

"THIN-WALLED LINING PLATES AND PANEL PLATES"

The invention relates to thin-walled lining plates, panel plates and the like, for mounting on a building and
5 consisting of a board or board strip.

Such lining plates or panel plates, used for example to face a facade, are exposed in particular to large wind, pressure and suction forces. The expression "board" is used when the ratio of the longitudinal sides is less than
10 two, i.e. when the longer side of the board is not more than twice the length of the shorter side of the board. The term "board strip" is used when the ratio of the longer side to the shorter side is greater than two. Depending on
15 the thickness of the board or board strip the expression stiff board, or flexible board, or absolutely flexible board or a diaphragm, is used. A stiff board is when the deflection of the board centre area due to external load remains small compared with the board thickness, i.e. when
20 the deflection is not more than $1/5$ to $1/4$ of the board thickness. A flexible board is one which undergoes a deflection or sagging under a load substantially of the order of the board thickness. If the deflection exceeds

several times the board thickness, for example if it is five times the board thickness, the term absolutely flexible board or diaphragm is used.

For stiffening such a board or board strip it is known to
5 weld to the back of the board or board strip at regular intervals a row of bolts to which stiffening elements are then firmly screwed. The welding on of the bolts impairs the appearance of the front of the plate, slab or board in a manner considered disadvantageous.

10 Due to their rigid securing to the board or board strip, the stiffening elements are flexurally stressed when an area or punctiform force acts on the front of the board. To accommodate these flexural stresses the stiffening elements must have correspondingly high moments of inertia
15 or section modulus.

The problem underlying the invention is to provide facing or lining elements in which stiffening elements of small cross-section can be used and there is no visual impairment of the front of the plate or panel.

20 The invention provides a thin-walled lining plate or panel plate for mounting on a building and consisting of a board or a board strip with a substantial surface area and having rearwardly disposed stiffening elements, that is disposed

on the side of the board or board strip which is not visible when the latter is mounted, wherein only opposite edges of the board or board strip are braced there being no connection thereof with the stiffening elements except at
5 said opposite edges.

Since the stiffening elements engage only at the edges of the board or board strip there is no sign of any securing bolts at the visible surface of the board or board strip. The stiffening elements which engage these edges of the
10 board or board strip are subjected only to pressure so that increased load-bearing capacity is achieved with reduced cross-section of the stiffening elements. In addition, a more uniform deformation behaviour of the board or board strip is obtained and this also contributes to improving
15 the optical impression. Also, facing or lining elements according to the invention can be manufactured with significantly lower production costs.

According to one preferred embodiment of the invention, the edges of the board or board strip are beveled and between
20 the beveled edges spaced compression rods are disposed. Under a pressure or suction force which may act in punctiform or area manner on the visible surface of the board such forces are introduced in the longitudinal direction into the stiffening elements so that the latter
25 are subjected only to compressive stress. As a result the

cross-section of said compression bars can be kept relatively small because no flexural stresses occur.

According to another embodiment, at opposite edges of the board or board strip spaced-apart spacers are secured and
5 in each case two opposite spacers are connected together via a compression bar. With this embodiment beveling of the edges may be dispensed with.

According to a further embodiment opposite edges of the board or board strip are beveled and the bevelings are anchored to the building at intervals via tension elements. Said tension elements are only subjected to tensile stresses and with these tensile forces once again no flexural stressing occurs.

According to a preferred embodiment the compression bar is a square tube and the spacing of the stiffening points is about $1/3$ of the length of the board or board strip.

If the distance from the parallel extending edges of the board or board strip is in each case $1/6$ and the distance of the bracing elements from each other $1/3$ of the length of the board or board strip with a board of about 5 m X 1 m only three stiffening elements are needed.

