



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification³ : G09F 13/18</p>	<p>A1</p>	<p>(11) International Publication Number: WO 84/ 04838 (43) International Publication Date: 6 December 1984 (06.12.84)</p>
<p>(21) International Application Number: PCT/SE84/00188 (22) International Filing Date: 17 May 1984 (17.05.84) (31) Priority Application Number: 8302959-5 (32) Priority Date: 26 May 1983 (26.05.83) (33) Priority Country: SE (71)(72) Applicant and Inventor: HENKE, Ulf [SE/SE]; Nordostpassagen 53, S-413 11 Göteborg (SE). (74) Agent: LINDBERG, Bo; Cederbom & Lindberg AB, Box 53252, S-400 16 Göteborg (SE). (81) Designated States: AT (European patent), AU, BE (European patent), BR, CH (European patent), DE, DE (Auxiliary utility model), DE (European patent), DK, FR (European patent), GB, GB (European patent), JP, LU (European patent), NL (European patent), SU, US.</p>		<p>Published <i>With international search report.</i></p>
<p>(54) Title: AN ARRANGEMENT FOR A DISPLAY DEVICE WHICH CAN BE ACTED UPON BY LIGHT AND IS PROVIDED WITH A DISPLAY SURFACE</p>		
<p>(57) Abstract</p> <p>Arrangement for a display device which can be acted upon by light and is provided with a display surface, and which can be acted upon by light striking it substantially parallel to the said display surface. By means of the invention the light is distributed effectively over the whole of the display surface of the device. According to the invention a plate (1) or the like, made of plexiglass or a material with similar light-conducting properties, has a curved surface (3) on the opposite side to the said preferably planar display surface (2) of the said plate.</p>		

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An Arrangement for a Display Device which can be acted upon by light and is provided with a display surface.

The present invention relates to an arrangement for a display device which can be acted upon by light, with a preferably planar display surface with a considerable extent over one plane, this arrangement consisting of a
5 plate or similar object made of plexiglass or a material which displays similar light-conducting properties to those of plexiglass, the said plate, the thickness of which is tapered down towards one of its ends, being designed to admit the effective light in a direction from
10 the end opposite to the end where the thickness is tapered down, along the display surface to the interior of the plate for subsequent refraction in the plate before it emerges in the direction of the display surface.

The main object of the present invention is primarily
15 to provide an arrangement of the above-mentioned kind wherein the light is dispersed effectively over the whole of its display surface.

The said object is achieved by means of an arrangement according to the present invention which is essentially characterised in that the plate has a substantially curved convex surface which has a great number of
20 recesses made in it, for example by knurling, blasting or stamping, with light-refracting surfaces disposed extending transverse to the light entering from the direction
25 of the plate end.

The invention is described below by way of a number of preferred embodiments, with reference to the accompanying drawings, on which

Figure 1 shows a plurality of display device plates
30 adjoining a common light-source, viewed along the direction in which the light is refracted,

Figure 2 shows two parallel-connected plates,



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Figure 3 shows the plates in Figure 2 viewed from the direction of their curved sides,

Figure 4 shows a plurality of plates series-connected in a row, viewed from the side,

5 Figure 5 shows the plates in Figure 4 viewed from the direction of their curved sides,

Figure 6 shows a plurality of double-mounted series-connected plates,

10 Figure 7 shows the arrangement associated with a light-source with a rotatable casing,

Figure 8 is a cross-section through the casing and the light-source shown in Figure 7,

Figure 9 shows a drive arrangement appertaining to an arrangement as shown in Figures 7 and 8,

15 Figure 10 is a cross-section through a drive wheel which drives the casing round the light-source, and Figures 11 and 12 show two embodiment examples where the arrangement is being used in a so-called image-distorter.

20 According to the invention the display device comprises a plurality of plates 1 each made of a material with light-conducting properties. A suitable material for this is plexiglass or a material with similar properties to those displayed by plexiglass. The said plate 1 is expediently formed from part of a piece made
25 in the form of the segment of a circle, as is shown clearly, for example, in Figure 1, where plates 1¹, 1² with different shaping are shown.

