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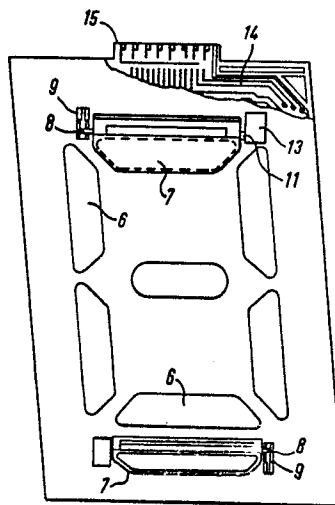
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⑤④ **Display panel.**

⑤⑦ In order to provide a display of numeric or alpha numeric information, a multi-segment array consists of a series of apertures 6 in an opaque sheet 4. Each aperture 6 is associated with a light-tight shutter or flap 7 individually controlled by an electromagnetic arrangement for movement between a closed position wherein it occludes the aperture 6 and an open position concealed behind the opaque sheet (4). The apertures 6 are preferably back-lit by a source of diffused light, which may illuminate a number of panels, but front lighting and reflecting coating on the flaps 7 may be used if desired.



DISPLAY PANEL

This present invention relates to a visual display panel. During recent years there has been increasing resort to the use of public display panels which generate and utilise moving or changing images. Such display systems can be found at airport enclosures, railway
5 stations, motorways and traffic routes, petrol stations, sports stadia, supermarkets and at many other localities where it is necessary to transmit and display information and data to a number of people at some distance.

Typical of such display systems are digital clocks,
10 data indicators, timetable boards, scoreboards, traffic flow indicators, hazard warnings and price and cost indicators.

Certain of these displays are fully automatic, such as digital clocks which do not require an externally
15 generated signal to change or update the displayed image. It is of benefit, however, for other types of public display systems, such as scoreboards, to be changed remotely and quickly as and when required by an operator or as automatically selected by a previously programmed con-
20 troller which may be linked to a transducer or similar sensor.

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Using individual light sources, such as bulbs, neon or fluorescent tubes which can be switched, blanked-off or shuttered, the desired image in either composite or single silhouette form can be generated. Electro-
5 mechanical drive systems are usually coupled to rotating, multi-faceted drums or continuous flexible rolls storing a flange of fixed images which are individually selected.

Alternatively, when reflected light, rather than back illumination, is to be used, the electromechanical
10 drive system may be in the form of a series of reflective shutters located in a position spaced behind a suitably silhouetted board thus building up a composite image or line display to be presented to the observer.

However, all such displays have inherent disadvantages, particularly: high production costs, complexity of
15 parts, lack of versatility, high failure rate, maximum size limitations.

It is an objection of the invention to provide an arrangement in which backlighting is used in a multi-
20 segment array, and in which a large commonality of parts may be obtained if it is preferred to use reflected light.

According to the present invention there is provided a display panel for displaying any one of a group of characters by selective illumination of segments of a

multi-segment array, comprising an opaque sheet having apertures to be selectively occluded or opened to constitute the said segments, in which each aperture is adapted to be occluded by a respective substantially opaque flap fitting snugly in the aperture in a substantially light-tight manner and having means for pivoting the flap clear of the aperture to an open position wherein it is normally concealed behind the opaque sheet.

Such a panel may for instance be in the form of a seven segment set for numerical display, but it may also be used for a sixteen segment set for full alpha numeric display.

In a preferred form, the flaps are black and the apertures are backlit from a diffused light source so that the open apertures are illuminated, and the closed ones effectively form part of the black background.

For a reflected light display, the front faces of the flaps may be reflective, eg. by paint or other applied reflective material, possibly coloured, so that when front-lit either by natural or artificial light, the closed apertures form the display. The logic is thus reversed as compared with the backlit form. but this can be easily accommodated by reversing the direction of operation of the flaps for a given control signal.

It is also preferred that the opaque sheet carry printed circuitry for control of the flap actuating mechanisms.

