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(54) **Vaulted acoustic element.**

(57) Structural element for providing a limiting surface of a room or a part of a room, in particular an element for ceilings, walls and similar parts of industrial premises, office premises etc., and comprising a vaulted supporting layer, preferably a perforated layer (6) of sheet metal, plastic, cross veneer, particle board or an equivalent material, which on the surface thereof facing the room carries a porous, preferably light coloured layer (7) of for instance glass fibre vlies or woven glass fibre, which layer covers at least the largest portion supporting layer (6), and which is attached thereto by means of glue, double sticking tape or a similar attachment means.

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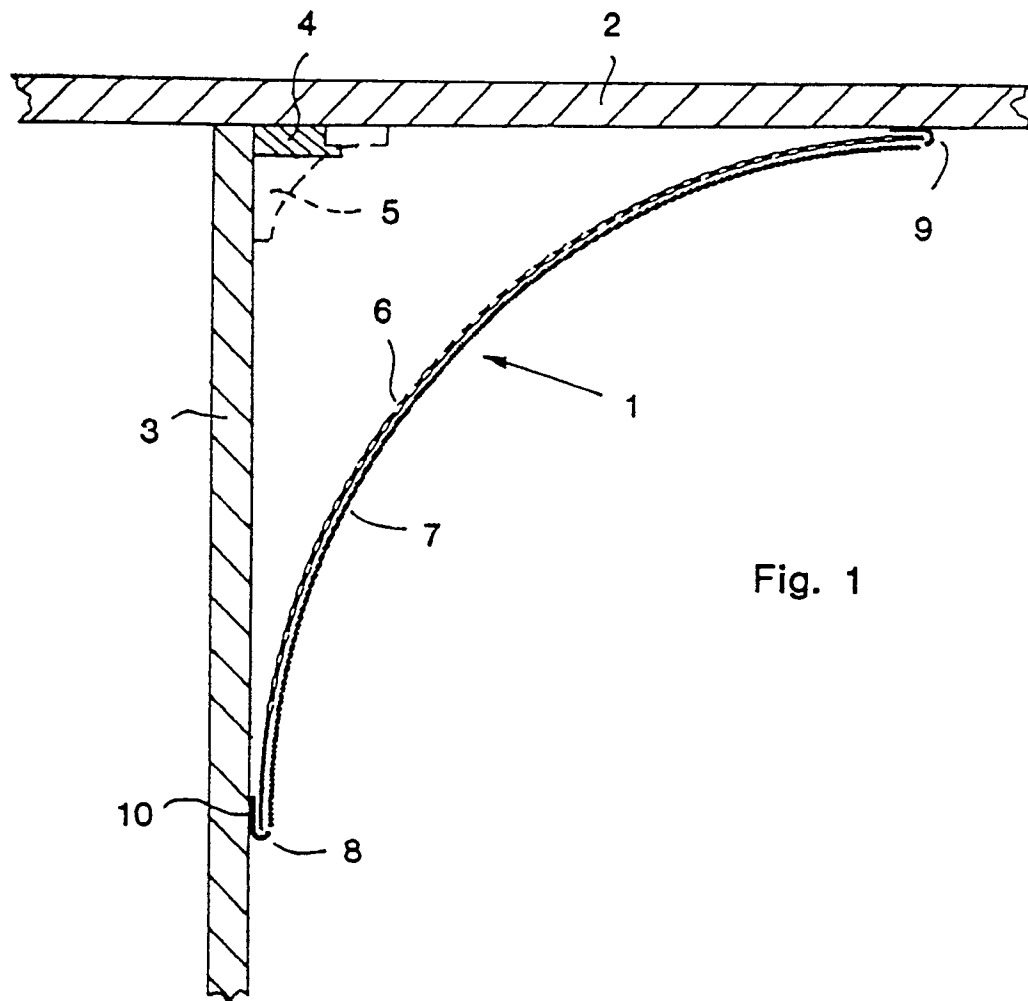


Fig. 1

The present invention relates to a structural element for providing a limiting surface of a room or of a part of a room, in particular of a ceiling of industrial premises, but also of walls and other structural means, and the invention is more particularly directed to a sound insulating element for the said purpose.