The plate 1 has a display surface 2 which is preferably planar. On the face opposite to the said preferably
30 planar display surface 2 of the said plate 1, the plate 1 has a curved surface 3. The said curved surface 3 may be double-curved over an outer pointed part 4 of the said plate 1 in order to improve the effect of the arrangement. The curved surface 3 may be polished and coated, for ex-
35 ample with reflecting paint, or it may be chromed or treated in some other way with a view to increasing the light-

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reflecting capacity, and/or it may be provided with transverse grooves for the same purpose. However, it is most expedient to blast the said surface 3, possibly with subsequent surface-treatment.

5 A diffusor 5 which acts in a manner which is known per se can be disposed over the preferably smooth or blasted display surface 2, for the purpose of collecting the light on the front face A of the plate. The blasting on the surface 3 is for the same purpose.

10 Between the display surface 2 and the reflecting surface 3 there extends a preferably planar light-admission surface 6, preferably disposed at right-angles to the display surface 2, and preferably smooth.

15 In the vicinity of the said light-admission surface 6 on the respective plates 1 there is a light-source 7 which can be of a known type, such as a light tube, an incandescent lamp, etc., for example. The light may also be guided in the direction of the said respective light-admission surfaces 6 by means of a mirror, for example.

20 The light from the said light-source 7 strikes the plate 1 via the surface 6, substantially parallel with the surface 2, in the direction of the arrow 8. The curved reflecting surface 3 now reflects the light so that it is conducted substantially in a direction out
25 through the display surface 2, as shown schematically by the arrow 9 in Figure 1.

The displaying of various images, symbols, etc., or the provision of uniform display illumination can be effected or obtained in this way with the said arrangement.

30 Figures 2 and 3 show how a common light-source 7 is used for plates 1 disposed on either side thereof with a view to obtaining a light-actuated display device designed according to the present invention.

35 Figures 4 and 5 show a plurality of plates 1 connected together in series to form a strip with the respective outer ends 4 of the said curved surfaces 3 adjoin-



ing the said light-admission surfaces 6 on the respective plates 1. A light-source 7 is located at the respective light-admission surfaces 6 and the said arrangement enables a whole wide display surface 11 to be produced from the said plurality of smaller display surfaces 2 without any interrupting joins occurring.

Figure 6 shows an arrangement for producing two wide display surfaces 12 and 13 respectively, facing in opposite directions from each other. This is made possible by series-connecting a plurality of plates 1 in parallel rows with the curved surfaces 3 on the respective plates 1 disposed facing towards each other and connecting the respective plate pairs 14, 15 etc. to a preferably common light-source.

Figures 7 and 8 show an arrangement wherein a plate 1 is connected to a light-source 7 which is enclosed in a patterned, etc., transparent cylinder 16 which is operated via a motor 17 as shown in Figures 9 and 10, by a cable 18 and/or a drive wheel 19 mounted on an arm 20, causing it to be driven in the direction of the arrow 21 so that a moving pattern 22 is transmitted to the plate and is shown on its planar display surface 2 in accordance with the above-mentioned principle.

Figure 11 shows a plate 1 associated with a light-source 7 and a reflector 23 which spreads the light uniformly, situated behind the light-source 7. A distorted image 24 such as a diapositive image, for example, which is located between the light-source 7 and the light-admission surface 6 is shown with its correct proportions when displayed on the front face 2 of the plate.

Figure 12 shows how a diapositive image 25 or the like is lit by a light-source 7 which again co-acts with a reflector 26. The image is thereby distorted in a lens system 27 so that a distorted image 28 is obtained, substantially the same size as the edge 6 of the plate 1. When the image is displayed on the front face 2 of the

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plate it assumes its correct proportions again, but is magnified.

The theory of the above is as follows: In the light plate 1 the loss of light with distance is compensated. The weaker beam of light further away from the light-source 7 is compensated by projecting it on an increasingly small surface P2, P1. The light is reflected at the surfaces and out through the front face 2.

The shape of the projecting plate is part of the segment of a circle.

The radius R_x , R_y of the circle is determined by the following, amongst other things:

- a) the loss of light with distance
- b) the dispersion of the light, i.e. how parallel are the light beams entering the plate
- c) the strength of the light-source
- d) an index can be established giving the loss of light with distance in the plate.