5 The display panels according to the invention are modular and may be built up into a multiple display arrangement, eg. of one or more rows of characters. The panels in a row (or column) may if required be illuminated by a common light source and the same light source may illuminate display panels on each side of a complete
10 display arrangement whereby information may be read from either side.

The invention will be further described with reference to the accompanying diagrammatic drawings which show various embodiments of the invention, and in which;

15 Figure 1 is a sectional view of a display arrangement showing a typical light source and display panels in accordance with the invention;

Figure 2 illustrates from the inner side a typical panel in accordance with one form of the invention;

20 Figure 3 is a cut away and sectional view illustrating the mounting of a panel;

Figure 4 is an enlarged view of a detail of a variation;

25 Figure 5 is a side view of a flap and associated mechanism;

Figure 6 is an end view of the arrangement of Figure 1 showing the flap in a closed position;

Figure 7 is a side view similar to Figure 6 showing the flap in the open or raised position;

5 Figure 8 illustrates two parts of a two part form of flap;

Figure 9 is an enlarged end view of a flap actuating mechanism; and

10 Figure 10 illustrates diagrammatically a sixteen segment array.

Turning now to the drawings, and in particular Figure 1, this shows a housing 1 for a display arrangement in which are mounted a plurality of lighting tubes 2, eg. fluorescent which together constitute a light source. Diffusers 3 are arranged on each side of the tubes 2 so as to constitute a single light source of substantially uniform intensity over the whole area of display panels illustrated, generally indicated by 4. The display panels 4 are shown as being mounted in frames 5 set in the housing 1.

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The preferred method of image generation is with each modular display board mounted within an individual or common light cabinet fitted with electrically powered lamp(s) or fluorescent tube(s) of a fixed or changing

light intensity to suit the particular application and, in particular, the local ambient lighting conditions where the display is to be used.

By means of a light-sensitive device, mounted so as to detect the ambient light, the illumination intensity of the light source may be controlled, that is it may be dimmed or intensified to suit visual conditions.

Figure 2 shows a typical display panel 4 in the form of a sheet of opaque material having apertures 6 forming a seven segment array for numeric display. Each aperture is provided with an obturating flap 7, although only two such flaps are illustrated, namely on the uppermost and lowermost apertures 6, with that in the uppermost position in the closed position and that in the lowermost position in the open position. The other flaps are omitted for clarity of illustration. Each flap has a stub shaft 8 mounted in a bearing or trunnion 9 mounted on the panel 4 and a stub shaft 11 which carries an annular magnet 12 (see Figures 6 and 7 in particular) cooperating with an actuating mechanism 13. The stub shaft 11 is also mounted in a bearing mounted on the panel. The actuating mechanisms will be described in more detail hereinafter but it will be seen that the panel 4 includes printed circuitry, illustrated at 14, to carry control signals to the actuating mechanism 13, and the panel further includes an edge connector 15

for rapid connection of the printed circuitry 14 into an appropriate control circuit.

5 The display board 4 comprises a substrate over-printed with a conductive material suitably etched and
channeled so as to distribute and transmit electrical
power or signal to the flapper drives in any desired
order depending on the complexity and number of cut-outs
required to generate the particular range of displayed
images. A further substrate is superimposed onto the
10 outer face of the circuit board to form an opaque
facing through which light from the illumination source
within the light enclosure cannot readily pass.

Figure 3 shows part of a frame 5 as being adapted
to hold a display panel 4 and slightly displaced out-
15 wardly thereof, an outer glass or transparent plastics
covering 16, which may have some play in relation to the
panel 4 in order to allow for differential thermal expan-
sion and contraction. The glass or other transparent
covering 16 may be provided with a fine pattern of emboss-
20 ing, eg. a pin spot pattern to enhance the aesthetic
effect of the display panel. Also, it may be coloured if
desired. The purpose of such a covering is two-fold.
Firstly, it serves to diffuse the harsh edges and
shadows of the flap and, secondly, it may serve to polarise
25 the emitted light.

