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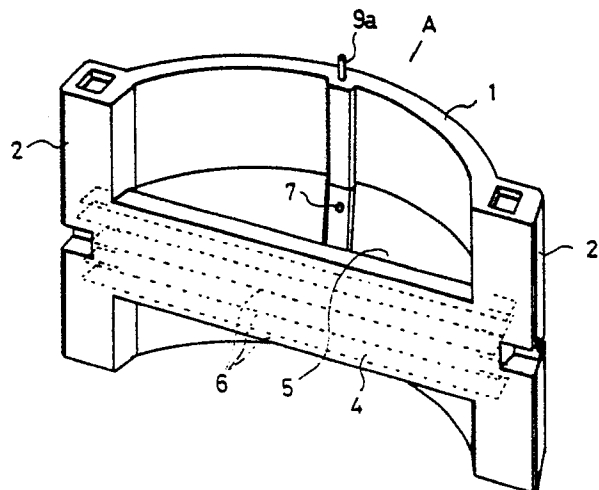
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54 **Retaining panel.**

57 The present invention relates to a retaining panel used for constructing a retaining wall to prevent a slope from collapse in the civil engineering field. The retaining panel according to the present invention uses reinforcements instead of PC steel members. The retaining panel comprises an arcuate arch portion, a horizontal bottom wall provided inside the arch portion and a reinforcing portion stretched chordally to the arch portion at a right angle with respect to the bottom wall. A rack portion surrounded by the arch portion, bottom wall and reinforcing portion is formed. The reinforcing portion has a plurality of reinforcements disposed chordally to the arch portion. The reinforcements bear tensile force to prevent the arch portion of the panel from displacement. The reinforcements will do so long as they are disposed, so that high degree of technique is not needed.

FIG.1



**EP 0 278 145 A1**

## RETAINING PANEL

This invention relates to a retaining panel for preventing collapse or movement of ground, e.g. having a slope or the like, and more particularly to such a retaining panel having an arch-type construction.

The present inventor has previously disclosed various inventions relating to a retaining panel having an arch-type construction. The inventor has already described how the arch-type construction has certain advantages, not only in tunnel construction but also for retaining panels.

Above all, as shown in Figs. 9 to 11, the inventor has disclosed a retaining panel, in which a PC steel member b is chordally stretched across an arcuate arch portion a to give prestress force thereto, and wherein the displacement of the arch portion a due to earth pressure is prevented or reduced by the prestress force, thereby to reduce the occurrence of cracks so that such a panel can bear large earth pressure.

The introduction of such a prestress force needs high degree engineering, and a great deal of labour and time are required for production of the panel, thus leading to increased production cost.

Further, as shown in Fig. 11, the present inventor has disclosed that a single PC steel member extends through a plurality of panels to be integrally fixed thereto and that prestress force is given at one time and as a whole. However, problems are encountered in such invention. For example, when the vertical positions of the panels are even a little displaced, as shown in Fig. 12, it is very difficult to provide the prestress force by extending the PC steel member through the panels. In addition, as shown in Fig. 13, similar problems are encountered when the panels are disposed on a curve.

Further, extremely high professional techniques and skilled operators are indispensably necessary to provide the prestress force.

Further, as shown in Fig. 14, when a PC steel member extends through a plurality of panels to give prestress force integrally, frictional resistance qr is produced on the bottom of the panels due to the own weight W thereof. In this way, the prestress force acting on the panel at the central portion is reduced due to the frictional resistance qr<sub>1</sub>, qr<sub>2</sub>, qr<sub>3</sub>, .... When the prestress force acting on the panels at the opposite ends is 100%, the prestress force acting on the panel at the central portion is reduced to 100 - α%. Accordingly, a problem is encountered in providing a plurality of panels with a prestress force integrally.

In a retaining panel according to the present invention the retaining panel comprises an arcuate

arch portion, a horizontal wall provided inside the arch portion and a reinforcing portion chordally stretched to the arch portion at a right angle with respect to the wall.

5 A rack portion is defined by the arch portion, the wall and the reinforcing portion.

The reinforcing portion has a plurality of reinforcements disposed chordally to the arch portion.

10 The reinforcements bear tensile force to prevent the arch portion of the panel from displacement. The reinforcements will suffice so long as they are disposed and high degree of technique is not required.

