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(54) **FLOOR OR JOIST SUPPORT/REINFORCEMENT SYSTEM, AND SUPPORT/REINFORCEMENT THEREFOR**

FUSSBODEN- ODER TRÄGERSTÜTZ-/VERSTÄRKUNGSSYSTEM UND STÜTZE/
VERSTÄRKUNG DAFÜR

SYSTÈME DE SUPPORT/RENFORT DE PLANCHER OU DE SOLIVE, ET SUPPORT/RENFORT
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Description

[0001] The present invention relates to a floor or joist support/reinforcement system and, in particular (but not exclusively), to a floor or joist support/reinforcement system that may be used to support a floor or joist in a loft (or attic) space or the like. US 2004/0200180 A1 discloses a system to reinforce a floor joist at the location of a hole in its web portion.

[0002] Roofs in most houses and certain other buildings are supported by roof trusses. Whilst roof trusses provide sufficient strength to support the roof above and a ceiling (e.g. plasterboard) of a room below, they do not provide sufficient strength to satisfactorily support a floor. Floors in a loft are typically supported by a series of parallel steel joists which run along the length of the loft. Such steel joists are heavy and often have to be put into place using a crane or other lifting equipment. This is expensive and inconvenient. One possible alternative would be to use solid timber joists, I-joists or other engineered timber joists. However, such joists would protrude through the proposed roof space (as shown in Figure 1) and would need a conventional roof to be moved to accommodate the joist. Accordingly, the use of steel joists is conventional as they can be accommodated in the available space.

[0003] The present invention seeks to address and/or mitigate one or more of the problems of the prior art.

[0004] Accordingly, in a first aspect, the present invention provides a floor or joist support/reinforcement system according to claim 1 and, in a second aspect, according to claim 2.

[0005] The support preferably comprises a fixing portion for fixing the support to a building.

[0006] The floor support system of the present invention facilitates the use of joists that could otherwise not be used because removal of part of the end of the joist would reduce the strength of the joist. Such a joist may not meeting building regulations.

[0007] The joist is preferably elongate. It is preferred that the joist has substantially the same cross section along whole of length of joist apart from the end portion (the end portion having a reduced cross-sectional area compared to the body portion).

[0008] The end portion of the joist comprises a face that is obliquely angled with respect to the longitudinal axis of joist. Such a joist may be supplied pre-shaped, or a worker may make an oblique cut in the end of the joist. The angle between the oblique face and the longitudinal axis of the body portion may be from 30 to 70 degrees, preferably from 30 to 50 degrees. The end portion of the joist may comprise a face that is substantially normal to the longitudinal axis of the body portion. Such a face may provide the end face of the joist. For the avoidance of confusion, it is noted that a joist may comprise a face that is obliquely angled with respect to the longitudinal axis of the body portion and a face that is substantially normal to the longitudinal axis of the body portion.

[0009] It is preferred that the joist is wooden. Such joists are light and may be easily shaped using manually-operated tools.

[0010] It is preferred that the support comprises a fixing portion for attachment to a building.

[0011] For the avoidance of confusion, it is hereby noted that the following statements in relation to the nature of the support apply to the support of the floor support system of the first aspect of the invention and the second aspect of the present invention.

[0012] The supporting portion may provide a slot into which the end portion of the joist may be received. This provides a simple and effective way of locating the joist in the support. A slot may allow the joist to be slid into place.

[0013] The supporting portion may comprise an enclosure portion for receiving the end portion of the joist. The enclosure portion provides a slot in the form of an enclosed cavity for receipt of the end portion of the joist.

[0014] The supporting portion may comprise a collar or sleeve for receipt of the end portion of the joist. The collar or sleeve defines a slot for the receipt of the end portion of the joist. In use, at least a part of the end portion of the joist protrudes through the collar or sleeve.

[0015] The enclosure portion, collar or sleeve may be provided by two or more side wall portions and a top portion interconnecting the side wall portions.

[0016] The enclosure portion, collar or sleeve may define an aperture for the receipt of the joist. The cross-section of the slot defined by the enclosure portion, collar or sleeve may decrease with increasing distance from the aperture. In other words, in use. The cross-section of the slot defined by the enclosure portion, collar or sleeve may decrease with increasing distance from the body portion of the joist.

[0017] The support may be made from a metal, such as steel.

[0018] The support may comprise a strap portion for attaching the support to the joist.

[0019] The support or part thereof may be readily deformable from a first configuration in which the joist may be readily presented to, and removed from the support, to a second configuration in which the support or part thereof frictionally engages with the joist to inhibit removal of the joist from the support. The support may be provided with deformable elements which are readily deformable. The deformable elements may be in the form of walls.

[0020] The support may be provided with a barb, and the support or part thereof may be readily deformable from a first configuration in which the joist may be readily presented to, and removed from the support, to a second configuration in which the barb engages with the joist to inhibit removal of the joist from the support.

[0021] The support may be provided with one or more barbs to inhibit the removal of the joist from the support once the support has been fitted to the joist.

[0022] Preferred embodiments will now be described

by way of example only with reference to the following drawings. Figures 15a to 15d and 17a to 17b disclose embodiments according to the invention. The remaining embodiments do not form part of the invention.

Figure 1 is a schematic cross-sectional view of a conventional roof structure, showing the size and shape of a conventional prior art joist in relation to the roof structure;

Figure 2 is a schematic perspective view of an embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a hollow body portion which defines an opening for the receipt of a joist;

Figure 3 is a schematic perspective view of an alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a bracket which defines a surface for the receipt of a joist;

Figure 4 is a schematic perspective view of a further alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a U-shaped supporting portion which defines a slot for the receipt of a joist;

Figure 5 is a schematic perspective view of an alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a slot for the sliding receipt of the lower flange of a joist (I-joist shown);

Figure 6 is a schematic perspective view of a yet further alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising deformable side-wall portions that have been deformed to frictionally engage with a joist;

Figure 7 is a schematic perspective view of an alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a collar which defines a space for the receipt of a joist;

Figure 8 is a schematic perspective view of a further alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a shoe portion and a deformable strap portion for attaching to the joist;

Figure 9 is a schematic perspective view of an alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising two laterally-extending fixing portions and a hollow body portion which defines an opening for the receipt of a joist;

Figure 10 is a schematic perspective view of a further alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising two laterally-extending fixing portions and a hollow body portion

which defines an opening for the receipt of a joist; Figure 11 is a schematic perspective view of an alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a U-shaped supporting portion which defines a slot for the receipt of a joist;

Figure 12 is a schematic perspective view of a further alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a bracket which defines a surface for the receipt of a joist;

Figure 13 is a schematic perspective view of an alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a bracket which defines a surface for the receipt of a joist;

