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(71) Applicant: **Cullen Building Products Limited**
Southfield Industrial Estate
Glenrothes,
Fife FY6 2SW (GB)

(72) Inventors:
- **Smith, Robert Sean, Building & Performance Centre**
  Edinburgh EH10 5BT (GB)
- **McAndrew, Scott**
  Windygates, Fife KY8 5RW (GB)

(74) Representative: **Campbell, Arlene**
Murgitroyd & Company
Scotland House
165-169 Scotland Street
Glasgow G5 8PL (GB)

(54) **Improvements in or relating to building components.**

(57) A structural tie or strap in the form of a connector for use in the construction industry. The connector is substantially rectangular with fixing points at either end for fastening to walls or the like and includes an acoustic attenuation mechanism to enhance acoustic performance between the walls. The acoustic attenuation mechanism is embodied as folds, apertures and/or openings through the connector which prevent direct passage of sound and vibration waves through the connector, between the walls. An embodiment as a party wall strap is described.

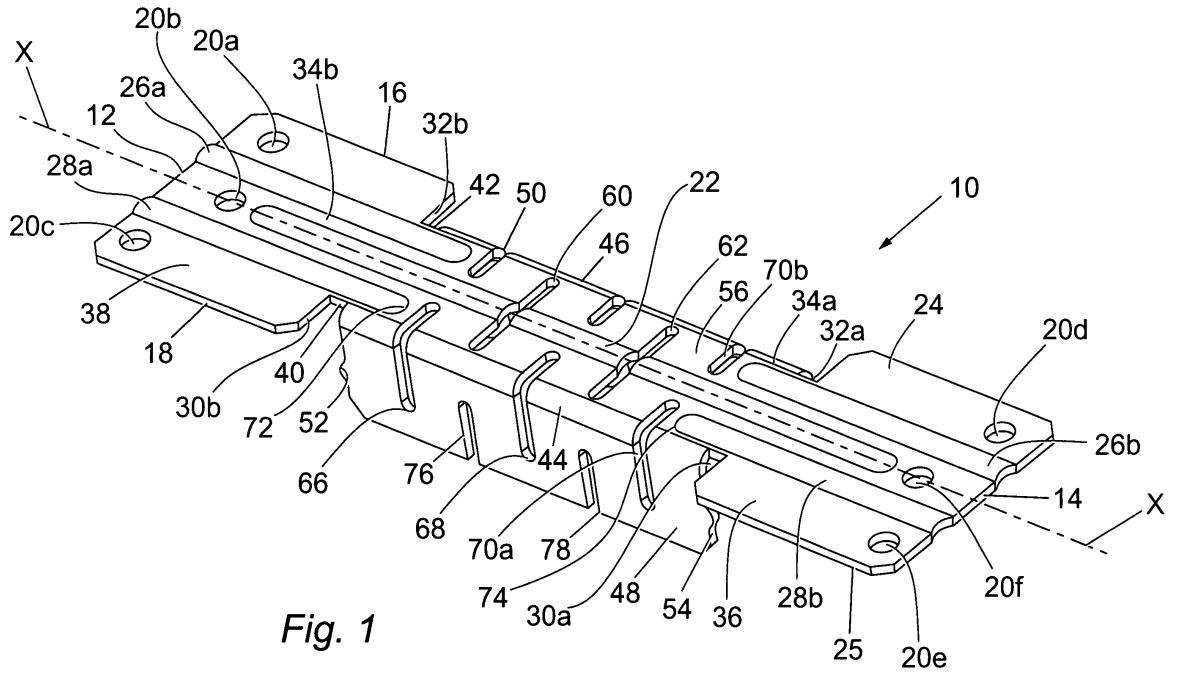

Fig. 1

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Description

[0001] The present invention relates to structural ties or straps as used in the construction industry and more particularly, though not exclusively, to a party wall strap with enhanced acoustic performance.

[0002] Structural straps and ties for use in construction typically comprise a rectangular metal plate in which apertures are arranged for fixing points. In use, nails, screws or the like are located through the apertures for attaching each end of the strap onto a structural member such as a timber frame or masonry wall. In this way, the strap effectively tyes two structural members together.

[0003] An application of the structural strap or tie is in a party wall. Here two timber frame wall leafs are located a short distance apart. A party wall strap is located across the opening and nailed or screwed at each end into the respective timber frames. It is known that noise and vibration through party walls is a problem.