15 The retaining panel according to the present invention comprises an arcuate arch portion having a reinforcing portion in which the reinforcements are disposed. Therefore, the following effects can be obtained:

20 (a) Since the retaining panel has an arcuate arch portion and receives earth pressure upon the arch of the arch portion, a large proof-stress retaining panel may be provided. Experiments show that the panel has 5 times or more proof-stress than a prior flat panel using the same volume of concrete, or 10 times or more proof-stress according to conditions.

25 (b) Compared with the flat panel, a panel according to the present invention uses smaller amount of concrete, thereby markedly to reduce the weight so that transportation and execution may be extremely facilitated.

30 (c) Since this panel has a reinforcing portion in which reinforcements are disposed, the reinforcements bear the tensile force acting on the arch portion to prevent the panel from undergoing horizontal displacement, thereby to provide a panel having high mechanical strength and durability. Such a panel can achieve a durability similar to that of the case of using the PC steel member to give the prestress force.

35 (d) The reinforcements will suffice so long as they are disposed, so that high degree of technique in providing prestress is not needed, thereby making it possible to produce the panel economically.

40 (e) The execution is facilitated without giving the prestress force in a site while skilled operators are not needed.

45 (f) Earth and sand can be packed in the rack portion for planting to improve the external appearance while the environment can be beautified. Also, cracks are less liable to take place and the surface of the panel can be maintained beautifully for a long time without stains.

(g) A high economy panel can be provided since the mechanical strength of concrete can be somewhat increased as the earth load is increased, particularly without changing the thickness of the panel and the proof stress of the panel can be improved only by increasing the number of thickness of reinforcements without changing the mold.

(h) The prestress force is not given to the panel at the site and the frictional resistance produced on the bottom of the panels may not affect the panel.

#### Brief Description of the Drawings:

Fig. 1 is a perspective view showing an embodiment of a retaining panel according to the present invention;

Fig. 2 is a longitudinal sectional view showing the embodiment;

Fig. 3 is a longitudinal sectional view showing a different embodiment;

Fig. 4 is a perspective view showing a further embodiment;

Fig. 5 is a longitudinal sectional view showing the embodiment shown in Fig. 4;

Fig. 6 is a plan view showing an anchor;

Fig. 7 is a sectional view taken along line VII-VII in Fig. 6;

Fig. 8 is a perspective view showing the execution condition;

Fig. 9 is a perspective view showing a yet further embodiment;

Fig. 10 is a longitudinal sectional view showing the embodiment shown in Fig. 9; and

Figs. 11 to 14 are views for explaining prior art, respectively.

Referring to the Figures, reference symbol A designates a retaining panel according to the present invention and reference numeral 1 an arcuate arch portion. The arch portion 1 is formed on both left and right ends with prismatic support portions 2,2 and on the inside with a horizontal bottom wall 3. A reinforcing portion 4 is stretched chordally across the arch portion 1 at a right angle with respect to the bottom wall 3.

A rack portion 5 providing a groove-like space is formed by the arch portion 1, bottom wall 3 and reinforcing portion 4.

In said reinforcing portion 4 are disposed a plurality of reinforcements 6 stretched chordally to the arch portion 1 and spaced horizontally from each other. Both left and right ends of the reinforcements 6 are bent in the form of a hook in the support portions 2,2 without staggering in the support portions 2,2. The reinforcements 6 may be provided with end mounting nuts instead of having their ends bent.

In the Figures, reference numerals 7,8 designate drip holes. Also, a positioning member 9a projects intermediate the left and right upper surface of the arch portion 1, and a hole 9b is provided in the lower surface.

For installing the retaining panel A thus constituted on the natural ground an anchor 10 is used, as shown in Figs. 6 and 7. The anchor 10 comprises a steel anchor member 12 extending through a sheath 11. The sheath 11 is made of synthetic resin or the like and has a plurality of large width expanded portions 13. The width w of the expanded portion 13 is 3 to 10 times the height. The sheath 11 is packed with grout materials.

This anchor 10 is embedded in a backing or infill 15 and the retaining panel A is fixed by a nut 14. The backings 15 are sequentially stacked on the anchors 10 and then the anchors 10 are provided on the backings to fix the retaining panel A. Operations noted above are repeated for fixing the retaining panels (Fig. 8).

The rack portion 2 is packed with earth and sand to permit planting so that the external appearance is improved and the environment can be beautified.

