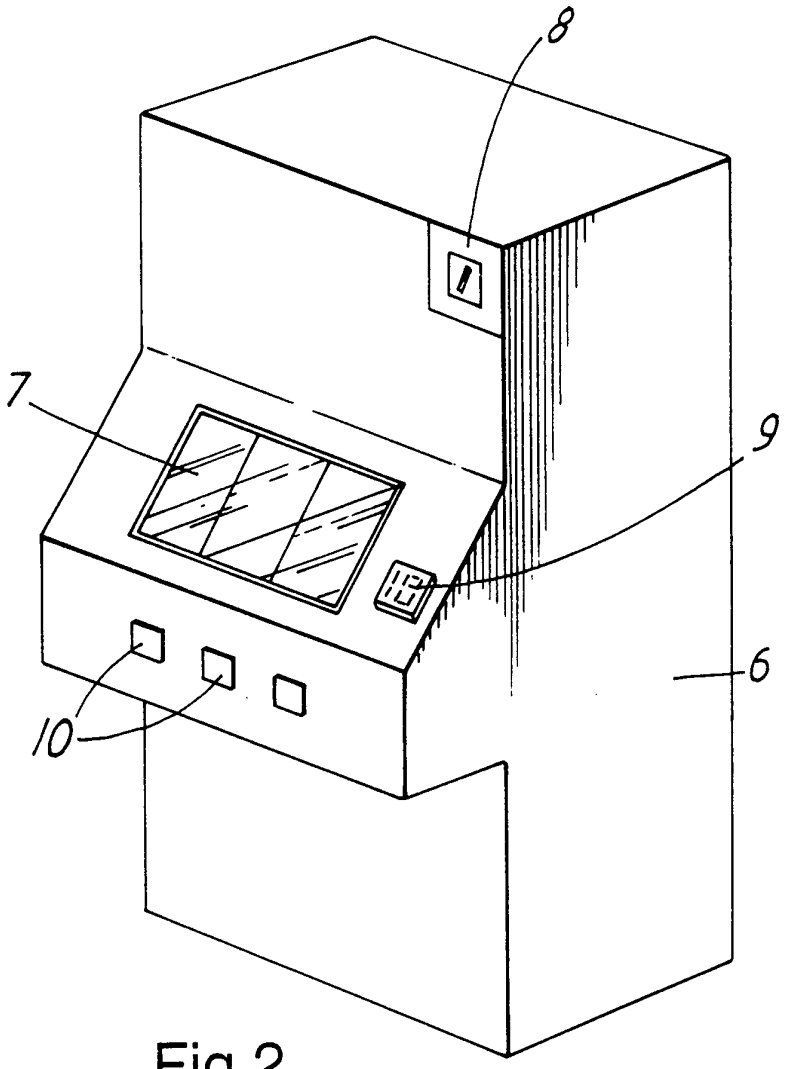


Fig.2

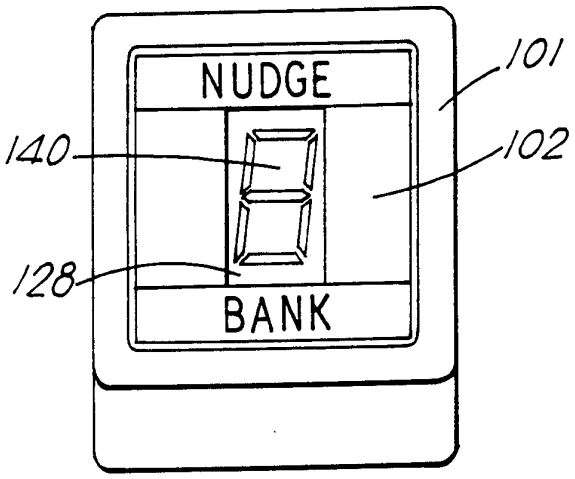

NUDGE
BANK
101
102
140
128

Fig.3.