[0004] A gap or opening is required to be maintained as an insulator between the frames to assist in resisting the passage of sound and vibration. This is because the cavities formed between panels have set acoustic resonances and other sound transmission mechanisms. Cavities which are too small or narrow between the opposite panels can lead to significant dips in acoustic and sound insulation performance at low frequencies. A disadvantage of current party wall straps formed as a rectangular metal plate, is that they allow the user to arrange the timber frames at any separation and thus risk adverse acoustic performance between the walls.

[0005] Additionally any connection between the walls provides a passage for sound and vibration. Accordingly the minimum number of straps are used to minimize the risk of sound transfer. Thus a disadvantage in using party walls straps is that they themselves reduce the acoustic performance. Such reduction is proportional to the contact area between the strap and each timber frame. Regulations are therefore set to ensure that a minimum number of straps are used to achieve correct tying of the frames together while attempting to minimise the risk of sound and vibration transfer.

[0006] It is therefore an object of the present invention to provide a connector for use as a structural tie or strap which includes acoustic attenuation mechanism for enhanced acoustic performance over known structural ties and straps.

[0007] According to a first aspect of the present invention there is provided a connector for use as a structural tie or strap comprising a substantially rectangular member having first and second ends on a first axis, at least one fastening point at each end respectively and characterised in that the member includes acoustic attenuation means.

[0008] Preferably, the acoustic attenuation means comprises one or more apertures in the member wherein at least one aperture is arranged on the first axis. Preferably also the aperture is a slot. Advantageously the aperture is arranged asymmetrically to the first axis. More preferably the aperture is arranged perpendicularly to the first axis. In this way a discontinuous path is created along the first axis forcing sound and vibration waves to take a longer path route which reduces the transmitted sound and vibration through the member.

[0009] Preferably, the acoustic attenuation means comprises one or more openings at first and second edges of the member. Preferably the openings are slots cut into the edges. More preferably the openings are arranged asymmetrically to the first axis. Preferably the openings are arranged perpendicularly to the first axis. Advantageously a pair of oppositely arranged openings are formed to create a bridge section transverse to the first axis. Such a narrow bridge section reduces the structural acoustic and vibration passageway between the ends of the connector.

[0010] Preferably a longitudinal portion of the member at an edge is folded with respect to an upper surface of the member. Creating folds in the connector causes the sound and vibration waves to change direction and change form. Changing the form of the waves reduces the transmitted vibration. Advantageously each portion is a central section of the member located between two longitudinally arranged openings on an edge and folded along a fold line. In this arrangement the connector includes first and second plates at the first and second ends respectively. Preferably there are two portions, one at each edge. Preferably the folded portions are arranged symmetrically to the first axis. In this way a bridge is formed between each portion and plate respectively. Advantageously the portions are folded to be perpendicular to the upper surface. More advantageously the length of the portion is selected to be equal to a desired separation of the structural members to which the connector may be used. In this way, use of the connector ensures that a correct separation is maintained between the structural members. Additionally protrusions may be formed in the edges of the longitudinal portions. Such protrusions can be used to contact the structural members and thus reduce the contact area of the connector to the structural members.

[0011] Preferably apertures are formed on the fold lines. Advantageously the aperture is arranged asymmetrically to the fold line. More preferably the aperture is arranged perpendicularly to the fold line. Advantageously apertures and openings are arranged so that portions of each overlap longitudinally and prevent a continuous straight line path between the ends of the member.

[0012] Preferably at least one strengthening rib is arranged upon the member. The strengthening rib may be formed by raising the profile of the member. Preferably the strengthening rib is arranged in parallel to the first axis. More preferably the strengthening rib is arranged on the first axis. The strengthening rib may extend over a portion of the member. One or more strengthening ribs may be arranged on the end plates. Advantageously at

least one strengthening rib is arranged across a bridge.

[0013] The fastening point may be an aperture sized to accept a nail, screw or like to attach the connector to a structural member. Alternatively the fastening point may provide protrusions such as spikes for nailing the connector directly to the structural member.

[0014] An embodiment of the present invention will now be described by way of example only with reference to the accompanying drawings of which:

Figure 1 is a plan view of a connector according to the present invention; and

Figure 2 is a schematic illustration of the connector of Figure 1 located between structural members.