The noise level often is high in factory premises and other production premises, and it is a constant aim to reduce the noise level by any means, thereby improving the noise climate of such premises, for instance by sound insulating both machines and localities. There are often also acoustic problems in different types of office premises.

Generally it is desirable to meet aesthetic requirements for the structural elements, and in combination thereto it is desirable that the elements have a good ability of damping noise and to improve the acoustical conditions of the premises.

In many cases, for instance in large manufacturing premises, in office landscapes etc. it is desirable to provide a type of indirect acoustical and optical partitioning of the premises into smaller units without the use of obstructing and disturbing partition walls. An optical partitioning of the room can be established by more frequently using light reflecting elements for making it possible to provide an indirect illumination. Such light reflecting elements thereby also can be formed so as to likewise provide a sound absorbing or sound reflecting activity. The elements adjacent the ceiling are of great importance. When designing said elements it has to be considered that it must be easy to clean the elements, since the light reflection easily is impaired by dirt. In addition to the optical, acoustical and aesthetical demands said elements also should have a low weight, and it should be easy to mount the elements.

To an increasing extent vaulted plate elements have been used as part elements of the ceiling of premises. Such elements can easily be cleaned and the elements can be formed with a lasting light reflecting capacity. Such elements, however, have no sound absorption property.

The invention is intended to solve this problem and to provide a vaulted or cup-shaped structural element suited for being used, in particular, as a kind of cavetto-like element in the construction of ceilings or parts of ceilings of industrial premises and large office premises etc., and which element should have both light reflecting and sound absorbing properties. Of course it also should be possible to use the element for other purposes, for instance as corner elements in wall corners, as free-standing elements which separately or in pairs have light reflecting and sound absorbing properties and are mounted in ceilings and on walls etc.

According to the invention the structural element is vaulted or cup-formed and comprises a curved, supporting layer of sheet metal, plastic or a similar thin

and lightweight material. On its concave inner surface, that is the surface of the element which is facing the interior of the room, said supporting plate layer has a porous layer, which covers at least the largest portion of the supporting plate surface, and which is connected to said surface by a glue joint.

For improving the acoustic properties of the element, and for giving the element a low weight the supporting plate layer preferably is perforated. From optical viewpoint the porous inner layer preferably also should be colour which is light enough to well reflect the incoming light.

Now the invention is to be described more closely in connection to the accompanying drawings, which show some preferred embodiments and applications of structural elements according to the invention.

Figure 1 shows a transversal cross section through a simple embodiment of a structural element according to the invention. Figure 2 correspondingly shows a similar structural element which along the edges thereof are formed with strengthening box profiles, and figure 3 shows an alternative embodiment of a such strengthened element. Figure 4 shows an application in which an element according to the invention, formed with longitudinally extending strengthening boxes, is connected with further plate elements along said two boxes. Figure 5 is a vertical view of an element used also for illumination purposes, and figure 6, finally, is a perspective view of the element of figure 5.

The structural element 1 shown in the drawings is formed as a vaulted or curved element, which in the first place is intended to be mounted free-hanging from the ceiling, free-standing on the floor or mounted in the angle between a ceiling 2 and a wall 3, or between two walls, or between two other elements which are connected to each other in an angular configuration, and whereby the ceiling 2 and the wall 3, or the two walls respectively, are joined over an angle of about 90°. It is, however, obvious to the expert that the element easily can be arranged for being connected between building elements which form both greater and less angle to each other than a right angle, and that the structural element 1, depending on the size of the element, also can be mounted over and covering an available shade ledge or a cavetto 5. It is also obvious that the structural element 1 can be mounted against acoustic plates already present on the wall or the ceiling, or against any other wall or ceiling elements.

Generally the structural element comprises a supporting plate element 6, which on its concave side, that is the side of the element facing the room, carries a layer 7 which covers at least the largest part of the plate element 6 and the purpose of which is to provide both a sound damping and a light reflecting layer on the plate element 6.

By "plate element" is meant, in this connection, a

supporting element of any type of material having a sufficient pliability and strength for being formed and mounted as illustrated, for instance an element of sheet steel or other sheet metal material, plastic, cross veneer, mould-baked particle board etc.