Figure 4 shows how, in addition, the individual



apertures 6, in the display panel 4 may be provided with individual lenses 18.

Turning now to Figures 5, 6 and 7, can be seen that each flap 7 is a thin moulding which is dished as shown at 7a so as to enter the corresponding aperture and is provided with a flange 7b which completes the occlusion of the aperture. The light-tightness may be augmented if required by inclusion of a suitable rubber or synthetic gasket layer on the flange 7b.

In order to restrict the amount of power required for moving the flap 7, and also to make it independent of the angle at which the flap is mounted, each flap may have a counterbalance weight 21 associated with it. This counterbalance may be obtained by moulding a piece of heavy material, such as metal, into the plastics material of the flap so as to restrict its dimensions and ensure that it is not obtrude across the aperture 6 when the flap is in the open position shown in Figure 7. It will be seen that in the open position the flap is concealed behind the opaque shutter.

As illustrated in Figures 6 and 7, the stub shaft 11 carries the annular magnet 12 and this is located between pole pieces 22 and 23 of an electromagnet 24.

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The coil of the electromagnet 24 is bifilar wound and centre tapped so that the electromagnet may be magnetised strongly in one direction or the other to cause the permanent magnet 12 to rotate between two extreme positions which are controlled by mechanical stops built into the mechanism. Cushioning or damping of the movement may be provided. The arrangement is such that the position of the flap is bistable, being held by the remanent magnetism in either position and readily shifted by the electromagnet when the pole is reversed.

In a conventional reflective display panel, the display plane formed by the faces of the reflective sides of the movable elements, equivalent to the flaps 7, is substantially parallel with or tangential to the motion of the reflective sides at the instant of leaving or entering the display plane. Such an arrangement is not appropriate for forming a light-tight closure of an aperture 6 in the panel 4. It will be seen especially from Figures 4, 6 and 7, that in the present arrangement, on entering or leaving the aperture 6, the flap 6 is moving substantially normal to the plane of the panel 4 and the apertures 6.

Figure 8 shows how the flap 7 and the part carrying the counterbalance weight 21, which part is integral with

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the stub shafts 8 and 11, may be separately moulded portions which are snap fitted together.

The material of which the flap 7 is made has to stand up to exacting conditions since it may be subjected to quite extreme temperature and other climatic conditions and needs to maintain the light type fitting in the apertures 6. The material also needs to be opaque and non-reflective. A material has been found suitable to meet these requirements and is the thermoplastic polyester material which is sold under the registered trade mark Pocan B1505. This material is a partially crystalline thermoplastic polyester based on polybutylene terephthalate.

Figure 9 shows somewhat an enlarged view of an electromagnet arrangement and shows how between the pole pieces 22 and 23 there extends a piece of non-magnetic material, preferably plastics, forming part of the flapper bearing moulding, and in this there is embedded a switch 31 which is actuated by the rotation of the magnet 12. This can provide means of positive error detection, in that when the poles of the magnet 12 are aligned with the switch 31, the switch will be held closed by the magnetic field. When a pulse is fed to the coil 24 the position of the flap changes and the poles of the magnet 12 move such that the switch 31 can

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poles of the magnet 12 move such that the switch 31 can then open. The position of the switch 31 can be fed back to a micro-processor or other logic checking the operation.

While the arrangement has been described primarily in connection with a seven segment array for numeric displays, it will be understood that it is also applicable to other arrays, and Figure 10 shows diagrammatically an arrangement of apertures 6 in a sixteen segment array which can be used to give full alpha numeric display. It has been found possible to arrange similar flaps 7 to such apertures 6 to provide this arrangement.