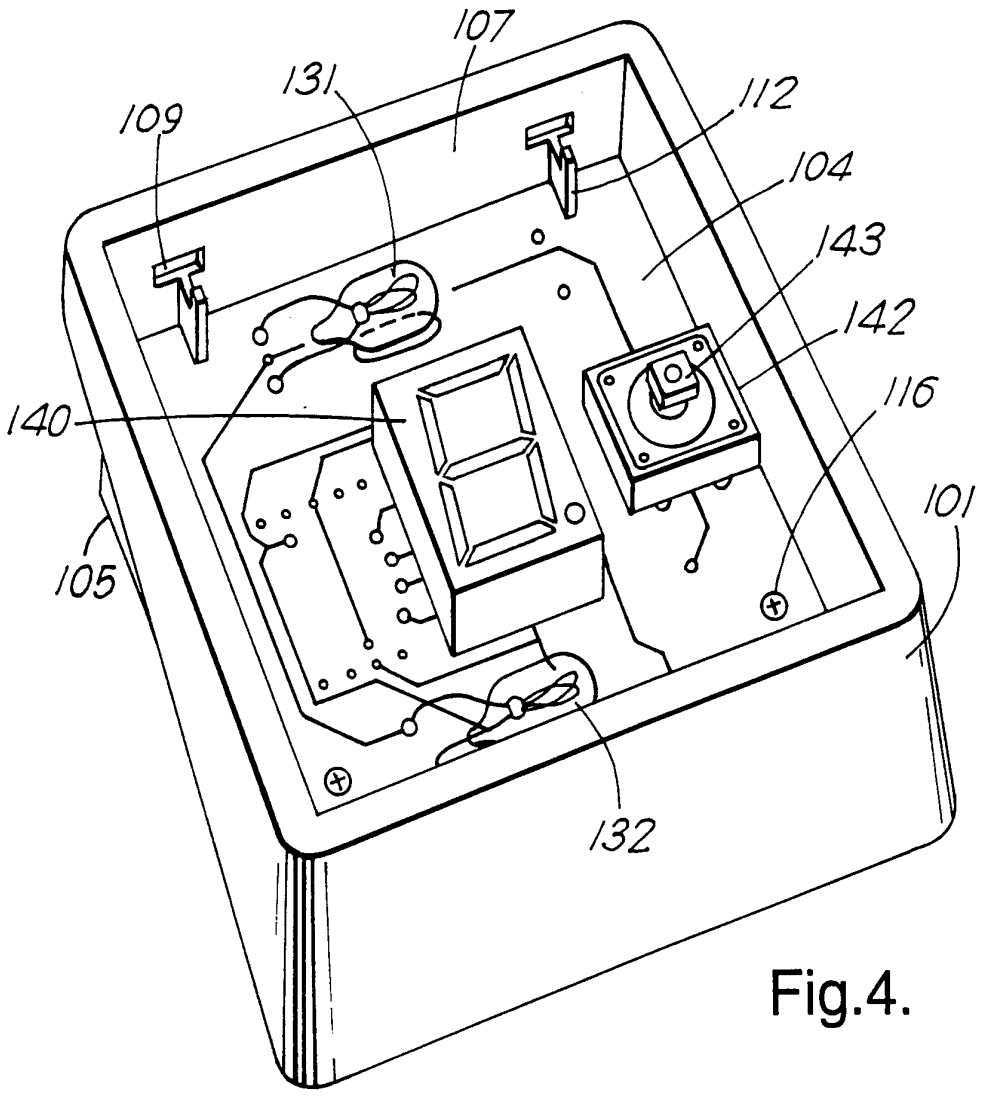

107
131
109
112
104
143
142
116
140
101
105
132

Fig.4.

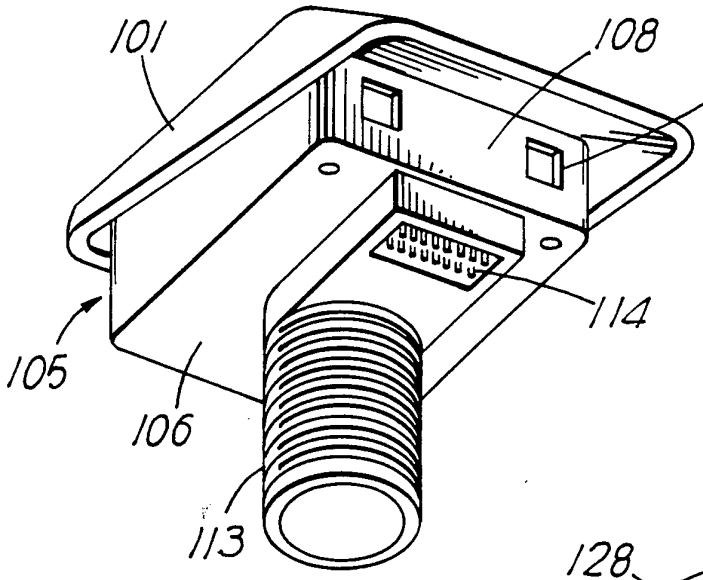


Fig.5.

