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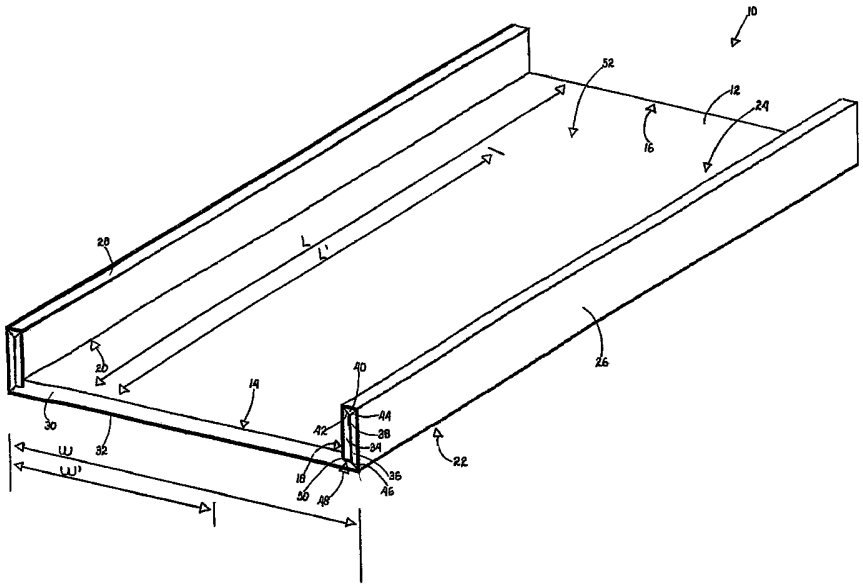
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(54) Title: A CEILING ELEMENT



(57) Abstract: The invention provides a ceiling element (10), a blank and a method of construction for the ceiling element, which ceiling element has a planar body (12) with a flexible panel (30) and a flexible cover (32) attached to the panel, and at least one upstanding, elongate rigidifying member (26, 28) on the body which rigidifying member is movable relatively to the body and which has a first stiffening element (34), a first fold line (42) between the first stiffening element and the body, a second stiffening element (36) which is attached to the first stiffening element, a second fold line (44) and a third fold line (46) which are spaced from, and parallel to the first fold line and located between the first and second stiffening elements and at least a first elongate reinforcing member (38).

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A CEILING ELEMENT

BACKGROUND OF THE INVENTION

[0001] This invention relates to a ceiling element and a method of construction thereof.

[0002] Known ceiling panels made from gypsum or fibre cement are rigid and installed in a building by nailing the panels to brandering or roof supports. Alternatively a suspended frame is installed from which the panels are suspended. Installation of these types of ceiling panels requires skilled labour, is time consuming and costly. Additionally when a ceiling panel is nailed to brandering or roof supports the weight and stiffness of the ceiling element may render the task difficult.

[0003] Damage as a result of handling and transportation of rigid ceiling panels often occurs due to the stiffness and inflexibility of the panels.

SUMMARY OF THE INVENTION

[0004] This invention aims to provide an alternative ceiling element which might alleviate some of the aforementioned problems.

[0005] The invention provides a ceiling element which includes a rectangular, planar body which has first and second opposing ends, first and second opposing sides, an underside and an upper side, and at least one upstanding, elongate rigidifying member on the body.

[0006] The body preferably includes a panel member and a cover means attached to at least one side of the panel member. The panel member may be made from a lightweight cellular foam material such as an expandable plastics material or expandable polystyrene or polyurethane foam. Preferably the panel member is flexible at least to a limited extent.

[0007] The cover means may include a reflective material, an insulating material or an ornamental material. These materials may be in the form of paper, vinyl or foil. The cover means may be glued or laminated to the panel member. The cover means is preferably flexible at least to a limited extent.

[0008] The cover means may be attached to the rigidifying member and preferably envelopes at least part of the rigidifying member.

[0009] The rigidifying member may form an integral part of the body, or be formed from the body, or be attached to the body. The rigidifying member may be integrally formed with the body.

[0010] The rigidifying member is preferably movably attached to the body, for example to a periphery of the body. The rigidifying member may include at least a first stiffening element which extends at a right angle away from the body. A first fold line may be defined between the first stiffening element and the body. Preferably the rigidifying member includes second and third fold lines which are spaced from, and parallel to, the first fold line. A second stiffening element may be defined between the second and third fold line and a bridge may be defined between the first and second fold lines. The first stiffening element may be attached to the second stiffening element in any appropriate manner and is preferably glued to the second stiffening element.

[0011] The rigidifying member may include a first elongate reinforcing member. Preferably the rigidifying member includes a second elongate reinforcing member. The first and a second elongate reinforcing members may extend at a right angle relatively to one another.

[0012] In a preferred form of the invention the ceiling element has a first rigidifying member on the first side of the body and a second rigidifying member on the second side of the body. A U-shaped recess may be defined between the first and second rigidifying members and the body.

[0013] The ceiling element may include insulation means located in the recess. The insulation means may include insulation wool or an insulation sheet. The insulation means may be spaced from the body to define a cavity between the body and the insulation means.

[0014] The invention also provides a ceiling which includes a plurality of ceiling elements of the aforementioned kind and mounting means which is attachable to fixed structure to support the ceiling elements.

[0015] Preferably the ceiling includes at least two opposing mounting means with which the ceiling elements are slidingly engageable. Each mounting means may be in the form of a respective support beam. The support beam may be U-shaped in cross section. Alternatively the mounting means may be in the form of hangers from which the ceiling elements are suspended.

[0016] The ceiling may include a plurality of attachment members to attach adjacent ceiling elements to one another. Each attachment member may be in the form of a fastener or a U-shaped clip.

[0017] The fastener may include a female formation and a male formation which are resiliently interlockable. Preferably the female formation includes an elongate tubular neck extending from a first enlarged head. The male formation may include an elongate shaft which extends from a second enlarged head and may have a resiliently deformable catch attached to a leading end of the shaft. The shaft may be extendable through the neck.