In a further development of the invention an outer shell may be provided with beveled opposite edges connected via spaced compression bars and at the inside of the lining element an inner shell can be disposed with beveled edges at all sides, the outer shell being connected to the inner shell via an all-round adhesion member and between the outer shell and the inner shell an insulating material is provided. Since mineral wool cannot transmit any forces the outer shell is not fixedly connected to the inner shell via the insulating material. As a result, with such double-shell panels the problem also arises that the outer shell is exposed to high pressure and suction forces which lead to pronounced deflections or sagging thereof. For this reason stiffening is also provided of this outer shell by regularly spaced compression bars.

Examples of embodiment of the invention will be explained with the aid of the drawings, wherein:

Fig. 1 is a rear view of a board strip with conventional stiffening elements known in the art,

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- Fig. 2 is a cross-section along the line II-II of Fig. 1,
- Fig. 3 shows a board strip with bracings according to the invention in the form of compression rods in rear view,
- Fig. 4 is a cross-section along the line IV-IV of Fig. 3,
- Fig. 5 is a cross-section of a second embodiment of a stiffened board strip,
- Fig. 6 is a cross-section of a third embodiment of a stiffened board strip,
- Fig. 7 is a cross-section through the edge region of a panel,
- Fig. 8 is a plan view of the connection of a compression bar or rod to the outer shell of the panel of Fig. 1 and
- Fig. 9 shows the connection of two panels with stiffenings to a facade post.

Fig. 1 shows a board strip 10 whose longest side 12 is more than twice as long as its shorter side 14. The board strip 10 is formed at its longitudinal edges with bevelings 16, 18. At the rear side at regular intervals seven rows of securing bolts 20 are provided. Said securing bolts 20 are welded to the back of the board strip 10 so that the weld points are not apparent on the visible side. However, by material deformations and material stresses area changes are noticeable in the region of said securing bolts 20. With the aid of these securing bolts 20 flexural rods 22 are screwed to the back of the board strip 10.

The board strip 26 shown in Fig. 3 has the same dimensions as that in Fig. 1. At the longitudinal edges of the board strip 26 bevelings 28 and 30 are formed. With a spacing of about $1/3$ of the longer board side stiffening elements 32, 34 and 36 are disposed. These stiffening elements are connected only at their end sides to the beveled edges 28 and 30. The securing may be via welding or screwing or rivets. The spacing of the stiffening element 32 from the

upper edge of the board strip and the spacing of the stiffening element 36 from the lower edge of the board strip is about $1/6$ of the length of the board strip and the spacing between the stiffening elements 32 and 34 and 34 and 36 respectively is about $1/3$ of said length. In contrast to the example of embodiment shown in Fig. 1 and corresponding to the prior art for the board strip of the same length three stiffening elements are adequate and in the form of compression bars take up punctiform or area suction or pressure forces acting on the front of the board strip.

Since only three stiffening elements are connected only at their end faces to the board strips with the aid of the method according to the invention the work is far more economical and in addition the results are better.

In the example of embodiment of a board strip 40 shown in cross-section in Fig. 5 at the back thereof in the longitudinal extent of the board strip opposite spacers 42 and 44 are secured at regular intervals and are in turn connected together via a stiffening rod 46. Said stiffening rod 46 is subjected only to compressive stress when the board strip 40 is deformed because when the board strip 40 deflects in sagging manner the edges thereof tend to approach each other. The forces which then occur are introduced in the longitudinal direction into the stiffening rod 46.

In the example of embodiment of a board strip 48 shown in cross-section in Fig. 6 the edges thereof are formed with bevels 50 and 52. At these edges 50 and 52 tension elements 54 and 56 engage which are anchored to building elements 58 and 60. These elements 54 and 56 are subjected only to tensile stress when forces acting on the board strip 48 tend to deflect the latter.

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The stiffening elements shown in Figs 3 to 5 are spaced from the back of the board strip so that when a sagging deflection of the strip occurs in the direction of the stiffening elements there is no connection between the board strip and the stiffening elements so that said elements do not bend.