Figure 14a is a schematic side elevation view and Figures 14b to 14e are schematic perspective views of further alternative embodiments of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcements comprising flanges or portions for attachment to a joist;

Figure 15a is a schematic side elevation view and Figures 15b to 15d are schematic end elevation views of further alternative embodiments of floor or joist support/reinforcement system and support/reinforcement according to the present invention, the support/reinforcements comprising flanges or portions for attachment to a joist;

Figures 16 is a schematic perspective view of a further alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising flanges or portions for attachment to a joist;

Figure 17a is a schematic perspective view and Figure 17b is schematic end elevation view of a further alternative embodiment of floor or joist support/reinforcement system and support/reinforcement according to the present invention, the support/reinforcement comprising brackets for attachment to a joist;

Figure 18a is a schematic perspective view and Figure 18b is schematic plan view from above of a further alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a strap for attachment to a joist;

Figure 19 is a schematic side elevation view of an alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising a bracket which defines a surface for the receipt of a joist; and

Figure 20 is a schematic side elevation view of a further alternative embodiment of floor or joist support/reinforcement system and support/reinforcement, the support/reinforcement comprising straps for attachment to a joist.

[0023] Referring first to Figure 1, there is shown a cross-section through a conventional roofing structure 1. The roofing structure 1 comprises a plurality of roof trusses 2, only one of which is shown in the figure. The roof truss 2 comprises a substantially horizontal portion 3 and an angled portion 4. The roof truss 2 is supported via a wall plate 6 provided on an inner wall 5, the upper end of which is slightly raised compared to the outer wall 8 and the wall cavity 7. The roofing structure 1 presents a space for the possible insertion of a floor-supporting joist. A conventional floor-supporting joist is shown in dashed lines and is denoted by reference numeral 9. As can be seen, a conventional floor-supporting joist 9 compromises the conventional roofing structure as it cannot be accommodated without extending the roof covering (not shown) or moving the roofing structure 1. This is highly inconvenient given that many floor-support joists 9 would be required to support a floor in a roofing space such as a loft or attic.

[0024] A first embodiment of each of a floor or joist support/reinforcement system 10 and a support/reinforcement 40 are shown in Figure 2. The floor or joist support/reinforcement system 10 comprises a joist 20 suitable for supporting a floor (not shown) and a support/reinforcement 40 for the joist 20. The joist 20 shown in this embodiment is an I-joist (although any joist may be beneficially employed) and comprises an upper flange 21, a lower flange 22 and a web 23 extending therebetween. The joist 20 further comprises an end portion 25 (hidden inside the support/reinforcement 40) and a body portion 24, the cross-sectional area of the end portion 25 being less than the cross-sectional area of the body portion 24. The reduced cross-sectional area of the end portion 25 of the joist 20 permits it to be accommodated within the available space of a conventional roofing structure 1. The end portion 25 may typically be formed by making an oblique cut into a conventional joist. However, this compromises the structural integrity of the joist 20 as the effective shear plane of the reduced cross-sectional area of the end portion 25 is less than that of the cross-sectional area of the body portion 24 (as can best be seen in Figure 19). Accordingly, to recover the necessary amount of effective shear plane, the floor or joist support/reinforcement system 10 further comprises the support/reinforcement 40 for supporting and/or reinforcing the end portion 25 of the joist 20. The support/reinforcement 40 comprises an enclosure portion 45 which provides additional strength to the end portion 25 of the joist 20 so that it recovers sufficient of its effective shear plane to function effectively. The enclosure 45 is formed of flanges 47 which receives and encloses the end part of the end portion 25 of the joist 20. The enclosure 45 provides a slot into which the end portion 25 of the joist 20 is inserted. The cross-sectional area of the enclosure 45 decreases with increasing distance from the body portion 24 towards the end portion 25 of the joist 20. The joist 20 may be simply received in the support/reinforcement 40, or may be fixed in place using fasteners 90.

Alternatively or additionally, tabs, barbs or other means (not shown) may be beneficially employed to retain the joist 20 in place within the support/reinforcement 40. Optionally, an interference fit between the joist 20 and support/reinforcement 40 may be employed. Without the additional support of the support/reinforcement 40, however, the joist 20 may not be sufficiently strong to support any overlying floor and may not meet building regulations. The support/reinforcement 40 shown further comprises an optional return flange 46 for fixing the support/reinforcement 40 to the outer surface of the inner wall 5 of the house or other building or structure. In this case, the flange 46 is attached using fasteners 90. The outer wall 8 and wall cavity 7 are shown in dotted line. The support/reinforcement 40 shown also comprises a section 48 for receiving the upper flange 21 of the main body 24 of joist 20. This provides the option to tie (using fasteners) the upper flange 21 to the lower flange 22 of the joist 20 by making use of the structural integrity of the support/reinforcement 40, thereby increasing the load capacity of the system 10.

[0025] The support/reinforcement 40, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the support/reinforcement 40 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the support/reinforcement 40 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20 (as shown).

[0026] Figure 19 usefully demonstrates (schematically) the respective shear plane mechanisms at play when a joist 20 is mounted on top of a wall 5 via a wall plate 6. In a first case, with no support/reinforcement present (ignoring the support/reinforcement 1740), the effective shear plane is at A, in line with the point at which the wall 5 ceases to support the joist 20. It will be readily understood by those skilled in the art that the effective shear plane at A is significantly reduced due to the reduced cross sectional area of the joist at this point. This is a direct result of the oblique cut in the joist 20 necessary to accommodate the joist 20 in the roof structure 1. In a second case, with a support/reinforcement in place, the effective shear plane is moved to B in line with the point at which the support/reinforcement ceases to support the joist 20. It will be readily understood by those skilled in the art that the full effective shear plane at B is restored due to the joist having its full cross sectional area available at this point.

[0027] Further embodiments of floor or joist support/reinforcement systems and support/reinforcements are shown in Figures 3 to 20. Many of the features of the floor or joist support/reinforcement systems and support/reinforcements are the same as those shown in Figure 2 and will not be described further in detail. For these

features, like numbering has been used. In the embodiments shown, the joist 20 comprises an end portion 25 and a body portion 24, the cross-sectional area of the end portion 25 being less than the cross-sectional area of the body portion 24 (in the Figure 20 embodiment the cross-sectional area of the end portion 25 is zero). In each of Figures 3 to 8, the joist 20 is shown in dotted line in order that the features of the support/reinforcement may be seen more clearly.