A plate element of steel or other metal, for instance of galvanized sheet iron or of aluminum can have a thickness of 0,3 - 2 mm depending on the size of the element. An element of a plastic material ought to be somewhat thicker than an element of metal plate, and an element of veneer, particle board or other wooden material ought to be still thicker. An element of sheet metal preferably should be perforated, both in order to improve the sound damping properties and also to reduce the weight of the element as much as possible. The perforation can be in the form of through bores, for instance circular bores spaced in a triangle shape in relation to each other, or slots or otherwise formed perforations, and so that the plate element gets an open or perforated area of about 15-50%. The element can be made in any optional sizes, for instance with widths of from 100 mm to about 3.000 mm.

The sound damping and light reflecting inner layer 7 preferably is a porous layer, for instance a layer of woven glass fabric or glass fibre vlies having a weight of between 10 and 300 g/m<sup>2</sup> or preferably between 50 and 150 g/m<sup>2</sup>. Preferably the inner layer 7 is painted with a light colour so as to get a good light reflecting ability. It also ought to have a relatively smooth surface so that dust does not stick so easily to the surface and so that the surface can be dedusted and wiped off if needed.

The inner layer 7 preferably should cover as large part of the inner surface of the supporting element as possible and it can be attached to the support surface by means of glue, double sticking tape or in any corresponding way.

The combined structural element can be manufactured as an endless path which is cut into pieces as desired. The width of the element can be varied but a suitable width is between 100 and 3000 mm. The element is vaulted in the cross direction so as to form an elongated, curved element. Along each longitudinal edge the element is formed with some kind of strengthening means, which can also be used as a mounting element 8 and 9 respectively, by means of which the structural element can be mounted for instance between the ceiling 2 and the wall 3. In the most simple form said strengthening means or mounting means can consist of double edges which are folded rearwards (from the insulation element 7), or it can be a separate U-shaped bar 10 as shown in figure 1, which can be nailed or otherwise fixed connected to the ceiling 2 and the wall 3 with the open grooves thereof facing each other. The combined element is mounted by being being bowed like an arc and by being introduced in the U-shaped grooves of said

mounting bars 10 in which position the element is pressed into engagement by its own spring action.

The supporting, perforated layer 6 and the porous layer 7 are preferably formed so that the combined element gets a flow resistance of between 250 and 2000 Ns/m<sup>2</sup>.

Figure 2 shows a structural element 1', which along the longitudinal edges thereof is formed with box shaped strengthening and mounting elements 8' and 9', which can be glued, nailed and screwed etc. to the ceiling and to the walls respectively. Said box shaped strengthening elements 8' and 9' can be formed "lying" as shown in figure 2, or they can be formed "standing" as shown in figure 3, whereby the support plate 6 is bowed outwards from the porous layer 7 in an angle of about 90°.

Figure 4 illustrates how a structural element 1'' according to the invention can be used for instance as a vertical corner element bridging two wall elements 11 and 12. In order to give the structure as small visible joints as possible the longitudinal edges of the support layer 6'' is formed with an S-shaped bending 13, which with its lower bending part 14 covers half the width of the strengthening box 8'' and 9'' respectively, and the wall elements 11 and 12 are formed with similar S-bendings 15 (element 11) or spiral-formed bendings 16 (element 12), by means of which the wall elements 11 and 12 become joined with the corner element 1'' so that the elements nearly contact each other with their S-shaped bendings and so that there are as small visible joints as possible.

In a special embodiment of the invention, shown in figures 5 and 6, at least one of the box-shaped strengthening elements, the lower strengthening element of a horizontally hanging element, or eventually both strengthening elements, is formed as armatures for fluorescent tubes, which armatures can have a U-shaped cross section facing downwards, and can be formed with through bores in the bottom of the armature box, so that light is transmitted both inwards the concave inner surface 7 and out and down from the element, for instance so that the armatures get about 25% upwards directed light and 100% downwards directed light.