The arrangement is also described primarily in connection with a backlit display using the light sources illustrated in Figure 1, but it will be seen that if the outer faces of the dished portions 7a of the flaps 7 are made reflective, then the array can be used for front-lit displays. However, since the closed apertures are then the lit ones, the logic is reversed and this is best achieved by reversing the coils 24 so as not to interfere with the printed circuit arrangements and controls which are designed for the backlit arrangement. Also, it is then important to ensure that only non-reflective parts are used behind the apertures 6.

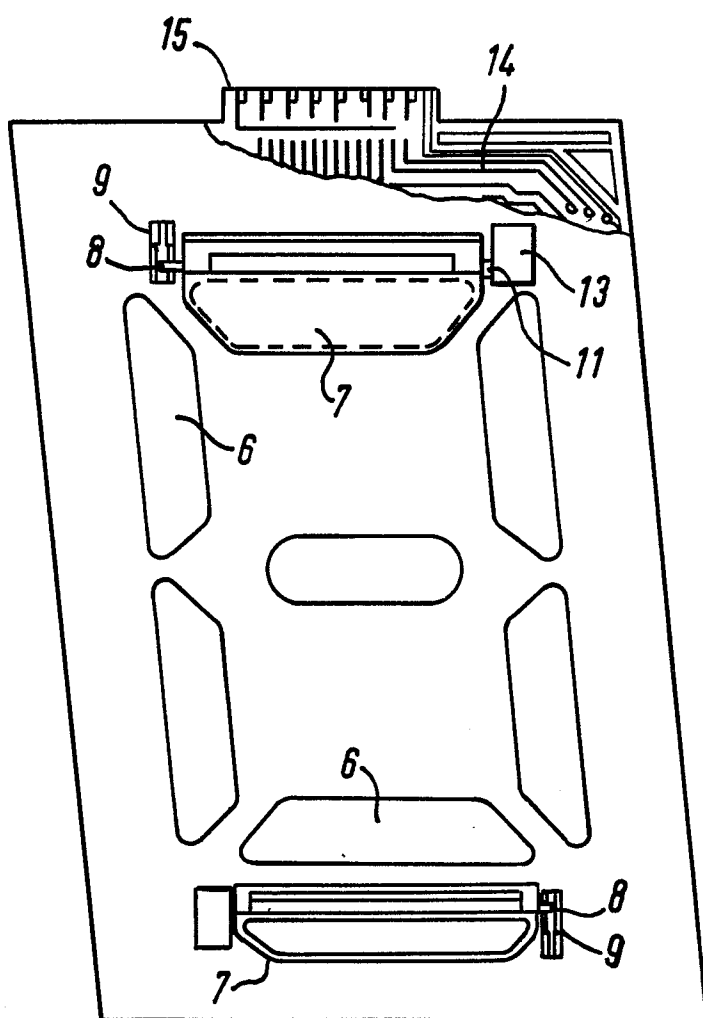
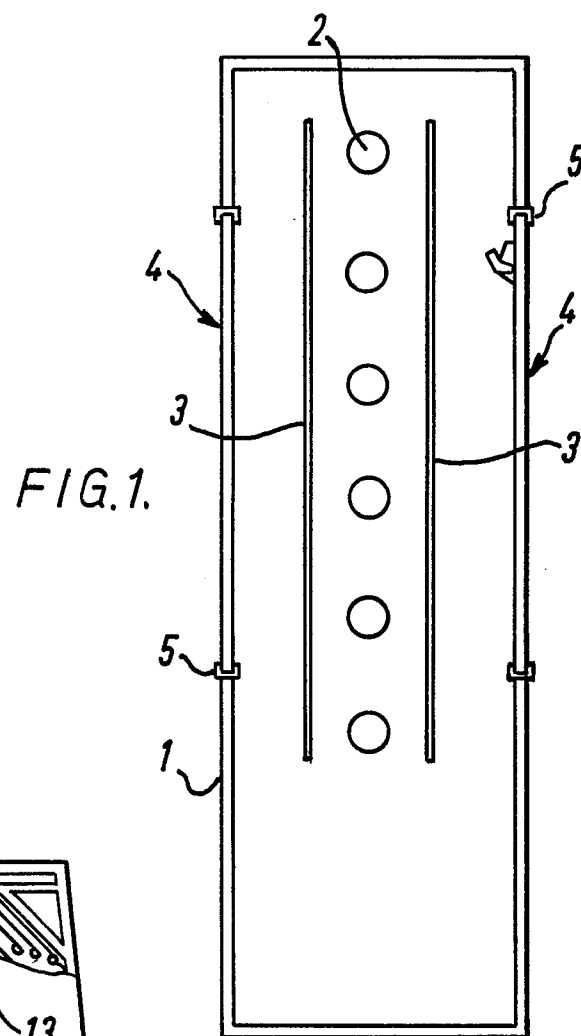
Various other modifications may be made within the scope of the invention.