[0028] Referring next to the floor or joist support/reinforcement system 100 and support/reinforcement 140 of Figure 3, the support/reinforcement 140 can be seen to comprise an L-shaped bracket. A first arm 142 of the bracket is provided with fastener/fixture-receiving apertures 143 (only one of which is labelled) for fixing the support/reinforcement 140 to the wall of a house or other building or structure, typically using fasteners or fixtures (not shown). A second arm 144 of the bracket provides a support surface for, and strength to, the joist 20. The second arm 144 of the bracket is provided with fastener/fixture-receiving apertures 145 (only one of which is labelled) for fixing the joist 20 to the support/reinforcement 140 using fasteners or fixtures (not shown). The second arm 144 of the bracket, which provides additional strength to the end portion 25 of the joist 20, is of such length as is necessary for the joist 20 to recover sufficient of its effective shear plane to function effectively. As such, the second arm 144 of the bracket may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the second arm 144 of the bracket may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 (as shown) to recover the full effective shear plane of the joist 20.

[0029] A further alternative floor or joist support/reinforcement system 200 and support/reinforcement 240 are shown in Figure 4. The support/reinforcement 240 comprises a flange 242 provided with fastener/fixture-receiving apertures 243 (only one of which is labelled) for fixing the support/reinforcement 240 to the wall of a house or other building or structure, typically using fasteners or fixtures (not shown). The support/reinforcement 240 comprises a substantially U-shaped portion 244 for receiving and providing strength to the end portion 25 of the joist 20. The U-shaped portion 244 forms a slot which is shaped to enable convenient location therein of the end portion 25 at least of the joist 20. The U-shaped portion 244 comprises upwardly extending flanges 245, 246 attached at their lower ends to a base portion 247. In the present embodiment, the flanges 245, 246 are relatively rigid and cannot be readily deformed. The joist 20 may be simply received in the U-shaped portion 244, or may be fixed in place using fasteners (not shown). It is anticipated, however, that it may be desirable for the flanges 245, 246 to be readily deformable so as to engage with the joist 20 once the joist 20 has been put in place, such engagement inhibiting removal of the joist 20 (by way of

frictional or deformable engagement). Alternatively or additionally, one or both of the flanges 245, 246 may be provided with a barb or barbs which inhibit removal of the joist 20 from the support/reinforcement 240 once the flange or flanges 245, 246 has or have been deformed to engage with the joist 20. Alternatively or additionally, fasteners may be used to fix the joist 20 in place. The U-shaped portion 244 of the support/reinforcement 240, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the U-shaped portion 244 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered (as shown). Alternatively, the U-shaped portion 244 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20.

[0030] A yet further alternative floor or joist support/reinforcement system 300 and support/reinforcement 340 are shown in Figure 5. The support/reinforcement 340 comprises a flange 342 provided with fastener/fixture-receiving apertures 343 (only one of which is labelled) for fixing the support/reinforcement 340 to the wall of a house or other building or structure, typically using fasteners or fixtures (not shown). The support/reinforcement 340 comprises a slot portion 344 for receiving and providing strength to the end portion 25 of the joist 20. A first slot region 345 and second slot region 346 are defined by a slot base portion 347 and slot-forming portions 348, 349. The first and second slot regions 345, 346 are arranged to slidably receive the lower flange 22 of an I-joist 20 (or lower part of a solid timber joist with grooves cut in). The gap (not labelled) between slot-forming portions 348, 349 facilitates the passage therein of the web 23 of joist 20. In the present embodiment, the slot-forming portions 348, 349 are relatively rigid and cannot be readily deformed. It is anticipated, however, that it may be desirable for the slot-forming portions 348, 349 to be readily deformable so as to engage with the lower flange 22 of the joist 20 once the joist has been put in place, such engagement inhibiting removal of the joist 20. Alternatively or additionally, one or both of the slot-forming portions 348, 349 may be provided with a barb or barbs which inhibit removal of the joist 20 from the support/reinforcement 340 once the slot-forming portion or portions 348, 349 has or have been deformed to engage with the joist 20. Alternatively or additionally, fasteners may be used to fix the joist 20 in place. It is further anticipated that the support/reinforcement 340 may be provided with an end stop which inhibits the support/reinforcement 340 from being slid along the length of the joist 20, ensuring that the support/reinforcement 340 remains located on the end of the joist 20. This may be achieved, for example, by bending downwards an end portion of one or both of the slot-forming members 348, 349 adjacent to the flange 342. The slot portion 344 of the support/reinforcement

340, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the slot portion 344 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the slot portion 344 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20 (as shown).

[0031] A further alternative floor or joist support/reinforcement system 400 and support/reinforcement 440 are shown in Figure 6. The support/reinforcement 440 comprises a flange 442 provided with fastener/fixture-receiving apertures 443 (only one of which is labelled) for fixing the support/reinforcement 440 to the wall of a house or other building or structure, typically using fasteners or fixtures (not shown). The support/reinforcement 440 comprises a slot portion 444 for receiving and providing strength to the end portion 25 of the joist. The slot portion 444 comprises side walls 445, 446 which have been deformed to engage with the joist 20. Prior to presentation of the joist 20 to the support/reinforcement 440, the side walls 445, 446 formed part of a substantially U-shaped structure for the receipt of the joist 20. Upon receipt of the joist 20, the side walls 445, 446 are then deformed to form a snug frictional or interference fit around the end portion 25 of the joist 20. Alternatively or additionally, one or both of the side walls 445, 446 may be provided with a barb or barbs which inhibits removal of the joist 20 from the support/reinforcement 440 once the side wall or walls 445, 446 has or have been deformed to engage with the joist 20. Alternatively or additionally, fasteners may be used to fix the joist 20 in place. It is further anticipated that the support/reinforcement 440 may be provided with an end stop which inhibits the support/reinforcement 440 from being slid along the length of the joist 20, ensuring that the support/reinforcement 440 remains located on the end of the joist 20. This may be achieved, for example, by bending downwards an end portion of one or both of the side walls 445, 446 adjacent to the flange 442. The slot portion 444 of the support/reinforcement 440, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the slot portion 444 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the slot portion 444 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20 (as shown).

[0032] A yet further alternative floor or joist support/reinforcement system 500 and support/reinforcement 540 are shown in Figure 7. The support/reinforcement 540 comprises a flange 542 provided with fastener/fixture-

receiving apertures 543 (only one of which is labelled) for fixing the support/reinforcement 540 to the wall of a house or other building or structure, typically using fasteners or fixtures (not shown). The support/reinforcement 540 comprises an arm 544 for providing strength to the end portion 25 of the joist 20. The support/reinforcement 540 further comprises a collar 545 for receiving and providing further strength to the end portion 25 of the joist 25. The cross-sectional area of the slot formed by collar 545 decreases with increasing distance from the body portion 24 (not shown) of the joist 20 towards the end portion 25 of the joist 20. The joist 20 may be simply received in the collar 545, or may be fixed in place in the collar and/or on the arm 544 using fasteners (not shown). Alternatively or additionally, tabs, barbs or other means (not shown) may be beneficially employed to retain the joist 20 in place within the collar 545 and/or on the arm 544. Optionally, an interference fit between the joist 20 and support/reinforcement 540 may be employed. The arm 544 and collar 545 of the support/reinforcement 540, which provides additional strength to the end portion 25 of the joist 20, are of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the arm 544 and/or collar 545 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered (as shown). Alternatively, the arm 544 and/or collar 545 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20.