From this, one or more radii can be found which give uniform excellent illumination over the whole plate. One suitable shape would be obtained if the surface 3 were formed as a parabola. It will be seen from the above that there is a link between the surface of the plate and its thickness. To put it simply, the thickness of the plate can be increased from the index. This index is influenced by lenses, for example, (the parallelity of the incident light), the strength of the light-source and, if applicable, by different types of transparent material in the plate.

A process for producing an arrangement as described above can be effected by extruding, or by pressing the material of a plate-shaped workpiece with a grooved and/or blasted stamping tool so that two curved surfaces 3 are formed, after which the workpiece is cut in the zone between the said curved surfaces 3 and, optionally, subsequent chroming or some other surface treatment may be



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carried out on the said curved surface 3 of the respective plates 1.

Examples of fields of application for the above-mentioned device are as follows:

5 Displaying photographs, images, firms' names or the like at trade fairs, exhibition sites, etc. The dimension in the depth direction of the light plate is around 1/10 of that of a conventional light panel. The new light plate is more compact and less bulky to transport, and
10 is less susceptible to damage.

 Displaying X-ray images in hospitals. The arrangement allows easier installation due to its format, which eliminates the building-in of a light panel into the wall, which is the usual practice at the present time. Greater
15 possibility for sterile conditions and proper hygiene at a lower cost is also made possible. The operator can study X-ray pictures without leaving the sterile zones of the operating theatre since, for example, the images can be displayed suspended from the ceiling or on an ad-
20 jacent stand.

 Previously light panels were rarely used in the wards for X-ray pictures; these were generally studied against a window, etc. The new light plate can easily be taken along on the trolley used when making the rounds.

25 Displaying negatives and diapositives in photographic businesses and studios, for example, in photographic shops, advertising agencies, photographic studios, architects' offices and hobby centres, and some of the advantages are that it is cheaper and more compact than the normal light
30 panels. It is also possible to provide portable light-boards which can be laid directly on a desk.

 Shop signs for facades, which give a more uniform illumination with easier and cheaper maintenance.

35 Lighted signs for display windows and inside business premises. Advertisements for goods, for example, in shops and department stores for the individual depart-



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ments.

Illuminated road signs, providing compact and durable signs where the light fittings can be protected in poles, for example.

5 Indicator lights and brake lights for vehicles, eliminating the costly and conventional light reflectors and reducing the weight and volume of the vehicle, which is the aim of all manufacturers today.

10 Instrument lighting of various kinds, reducing the risk of dazzle and providing a compact unit.

Illuminated walls, counters, ceilings, floors and shelves, such as reception desks, bar counters, ceiling fittings, illuminated steps and stairs, etc.

15 For optical traffic beacons of the type based on the so-called moire effect, where the single line system reduces the depth of the light panel. This means that the range of application and the durability are increased and maintenance reduced.

20 The invention is not limited to the embodiment examples described above and shown on the drawings, but may be modified within the framework of the following Patent Claims without exceeding the concept of the invention.



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P a t e n t C l a i m s

1. An arrangement for a display device which can be acted upon by light and has a preferably planar display surface (2) with a considerable extent over one plane, this arrangement consisting of a plate (1) or similar object made of plexiglass or a material which displays similar light-conducting properties to those of plexiglass, the said plate (1), the thickness of which is tapered down towards one of its ends, being designed to admit the effective light in a direction from the end (6) opposite to the end where the thickness is tapered down, along the display surface (2) to the interior of the plate for subsequent refraction in the plate (1) before it emerges in the direction of the display surface, characterised in that the plate has a substantially curved convex surface (3) which has a great number of recesses made in it, for example by knurling, blasting or stamping, with light-refracting surfaces disposed extending transverse to the light entering from the direction of the plate end (6).
2. An arrangement according to Patent Claim 1, characterised in that the light plate (1) is formed from part of a piece shaped as the segment of a circle, which is preferably formed with a double curved section at the reflecting surface.
3. An arrangement according to either of Patent Claims 1-2, characterised in that the said curved plate surface (3) is polished and coated with reflective paint, chromed, or the like, with a view to increasing its light-reflecting capacity.
4. An arrangement according to any of the preceding Patent Claims, characterised in that the plate has a planar light-admission surface (6), preferably smooth and preferably extending at right-angles to the display surface (2).