[0015] Referring initially to Figure 1 there is a connector, generally indicated by reference numeral 10, according to an embodiment of the present invention. Connector 10 is formed from a rectangular section of sheet metal having first and second ends 12,14 together with first and second edges 16,18. At each end there are arranged fastening points, in the form of holes 20a-f, through which fastenings such as nails may be located. The connector 10 is symmetrical across a central axis X.

[0016] Arranged on the central axis X is a strengthening rib 22. Rib 22 extends over a substantially portion of the connector 10. Rib 22 is formed by pressing an oblong section of the metal forward to be raised above the upper surface 24 of the connector 10. The lower surface 25 thus has gaps at points where the rib 22 is located.

[0017] At each edge 12,14 there are located two further ribs 26,28. Ribs 26,28 are arranged from the edge 12,14 inwards across the surface 24, parallel to the central axis X and end equidistantly on either side of the rib 22.

[0018] On each edge 16,18 there is arranged a cut-away 30,32 equidistantly from the ends 12,14. The cut-aways are substantially rectangular slots cut into the metal to form a bridge 34a,b between opposing cut-aways 30a,32a which is transverse to the axis X. The cut-aways 30,32 do not cross the ribs 26,28, In this way there are three ribs 22,26,28 passing over each bridge 34 and each bridge is at the narrowest width of the connector 10.

[0019] The portion between each edge 12,14 and cut-aways 30,32 forms an end plate 36,38 respectively. The end plates 36,38 are cut to be narrower in width than the original metal rectangular section. Each end plate 36,38 includes the ribs 22,26,28 and the fastening holes 20. At the inner edges 40,42 of the cut-aways 30,32 connecting cut-aways on the same edge 16,18 there is arranged a fold-line 44,46. Along these lines 44,46 the metal is folded through 90 degrees away from the upper surface 24. The folded portions 48,50 are perpendicular to the upper surface 24 and parallel to the central axis X. The connector 10 is thus not a substantially flat plate as in the prior art but has central legs or raised sections 48,50 which are angled from the end plates 36,38.

[0020] On the longitudinal edges of the folded portions 48,50 there are arranged protrusions 52,54. The protrusions are small triangular sections which protrude into the cut-aways 30,32.

[0021] Between the bridges 34 there is provided a central portion 56 or tie zone. The folded portions 52,54 lie within the central portion along with the central section 58 of the upper surface 24. In the central portion 56, across the axis X are located two apertures 60,62. The apertures 60,62 are oblong slots cut through the connector 10. The apertures 60,62 are transverse to the axis X and equidistant from the edges 12,14. Each aperture 60,62 crosses the strengthening rib 22 and extends to a position adjacent the fold-line 44,46.

[0022] Located equidistantly between the bridges 34 and transversely over the fold-lines 44,46 are three pairs of further apertures 66,68,70. The further apertures 66,68,70 extend from the folded portions 48,50 into the central portion 56 but stop before crossing the strengthening rib 22. The further apertures 66,68,70 lie between the ends 72,74 of the ribs 26,28 and the apertures 60,62.

[0023] At the edges 16,18 there are arranged two openings 76,78 on each edge. The openings 76,78 form cut-away slots which extend up the folded portions 48,50 to lie equidistantly between the further openings 66,68,70 and in line with the apertures 60,62.

[0024] In a preferred embodiment of the invention the connector 10 has a length of 98mm, a width of 35mm and a depth of 14mm.

[0025] In use, the connector 10 is suitable as a structural tie or strap between walls spaced a distance apart. Such an arrangement is found in timber frame constructions at a party wall. The connector 10 may then be referred to as a party wall strap.

[0026] Reference is now made to Figure 2 of the drawings which illustrates the connector 10 located between timber frames 80,82 as may be found in a party wall. The frames 80,82 are brought in so that the inner walls 84,86 rest against the protrusions 52,54. This provides a small contact area between the inner walls and the frames while ensuring that the frames are spaced a fixed distance i.e. the length of the folded portion 48,50 apart. The end plates 36,38 then rest upon the facing surfaces 88,90 of the frames 80,82. As per conventional wall ties, nails 92 are located through the holes 20 to secure the connector 10 to the frames 80,82. While the end plates 36,38 sit flush with the facing surfaces 88,90 only portions of there respective surfaces 25,88,90 will meet due to the raised sections at points of the strengthening ribs 26,28.

[0027] For any strap or tie located in a party wall, the mere connection provides a route for the passage of sound and vibration between the frames. In addition the cavity 94 provided between the frames 80,82 have their own acoustic resonances and other sound transmission mechanisms which must be considered. The structural and acoustic benefits of the connector 10 as compared to a conventional structural tie or strap can be detailed as follows.