When the earth pressure acts on the panel A, force will act to open the arch portion 1 in the left and right directions since the left and right ends of the panel are fixed by the anchors 10. This force acts as tensile force on the concrete of the arch portion 1. However, since the reinforcing portion 4 in which the reinforcements 6 are disposed exists, the reinforcements 6 bear the tensile force to prevent the arch portion 1 from undergoing horizontal displacement.

Accordingly, the mechanical strength of the retaining panel A may be improved to prevent or minimise the occurrence of cracks.

The presence of the reinforcing portion 4 in which the reinforcements 6 are disposed enables the panel A to be used for a high mechanical strength and durability panel since the reinforcements 6 bear the tensile force acting on the panel A. In addition, it may be used for a panel A having the beautiful external appearance.

Fig. 3 shows the large reinforcing portion 4 formed above and below the bottom wall 3.

Figs. 4 and 5 show the rack portion 5 formed on the lower end of the retaining panel A.

The present invention may be used for constructing a retaining wall to prevent a slope from collapse in the civil engineering field and further embodied in the production field of concrete products manufactured in factories.

**Claims**

1. A retaining panel comprising:  
 an arcuate arch portion;  
 a horizontal wall provided inside said arch  
 portion; 5  
 a reinforcing portion chordally stretched to the  
 arch portion substantially at right angles with re-  
 spect to said wall;  
 a rack portion defined by said arch portion, 10  
 said wall and said reinforcing portion; and  
 a plurality of reinforcements disposed chor-  
 dally to the arch portion in said reinforcing portion.
2. A retaining panel according to Claim 1,  
 wherein an end of a said reinforcement is bent in 15  
 the form of a hook.
3. A retaining panel according to Claim 1,  
 wherein a nut is mounted on the end of a said  
 reinforcement.
4. A retaining panel according to any of Claims 20  
 1 to 3, wherein the rack portion is packed with  
 earth and sand for planting.
5. A retaining panel according to any one of  
 the preceding claims, wherein said horizontal wall  
 is located at the base of said arch portion. 25
6. A retaining panel according to any one of  
 the preceding claims, wherein means are provided  
 for anchoring said panel to a slope, said means  
 comprising a longitudinally extending steel member  
 and a sheath of synthetic resin surrounding said 30  
 steel member and having anchoring portions of  
 increased width located at longitudinal intervals  
 therealong.
7. A retaining wall for preventing the collapse  
 or movement of ground, which wall comprises a 35  
 plurality of retaining panels as defined in any one  
 of the preceding claims, said panels being ar-  
 ranged adjacent to each other to provide a gen-  
 erally planar continuous wall.