5. An arrangement according to any of the preceding Patent Claims, characterised in that the curved surface (3) on the plate (1) adjoins a planar light-admission surface (6) extending substantially at right-angles to the plate display surface of a further plate (1) located adjacent to the first plate (1) and disposed to form a row, with a light-source (7) situated at the said light-admission surface.
6. An arrangement according to any of the preceding Patent Claims, characterised in that two plates are located next to each other with their curved surfaces (3) facing towards each other, and a light-source (7) is disposed between the plates (1).
7. An arrangement according to any of the above-mentioned Patent Claims, characterised in that the light-source contains an illuminated image which is transmitted via a movable, preferably rotatable, cylinder (16), via a lens (27) or directly, to an adjoining plate (1).
8. An arrangement according to Patent Claim 7, characterised in that the rotatable cylinder (16) is designed to be operated by means of a cable (18) and/or a drive wheel (19) designed to rest against the cylinder (16), which are driven by a motor (17).

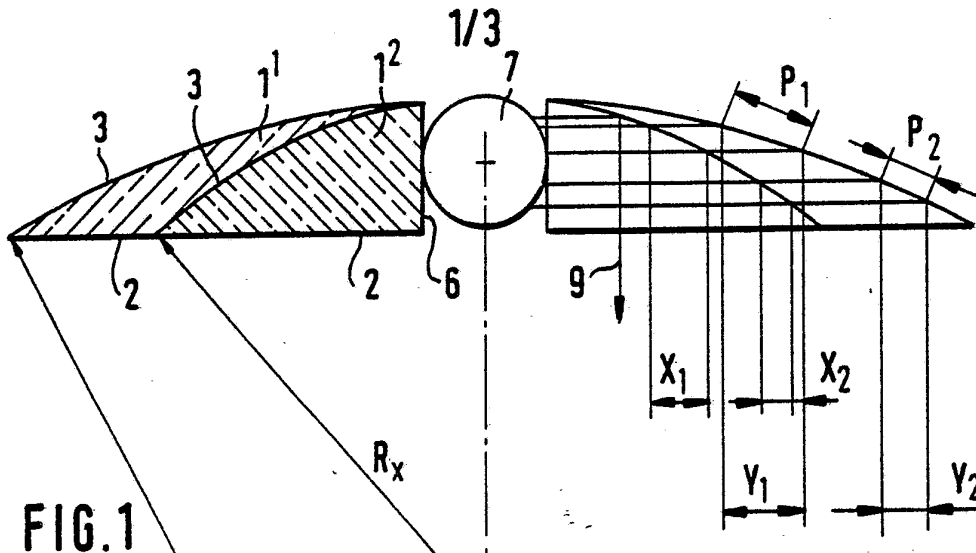


FIG. 1

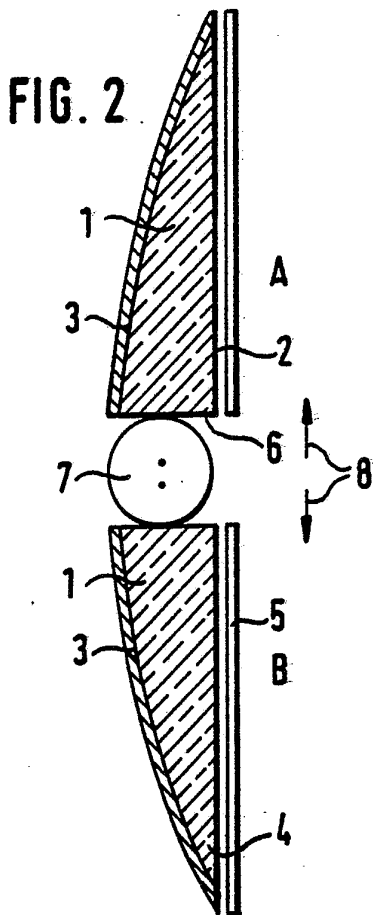


FIG. 2

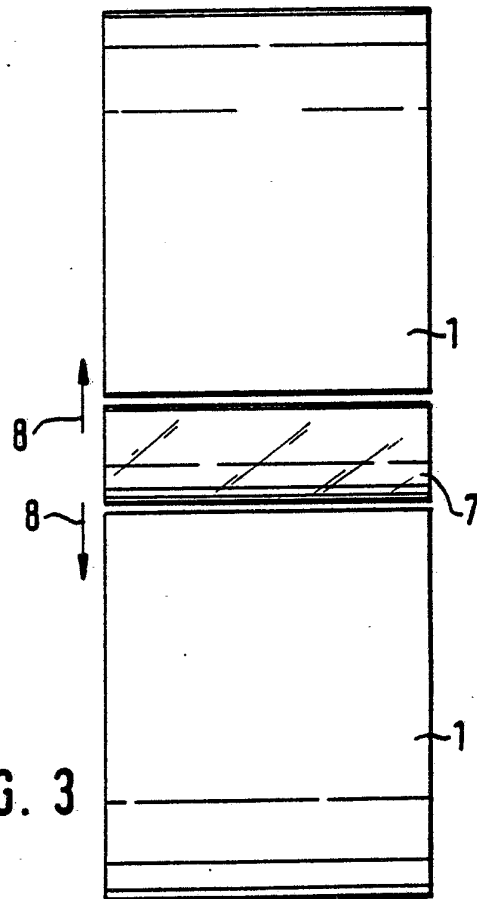


FIG. 3

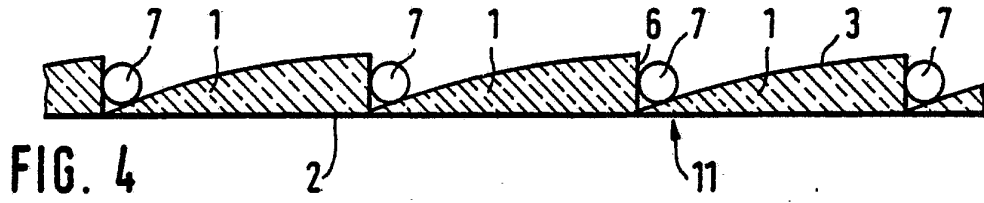


FIG. 4

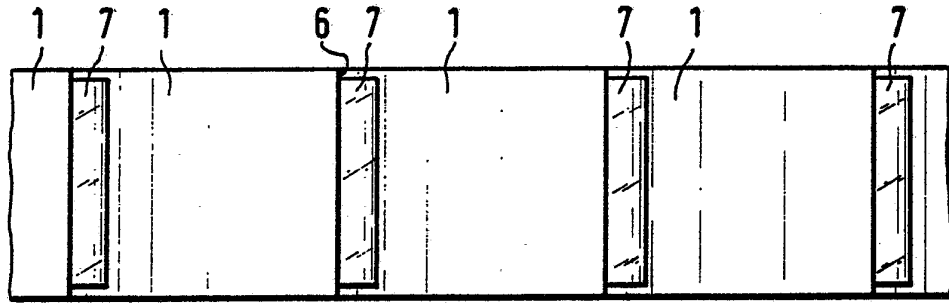


FIG. 5

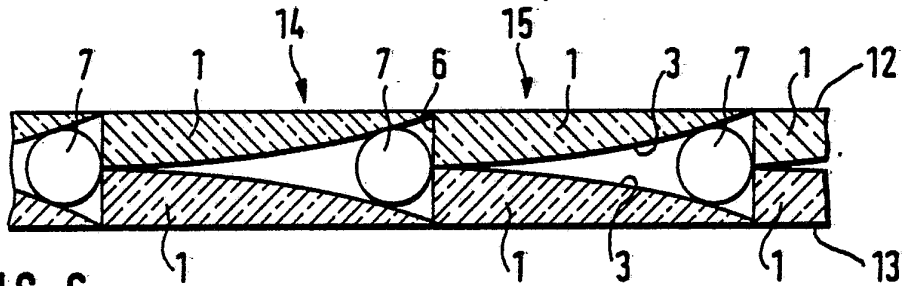


FIG. 6

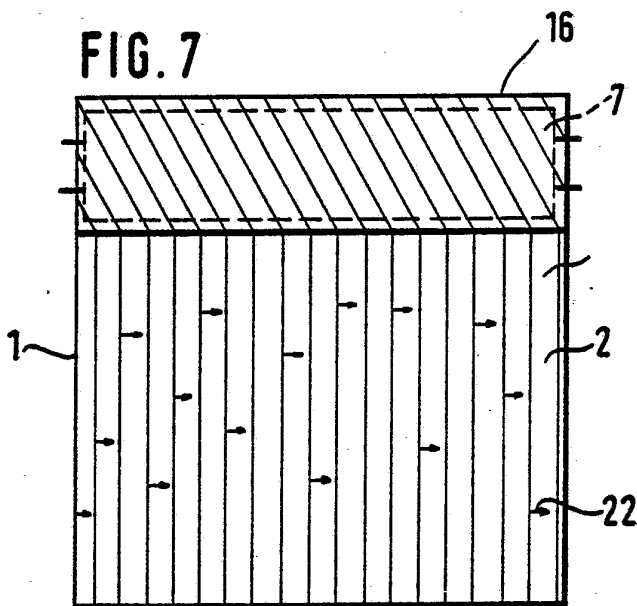


FIG. 7

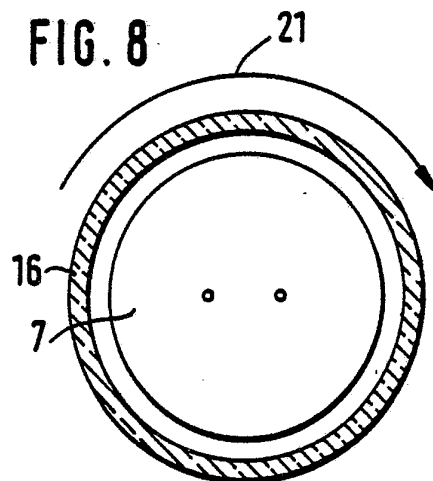


FIG. 8

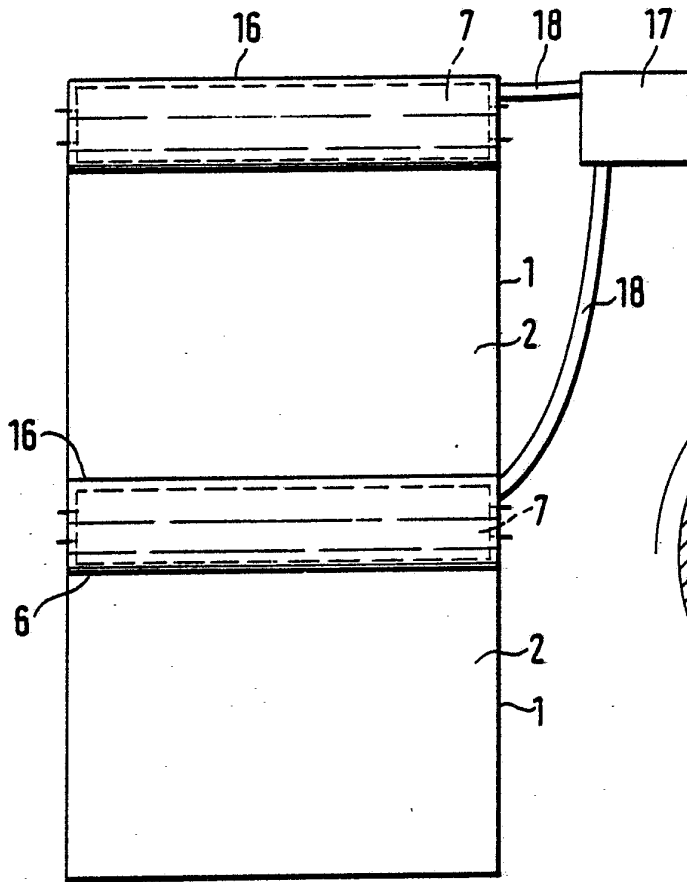


FIG. 9

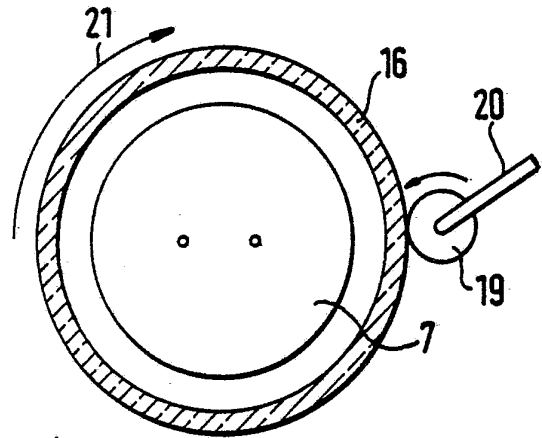


FIG. 10

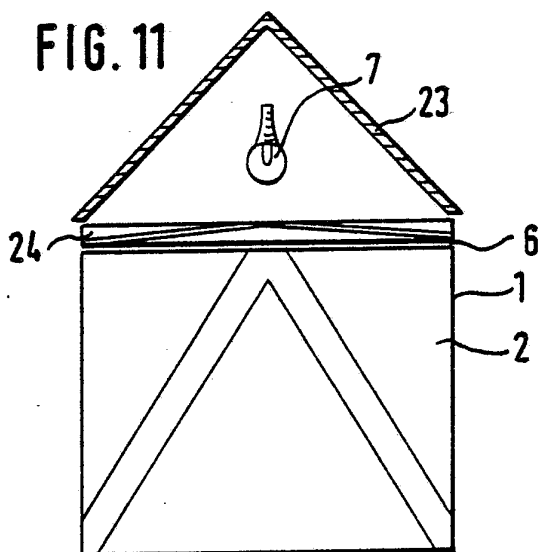


FIG. 11

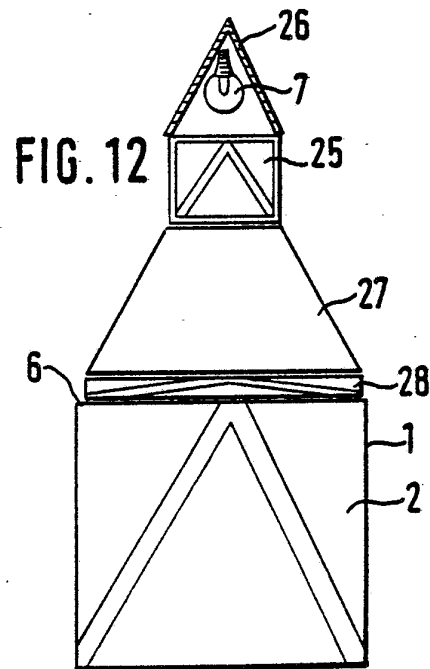


FIG. 12

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE84/00188

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ³		
According to International Patent Classification (IPC) or to both National Classification and IPC ³		
G 09 F 13/18		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁴		
Classification System	Classification Symbols	