CLAIMS

1. A display panel for displaying any one of a group of characters by selective illumination of segments of a multi-segment array, comprising an opaque sheet (4) having apertures (6) to be selectively occluded or opened to constitute the said segments, characterised in that each aperture (6) is adapted to be occluded by a respective substantially opaque flap (7) fitting snugly in the aperture (6) in a substantially light-tight manner and having means for pivoting the flap (7) clear of the aperture (6) to an open position wherein it is normally concealed behind the opaque sheet (4).
2. A display panel according to claim 1, characterised in that the apertures (6) are back-lit by a source (2, 3) of diffused light behind the opaque sheet (4), whereby the segments are illuminated when the respective flaps (7) in the open position.
3. A display panel according to claim 1 or 2, characterised in that the said opaque sheet (4) includes a printed circuit board (14) carrying electrical connectors to flap (4) activating devices (24) mounted on the concealed side of the sheet (4).

4. A display panel according to claim 3, characterised in that the flap-actuating devices comprising electro-magnets (24) cooperating with permanent magnets (12) pivotal with the flaps (7).
5. A display panel according to any of claims 1 to 4, characterised in that the flaps (7) are provided with counterbalance weights (21).
6. A display panel according to any of the preceding claims, characterised in that the flaps (7) are thin mouldings of a partially crystalline thermoplastic polyester based on polybutylene terephthalate.
7. A display panel according to any of the preceding claims, characterised by having an outer transparent covering (16) mounted with some play with respect to the opaque sheet (4)
8. A display panel according to claim 7, characterised in that the outer transparent covering (16) has a fine or pin spot pattern of embossing.
9. A display arrangement comprising a plurality of display panels according to any of the preceding claims.

10. A display arrangement according to claim 9, in which a plurality of display panels are arranged in juxtaposition, characterised in that the juxtaposed panels are illuminated by a common light source.