[0018] The ceiling may also include an elongate connection member connecting opposing ends of adjacent ceiling elements to one another. Preferably the connection member is H-shaped in cross section and slots into each respective end. The connection member may include a tie formation with which the connection member may be suspended from fixed structure.

[0019] The invention further extends to a blank for a ceiling element of the aforementioned kind which includes a rectangular body with first and second opposing ends, first and second opposing sides, an upper side and an underside, a cover means attached to the underside and a first line of weakness formed on the upper side to define a first rigidifying member attached to the body at the first side and a second line of weakness on the upper side to define a second rigidifying member attached to the body at the second side.

[0020] Preferably each of the first and second rigidifying members includes a plurality of lines of weakness.

[0021] The invention further provides a method of construction of a ceiling element which includes the steps of:

(a) forming at least a first fold line on a panel to define a rectangular body and an elongate first stiffening element attached to the body; and

(b) folding the first stiffening element on the first fold line to a position wherein the first stiffening element extends at a right angle relatively to the body.

[0022] The method may include the step of attaching a cover means to the panel. The cover means may be laminated or glued to the panel and preferably both the panel and the cover means are flexible at least to a limited extent.

[0023] The method may include the step of cutting the panel from a block of material. The material may be in the form of a lightweight cellular foam material such as expandable polystyrene or polyurethane foam.

[0024] The method may include the step of forming second and third fold lines on the panel which are spaced from and parallel to the first fold line. A second stiffening element may be defined between the second and third fold lines and a bridge member may be defined between the second and first fold lines.

[0025] The method may include the step of folding the first and second stiffening elements towards one another on the first and second fold lines. Preferably the method includes the step of attaching the first and second stiffening elements to one another. The first and second stiffening elements may be glued to one another.

[0026] The method may include the step of folding the first and second stiffening elements on the third fold line to form a first rigidifying member which is attached to a periphery of the body and which extends along at least part of the body and away from the body.

[0027] The method may include the step of reinforcing the rigidifying member with at least one elongate reinforcing member.

[0028] The method may include the step of forming a second rigidifying member on the body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The invention is further described by way of examples with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a ceiling element according to the invention;

Figure 2 is a partial view of a blank used to form the ceiling element of Figure 1;

Figure 3 is a perspective view of a corner section of the blank of Figure 2 in a first folded position;

Figure 4 is a perspective view of the corner section of Figure 3 in a second folded position;

Figure 5 is a perspective view of the corner section of Figure 3 in a third folded position which is similar to the position shown in Figure 1;

Figures 6 and 7 are side views of ceiling elements according to Figure 1 in use;

Figure 8 is an enlarged side view of opposing flanges of adjacent ceiling elements being attached to one another;

Figure 9 is a side view of opposing ends of adjacent ceiling elements being connected to one another by a connection bracket; and

Figure 10 is a schematic representation of the method of construction of the ceiling element of Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

[0030] Figure 1 illustrates a ceiling element 10 with a central, horizontally extending and planar rectangular body 12 which has first and second opposing ends 14, 16, first and second opposing sides 18, 20, an underside 22 and an upper side 24, and first and second opposing and upstanding rigidifying members or flanges 26, 28 which are respectively attached to the first and second sides 18, 20.

[0031] The body 12 has a panel 30 to which a cover sheet 32 is attached. The panel 30 is made from a lightweight cellular foam material such as an expandable plastics material or expandable polystyrene or polyurethane foam.

[0032] The sheet 32 is made from an appropriate flexible sheet material and depending on requirements the sheet 32 can have reflective, insulating or ornamental qualities. For example the sheet 32 can be made from paper, vinyl or foil. The sheet 32 is either glued or laminated to the panel 30 as well as the flanges 26, 28. As is evident from Figure 1 the sheet 32 envelopes at least part of each flange 26, 28.

[0033] The first and second flanges 26, 28 are attached to the periphery of the body 12 and respectively extend at a right angle away from the body 12. The first and second flanges 26, 28 are mirror images and only the first flange 26 is described. The first flange 26 has a first stiffener element 34 and a second stiffener element 36 which extends parallel to the first stiffener 34. The first and second stiffeners 34, 36 are glued to one another and a first elongate reinforcing bar 38 is trapped between the first and second stiffeners 34, 36. A triangular bridge section 40 is formed between the first and second stiffeners 34, 36 and the sheet 32. A first line of weakness or fold line 42 is defined between the first stiffener 34 and the bridge 40 and a second fold line 44 is defined between the bridge 40 and the second stiffener 36. The second stiffener 36 is attached to, and is integrally formed with, the panel 30 and a third fold line 46 is defined between the second stiffener 36 and the panel 30. The first, second and third fold lines 42, 44, 46 are spaced from and parallel to one another.

[0034] A step formation 48 is formed on the panel 30 and the first stiffener 34 engages the step 48.

[0035] Depending on requirements the first stiffener 34 can be glued to the panel 30 on the third fold line 46 and the step 48.

[0036] A second elongate reinforcing bar 50 is located between the first stiffener 34 and the step 48.

[0037] The first and second bars 38, 50 are each in the shape of a flat bar and are made from an appropriate rigid material such as a metal e.g. aluminium, wood or a plastics material. The first and second bars 38, 50 extend at a right angle relatively to one another.

[0038] A U-shaped recess or channel 52 is formed between the respective flanges 26, 28 and the body 12.

[0039] As is shown in Figures 2 to 5 the ceiling element 10 is formed from a blank 60. As is schematically illustrated in Figure 10 the blank 60 is formed by cutting a rectangular panel 62 from a block of material 64 (in this example expanded polystyrene) in a cutter 66. The panel 62 is laminated with the sheet 32 in a laminator 68. This results in a laminated panel 70 of uniform cross section. The laminated panel 70 is cut by means of blade and router cutters 72 to remove material from two sides of the panel 70 to form the step 48, the fold lines 42, 44, 46, the stiffeners 34, 36 and the bridge 40. This results in the blank 60 shown in Figure 2.