[0028] In comparison to other party wall ties the smaller

end plate 36,38 of the connector 10 reduces the area of contact for sound and vibration energy to couple from the frame 80,82 into the connector 10. The small contact area is further reduced by the presence of the holes 20.

[0029] The end plates 36,38 also include structural stiffening ribs 26,28. The raised profile of the strengthening ribs 26,28 reduces the potential surface contact area with the frame 80,82 thus reducing the sound and vibration transmission. These also stiffen the wall connector 10 which benefits sound insulation at low frequencies.

[0030] The connector 10 cross-sectional area then narrows at the bridges 34 and this in conjunction with the end strengthening ribs 26,28 reduces the bridging function between end plates 36,38 and the central portion 56.

[0031] At low frequencies of sound it is important for twin frame or twin plate elements, which are structurally connected, to be stiff and rigid and thus reduce displacement or deflection of the structural elements lightweight studs (frame) or panels if present. The strengthening rib 22 structurally strengthens the central portion 56, thus making it more rigid and stronger but in addition this increases the stiffness of the connector 10 acoustically which is important at low frequencies for sound insulation and reduces the influence of acoustic forced motion.

[0032] The bend and angle created by the folded portions 48,50 cause the sound and vibration waves to change direction but also change form, thus changing in-plane waves to flexural waves and vice versa. As the wave type changes form this causes reductions in transmitted vibration.

[0033] The folded portion 48,50 also provides additional acoustic and structural stiffness by reducing the displacement or deflection of the frame 80,82 or panels (e.g. sheathing panels where present). By incorporating this structural stiffness the connector 10 overcomes any weaknesses which would arise through the number of apertures 60,62,66,68,70,76,78 present.

[0034] Cavities 94 formed between panels 96 have set acoustic resonances and other sound transmission mechanisms. Cavities which are too small or narrow between the opposite panels 96 can lead to significant dips in acoustic and sound insulation performance at low frequencies. It is important to be able to maintain the minimum cavity width and avoid such panels being placed too close together, when constructed or being assembled.

[0035] By setting the central portion 56 at set widths, by using the angled folded portions 48,50 as a 'spacing' element, this can maintain the required minimum cavity dimensions of the separating wall between frame 80,82 or panels 96 as set out in the construction design specifications. This can thus allow the acoustic resonances which form in such twin leaf cavities to be designed to set frequencies by maintaining the exact minimum cavity widths.

[0036] In addition this benefits a number of other issues:

- improves workmanship on-site practice by reducing the potential for varying cavity widths
- improves the potential to maintain site setting out (dimension) requirements as stipulated in the site plans
- can be used in open frame, closed panel, cassette systems and volumetric (i.e. pod or module or box style methods of construction)
- assist in setting out and keeping to foundation footings or substructure support requirements
- assists in meeting dimension requirements for roof elements (e.g. valley sections, ridge tiles, cavity stops, fire stops)

[0037] The further apertures 66,68,70 which span into the angled folded portions 48,50 create discontinuities to reduce direct transmission thus forcing the sound and vibration waves to take a longer path route and change wave type form, as mentioned above. Thus the effective direct unchanged wave type transmission path through the connector 10 is severely restricted to where the material is only continuous.

[0038] The central apertures 60,62 further reduce the direct transmission path and provide discontinuities and boundaries which cause reflection of sound and vibration waves. These distort the wave path into the folded portions 48,50.

[0039] The openings 76,78 at the perimeter edges 16,18 of the folded portions 48,50 prevent direct transmission along the perimeter edge 16,18 and force the sound and vibration waves back into the fold line 44,46 thus causing the waves to further change format and be distorted.

[0040] The principal advantage of the present invention is that it provides a connector for use as a structural tie or strap with enhanced acoustic attenuation.

[0041] A further advantage of at least one embodiment of the present invention is that it provides a party wall strap with a fixed distance achievable between the walls.

[0042] A yet further advantage of at least one embodiment of the present invention is that it provides a party wall strap with increased compression strength by the incorporation of a folded configuration.

[0043] Various modifications may be made to the invention herein described without departing from the scope thereof. For instance, the numbers of and sizes of the apertures, openings, holes and ribs may be varied. The positioning of these components may also be varied provided that an uninterrupted straight path cannot be drawn between the ends of the connector.