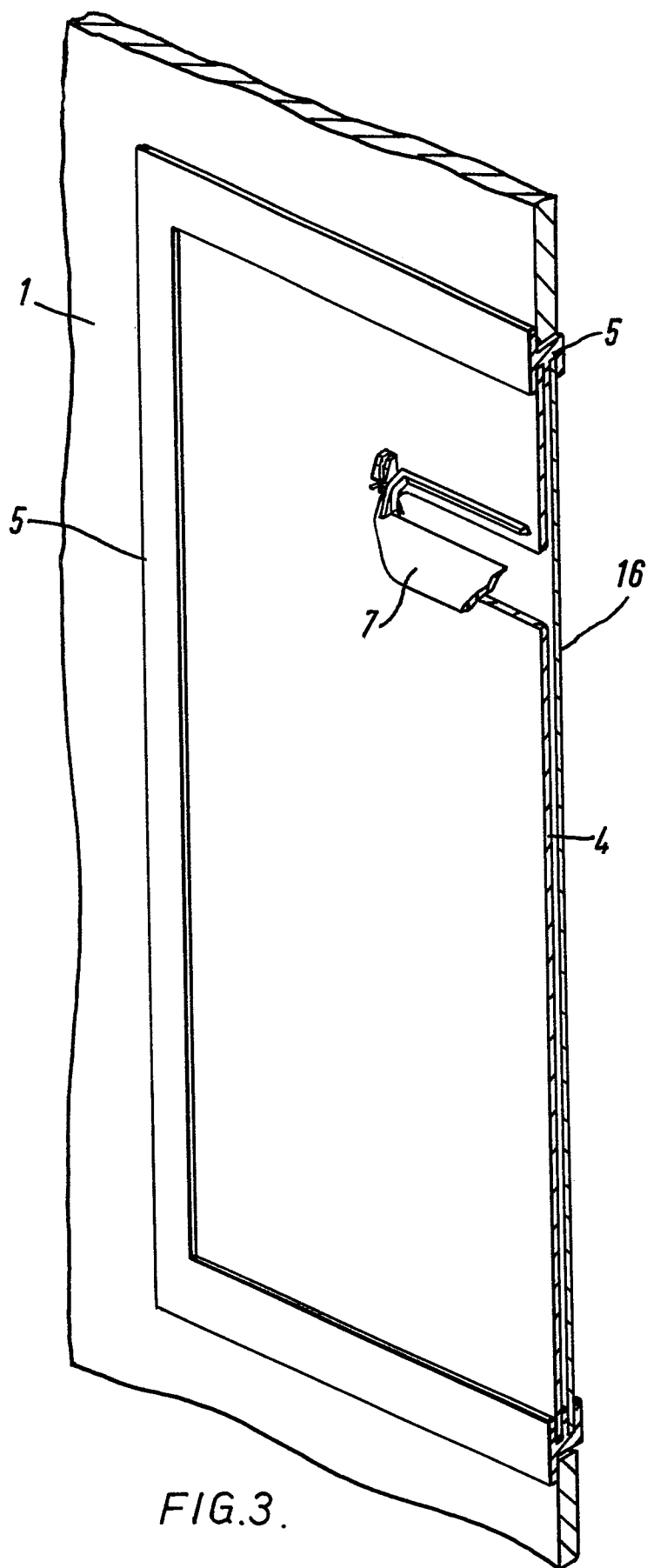


FIG.3.