[0040] The fold lines 42, 44, 46 are in the form of elongate, V-shaped slots. These slots cause zones or lines of weakness in the blank 60 which allow the folding of the blank 60 on the fold lines 42, 44, 46.

[0041] Thereafter the reinforcing bars 38, 50 are glued or bonded to the respective second stiffener 36 and step 48.

[0042] Adhesive 74 is applied to the first and second fold lines 42, 44 and the first and second stiffeners 34, 36 whereafter the first stiffener 34 is folded to the position shown in Figure 3. In this position the stiffener 34 extends at a right angle relatively to the blank 60. The first stiffener 34 is folded again to come into contact with the second stiffener 36. This results in the flat configuration shown in Figure 4.

[0043] While in the flat configuration the ceiling element 10 is transported to site. In the flat configuration the ceiling element 10 is flexible, at least to a limited extend, in all vertical directions. This flexibility limits the likelihood of damage to, and breakage of, the ceiling element 10 during handling and transport. Additionally as the ceiling element 10 lies flat, space requirements during transport are reduced compared to the assembled configuration of the ceiling element 10 shown in Figure 1.

[0044] On site the first and second stiffeners 34, 36 are folded on the third fold line 46 in order for the first stiffener 34 to engage with the step 48 and for the flange 26 to extend vertically. Depending on requirements adhesive is applied to the third fold line 46 and step 48 so that the flanges 26, 28 are glued to the panel 30. The ceiling element 10 is now in the assembled configuration shown in Figures 1 and 5 and is ready for installation.

[0045] In the assembled configuration the rigidity of the ceiling element 10 in a longitudinal direction is increased as a result of the flanges 26, 28 which rigidify the body 12. An important aspect is that the sheet 32 extends around each flange 26, 28. This improves the strength and rigidity of the respective flanges 26, 28. Additionally the reinforcing bars 38, 50 reinforce each flange 26, 28 in both the horizontal and vertical directions.

[0046] As is shown in Figures 6 and 7 a plurality of ceiling elements 10A, B..N are used to create a ceiling 80 for a building or fixed construction 82 which has opposing inner walls 84A, B, C, D. Only walls 84A, B, C are shown as the wall 84D opposes the wall 84B and extends at a right angle from the respective walls 84A, C. In order to install the ceiling elements 10 support members or beams 86 are fixed to the walls 84. The beams 86 are fixed to the walls 84 in any appropriate manner and for example can be glued, nailed or riveted. In Figure 6 the beams 86 are shown in the form of a quarter round. Alternatively, as is shown in Figure 7, each beam 86 is in the form of a U-shaped channel. Depending on requirements the beams 86 can be of any other appropriate cross sectional shape.

[0047] A gap 88 is left in a section of the beams 86 on opposing walls 84B, D through which the ceiling elements 10 can be fed.

[0048] Before installation each ceiling element 10 is cut, in any appropriate manner, to an appropriate length L' which will fit snugly between the opposing walls 84B, D.

[0049] Each ceiling element 10 is mounted on the beams 84 by feeding the ceiling element 10 through the gap 88 with the flanges 26, 28 extending upwardly from the body 12 and at a

right angle to the opposing walls 84B, D. The underside 22 of the body 12 faces downwardly. As the flexibility of the ceiling element 10, in a crosswise direction, is not affected by the flanges 26, 28 the ceiling element 10 can be bent, at least to a limited extent, on its width W in order to facilitate movement of the ceiling element 10 through the gap 88. Once the ceiling element 10 is fed through the gap 88 the ceiling element 10 extends between opposing beams 86 which support the first and second ends 14, 16 of the body 12. While in this position the ceiling element 10 is slid on the beams 86 until it abuts the wall 84A or an adjacent ceiling element 10. In this manner the ceiling 80 is filled with ceiling elements 10.

[0050] In order to install the last ceiling element 10N the distance between the wall 84C and the second last ceiling element 10 is measured and the last ceiling element 10N is cut, in a lengthwise direction, to the appropriate width W'. The last ceiling element 10N thus has only one flange 28 on the body 12. The last ceiling element 10N is fed through the gap 88 and is bent so that the body 12 engages the beam 86 on the wall 84C. The last ceiling element 10N rests on the beams 86 on the walls 86B, C, D. Finally remaining sections of the beams 86 are fixed to the opposing walls 86B, D to close the gap 88.

[0051] As is shown in Figure 6 the ceiling elements 10 lie on top of the beams 84 and each body 12 is rigidified by the flanges 26, 28. Depending on requirement a plurality of hangers 90 may be attached to the ceiling elements 10 in any appropriate manner. The hangers 90 are mounted to roof supports or brandering 92 of the building 82. In this manner the ceiling elements 10 can also be suspended on the hangers 90 without using the beams 86.

[0052] In order to avoid possible upward movement of the ceiling elements 10 caused by air pressure variations above and below the ceiling 80, the ceiling elements 10 are mounted to the U-shaped channels shown in Figure 7. Alternatively the ends 14, 16 can be weighted down in any appropriate manner.

[0053] Once installed, adjacent ceiling elements 10 abut one another. In certain applications it might be desirable to attach the ceiling elements 10 to one another. This can be done by means of a U-shaped clip 94 of the kind shown in Figure 8. The clip 94 has a flared mouth 95 and clips across two adjacent flanges 26, 28 of adjacent ceiling elements 10A, B.