#### Reference numerals

1	structural element
2	ceiling
3	wall
4	shade ledge
5	cavetto
6	supporting plate
7	porous layer
8	strengthening bar
8'	box shaped strengthening (8")
9	strengthening bar
9'	box shaped strengthening (9")

- 10 mounting bar
- 11 wall
- 12 wall
- 13 S-bending
- 14 lower bending part (of 13)
- 15 lower bending part
- 16 spiral bending

#### Claims

1. Structural element for providing a sound absorbing and light reflecting limiting surface of a room or for a part of a room, in particular an element useful for ceilings, walls etc. of industrial premises, office premises etc., **characterized** in that the element comprises a vaulted supporting layer (6) of sheet metal, a plastic material, cross veneer, particle board or a similar material, which on its inwards to the room facing surface carries a porous, preferably light-coloured layer (7) which covers at least the largest portion of the supporting layer (6) and which is attached thereto by means of glue, double sticking tape or a similar attachment means.
2. Element according to claim 1, **characterized** in that the supporting layer (6) is perforated and preferably has a perforated, open area of 15-50%, comprising for instance circular bores spaced in a triangle shape from each other, through slots or similar perforations.
3. Element according to claim 1 or 2, **characterized** in that the supporting layer (6) is made of steel, galvanized iron, aluminum, or a so called sheet metal-plastic or any other sheet metal having a thickness of from 0,3 to 2 mm.
4. Element according to claim 1 or 2, **characterized** in that the element can be made in a width of from 100 to about 3000 mm.
5. Element according to any of the preceding claims, **characterized** in that the porous layer (7) is made of fibre glass vlies or of woven glass fibre.
6. Element according to claim 5, **characterized** in that the porous layer has a weight per square unit of between 10 and 300 g/m<sup>2</sup> or preferably between 50 and 150 g/m<sup>2</sup>.
7. Element according to any of the preceding claims, **characterized** in that the supporting layer (6) and the porous layer (7) of the combined element has a total flow resistance of between 250 and 2000 Ns/m<sup>2</sup>.

8. Element according to any of the preceding claims, **characterized** in that the vaulted element has longitudinally extending strengthening edges or portions.
9. Element according to claim 8, **characterized** in that the strengthening portions of the element are formed as mounting bars (10), by means of which the element can be mounted across the corner between a ceiling and a wall, between two angularly positioned walls etc.
10. Element according to claim 8, **characterized** in that the strengthening portions (8', 8'') of the element are formed as upright or lying longitudinally extending boxes having a rectangular cross section for mounting of the element against ceilings and walls, and with which similarly formed wall elements can be joined with the corner element.
11. Element according to claim 9, **characterized** in that at least one of the strengthening portions of each vaulted element is formed as elongated fluorescent tube armatures for transmitting light both to the inner concave layer (7) and out from the element respectively.