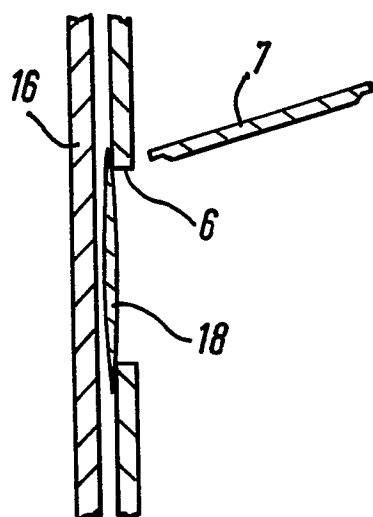
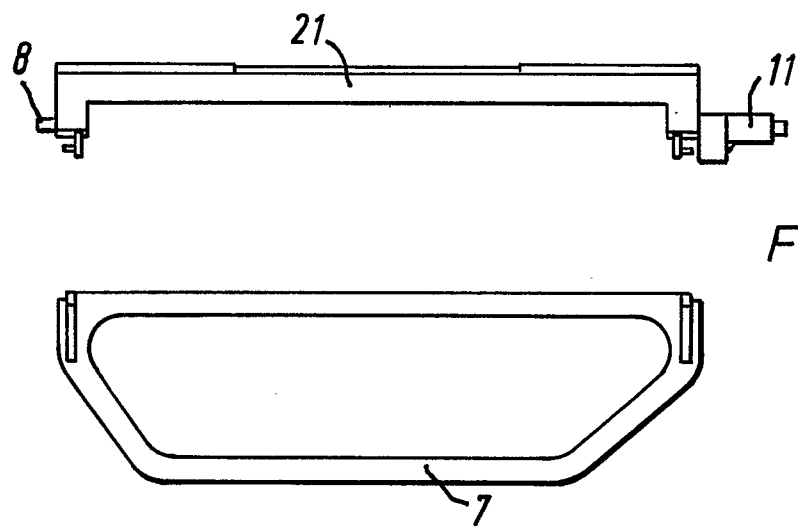
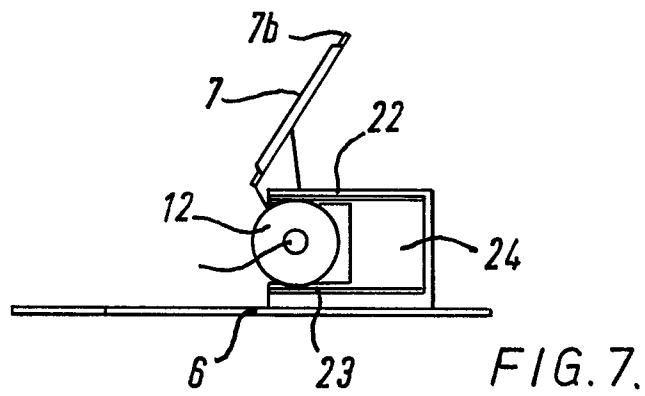
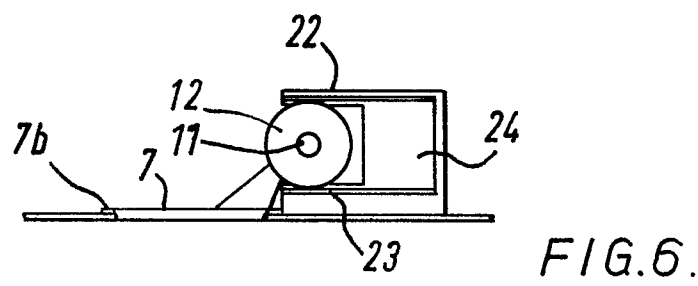
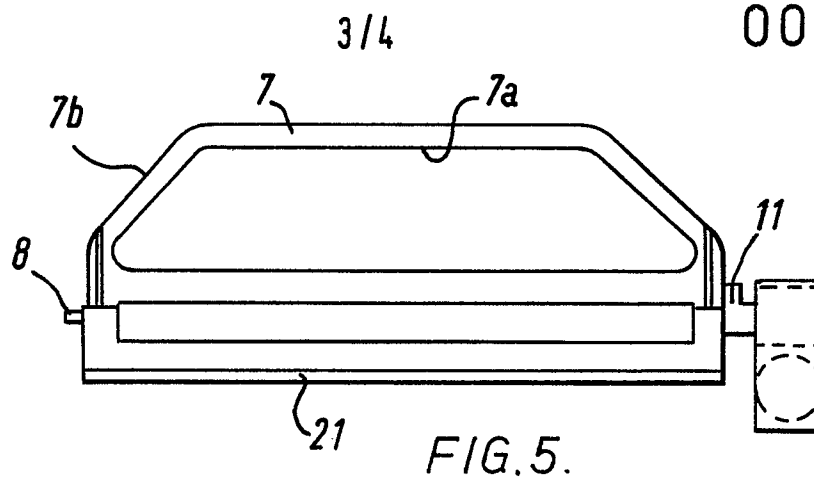


FIG.4.