[0054] Alternatively a fastener 96 is used to connect the adjacent flanges 26, 28 to one another. The fastener 96 consists of a female formation 98 and a male formation 100 which are resiliently interlockable. The female formation 98 has an elongate tubular neck 102 which is attached to, and extends from, a first enlarged, circular head 103. The male formation 100

has an elongate shaft 104 which is attached to, and extends from, a second enlarged, circular head 106. The shaft 104 has a resiliently deformable, barbed catch 108 attached to its leading end. In order to engage the fastener 96 with the respective flanges 26, 28 the female formation 98 is press-fitted through the flanges 26, 28 as is illustrated in dotted outlines in Figure 8. Thereafter the male formation 100 is pushed through the neck 102 and any material caught inside the neck is expelled there from at the head 103. The shaft 104 extends through and fits snugly into the neck 102 and the catch 108 catches on the head 103 to lock the male and female formations 98, 100 to one another. If required, hangers 90 can be attached to the neck 102 or shaft 104.

[0055] In exceptional cases it might be required to connect opposing first and second ends 14, 16 of adjacent ceiling elements 10A, B to one another. In order to do this an elongate, H-shaped connection bracket 110, which is shown in Figure 9, is used. The bracket 110 slots into the respective ends 14, 16 of the adjacent ceiling elements 10A, B. Depending on requirement a hanger 90 or a tie 112 can be attached to the bracket 110. The hanger 90 or tie 112 is attached to the roof supports 92 in order to provide support to the bracket 110.

[0056] As is illustrated in Figures 6 and 7 each ceiling element 10 can be equipped with additional insulation material 114. The insulation material 114 can, depending on requirement, be in the form of insulation wool 114A (see Figure 6) or insulation sheets 114B (see Figures 6 and 7). The insulation material 114 is located in each recess 52. As is shown in Figure 7 the insulation sheet 114B may be spaced from the body 12 by spacers 116 in order to form an air pocket or cavity 118 between the body 12 and insulation sheet 114B.

[0057] The ceiling element 10 is of lightweight construction and easy to install. Additionally the flexibility of the ceiling element 10 can be varied to allow the ceiling element 10 to be flexible in all vertical directions during transport and handling but rigid during and after installation. A further advantage of the ceiling element 10 is the fact that the flanges 26, 28 are integrally formed on the body 12. The insulation properties of the ceiling element 10 can be varied with relative ease by adding the insulation material 114 to the recess 52.

[0058] The ceiling element 10 is produced in various lengths L for example 2,4m, 3m and 3,6m. Experimentation has shown that ceiling elements 10 with lengths L of up to 6m show limited distortion and sagging although only the opposing ends 14, 16 of the body 12 are supported. This illustrates the substantial rigidification of the body 12 achieved by the flanges 26, 28.

CLAIMS

1. A ceiling element which includes a rectangular, planar body which has first and second opposing ends, first and second opposing sides, an underside and an upper side, and at least one upstanding, elongate rigidifying member on the body.

2. A ceiling element according to claim 1 wherein the body includes a panel member and a cover means attached to at least one side of the panel member.

3. A ceiling element according to claim 2 wherein the panel member is flexible at least to a limited extent.

4. A ceiling element according to claim 2 or 3 wherein the cover means includes a reflective material, an insulating material or an ornamental material.

5. A ceiling element according claim 2, 3 or 4 wherein the cover means is glued or laminated to the panel member.

6. A ceiling element according to any one of claims 2 to 5 wherein the cover means is flexible at least to a limited extent.

7. A ceiling element according to any one of claims 2 to 6 wherein the cover means is attached to the rigidifying member.

8. A ceiling element according to any one of claims 2 to 7 wherein the cover means envelopes at least part of the rigidifying member.

9. A ceiling element according to any one of claims 1 to 8 wherein the rigidifying member forms an integral part of the body, is formed from the body or is attached to the body.

10. A ceiling element according to any one of claims 1 to 9 wherein the rigidifying member is integrally formed with the body.

11. A ceiling element according to any one of claims 1 to 10 wherein the rigidifying member is movably attached to the body.

12. A ceiling element according to any one of claims 1 to 11 wherein the rigidifying member includes at least a first stiffening element which extends at a right angle away from the body.

13. A ceiling element according to claim 12 which includes a first fold line between the first stiffening element and the body.

14. A ceiling element according to claim 13 wherein the rigidifying member includes second and third fold lines which are spaced from, and parallel to, the first fold line.

15. A ceiling element according to claim 12, 13 or 14 wherein the rigidifying member includes a second stiffening element which is attached to the first stiffening element.

16. A ceiling element according to any one of claims 1 to 15 wherein the rigidifying member includes a first elongate reinforcing member.

17. A ceiling element according to clam 16 wherein the rigidifying member includes a second elongate reinforcing member which extends at a right angle relatively to the first reinforcing member.

18. A ceiling element according to any one of claims 1 to 17 which includes a first rigidifying member on a first side of the body and a second rigidifying member on a second opposed side of the body.

19. A ceiling element according to claim 18 which includes a U-shaped recess defined between the first and second rigidifying members and the body.

20. A ceiling element according to claim 19 which includes insulation means located in the recess.

21. A ceiling element according to claim 20 wherein the insulation means is spaced from the body and a cavity is formed between the body and the insulation means.

22. A ceiling which includes a plurality of ceiling elements, each of which are according to any one of claims 1 to 21 and mounting means which is attachable to fixed structure to support the ceiling elements.

23. A ceiling according to claim 22 which includes a plurality of attachment members to attach adjacent ceiling elements to one another.

24. A ceiling according to claim 22 or 23 which includes an elongate connection member connecting opposing ends of adjacent ceiling elements to one another.

25. A blank for a ceiling element according to any one of claims 1 to 21 which includes a rectangular body with first and second opposing ends, first and second opposing sides, an upper side and an underside, a cover means attached to the underside and a first line of weakness formed on the upper side to define a first rigidifying member attached to the body at the first side and a second line of weakness on the upper side to define a second rigidifying member attached to the body at the second side.

26. A blank according claim 25 wherein each of the first and second rigidifying members includes a plurality of lines of weakness.

27. A method of construction of a ceiling element according to any one of claims 1 to 21 which includes the steps of:

(a) forming at least a first fold line on a panel to define a rectangular body and an elongate first stiffening element attached to the body; and

(b) folding the first stiffening element on the first fold line to a position wherein the first stiffening element extends at a right angle relatively to the body.

