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Remarks:

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(54) **Self-supporting construction system**

(57) Self-supporting construction system for comparatively large spans, basically consisting of a panel (1), e.g. an insulation panel, and one or more stiffening elements (2), such as an omega section, which in principle is mounted along the longitudinal axis of the panel

(1). According to the invention at least one slender or comparatively thin section (8, 10, 11, 16) has been fitted to the joint between the panel (1) and the stiffening element (2), in such a way that the composite system can perform every mechanical function of the supporting structures a building requires.

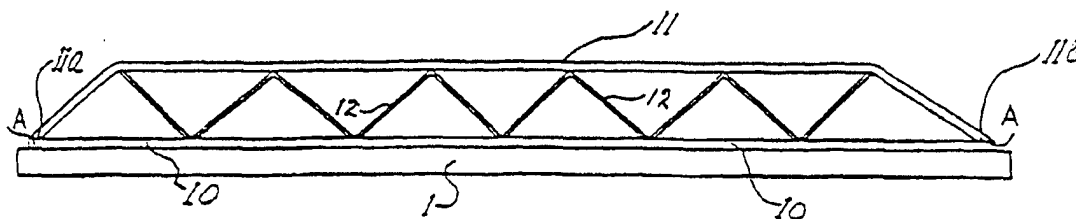


fig.3

Description

[0001] The present invention relates to a self-supporting construction system comprising a panel and at least one stiffening element which has been fixed to said panel along a longitudinal axis of said panel.

[0002] In most cases, a building in the (insulated) public utilities category consists of a supporting structure to which insulation covered panels are fitted. Often panels and insulation are combined into a supporting element in the shape of a sandwich panel. Because of the larger spans which are feasible with selfsupporting panels, it is possible to save on the required quantity of trusses or portals. Due to the reduction in weight of the structure which may so be obtained and the subsequent reduction in the required construction time, it is possible to save on the cost of the supporting structure. In a few cases this concept has been carried even further, viz. the sandwich panels have been provided with a rigid supporting element, a stiffening element, as a result of which the span per panel may increase substantially whereas the cost price and the weight of the supporting structure will decrease. The reduction in weight of the supporting structure, however, is followed by an increase in the weight of the panels resulting from the addition of the stiffening element, and consequently the net savings in the construction costs do not fully reflect what is saved on the supporting structure.

[0003] From FR-A-2418415 there is known a self-supporting construction system wherein the panel as well as the stiffening element is formed by a sandwich panel. Now, it is well known that under load the vertical leg of this system will often crossly turn-away or so-called tipping away. Indeed the fastening-nails of the L-shaped profiles will try to prevent this tipping, however, during load-fluctuations these nails will break off as practice has proven and obviously shall de-stabilise the system.

[0004] FR-A-2048158 disclose a skeleton for construction elements comprising upper and lower slender elements, which are staggered in a direction perpendicular to their length and with are interconnected by inclined members extending between the upper and lower slender elements.

[0005] The invention involves a construction system which not only uses stiffened panels but in which the supporting structure is also combined with the panels. This yields self-supporting elements of a design which allows building without a separate supporting structure. Subsequently it also turns out to be possible to save on building material consumption as well as on building costs.

[0006] Designs are possible in which the total weight of the superstructure for a hall with a free span of 20 m and a construction surface of 1000 m² will be approx. 25 kg/m². It is obvious that major savings in building material consumption are involved here. Since both the production and the construction require little effort, few

building facilities and few personnel, a quite sizeable reduction in costs of the total construction will be possible. Cost reductions in the order of 30-35% are feasible, as compared to the cheapest traditional construction methods.

[0007] The invention will be illustrated further by means of the figures, which will also demonstrate some advantageous embodiments.

Figure 1 shows an embodiment for a construction system;

Figure 2 shows an embodiment in accordance with figure 1, in which two panels were used;

Figure 3 shows a panel and stiffening element of the construction system in accordance with figure 1; Figures 4a-4c show various outside wall and roof structures using the construction system in accordance with the invention;

Figure 5 shows an embodiment in accordance with the principle illustrated in figure 1, yet using a single-walled panel.