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Fig. 7 shows in cross-section an edge portion of a panel 70 made up of an outer shell 72 and an inner shell 74. The outer shell 72 is connected via an all-round adhesion member 76 to the inner shell 74. The all-round adhesion member 76 may for example consist of a plastic. The edges of the outer shell 72 are formed with bevels 78. Between the beveled edges 78 at appropriate intervals stiffening elements 80 are provided. Said stiffening elements consist for example of a rectangular tube having the dimensions 40 mm X 20 mm X 3 mm. At the end faces of the stiffening element 80 end plates 82 are secured which are formed with internal threads 84. The connection of the beveled edge 78 to the end plate 82 is via screws 86 inserted in the threaded bores 84. The space between the outer shell 72 and the inner shell 74 is filled with an insulating material 88 which is not adhered to the insides of the shells 72 and 74. Said insulating material may for example be a mineral wool.

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Fig. 8 shows a plan view of the stiffening element 80 which is constructed as compression bar and to the end face of which the end plate 82 is for example welded. In the end plate threaded bores 84 are formed into which screws 86 are screwed which for this purpose pass through bores 90 made in the beveled edge 78 of the board strip 72. The securing of the stiffening element 80 to the edge 78 of the outer shell 72 may be by rivets, welding or adhesion.

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Fig. 9 shows in cross-section the joint of two panels 100 and 102 at a facade post 104. The panel 100 consists of an outer shell 106 and an inner shell 108 connected together via an all-round adhesive member 110. The space between the

shells 106 and 108 is filled with an insulating material 112. The beveled edges 114 of the outer shell 106 are connected at suitable intervals together via stiffening elements 116. The securing of the stiffening elements may be in the manner shown in Figs 7 and 8. The panel 102 has a structure analogous to the panel 100. The panels 100 and 102 are secured via a securing strip 118 which bears via seals 120 on the outsides of the panels 100 and 102. A securing screw 122 presses the securing strip 118 against the panels 100 and 102. The screw 122 is screwed into a threaded bush 124 disposed on the post 104. At the back of the inner shell 108 a sealing strip 126 is provided which bears on the front of the post 104.

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CLAIMS:

1. A thin-walled lining plate or panel plate for mounting on a building and consisting of a board or a board strip with a substantial surface area and having rearwardly disposed stiffening elements, that is disposed on the side of the board or board strip which is not visible when the latter is mounted, wherein only opposite edges of the board or board strip are braced there being no connection thereof with the stiffening elements except at said opposite edges.
2. A lining plate or panel plate according to claim 1, wherein the edges of the board or board strip are beveled and between the beveled edges spaced-apart compression bars providing said stiffening elements are arranged.
3. A lining plate or panel plate according to claim 1, wherein at opposite edges of the board or board strip spaced-apart spacers are secured and that oppositely disposed spacers are connected together in pairs via respective compression rods providing said stiffening elements.
4. A lining plate or panel plate according to claim 1, wherein opposite edges of the board or board strip are beveled and the bevels are anchored at intervals to a building via tension elements providing said stiffening



elements.

5. A lining plate or panel plate according to any one of claims 1 to 3, wherein each stiffening element is a rectangular tube acting as a compression bar.

6. A lining plate or panel plate according to any one of claims 1 to 5, wherein the spacing of the stiffening elements is about 1/3 of the length of the board or board strip.

7. A lining plate or panel plate according to any one of claims 1 to 6, wherein all the edge regions of the board or board strip are beveled and are welded at the corners.

8. A lining plate or panel plate according to any one of claims 1 to 7, wherein said braced opposite edges are at the long sides of the board or the board strip.

9. A lining plate or panel plate according to any one of claims 1 to 8, wherein an outer shell with beveled opposite edges is provided with these edges connected together via braced-apart compression bars providing said stiffening elements, and an inner shell with beveled edges at all sides is also provided, the outer shell being connected to the inner shell via an all-round adhesion member and an insulating material being disposed between the outer and inner shells.



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10. A lining plate or panel plate substantially as herein described with reference to Figs. 3 and 4, or any one of Figs. 5 to 9, of the accompanying drawings.