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FIG. 1

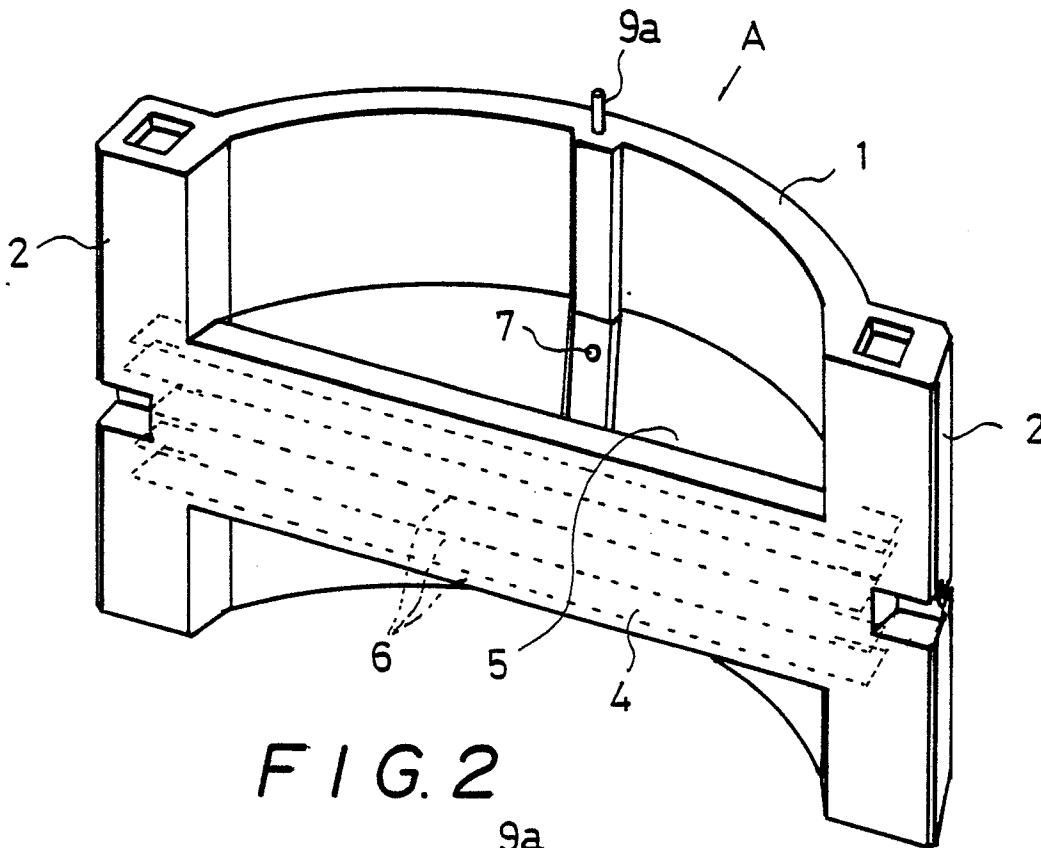


FIG. 2

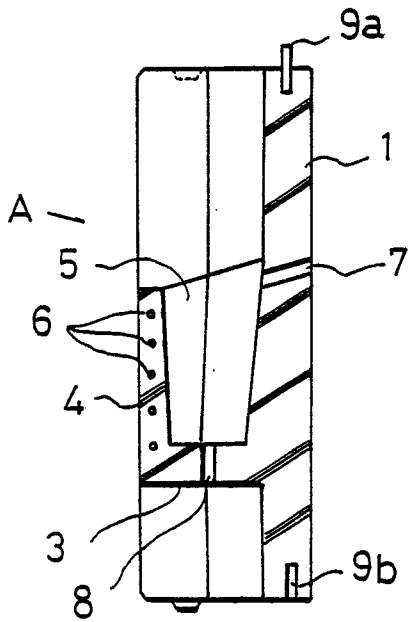


FIG. 3

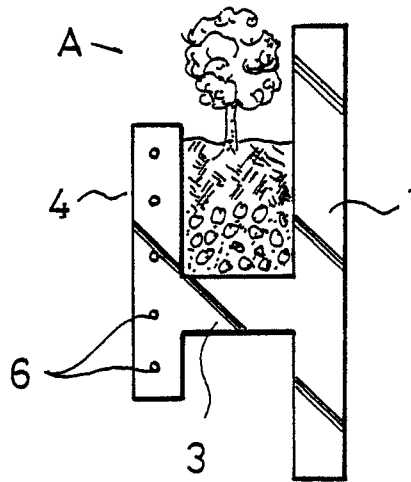