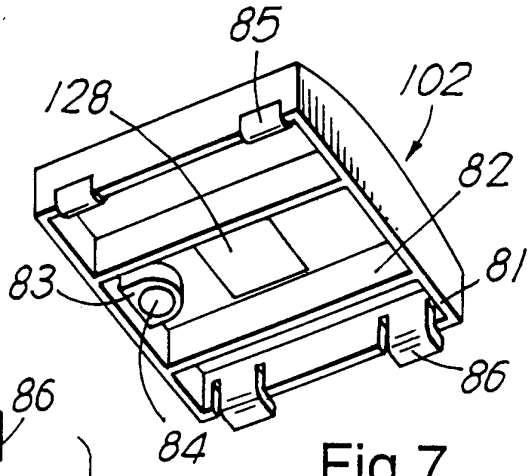


Fig.7.

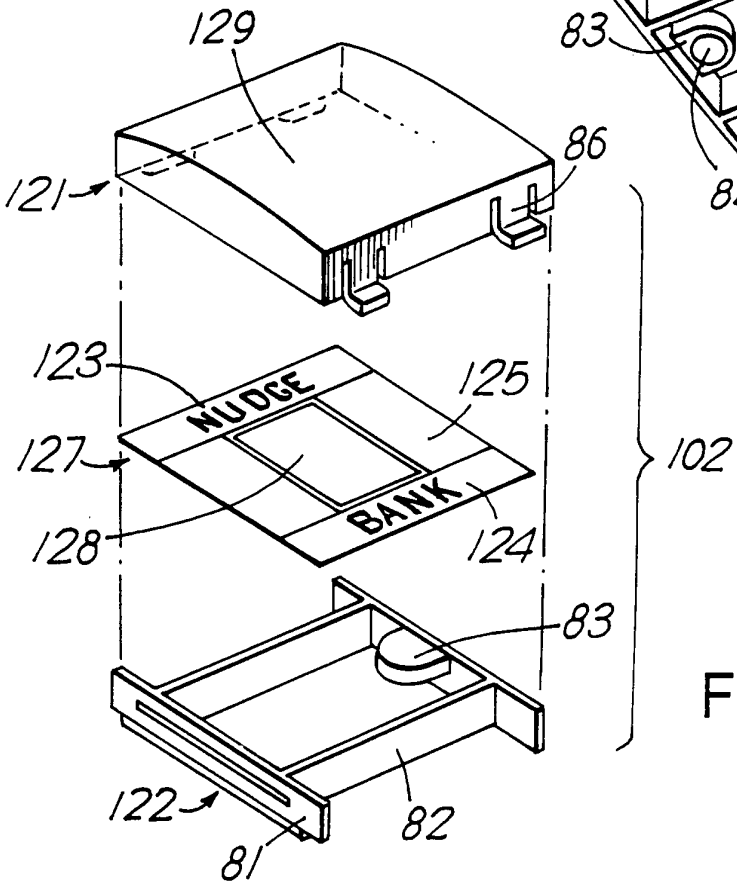


Fig.6.

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 94/00866

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 H01H13/02 H01H13/70

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)
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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	FR,A,2 542 895 (EATON CORP.) 21 September 1984 see claims 1,2; figure 1	1-3
X	EP,A,0 329 920 (TSCHUDIN & HEID AG) 30 August 1989 see abstract; figure 1	1-3
X	EP,A,0 232 137 (DOWTY COMPONENTS LTD) 12 August 1987 see abstract; figure 4	1-3
A	FR,A,2 673 761 (S.A. DE SYSTEMES ET D'AUDIO FREQUENCES) 11 September 1992 see abstract; figures	1-4

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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1

Date of the actual completion of the international search	Date of mailing of the international search report
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Information on patent family members

Inte nal Application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A-2542895	21-09-84	US-A- 4501937	26-02-85
EP-A-0329920	30-08-89	NONE	
EP-A-0232137	12-08-87	NONE	
FR-A-2673761	11-09-92	NONE	