[0033] A further alternative floor or joist support/reinforcement system 600 and support/reinforcement 640 are shown in Figure 8. The support/reinforcement 640 comprises a flange 642 provided with fastener/fixture-receiving apertures 643 (only one of which is labelled) for fixing the support/reinforcement 640 to the wall of a house or other building or structure, typically using fasteners or fixtures (not shown). The support/reinforcement 640 comprises a shoe portion 644 for receiving and providing strength to the end portion 25 of the joist 20. The shoe portion 644 comprises side walls 645, 646 and an end wall 647 extending upwardly from a base portion 648. The shoe portion 644 forms a recess which is shaped to enable convenient locating therein of the joist 20. The support/reinforcement 640 further comprises a strap portion 649 which is brought into contact with the oblique angled surface of joist end portion 25. Fastener/fixture means (not shown) may be inserted through fastener/fixture-receiving apertures 650 (only one of which is labelled) to attach the strap portion 649 to the joist 20. Alternatively or additionally, tabs, barbs or other means (not shown) may be beneficially employed to retain the joist 20 in place. Optionally, an interference fit between the joist 20 and support/reinforcement 640 may be employed. The shoe portion 644 of the support/reinforcement 640, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so

that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the shoe portion 644 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered (as shown). Alternatively, the shoe portion 644 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20.

[0034] A yet further alternative floor or joist support/reinforcement system 700 and support/reinforcement 740 are shown in Figure 9. The floor or joist support/reinforcement system 700 and support/reinforcement 740 are very similar to those shown in Figure 2. The arrangement for fixing the support/reinforcement 740 to the building is, however, different to that shown in Figure 2. In the embodiment shown in Figure 9, the flange 46 is dispensed with and in its place are provided two laterally-projecting fixing portions 746a, 746b which may be attached to the upper edge (e.g. wall plate 6) of inner wall 5 for example, using fasteners (not shown).

[0035] A further alternative floor or joist support/reinforcement system 800 and support/reinforcement 840 are shown in Figure 10. The floor or joist support/reinforcement system 800 and support/reinforcement 840 are very similar to those shown in Figure 9. The arrangement for fixing the support/reinforcement 840 to the building is, however, different to that shown in Figure 9 in that the two laterally-projecting fixing portions 846a, 846b extend substantially horizontally from the base 847 of the support/reinforcement 840 so as to lie on the upper edge (e.g. wall plate 6) of inner wall 5 along substantially their entire length. As in the Figure 9 embodiment, the two laterally-projecting fixing portions 846a, 846b may be attached to the wall plate 6 of inner wall 5 using fasteners 90. In addition, the substantially vertical sidewalls 841 of the support/reinforcement 840 differ from the Figure 9 embodiment in that they extend the full length of the end portion 25 of joist 20 from the end of the end portion 25 past the transition to the body portion 24 to recover the full effective shear plane of the joist 20. By fastening the support/reinforcement 840 to the upper flange 21 and lower flange 22 of the joist 20 using fasteners 90 as illustrated, the upper flange 21 and lower flange 22 of the joist 20 are tied together via the support/reinforcement 840, increasing the structural integrity of the joist 20 and thereby increasing the load capacity of the system 800.

[0036] A yet further alternative floor or joist support/reinforcement system 900 and support/reinforcement 940 are shown in Figure 11. The support/reinforcement 940 comprises a return flange 942 provided with fasteners 90 for fixing the support/reinforcement 940 to the wall plate 6 of a wall 5 in house or other building or structure. The support/reinforcement 940 comprises a substantially U-shaped portion 944 for receiving and providing strength to the end portion 25 of the joist 20. The U-shaped portion 944 forms a slot which is shaped to enable convenient locating therein of the end portion 25 at least

of the joist 20. The U-shaped portion 944 comprises upwardly extending flanges 945, 946 attached at their lower ends to a base portion 947. In the present embodiment the flanges 945, 946 are relatively rigid and cannot be readily deformed. The joist 20 may be simply received in the U-shaped portion 944 and fixed in place using fasteners 90. It is anticipated, however, that it may be desirable for the flanges 945, 946 to be readily deformable so as to engage with the joist 20 once the joist 20 has been put in place, such engagement inhibiting removal of the joist 20 (by way of frictional or deformable engagement). Alternatively or additionally, one or both of the flanges 945, 946 may be provided with a barb or barbs which inhibit removal of the joist 20 from the support/reinforcement 940 once the flange or flanges 945, 946 has or have been deformed to engage with the joist 20. Alternatively or additionally, fasteners 90 may be used to fix the joist 20 in place. Two laterally-projecting fixing portions 948a, 948b are provided and extend substantially horizontally from the base 947 of the support/reinforcement 940 so as to lie on the upper edge of the wall plate 6 of inner wall 5 along substantially their entire length. The two laterally-projecting fixing portions 948a, 948b are arranged so as to be substantially perpendicular to flanges 945, 946 and return flange 942, and may be attached to the wall plate 6 of inner wall 5 using fasteners 90. The U-shaped portion 944 of the support/reinforcement 940, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the U-shaped portion 944 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the U-shaped portion 944 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20 (as shown). A variation of this embodiment of support/reinforcement 940 is possible by omitting the base 947 of the U-shaped portion 944. Instead, each laterally-projecting fixing portion 948a, 948b may be arranged so as to be joined along an edge of the return flange 942. In turn, each flange 945, 946 may be arranged so as to be joined along an edge of one of the laterally-projecting fixing portions 948a, 948b. In use, each of the return flange 942, two laterally-projecting fixing portions 948a, 948b and flanges 945, 946 may be arranged substantially perpendicular to one another, as shown in Figure 11.