FIG. 4

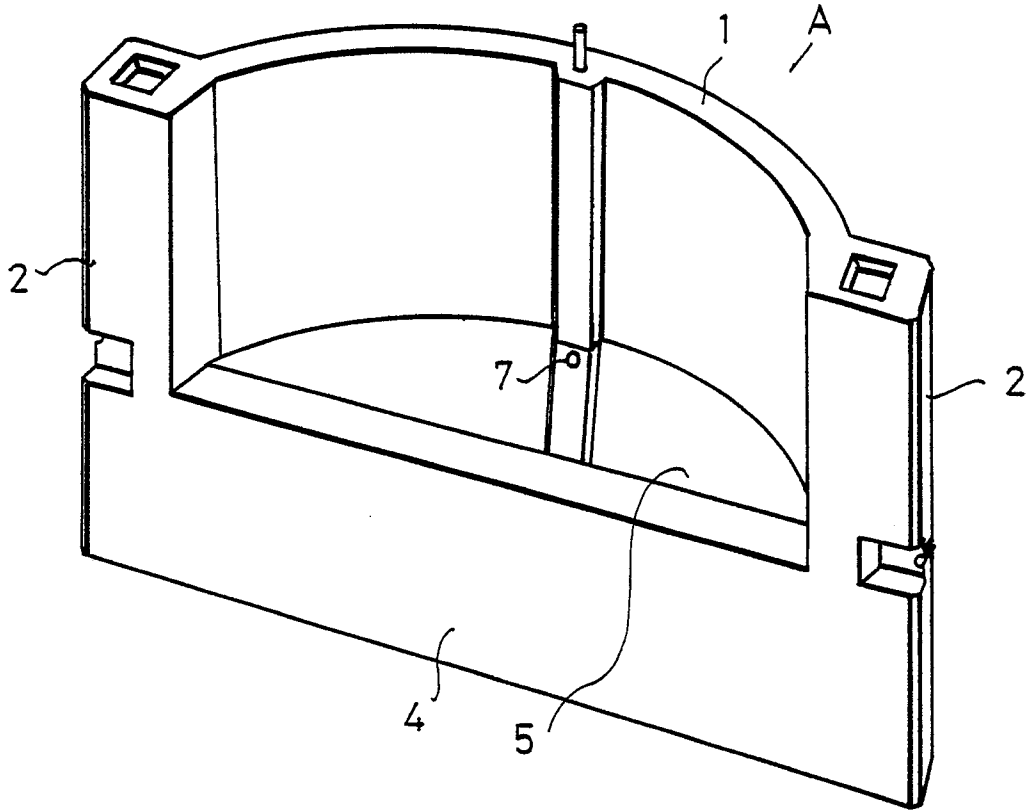


FIG. 5

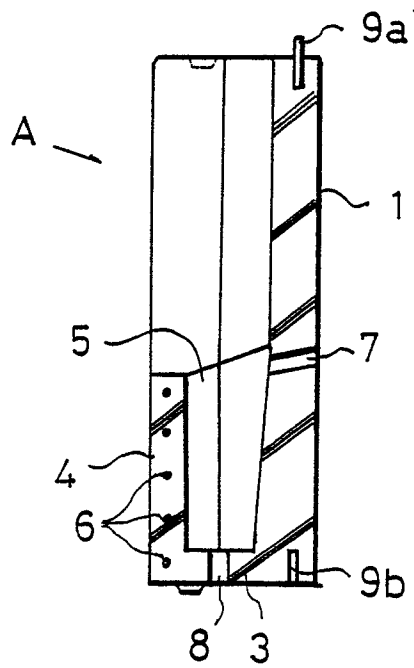


FIG. 6

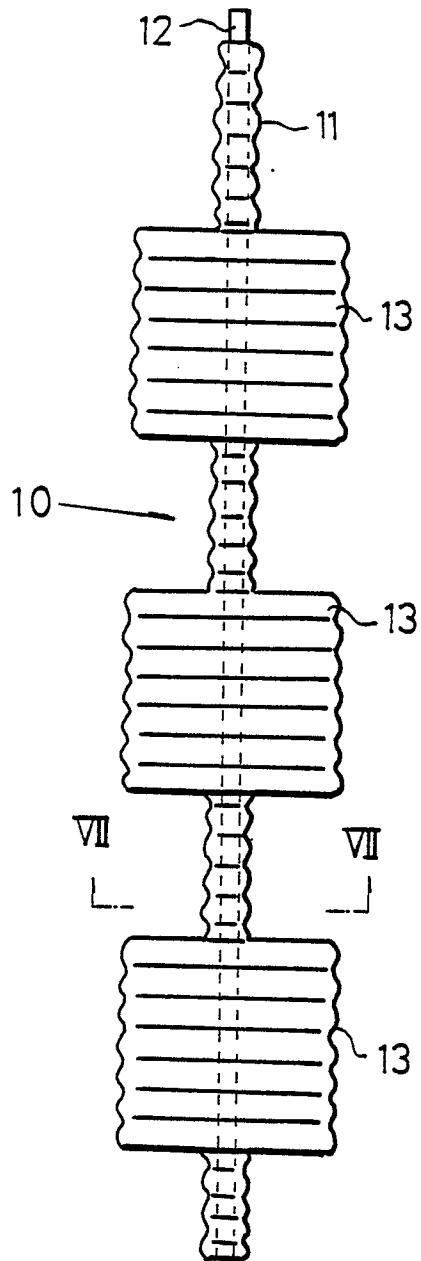
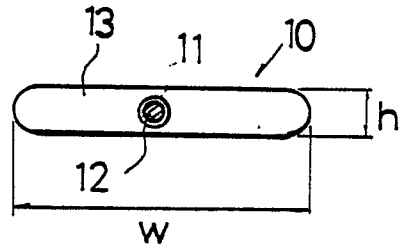