28. A method of construction of a ceiling element according to claim 27 which includes the step of attaching a cover means to the panel.

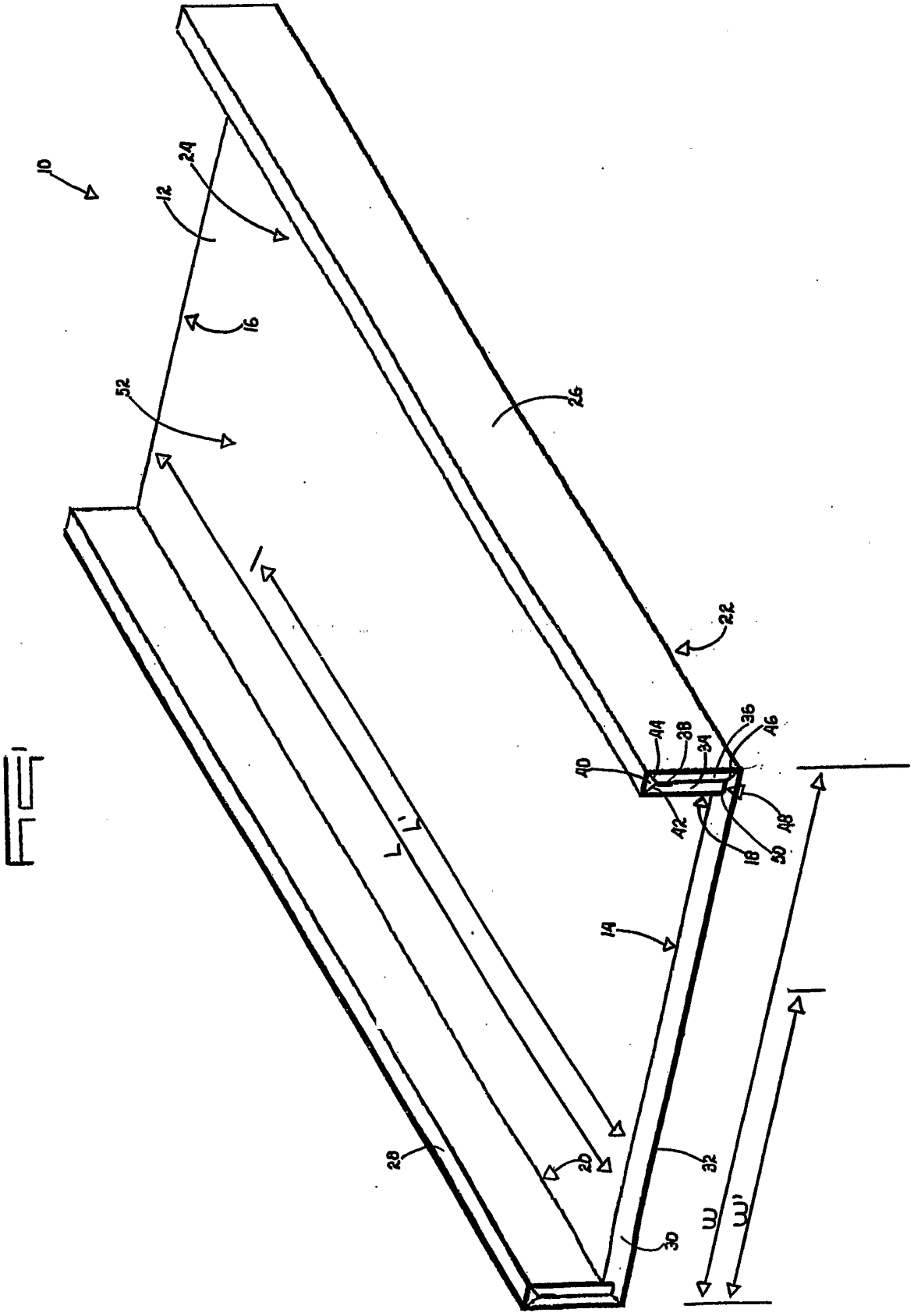
29. A method of construction of a ceiling element according to claim 27 or 28 which includes the step of forming second and third fold lines on the panel which are spaced from, and parallel to, the first fold line.

30. A method of construction of a ceiling element according to claim 29 wherein a second stiffening element is defined between the second and third fold lines and a bridge member is defined between the second and first fold lines.

31. A method of construction of a ceiling element according to claim 30 which includes the step of folding the first and second stiffening elements towards one another on the first and second fold lines.

32. A method of construction of a ceiling element according to claim 31 which includes the step of folding the first and second stiffening elements on the fold line to form a rigidifying member which is attached to a periphery of the body and which extends along at least part of the body and away form the body.

33. A method of construction of a ceiling element according to any one of claims 27 to 32 which includes the step of reinforcing the first stiffening element with at least one elongate reinforcing member.