[0037] A further alternative floor or joist support/reinforcement system 1000 and support/reinforcement 1040 are shown in Figure 12. The support/reinforcement 1040 comprises a substantially U-shaped portion 1044 for receiving and providing strength to the end portion 25 of the joist 20. The U-shaped portion 1044 forms a slot which is shaped to enable convenient locating therein of the end portion 25 at least of the joist 20. The U-shaped portion 1044 comprises upwardly extending flanges

1045, 1046 attached at their lower ends to a base portion 1047, the upwardly extending flanges 1045, 1046 further comprising upstanding strap elements 1050, 1051 which extend between the upper and lower flanges 21, 22 of the joist 20. By fastening the strap elements 1050, 1051 to the upper flange 21 and lower flange 22 of the joist 20 using fasteners 90 as illustrated, the upper flange 21 and lower flange 22 of the joist 20 are tied together via the support/reinforcement 1040, increasing the structural integrity of the joist 20 and thereby increasing the load capacity of the system 1000. In the present embodiment the flanges 1045, 1046 are relatively rigid and cannot be readily deformed. The joist 20 may be simply received in the U-shaped portion 1044 and fixed in place using fasteners 90. It is anticipated, however, that it may be desirable for the flanges 1045, 1046 and/or strap elements 1050, 1051 to be readily deformable so as to engage with the joist 20 once the joist 20 has been put in place, such engagement inhibiting removal of the joist 20 (by way of frictional or deformable engagement). Alternatively or additionally, one or both of the flanges 1045, 1046 and/or strap elements 1050, 1051 may be provided with a barb or barbs which inhibit removal of the joist 20 from the support/reinforcement 1040 once the flange or flanges 1045, 1046 has or have been deformed to engage with the joist 20. Alternatively or additionally, fasteners may be used to fix the joist 20 in place. Two laterally-projecting fixing portions 1048a, 1048b are provided and extend substantially horizontally from the base 1047 of the support/reinforcement 1040 so as to lie on the upper edge of the wall plate 6 of inner wall 5 along substantially their entire length. The two laterally-projecting fixing portions 1048a, 1048b are arranged so as to be substantially perpendicular to flanges 1045, 1046 and strap elements 1050, 1051, and may be attached to the wall plate 6 of inner wall 5 using fasteners 90. The U-shaped portion 1044 of the support/reinforcement 1040, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the U-shaped portion 1044 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the U-shaped portion 1044 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20 (as shown). A variation of this embodiment of support/reinforcement 1040 is possible by omitting the base 1047 of the U-shaped portion 1044. Instead, the support/reinforcement 1040 may comprise two parts, a left hand part and a right hand part. In this case, each laterally-projecting fixing portion 1048a, 1048b may be arranged so as to be joined respectively along an edge of a flange 1045, 1046 (itself incorporating a strap element 1050, 1051) to form a left hand or right hand part. In use, the laterally-projecting fixing portion 1048a, 1048b of each part may be arranged substantially

perpendicular to the flange 1045, 1046 of that part, as shown in Figure 12.

[0038] A yet further alternative floor or joist support/reinforcement system 1100 and support/reinforcement 1140 are shown in Figure 13. The floor or joist support/reinforcement system 1100 and support/reinforcement 1140 are similar to those shown in Figure 12. The arrangement is, however, different to that shown in Figure 12 in that the support/reinforcement 1140 connects to just one side of the joist 20. The support/reinforcement 1140 comprises a substantially L-shaped portion 1144 for receiving and providing strength to the end portion 25 of the joist 20. The L-shaped portion 1144 is shaped to enable convenient location therein of the end portion 25 at least of the joist 20. The L-shaped portion 1144 comprises an upwardly extending flange 1145 attached at its lower end to a base portion 1147, the upwardly extending flange 1145 further comprising an upstanding strap element 1150 which extends between the upper and lower flanges 21, 22 of the joist 20. By fastening the strap element 1150 to the upper flange 21 and lower flange 22 of the joist 20 using fasteners 90 as illustrated, the upper flange 21 and lower flange 22 of the joist 20 are tied together via the support/reinforcement 1140, increasing the structural integrity of the joist 20 and thereby increasing the load capacity of the system 1100. In the present embodiment the flange 1145 is relatively rigid and cannot be readily deformed. The joist 20 may be simply received in the L-shaped portion 1144 and fixed in place using fasteners 90. It is anticipated, however, that it may be desirable for the flange 1145 and/or strap element 1150 to be readily deformable so as to engage with the joist 20 once the joist 20 has been put in place, such engagement inhibiting removal of the joist 20 (by way of frictional or deformable engagement). Alternatively or additionally, the flange 1145 and/or strap element 1150 may be provided with a barb or barbs which inhibit removal of the joist 20 from the support/reinforcement 1140 once the flange 1145 has or have been deformed to engage with the joist 20. Alternatively or additionally, fasteners 90 may be used to fix the joist 20 in place. The base 1147a extends laterally, substantially horizontally, beyond the width of the joist 20 to a base portion 1147b so as to lie on the upper edge of the wall plate 6 of inner wall 5 along substantially its entire length. The base portion 1147 is arranged so as to be substantially perpendicular to flange 1145, and may be attached to the wall plate 6 of inner wall 5 using fasteners 90. The L-shaped portion 1144 of the support/reinforcement 1140, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the L-shaped portion 1144 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the L-shaped portion 1144 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the

body portion 24 to recover the full effective shear plane of the joist 20 (as shown). A variation of this embodiment of support/reinforcement 1140 is possible by reversing the hand of the support/reinforcement 1140 such that it connects on the opposite side of the joist 20, with the base 1147a and base portion 1147b extending under the joist 20 in the opposite direction to that shown in Figure 13.

[0039] Further alternatives of floor or joist support/reinforcement system 1200 and support/reinforcement 1240 are shown in Figures 14a to 14e. The support/reinforcement 1240 of Figures 14d and 14e illustrate an optional return flange 1242 provided with fastener/fixture-receiving apertures (not shown) for fixing the support/reinforcement 1240 to the wall of a house or other building or structure, typically using fasteners or fixtures. The support/reinforcement 1240 of each of Figures 14a to 14e comprise at least two side flanges 1245, 1246 for receiving and providing strength to the end portion 25 of the joist 20 so that it recovers sufficient of its effective shear plane to function effectively. The side flanges 1245, 1246 extend the full height between the upper and lower flanges 21, 22 of the joist 20. By fastening the side flanges 1245, 1246 to the upper flange 21 and lower flange 22 of the joist 20 using fasteners 90 as illustrated, the upper flange 21 and lower flange 22 of the joist 20 are tied together via the support/reinforcement 1240, increasing the structural integrity of the joist 20 and thereby increasing the load capacity of the system 1200. The side flanges 1245, 1246 are arranged such that the lower end of each side flange 1245, 1246 is at least partially located, and connected to the joist 20, in the end portion 25 of the joist 20. In the present embodiment the side flanges 1245, 1246 are relatively rigid and cannot be readily deformed. It is anticipated, however, that it may be desirable for the side flanges 1245, 1246 to be readily deformable so as to engage with the joist 20 once the joist 20 has been put in place, such engagement inhibiting removal of the joist 20 (by way of frictional or deformable engagement). Alternatively or additionally, the side flanges 1245, 1246 may be provided with a barb or barbs which inhibit removal of the joist 20 from the support/reinforcement 1240 once the side flange 1245, 1246 have been deformed to engage with the joist 20. Alternatively or additionally, fasteners may be used to fix the joist 20 in place. Simple side flanges 1245, 1246 may be provided in the form of straps, as shown in Figures 14a (side elevation) and Figure 14b (perspective view). Alternatively, a bottom flange 1247 (Figure 14d) and/or top flange 1248 (Figure 14c) may be incorporated to provide additional strength. The bottom flange 1247 and/or top flange 1248 may be an integral part (i.e. joined) with one or both of the side flanges 1245, 1246. The support/reinforcement 1240 may be one piece, either in the form of a collar which fully envelops the joist 20 and is slid onto the joist 20, or in the form a plate that folds around the joist 20 leaving a join line 1250, as illustrated in Figure 14e. It is therefore possible to partially or fully envelop the body portion 24 and end

portion 25 of the joist 20. The support/reinforcement 1240, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the support/reinforcement 1240 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20, or may be angled in a similar way to the oblique angle (but not necessarily the same angle) of the cut to the joist 20 to achieve this effect (as shown).