[0008] According to figure 1, a (sandwich) panel 1 is stiffened and made into a supporting element by utilizing slender sections 10, 11 and 12, which are stabilized against buckling by panel 1 itself.

[0009] The roof and/or wall element according to figure 1 is composed as follows:

A panel 1 is provided with a slender section 10 which is placed on its upper layer 1a and which is secured in several spots. A second section 11 is arranged perpendicularly (in relation to upper surface 1a of section 1) above section 10, at some distance and parallel to it. Both sections 10 and 11 are interconnected by sections 12 which are fitted in a zig-zag fashion. By bending ends 11 a and 11 b, see figure 3, of section 11 towards section 10 on upper layer 1a, junction A, an advantageous combination of a panel-frame girder is obtained. The forces occurring when this combination is bent manifest themselves mainly as internal forces in the frame structure. The loads on the connection between frames or stiffening elements 10, 11, 12 and panel 1 will diminish because of the bending. It is obvious that when the structure bends, junctions A will have to transmit great forces from section 10 to section 11, as a result of the bending related relative changes in length between these sections. In fact here the force level is highest. The loads on sections 12, which are placed at an angle, are comparatively light, so that even lighter sections may be used here.

[0010] For a standard commercial width of panel 1 and for spans up to approximately 30 m, e.g. the following sections may be used:

Section 10: U-section 35/45/35*2

Section 11: round tube 38*1.5

Section 12: round tube 27*1.5

[0011] These comparatively thin sections are excellently capable of absorbing the forces without the permissible material stresses being exceeded. However, in order to prevent such a frame, already provided with insulation material, from being unable to supply the required bearing capacity and stiffness, when the stability limit is exceeded far before the permissible stresses are reached, due to buckling of the sections, steps are taken to obtain the required stability viz. by connecting members 13 from outermost section 11 to panel 1. The characteristic feature of the preferred embodiment is that members 13 are in a plane perpendicular to the frame formed by sections 10-12.

[0012] With respect to the stabilization of the embodiment according to figure 1 (and figure 2), one further remark should be made: by being secured to the upper or cover surface of panel 1, U-section 10 is stabilized in this plane by the upper surface itself. Perpendicular to this plane, stabilization is provided partly by (sandwich) panel 1 and partly by the slanting sections or members 12. By so fitting a sufficiently large number of slanting sections 12 and connections or members 13 to the upper surface of panel 1, sufficient stability for the required function can be obtained in two planes perpendicular to one another. Tubular section 11 obtains stability, in the direction perpendicular to the upper surface, through slanting sections 12. Since these sections are connected with panel 1, either directly or by means of section 10, the final stability in this direction is provided by panel 1. In the direction parallel to the upper surface the stability for section 11 may not be quite sufficient to warrant using the structure as such. By also placing members 13 at an angle, from section 11 to panel 1 and outside the plane of frame of stiffening element 10, 11, 12, section 11 is supported against the panel. The support component parallel to the upper surface provides stability in this direction.

[0013] As for the slender section construction, the embodiment according to figure 2 is equal to that according to figure a; the advantage, however, is that the round section 11 has been replaced by U-section 10, to which a further panel 1 is fitted. It turns out that this has a favourable effect on the bearing capacity of the frame thus obtained; said bearing capacity has increased by a factor 6-8. Finally, by stabilizing section 11 (section 10 in figure 1) the frame or stiffening element has also been stabilized sufficiently since sections/members 12 and 13 are sufficiently short in length to absorb the loads without buckling, without requiring any additional facilities.

[0014] An application of a construction system as shown e.g. in figure 1 is demonstrated in figures 4a-4c. The construction systems erected and interconnected form a segment of a hall. For a flat-roofed hall, figure

4b, the minimum is three construction systems; a saddle-roofed hall, figure 4a, requires a minimum of four construction systems. This embodiment also uses parts 17, which serve as tie-bars to interconnect sections 11 of the systems. By fitting laterally placed angle sections 18 and strips 19, moment transmitting couplings are obtained when parts 18 and 19 are connected both to the two adjoining (sandwich) panels 1 and to the two adjoining sections 10. Such a hall segment with a span of approximately 20 mm and a panel width of 1.15 m has a stiffness per hall segment corresponding to that of an IPE 270 section, which amounts to an equivalent hall structure of one portal frame timber made of IPE 270 sections per 1.15 m.