FIG

FIG 2

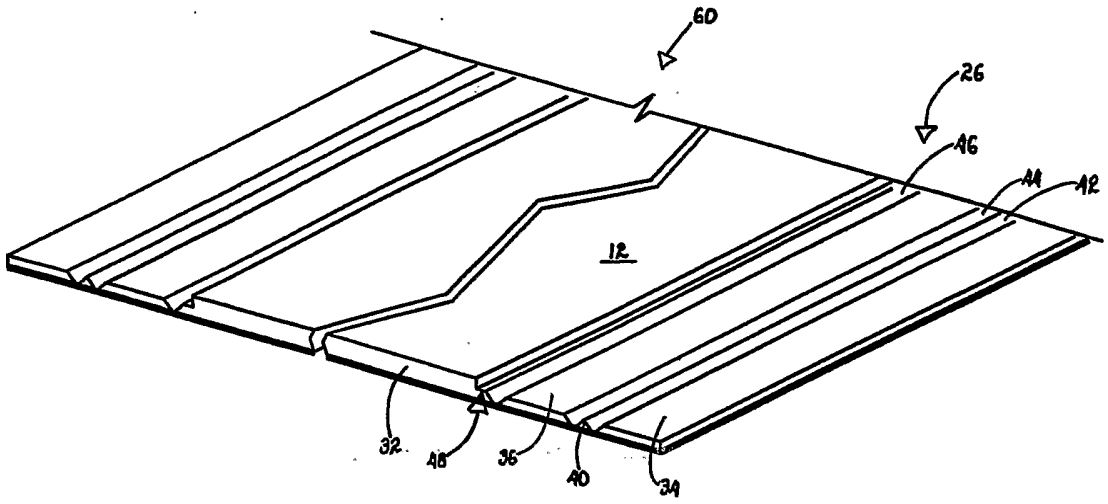


FIG 3

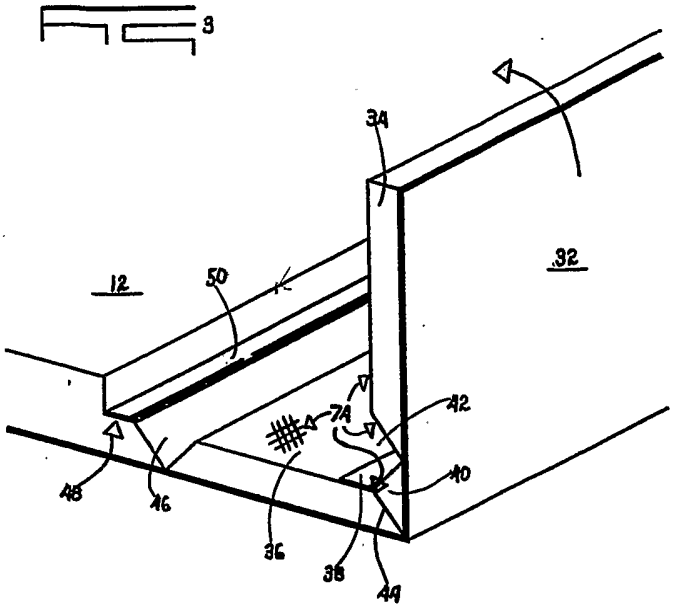


FIG 4

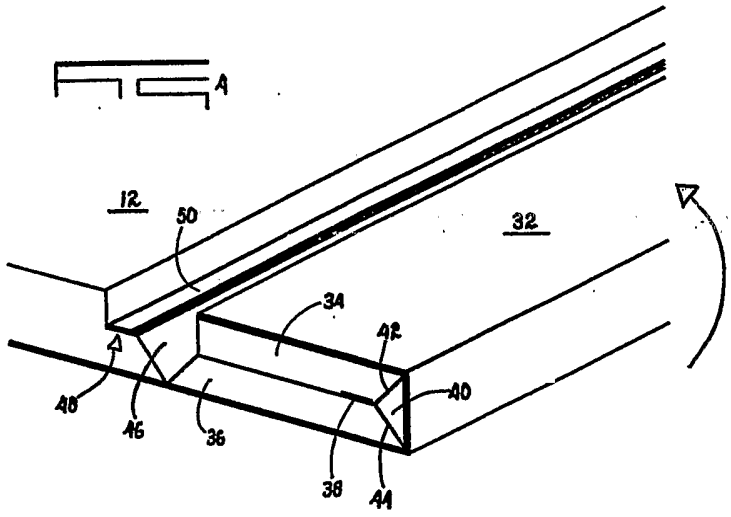
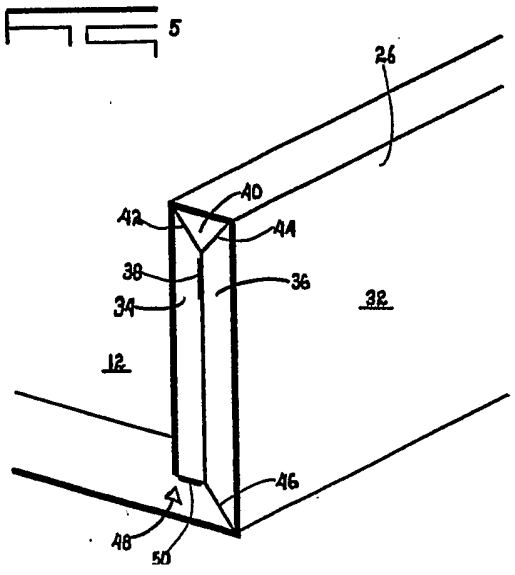
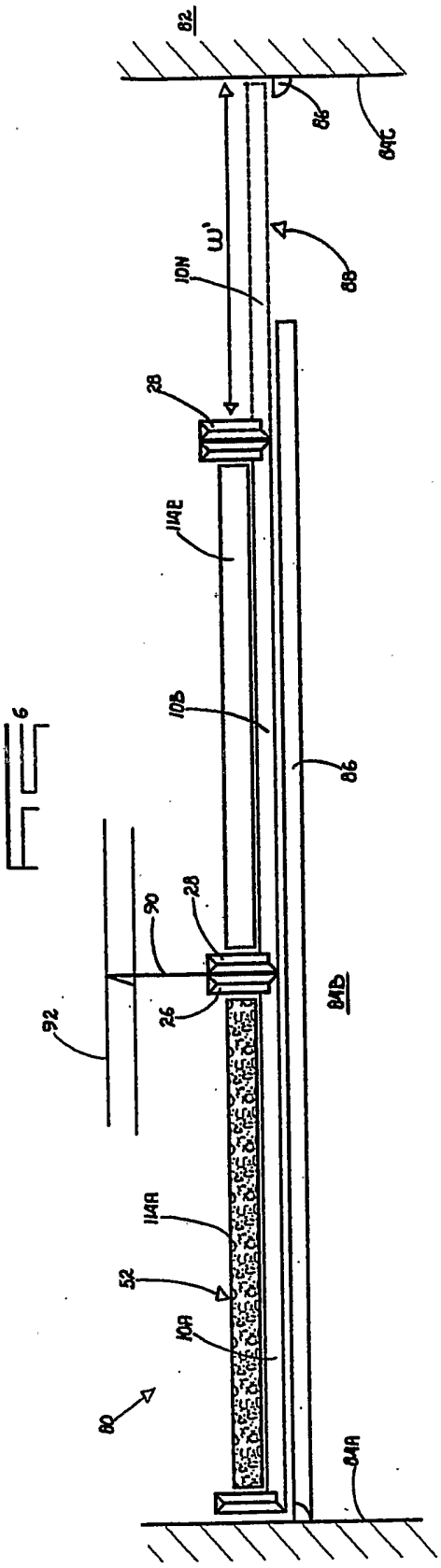
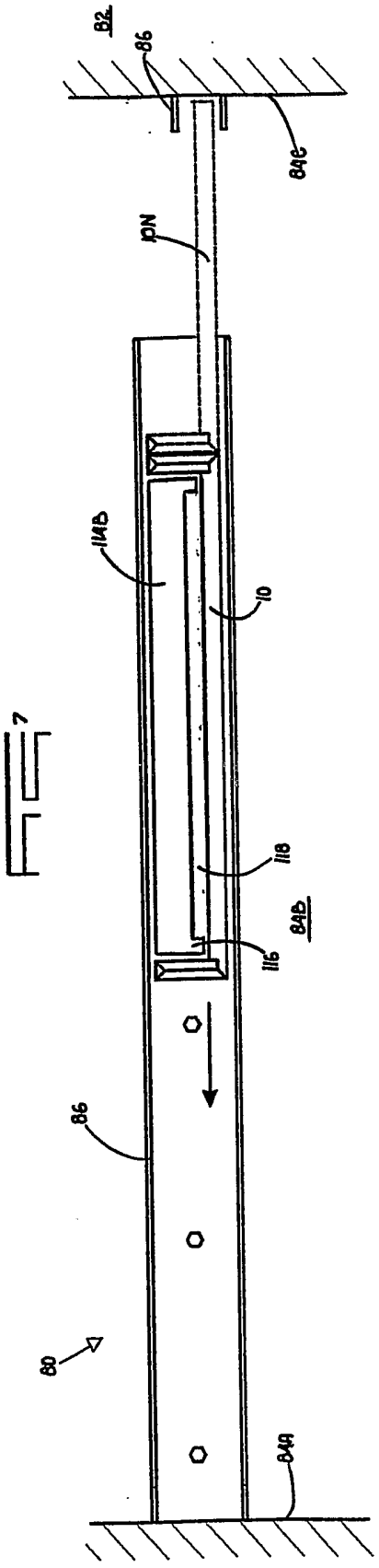