[0040] Yet further alternatives of floor or joist support/reinforcement system 1300 and support/reinforcement 1340 are shown in Figures 15a to 15d. The support/reinforcement 1340 may include an optional return flange (not shown) provided with fastener/fixture-receiving apertures (not shown) for fixing the support/reinforcement 1340 to the wall 5 of a house or other building or structure, typically via a wall plate 6 using fasteners or fixtures. The support/reinforcement 1340 of each of Figures 15a to 15c comprise at least two side flanges 1345, 1346 for receiving and providing strength to the end portion 25 of the joist 20 so that it recovers sufficient of its effective shear plane to function effectively. Each side flange 1345, 1346 is offered up to a side of the web 23 of the joist 20 and spans between the upper and lower flanges 21, 22 of the joist 20. Preferably, each side flange 1345, 1346 further comprises at least one lateral flange 1347, 1348 which extends substantially perpendicular to the side flange 1345, 1346 and is offered up to the inner face of the lower flange 22 of the joist 20, as shown in Figures 15a and 15b. Alternatively, or additionally, each side flange 1345, 1346 further comprises at least one lateral flange 1349, 1350 which extends substantially perpendicular to the side flange 1345, 1346 and is offered up to the inner face of the upper flange 21 of the joist 20. Additionally, each side flange 1345, 1346 may further comprise a lower side flange 1351, 1352 and/or upper side flange 1353, 1354 which is offered up to the side face of the respective lower and/or upper flange 21, 22 of joist 20, as shown in Figure 15c. Indeed, as shown in Figure 15d, the support/reinforcement 1340 may fully envelop the joist 20. Such a support/reinforcement 1340 may be one piece and, as such, be manufactured by extrusion or forming. These embodiments of support/reinforcement 1340 provide the option to tie (using fasteners 90) the upper flange 21 to the lower flange 22 of the joist 20 by making use of the structural integrity of the support/reinforcement 1340, thereby increasing the load capacity of the system 1300. In the present embodiment the support/reinforcement 1340 is relatively rigid and cannot be readily deformed. It is anticipated, however, that it may be desirable for the support/reinforcement 1340 to be readily deformable so as to engage with the joist 20 once the joist 20 has been put in place, such engagement inhibiting removal of the joist 20 (by way of frictional or deformable engagement). Alternatively or additionally, the support/reinforcement 1340 may be pro-

vided with a barb or barbs which inhibit removal of the joist 20 from the support/reinforcement 1340 once it has been deformed to engage with the joist 20. Alternatively or additionally, fasteners may be used to fix the joist 20 in place in the support/reinforcement 1340. The support/reinforcement 1340 may be one piece, either in the form of a collar which fully envelops the joist 20 and is slid onto the joist 20, or in the form a plate that folds around the joist 20 leaving a join line. It is therefore possible to partially or fully envelop the body portion 24 and end portion 25 of the joist 20. In either case, the support/reinforcement 1340 can be formed or trimmed so as to respect the oblique cut of the joist 20. The support/reinforcement 1340, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the support/reinforcement 1340 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20 (as shown).

[0041] A further alternative floor or joist support/reinforcement system 1400 and support/reinforcement 1440 are shown in Figure 16. The support/reinforcement 1440 comprises a substantially U-shaped portion 1444 for receiving and providing strength to the end portion 25 of the joist 20. The U-shaped portion 1444 forms a slot which is shaped to enable convenient locating therein of the end portion 25 at least of the joist 20. The U-shaped portion 1444 comprises upwardly extending flanges 1445, 1446 attached at their lower ends to a base portion 1447, which extend between the upper and lower regions of the joist 20. In the present embodiment the flanges 1445, 1446 are relatively rigid and cannot be readily deformed. The joist 20 may be simply received in the U-shaped portion 1444 and fixed in place using fasteners 90. It is anticipated, however, that it may be desirable for the flanges 1445, 1446 to be readily deformable so as to engage with the joist 20 once the joist 20 has been put in place, such engagement inhibiting removal of the joist 20 (by way of frictional or deformable engagement). Alternatively or additionally, one or both of the flanges 1445, 1446 may be provided with a barb or barbs which inhibit removal of the joist 20 from the support/reinforcement 1440 once the flange or flanges 1445, 1446 has or have been deformed to engage with the joist 20. Alternatively or additionally, fasteners may be used to fix the joist 20 in place. Two laterally-projecting fixing portions 1448a, 1448b are provided and extend substantially horizontally from the base 1447 of the support/reinforcement 1440 so as to lie on the upper edge of the wall plate 6 of inner wall 5 along substantially their entire length. The two laterally-projecting fixing portions 1448a, 1448b are arranged so as to be substantially perpendicular to flanges 1445, 1446 and may be attached to the wall plate 6 of inner wall 5 using fasteners 90. The U-shaped portion 1444 of the support/reinforcement 1440, which provides additional strength to the end portion 25 of the joist 20,

is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the U-shaped portion 1444 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the U-shaped portion 1444 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20 (as shown). A variation of this embodiment of support/reinforcement 1440 is possible by omitting the base 1447 of the U-shaped portion 1444. Instead, the support/reinforcement 1440 may comprise two parts, a left hand part and a right hand part. In this case, each laterally-projecting fixing portion 1448a, 1448b may be arranged so as to be joined along an edge of a respective flange 1445, 1446. In use, the laterally-projecting fixing portions 1448a, 1448b may be arranged substantially perpendicular to the flanges 1445, 1446 of each part, as shown in Figure 16.