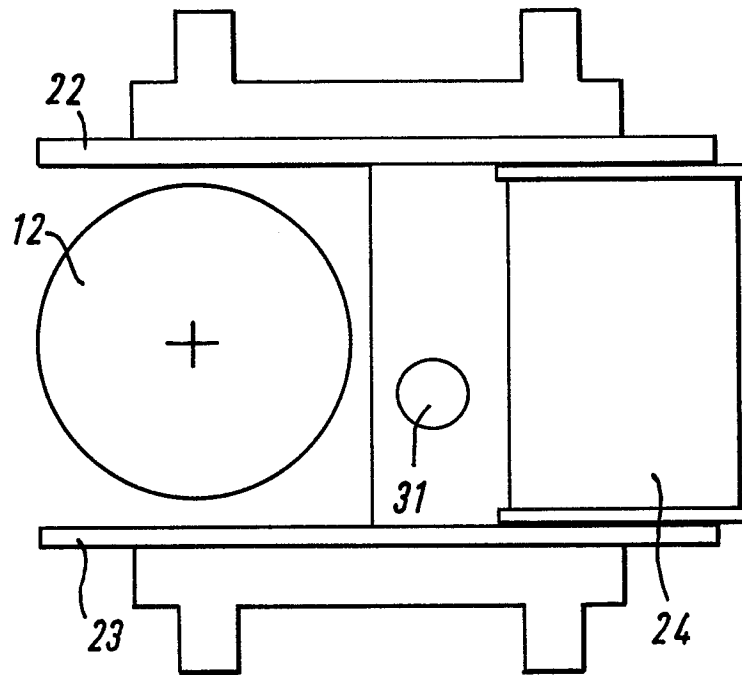


FIG. 9.

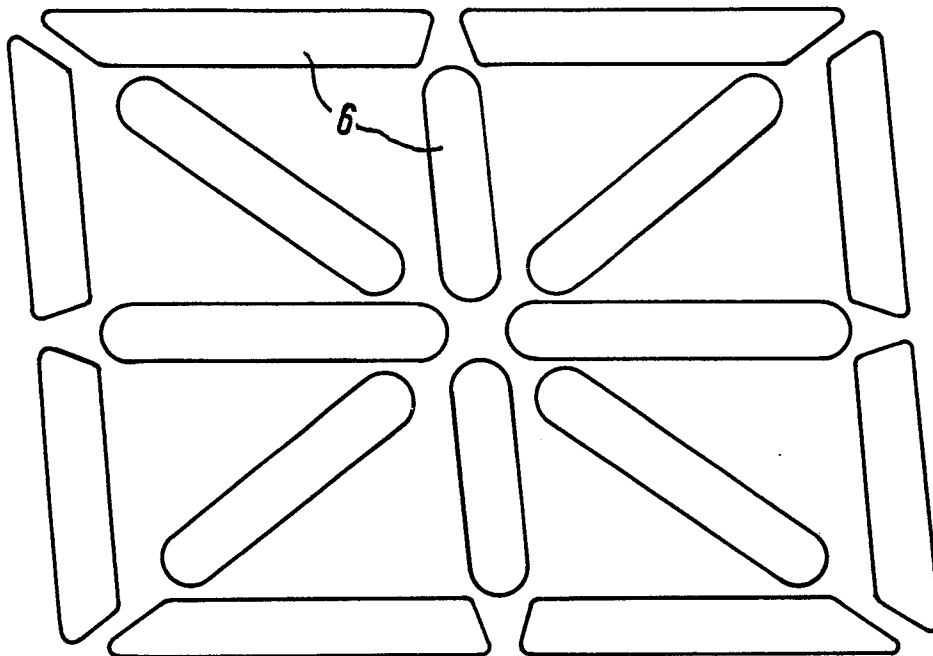


FIG. 10.



EP 82 30 3133

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
X	US-A-4 070 668 (M.KAWAHARADA and E.YOKOYAMA) *Claims 1-7,10; column 3, lines 30-63; column 5, lines 10-27 and lines 44-50; column 6, line 49 - column 7, line 2; figures 1-4,9,11,14-15*	1-5,7-10	G 09 F 9/37
X	US-A-3 947 984 (FERRANTI-PACKARD LTD) *Claim 1; column 2, lines 5-28; figures 1-4*	3	
X	US-A-4 215 338 (GUENTHER SELIG) *Claim 1; column 2, lines 60-68; column 3, lines 1-17; figures 1-4*	1-2,9-10	
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			G 09 F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24-09-1982	Examiner FRANSEN L.J.L.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			