FIG 5




82
88
84C
W'
10N
88
28
114B
10B
86
90
28
84B
26
92
114A
52
10A
80
84A

6


82
86
84C
10N
114B
10
118
84B
116
86
80
84A

7

FIG 8

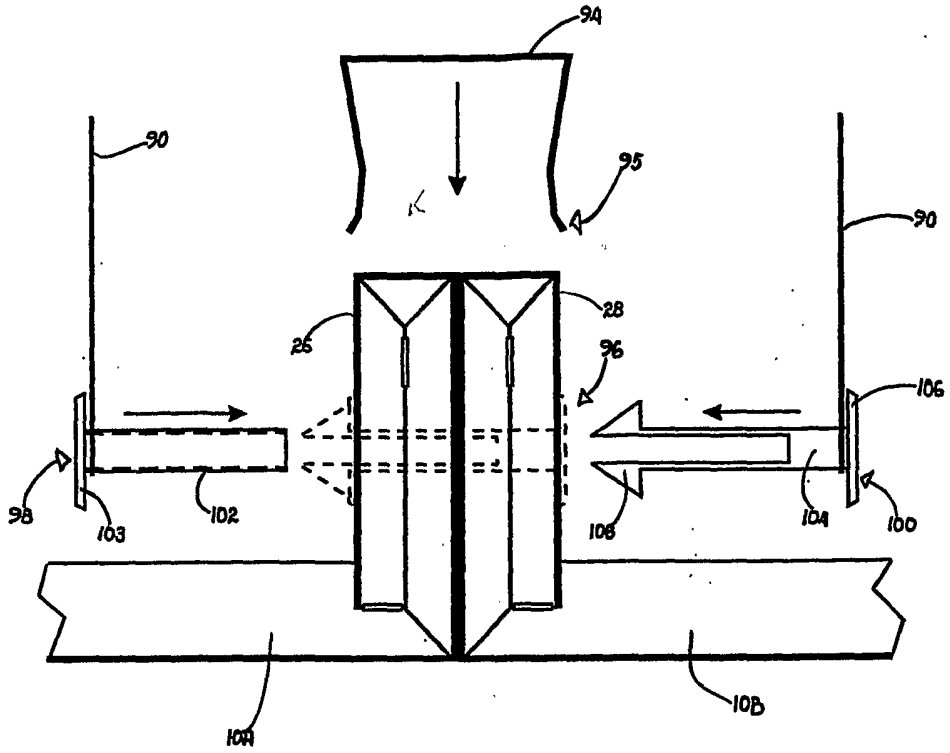
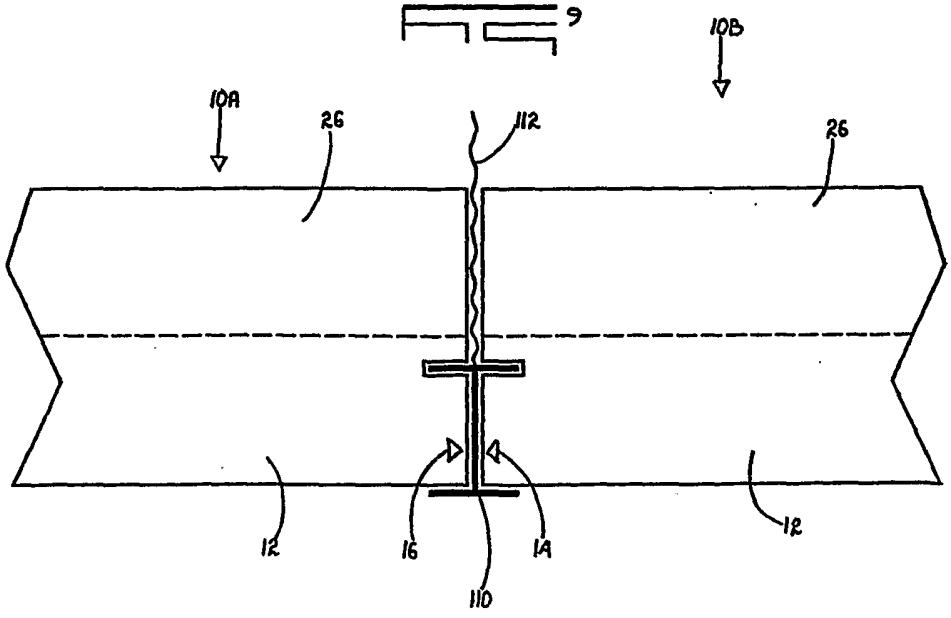