[0042] A yet further alternative floor or joist support/reinforcement system 1500 and support/reinforcement 1540 are shown in Figures 17a and 17b. The floor or joist support/reinforcement system 1500 and support/reinforcement 1540 are similar to those shown in Figure 16. The arrangement is, however, different to that shown in Figure 16 in that the support/reinforcement 1540 does not comprise laterally-projecting fixing portions. Instead, the support/reinforcement 1540 comprises substantially L-shaped portions 1544a, 1544b for receiving and providing strength to the end portion 25 of the joist 20. The L-shaped portions 1544a, 1544b are shaped to enable convenient locating therein of the end portion 25 at least of the joist 20. The L-shaped portions 1544a, 1544b comprise an upwardly extending flange 1545a, 1545b which extends between the upper and lower regions of the joist 20, each attached at its lower end to a base portion 1547a, 1547b. In the present embodiment, the flanges 1544a, 1544b are relatively rigid and cannot be readily deformed. The joist 20 may be simply received in the L-shaped portions 1544a, 1544b and fixed in place using fasteners 90. It is anticipated, however, that it may be desirable for the flanges 1545a, 1545b to be readily deformable so as to engage with the joist 20 once the joist 20 has been put in place, such engagement inhibiting removal of the joist 20 (by way of frictional or deformable engagement). Alternatively or additionally, the support/reinforcement 1540 may be provided with a barb or barbs which inhibit removal of the joist 20 from the support/reinforcement 1540 once the support/reinforcement 1540 has been deformed to engage with the joist 20. Alternatively or additionally, fasteners may be used to fix the joist 20 in place. The base portions 1547a, 1547b extend laterally, substantially horizontally, underneath and towards the centre of the joist 20 so as to lie on the upper edge of the wall plate 6 of inner wall 5. The base portions 1547a, 1547b are arranged so as to be substantially perpendicular to flanges 1545a, 1545b, and may be

attached to the wall plate 6 of inner wall 5 using fasteners 90. The L-shaped portions 1544a, 1544b of the support/reinforcement 1540, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the L-shaped portions 1544a, 1544b may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the L-shaped portions 1544a, 1544b may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20 (as shown).

[0043] A yet further alternative floor or joist support/reinforcement system 1600 and support/reinforcement 1640 are shown in Figures 18a and 18b. The support/reinforcement 1640 comprises an elongate strap for receiving and providing strength to the end portion 25 of the joist 20. The elongate strap comprises two side flanges 1644, 1645 and an end face flange 1646. The joist 20 may be simply received in the U-shape of the elongate strap, and the two side flanges 1644, 1645 and the end face flange 1646 fixed in place around the lower periphery of the joist 20 using fasteners 90. It is anticipated, however, that it may be desirable for the support/reinforcement 1640 to be readily deformable so as to engage with the joist 20 once the joist 20 has been put in place, such engagement inhibiting removal of the joist 20 (by way of frictional or deformable engagement). Alternatively or additionally, the support/reinforcement 1640 may be provided with a barb or barbs which inhibit removal of the joist 20 from the support/reinforcement 1640 once the support/reinforcement 1640 has or have been deformed to engage with the joist 20. The support/reinforcement 1640, which provides additional (tensile) strength in the bottom of the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the side flanges 1644, 1645 may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the side flanges 1644, 1645 may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 to recover the full effective shear plane of the joist 20 (as shown).

[0044] A further alternative floor or joist support/reinforcement system 1700 and support/reinforcement 1740 are shown in Figure 19. The support/reinforcement 1740 can be seen to comprise an F-shaped bracket. A first arm 1742 of the bracket is provided with fastener/fixture-receiving apertures (not shown) for fixing the support/reinforcement 1740 to the outer face of a wall of a house or other building or structure, typically using fasteners or fixtures (not shown). A second arm 1744 of the bracket provides a support surface for, and strength to, the joist 20. The second arm 1744 of the bracket is provided with

fastener/fixture-receiving apertures (not shown) for fixing the joist 20 to the support/reinforcement 1740 using fasteners or fixtures (not shown). A third arm 1743 of the bracket is provided substantially parallel to, but spaced inside of, the first arm 1742. The third arm 1743 is of sufficient length (same length, longer or shorter than the first arm 1742) to increase the strength of the bracket to resist bending moments from the supported joist, and may be provided with fastener/fixture-receiving apertures (not shown) for fixing the support/reinforcement 1740 to the inner face of a wall of a house or other building or structure, typically using fasteners or fixtures (not shown). The second arm 1744 of the bracket, which provides additional strength to the end portion 25 of the joist 20, is of sufficient length so that the joist 20 recovers sufficient of its effective shear plane to function effectively. As such, the second arm 1744 of the bracket may extend from the end of the end portion 25 of the joist 20 only partly along the length of the end portion 25 until sufficient of its effective shear plane is recovered. Alternatively, the second arm 1744 of the bracket may extend at least the full length of the end portion 25 of joist 20 to and/or past the transition to the body portion 24 (as shown) to recover the full effective shear plane of the joist 20. Reference numerals 1750, 1751 and 1752 represent a ceiling plasterboard, a dot and dab, and a wall plasterboard respectively.

[0045] An alternative embodiment of each of a floor or joist support/reinforcement system 1800 and a support/reinforcement 1840 are shown in Figure 20. The floor or joist support/reinforcement system 1800 comprises a joist 20 suitable for supporting a floor (not shown) and a support/reinforcement 1840 for the joist 20. The joist 20 shown in this embodiment is an I-joist (although any joist may be beneficially employed) and comprises an upper flange 21, a lower flange 22 and a web 23 extending therebetween. As before, the joist 20 further comprises a body portion 24 of full cross-sectional area. However, the end portion 25 of reduced cross-sectional area (when compared to that of the body portion 24) either stops short of the usual wall 5 or other support structure of the building or other structure, or is non-existent, as shown (has zero cross-sectional area, i.e. has less cross-sectional area than the body portion 24), such that the body portion 24 stops short of the usual wall 5 or other support structure of the building or other structure. This permits the joist 20 to be accommodated within the available space of a conventional roofing structure 1 without suffering an oblique cut. However, this compromises the structural integrity of the joist 20 as it stops short of the usual wall 5 or other support structure of the building, or other structure. Accordingly, to recover the lost section of joist 20 and necessary amount of effective shear plane, the floor or joist support/reinforcement system 1800 further comprises the support/reinforcement 1840 for bridging the gap between the joist 20 and supporting wall 5 and/or reinforcing the joist 20. In the embodiment shown, the support/reinforcement 1840 comprises one or more