[0015] It will now be clear that with application of the construction system according to the invention a building (walls, saddle-roofs, corrugated roofs etc.) is obtained which consumes considerably less building material; a factor that is of major economic significance, considering the extent of the building sector.

[0016] Finally it is stated that the panel 1 as indicated above is a construction element in the broadest sense, and thus is not limited to sandwich panels. Therefore advantages may be gained by using panels whose composition entails certain qualities, e.g. panels which are equipped with light-transmitting components. Likewise it is also possible, in accordance with figure 5, to use a single-walled panel or a flat or corrugated plate 21 instead of a sandwich or composite panel. The advantage of this embodiment is that the building costs can be reduced even further. Favourable in this respect is that plate 21 is connected to a slender section 23, which is also connected to members 12, mounted in zigzag fashion, and which by means of cross members 22 and members 13 is linked with the outermost section of purlin 11. This construction provides sufficient stabilization for the building element, in all directions. It should be noted that when a flat (single) plate is used, cross members 22 together with (stabilization) members 13 have sufficient moment transmitting capability.

Claims

1. Self-supporting construction system comprising a panel (1) and at least one stiffening element (10, 12), which has been fixed to said panel (1) along a longitudinal axis of said panel (1), **characterized in that** the stiffening element (10, 12) comprises a first slender section (10), which has been fixed to said panel and a second slender section (11) situated at a distance from and parallel to said first slender section (10), whereby said two slender sections (10, 11) have been interconnected by connecting members (12), which are arranged in a zigzag fashion between said two slender sections (10, 11), the arrangement being such that longitudinal axes of said two slender sections (10, 11) are situated in a plane

extending perpendicular to said panel (1), whilst further connecting members (13) extending each in a plane transverse to said plane through the longitudinal axes of said slender sections (10, 11) have been fixed at one end to said second slender section (11) and at the other end to the panel (1) in a point remote from said first slender section (10). 5

2. Self-supporting construction system according claim 1, wherein the ends (11a, 11b) of said second slender section (11) are bend towards and connected to the ends of said first slender section (10). 10
3. Self-supporting construction system according claim 1 or 2, wherein said further connecting members (13) extend each in a plane perpendicular to said plane through the longitudinal axes of said slender sections (10, 12). 15
4. Self-supporting construction system according any preceding claim, wherein the panel (1) is a sandwich panel. 20
5. Self-supporting construction system according any preceding claim 1-3, wherein a panel (1) is formed by a single plate shaped panel. 25
6. Self-supporting construction system according any of the preceding claims, wherein the ends of the further connecting members which are fixed to the panel (1) are interconnected by a cross-member (22) . 30
7. Self-supporting construction system according any of the preceding claims, wherein a slender section (10) is formed by an U-shaped beam. 35
8. Self-supporting construction system according any of the preceding claims, wherein a slender section (11) is formed by a rod. 40

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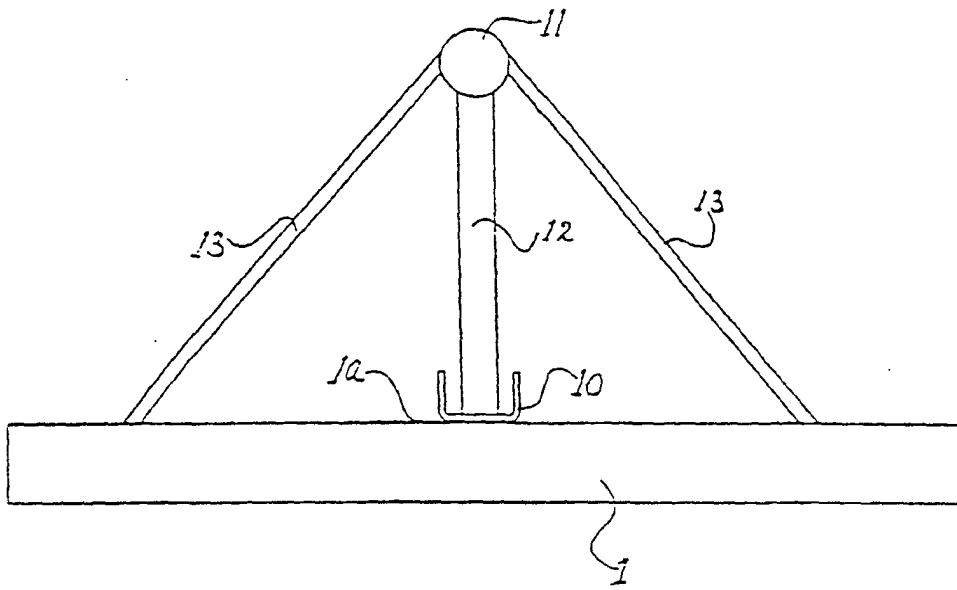