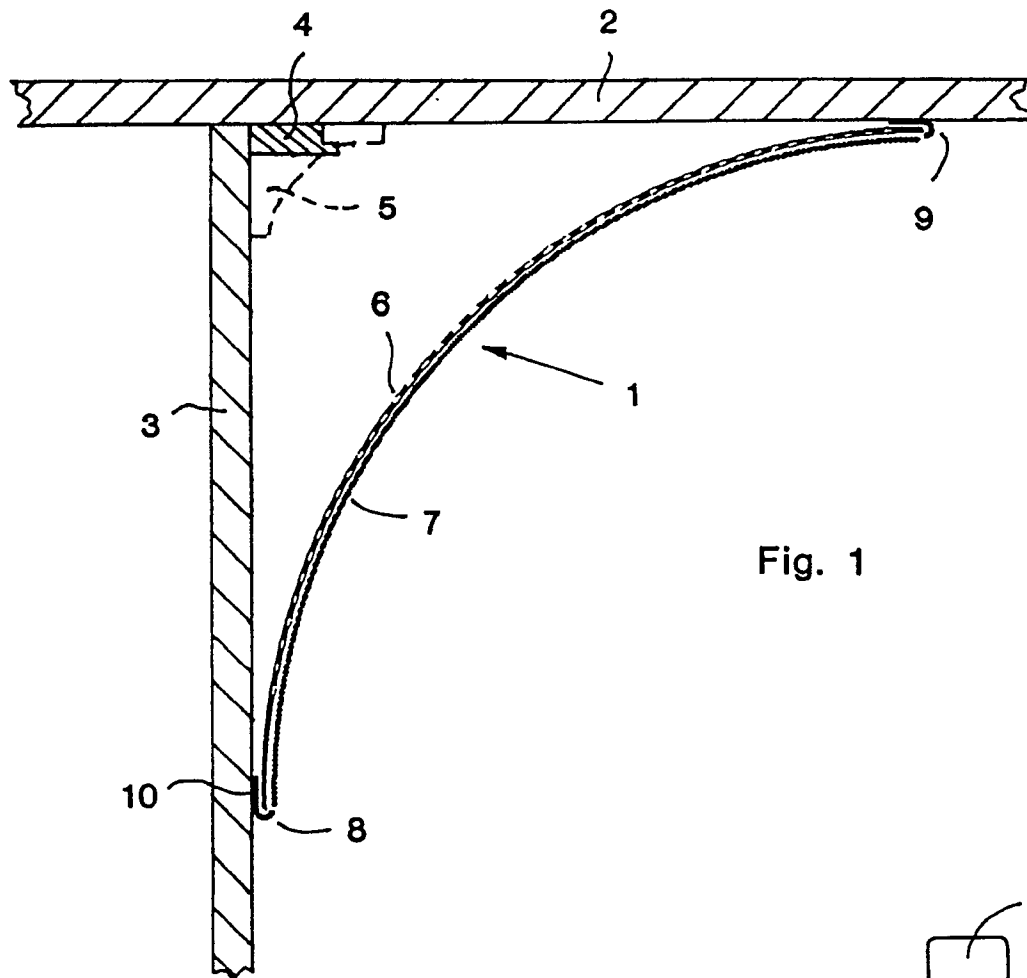


Fig. 1

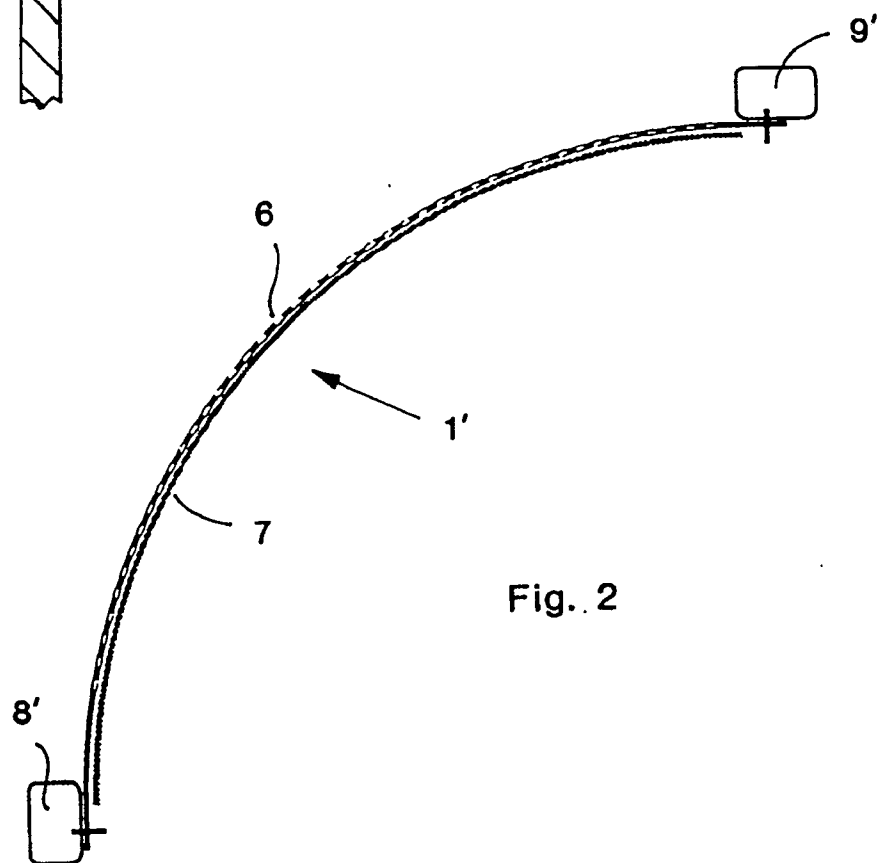