FIG. 7



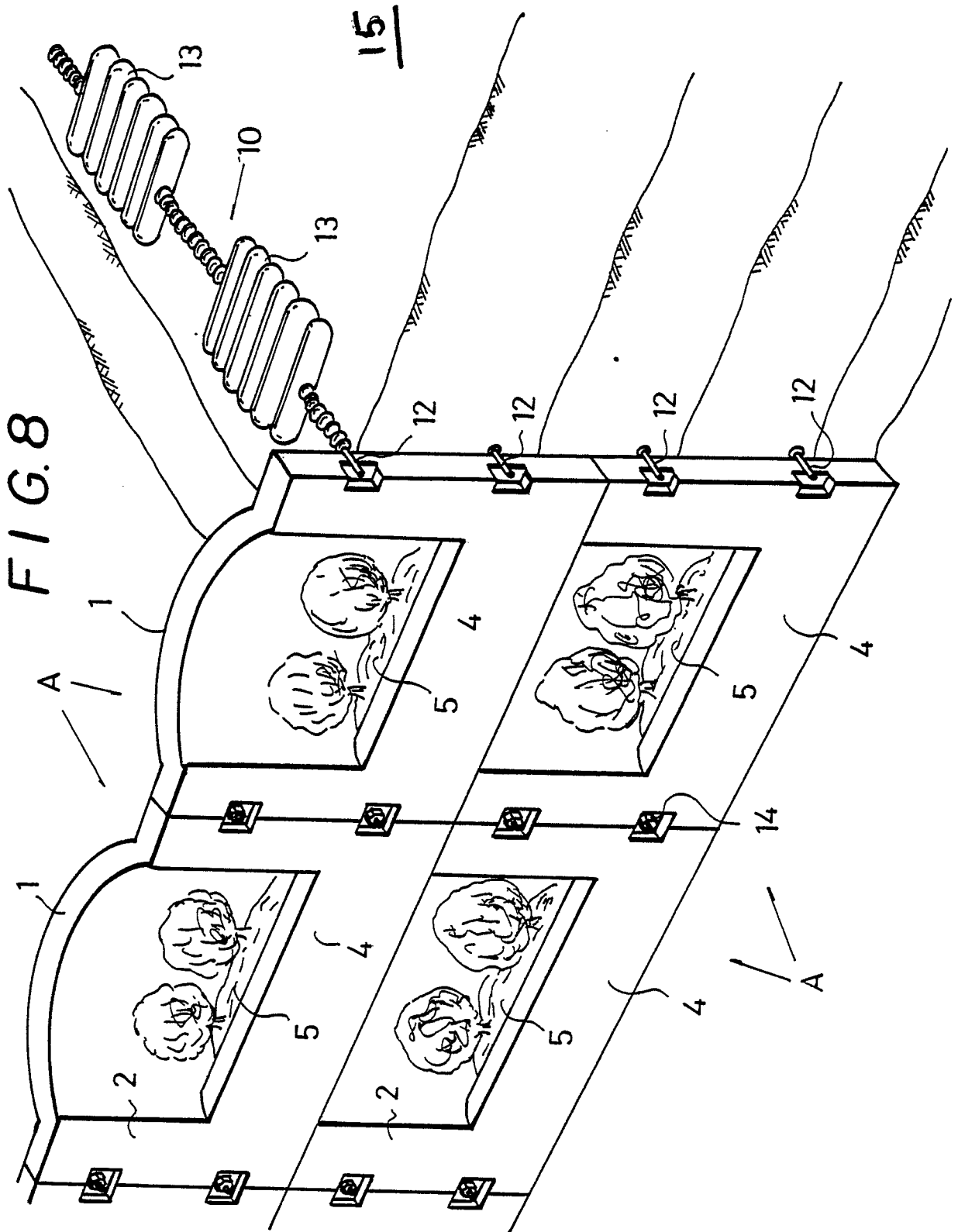




FIG. 9

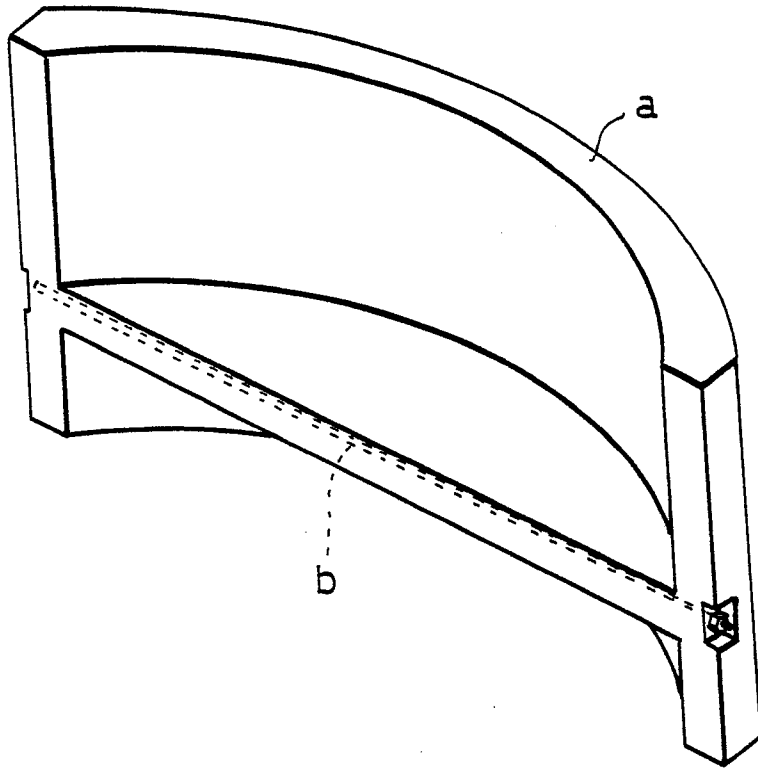


FIG. 10

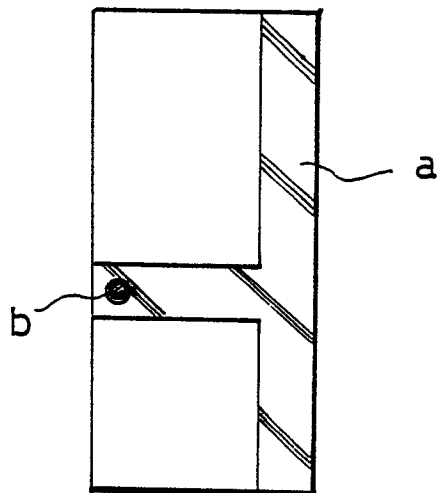


FIG.11

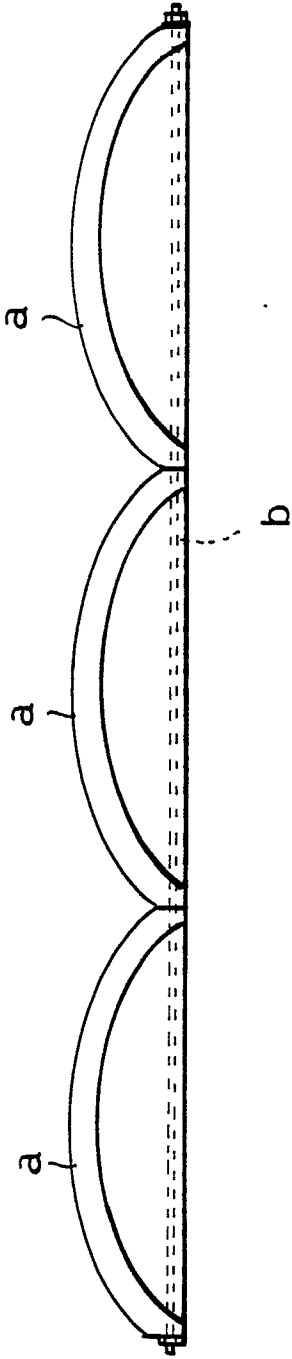


FIG.12

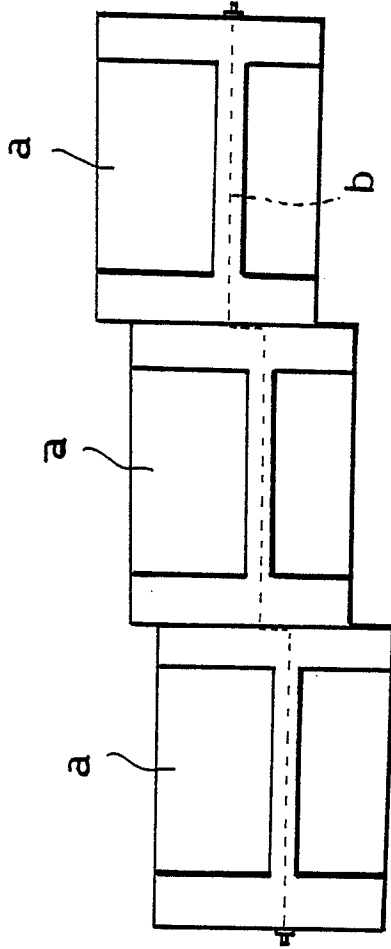


FIG.13

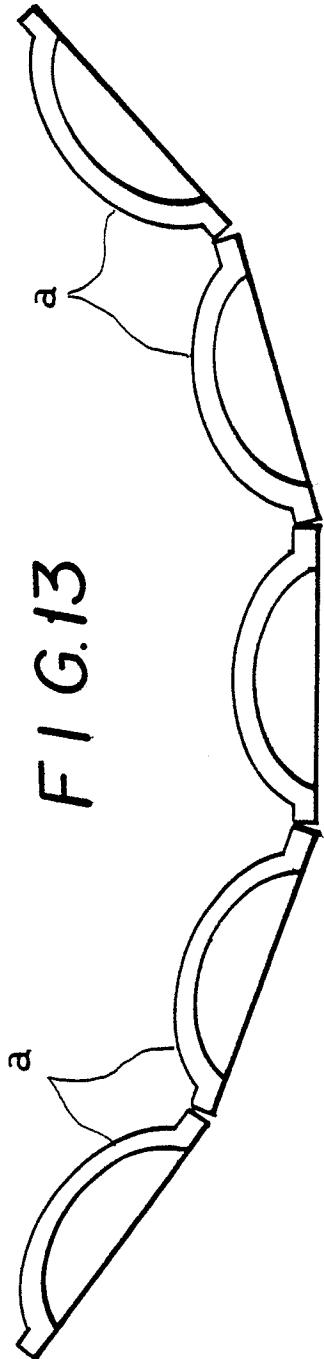