Claims

1. A connector for use as a structural tie or strap comprising a substantially rectangular member having first and second ends on a first axis, first and second edges located between the ends, at least one fas-

tening point at each end respectively and **characterised in that** the member includes acoustic attenuation means including one or more openings at least at one of said edges.

2. A connector according to claim 1 wherein the openings are slots cut into the edges.

3. A connector according to claim 2 are arranged perpendicularly to the first axis.

4. A connector according to anyone of claims 1 to 3 wherein the acoustic attenuation means further includes one or more apertures located through the member.

5. A connector according to claim 4 wherein the/each aperture is a slot arranged asymmetrically to the first axis.

6. A connector according to anyone of claims 1 to 6 wherein the apertures and the openings are arranged so that portions of each overlap longitudinally and prevent a continuous straight line path between the ends of the member.

7. A connector according to any preceding claim wherein at least one longitudinal portion of the member at an edge is folded with respect to an upper surface of the member, the portion being a central section of the member located between two longitudinally arranged openings on an edge.

8. A connector according to claim 7 wherein the portions are folded to be perpendicular to the upper surface.

9. A connector according to claim 7 or claim 8 wherein the length of the portion is selected to be equal to a desired separation of the structural members to which the connector may be used.

10. A connector according to anyone of claims 7 to 9 wherein additionally protrusions are formed in the edges of the longitudinal portions.

11. A connector according to any preceding claim wherein at least one strengthening rib is arranged upon the member.

12. A connector according to claim 11 wherein the strengthening rib is formed by raising the profile of the member.

13. A connector according to claim 11 or claim 12 wherein the strengthening rib is arranged in parallel to the first axis.

14. A connector according to any preceding claim wherein the fastening point is an aperture sized to accept a nail, screw or like to attach the connector to a structural member.

15. A connector according to anyone of claims 1 to 13 wherein the fastening point provides protrusions for nailing the connector directly to the structural member.

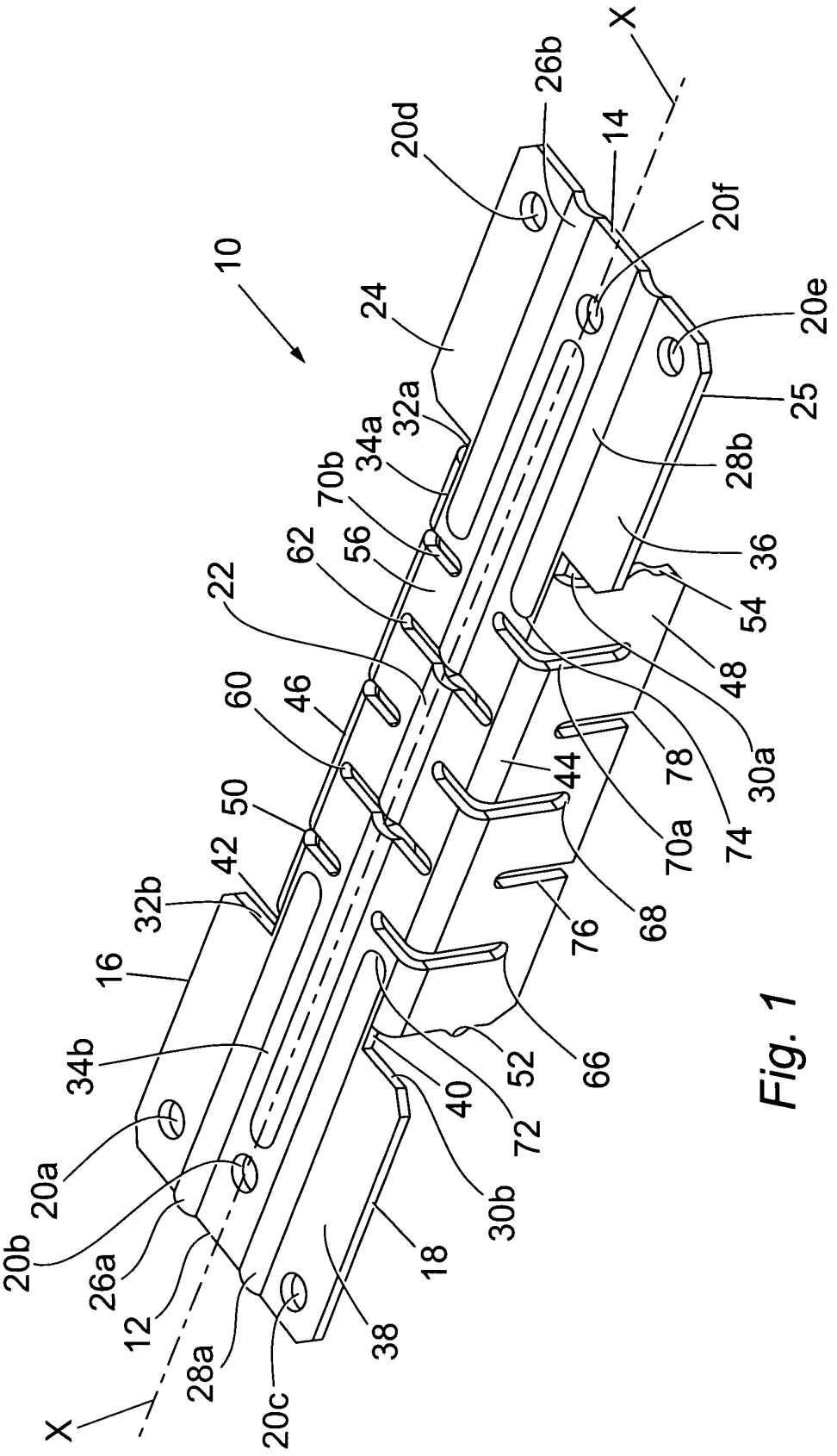
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Fig. 1