IPC 3	F 21 V 5/00, 5/02, 7/00-7/12, 7/22, 13/00-13/14; G 01 D 11/28; G 01 R 1/08; G 02 B 5/00-5/04; G 09 F 13/00-13/14, 13/18; G 12 B 11/00, 11/02 .../...	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category ⁶	Citation of Document , ¹⁵ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
X, Y	US, A, 2 347 665 (GB CHRISTENSEN AND C CHRISTENSEN) 2 May 1944, see especially figures 7-10, page 4, left column, line 54-right column, line 9 and page 2, right column, line 31-page 3, left column, line 9.	
X, Y	US, A, 4 385 343 (G W PLUMLY) 24 May 1983 & NL, 7909316 FR, 2445485 GB, 2039405 DE, 2951471 AU, 54158/79 JP, 55098779	
Y	US, A, 4 059 916 (N TACHIYAMA ET AL) 29 November 1977, see especially figures 16 and 20. & JP, 51088042 JP, 52017548 JP, 51141236 JP, 51144372 JP, 52049328 .../...	
<p>¹⁹ * Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search ¹	Date of Mailing of this International Search Report ²	
1984-08-08	1984-08-13	
International Searching Authority ¹	Signature of Authorized Officer ²⁰	
Swedish Patent Office	<i>Rune Larsson</i> Rune Larsson	

K.L.

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

II

Fields Searched (cont)

US CI 40: 130-134, 541, 546, 547,
553, 558, 563; 116: 250,
251, 256, 257, 263, 286;
240: 2.1; 250: 227; 362: 23,
26, 27, 29-32, 103, 317,
326-361.

National CI 54h: 2/01, 2/02, 2/04, 4, 5

V. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹⁰

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. Claim numbers because they relate to subject matter¹² not required to be searched by this Authority, namely:

2. Claim numbers because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out¹³, specifically:

VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ¹¹

This International Searching Authority found multiple inventions in this international application as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

The additional search fees were accompanied by applicant's protest.

No protest accompanied the payment of additional search fees.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No ¹⁸
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