fig.1

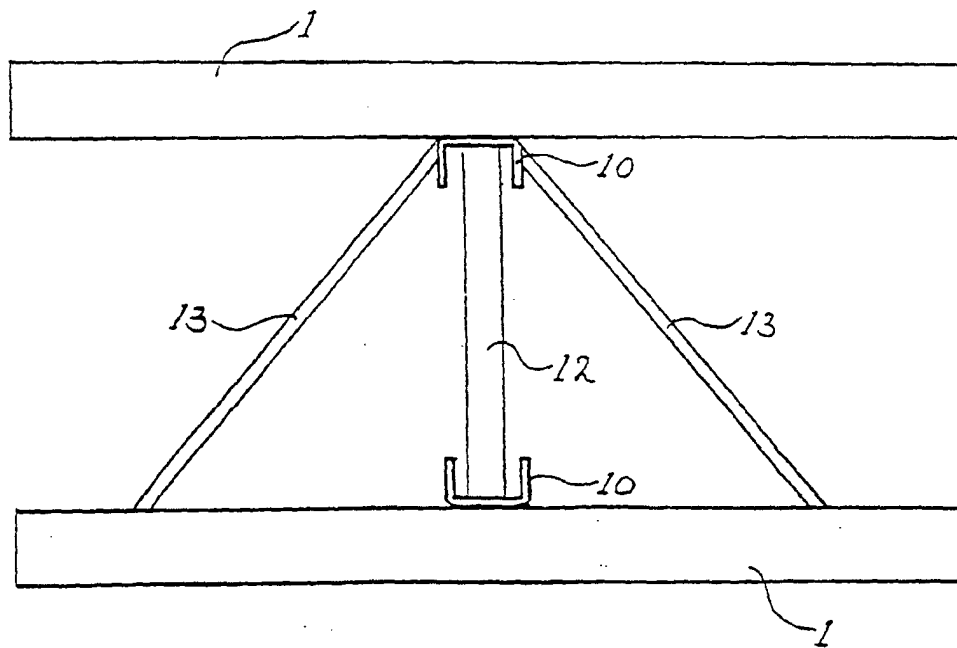


fig. 2

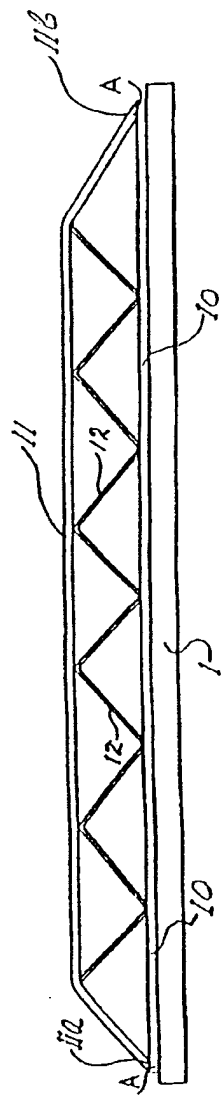
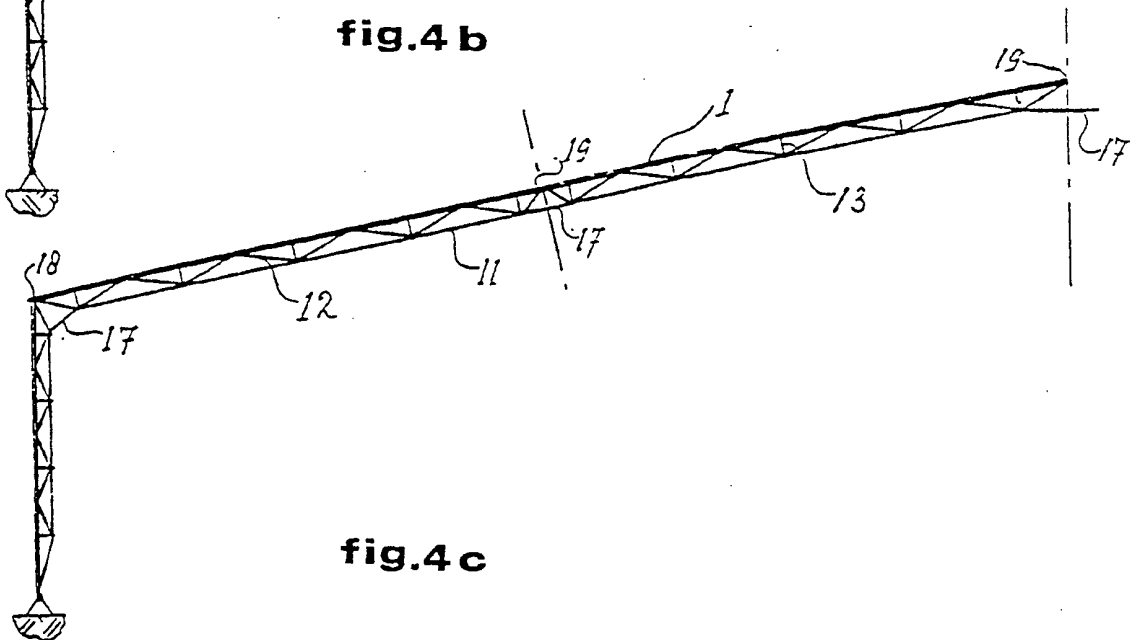
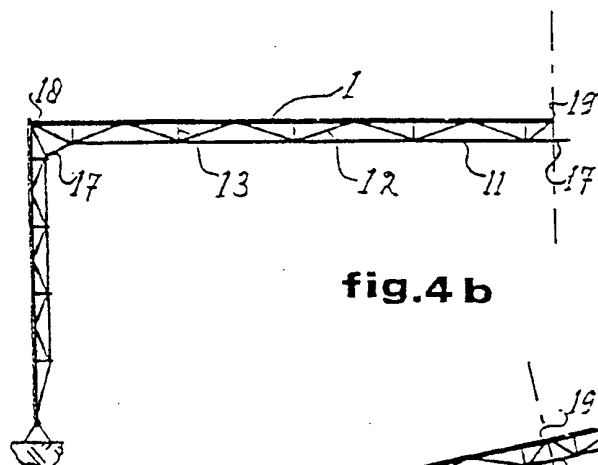
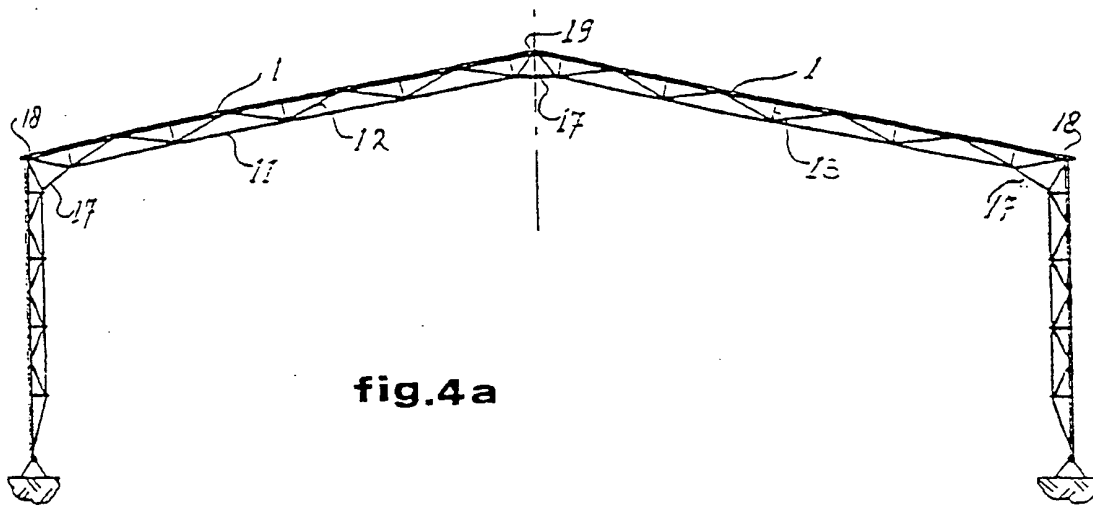