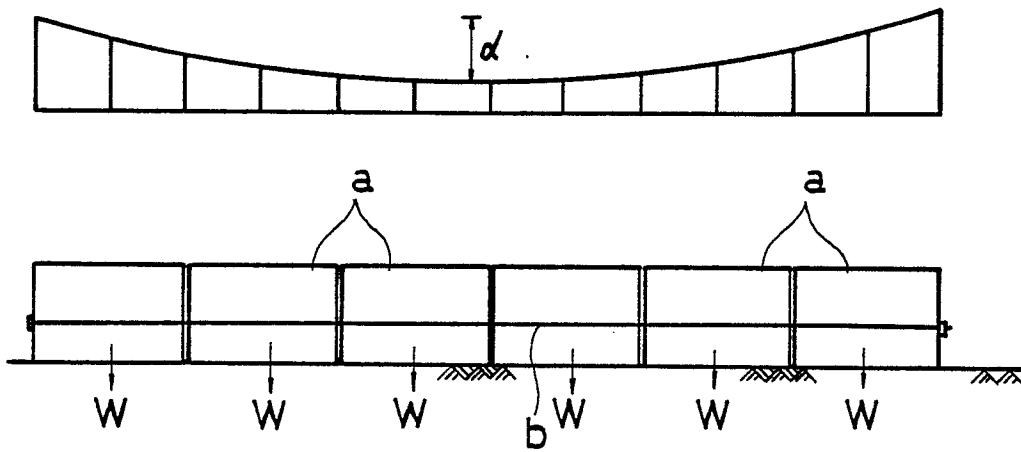


FIG. 14





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.4)
A	JP-A-61 266 735 (KENSETSU KISO) * Whole document *	1, 3-5, 7	E 02 D 29/02
A	US-A-3 922 864 (HILFIKER) * Column 2, lines 6-67; figures 1, 3 *	2, 6	
A	GB-A-2 157 737 (RYDER)		
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			E 02 D E 04 C E 02 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12-11-1987	Examiner KERGUENO J.P.D.
CATEGORY OF CITED DOCUMENTS		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	
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		& : member of the same patent family, corresponding document	