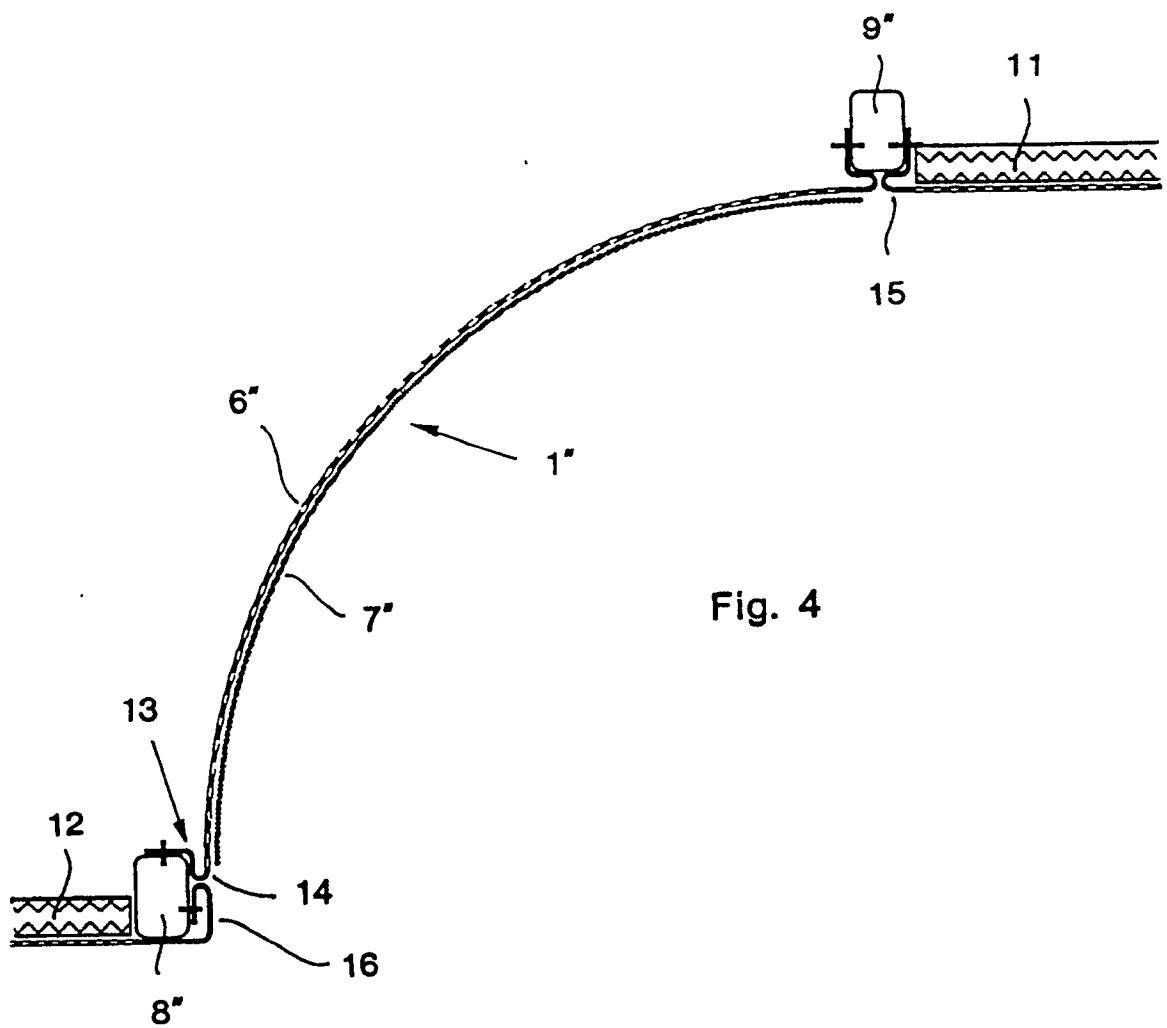
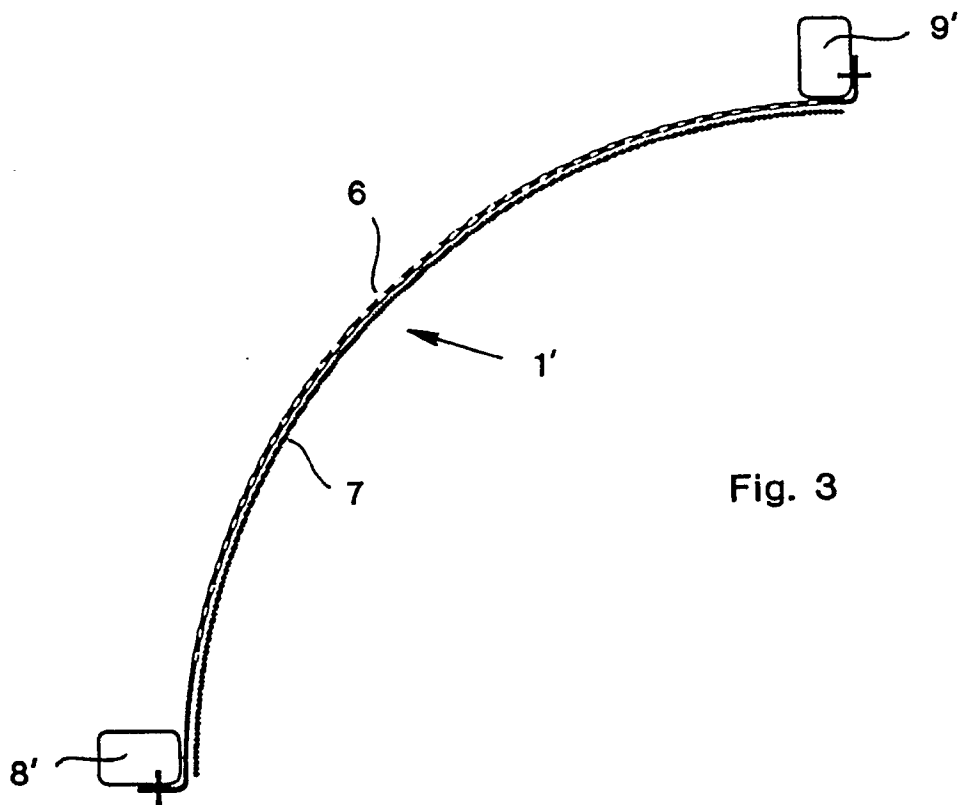