94
90
95
90
28
26
96
106
98
103
102
108
104
100
10A
10B

FIG 9


10B
10A
26
112
26
12
16
14
12
110

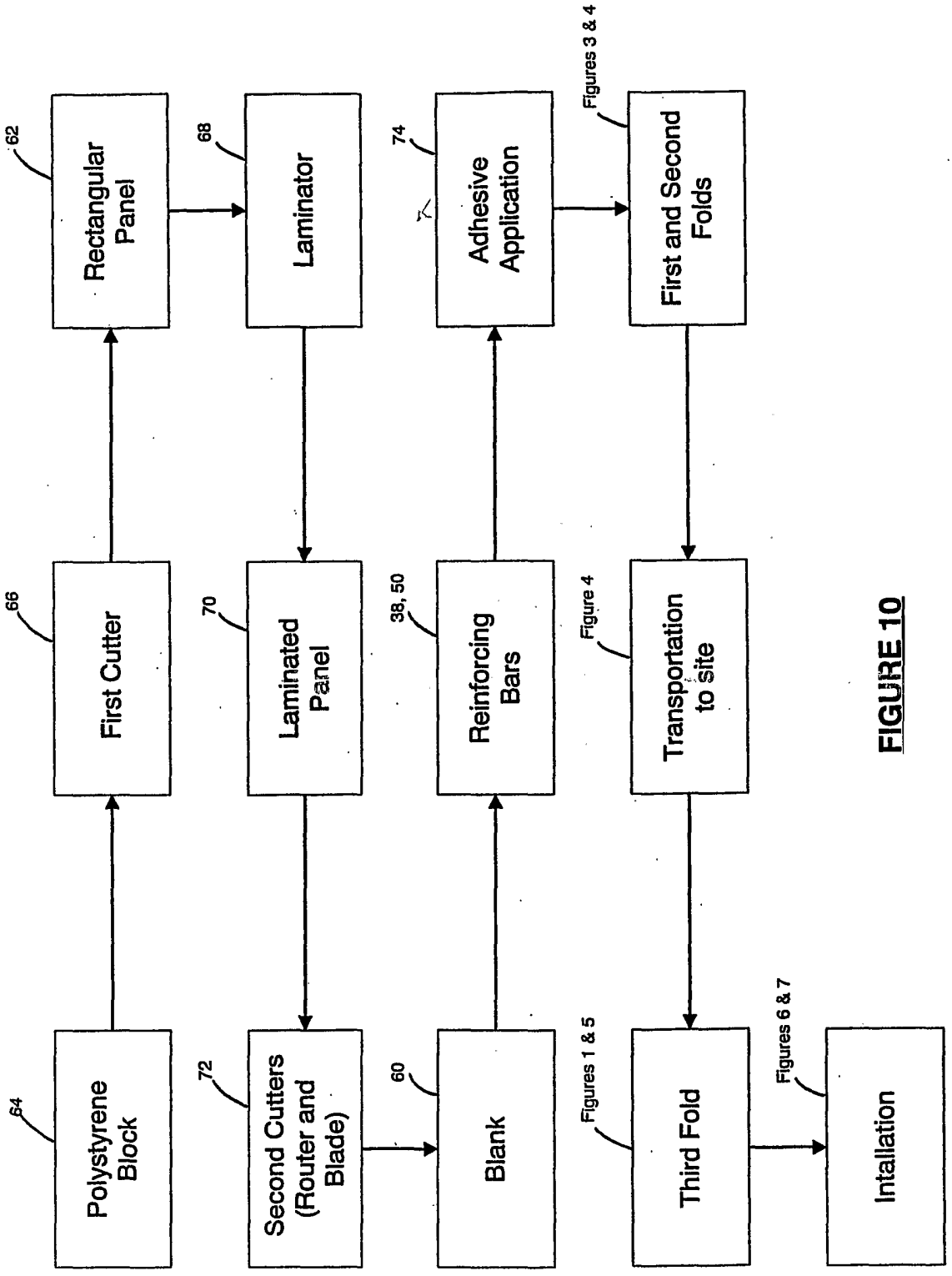

Polystyrene Block
64
First Cutter
66
Rectangular Panel
62
Second Cutters (Router and Blade)
72
Laminated Panel
70
Laminator
68
Blank
60
Reinforcing Bars
38, 50
Adhesive Application
74
Transportation to site
Figure 4
First and Second Folds
Figures 3 & 4
Third Fold
Figures 1 & 5
Intallation
Figures 6 & 7

FIGURE 10