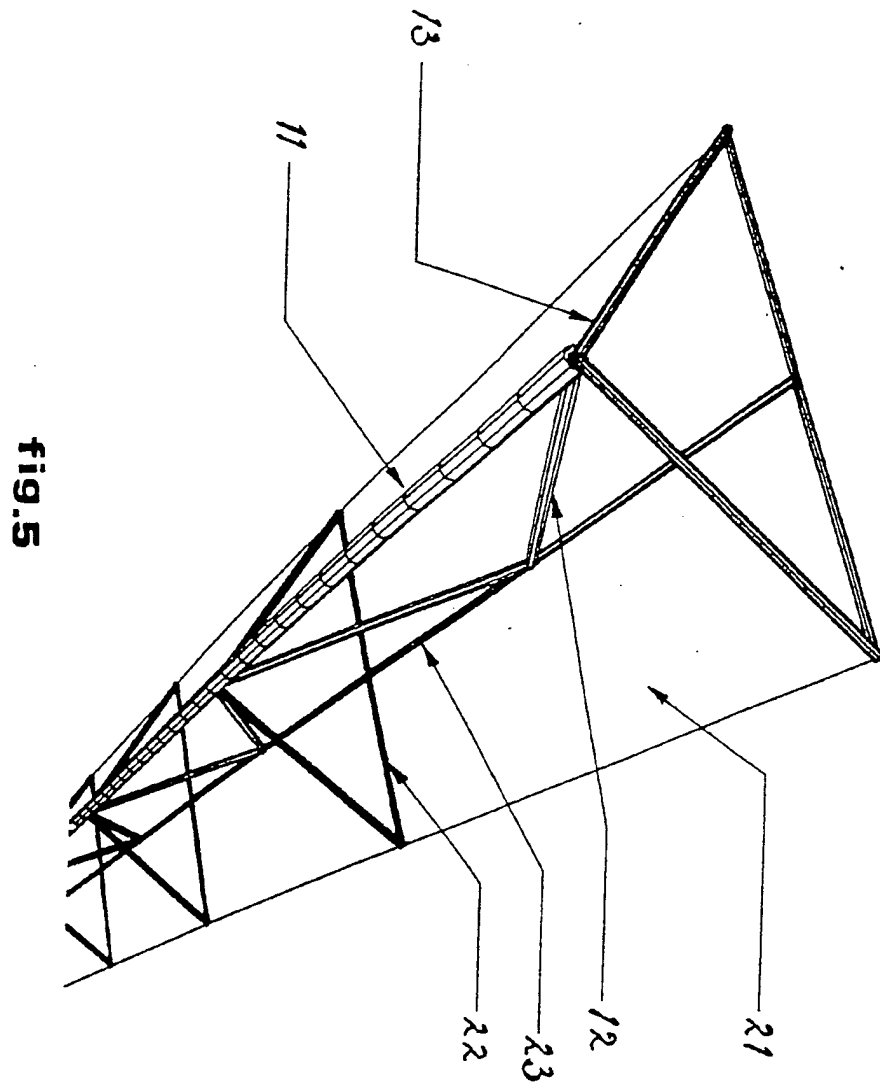


fig.3







European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 03 07 7967

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Place of search THE HAGUE		Date of completion of the search 10 November 2003	Examiner Kriekoukis, S
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			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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