Fig. 2



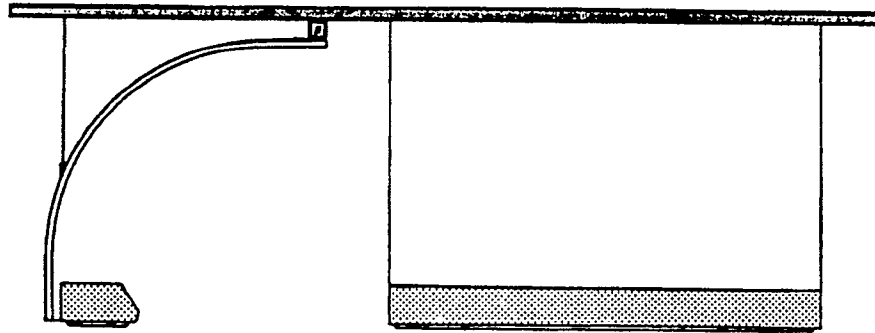


Fig. 5

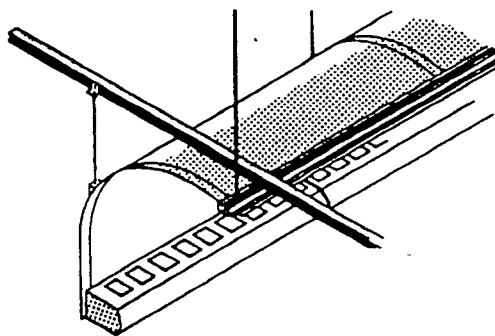


Fig. 6



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## EUROPEAN SEARCH REPORT

Application number  
EP 91850019.0

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.)
X	DE-C- 829 055 (GYPROC PRODUCTS LIMITED) *Page 2, lines 54-70, figures 1 and 2*	1,2	E 04 B 1/82
A	NO-B- 158 762 (BYGGNADSFYSIK A & K AB) *See claim 1*	1-11	
A	DE-A1-3 242 940 (H.J. SCHMITT) *See figure 1, details 1 and 2*		
A	GB-A- 2 191 518 (T.M. ECCLESHALL) *See figure 2, detail 33	1-11	
A	EP-A2-0 227 342 (CASEWARD LIMITED) *See figures 1 and 4*	1-11	
			TECHNICAL FIELDS SEARCHED (Int. Cl.)
			E 04 B E 04 F
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
STOCKHOLM		10-04-1991	JUVONEN V.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone		T : theory or principle underlying the invention	
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