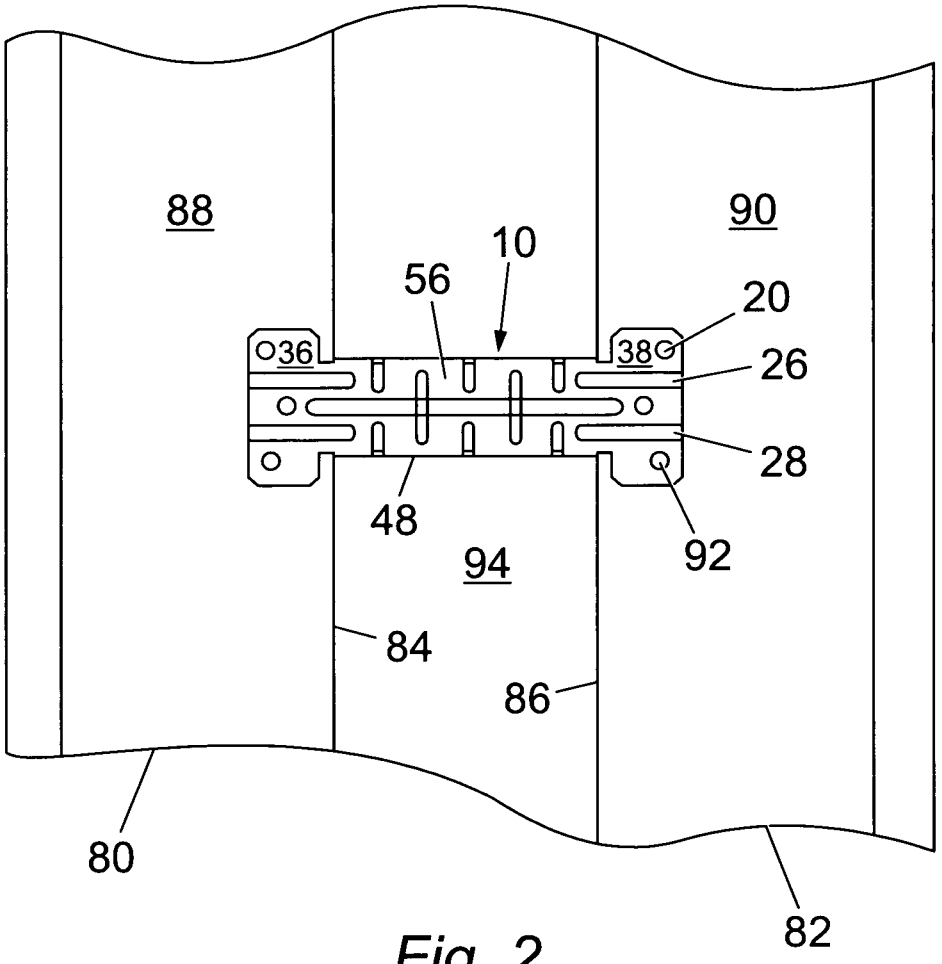

Fig. 2