horizontal straps 1841 which are connected using fasteners 90 to the lower flange 22 of the joist 20 and extend laterally to rest on and/or attach to wall plate 6 of the wall 5 of a house or other building or structure. The support/reinforcement 1840 further comprises one or more angled straps 1842 which are connected using a fastener or fasteners 90 to the upper flange 21 of the joist 20 and extend laterally and downwardly towards wall plate 6 where they connect to the respective one or more horizontal straps 1841 at pivot point 1847 (secured by way of a fastener or fasteners) at an angle α therebetween. Thus, the support/reinforcement 1840 recovers the lost section of joist 20 and necessary amount of effective shear plane and structural integrity required whilst fitting within the available space. The angle α may be varied as appropriate to fit the available space and/or provide the necessary structural integrity by varying the respective lengths of the horizontal straps 1841 and angled straps 1842, and/or the respective fixing positions of each on the joist 20. It will be appreciated that the support/reinforcement 1840 may take any suitable form and may make take the general (but adapted) form of any of the preceding embodiments of support/reinforcement described above. What is important, however, is that the cross-sectional area of the support/reinforcement 1840 (or its effective envelope) decreases with increasing distance from the body portion 24 of the joist 20 towards the wall 5 or other support structure of the building or other structure. The joist 20 may be simply received in the support/reinforcement 1840, or may be fixed in place using fasteners 90. Alternatively or additionally, tabs, barbs or other means (not shown) may be beneficially employed to retain the joist 20 in place within the support/reinforcement 1840. Optionally, an interference fit between the joist 20 and support/reinforcement 1840 may be employed. The support/reinforcement 1840 may further comprise a return flange (not shown) for fixing the support/reinforcement 1840 to the outer surface of the inner wall 5 of the house or other building or structure. In this case, the flange may be attached by use of fasteners 90.

[0046] Whilst preferred embodiments of the present invention have been described above and illustrated in figures 15a to 15d and 17a to 17b, these are by way of example only and non-limiting. It will be appreciated by those skilled in the art that many alternatives are possible within the ambit of the invention, as set out in the appended claims.

[0047] It will be understood by those skilled in the art that the support/reinforcement may be connected to the joist, or the joist connected to the support/reinforcement. The support/reinforcement may be provided in parts which may be assembled prior to, or during, its installation. The support/reinforcement may be retrofit.

[0048] It will also be understood by those skilled in the art that the support/reinforcement need not extend over the whole length of the end portion of the joist. It may be sufficient for the supporting member to extend over a fraction of the length of the joist end portion. The sup-

port/reinforcement, which provides additional strength to the end portion of the joist, is of sufficient length so that the joist recovers sufficient of its effective shear plane to function effectively. As such, the support/reinforcement may extend from the end of the end portion of the joist only partly along the length of the end portion until sufficient of its effective shear plane is recovered. Alternatively, the support/reinforcement may extend at least the full length of the end portion of the joist to and/or past the transition to the body portion to recover the full effective shear plane of the joist (as shown in Figure 19).

[0049] The fastener/fixture-receiving apertures referred to above are suitable for receiving screws, nails, pins, rivets, bolts or any other fixture means whatsoever that may be beneficially employed.

[0050] The support/reinforcements described may be manufactured from any suitable material, laminate or composite using any suitable manufacturing process. Typically, the support/reinforcements described will be made from sheet metal and folded, formed, welded as appropriate (for example, by cutting from one piece of metal or by joining pieces of metal, e.g. by welding). Alternatively, the support/reinforcements described may be extruded (particularly where they envelop the joist).

Claims

1. A floor or joist support/reinforcement system (1300) comprising:

a joist (20) for supporting a floor, the joist comprising a main body portion (24) of substantially uniform cross-sectional area, and an end portion (25) whose cross-sectional area is less than that of the main body portion (24) in that the end portion (25) of the joist (20) comprises a face that is obliquely angled with respect to a longitudinal axis of joist (20), wherein the main body portion (24) of the joist (20) is I-shaped in cross section; and

a support/reinforcement (1340) for supporting and/or reinforcing the joist (20), the support/reinforcement (1340) providing support for and/or strength to at least part of the end portion (25) of the joist (20), wherein the support/reinforcement (1340) comprises:

- at least two side flanges (1345, 1346) for receiving and providing strength to the end portion (25) of the joist (20), wherein each side flange (1345, 1346), is offered up to a side of a web (23) of the joist (20) and spans between upper and lower flanges (21, 22) of the joist (20); and

each side flange (1345, 1346) further comprises at least one lateral flange (1347, 1348) which

extends substantially perpendicular to the side flange (1345, 1346) and is offered up to the inner face of the lower flange (22) of the joist (20).

2. A floor or joist support/reinforcement system (1500) comprising:

a joist (20) for supporting a floor, the joist comprising a main body portion (24) of substantially uniform cross-sectional area, and an end portion (25) whose cross-sectional area is less than that of the main body portion (24) in that the end portion (25) of the joist (20) comprises a face that is obliquely angled with respect to a longitudinal axis of joist (20), wherein the main body portion (24) of the joist (20) is rectangular in cross section;

and

a support/reinforcement (1540) for supporting and/or reinforcing the joist (20), the support/reinforcement (1540) providing support for and/or strength to at least part of the end portion (25) of the joist (20), wherein the support/reinforcement (1540) comprises:

two substantially L-shaped brackets (1544a, 1544b) for receiving and providing strength to the end portion (25) of the joist (20), the L-shaped brackets (1544a, 1544b) comprising an upwardly extending flange (1545a, 1545b) which extends between the upper and lower regions of the joist (20), each upwardly extending flange (1545a, 1545b) attached at its lower end to a base portion (1547a, 1547b), wherein the base portions (1547a, 1547b) extend laterally, substantially horizontally, underneath and towards the centre of the joist (20).

3. A floor or joist support/reinforcement system as claimed in any one of the preceding claims wherein the support/reinforcement (1340) comprises a fixing portion for fixing the support to a building or other structure.

4. A floor or joist support/reinforcement system as claimed in claim 5 wherein the fixing portion comprises a return flange.

5. A floor or joist support/reinforcement system as claimed in any one of the preceding claims wherein the joist (20) is elongate and the joist has substantially the same cross section along whole of length of joist apart from the end portion (25), wherein the end portion has a reduced cross-sectional area.

6. A floor or joist support/reinforcement system as claimed in any one of the preceding claims wherein

the end portion (25) of the joist comprises a face that is substantially normal to the longitudinal axis of the body portion (24).

7. A floor or joist support/reinforcement system as claimed in any one of the preceding claims wherein the support/reinforcement (1340) provides at least a partial slot into which the end portion of the joist at least, or at least a portion thereof, may be received.

8. A floor or joist support/reinforcement system as claimed in any one of the preceding claims wherein the support/reinforcement (1340) comprises one or more planar plates (1345, 1346) for offering up to and/or attachment to the side face or web of a joist.

9. A method for the formation of at least part of a floor or joist support/reinforcement system (1300) as claimed in any one of the preceding claims, the method comprising the step of using at least one of the supports/reinforcements (1340, 1540) together with at least one joist (20).

25 Patentansprüche

1. Fußboden- oder Balkenunterstützungs-/Balkenverstärkungssystem (1300) umfassend:

einen Balken (20) zum Unterstützen eines Fußbodens, wobei der Balken einen Hauptkörperabschnitt (24) mit im Wesentlichen einheitlicher Querschnittsfläche und einen Endabschnitt (25) aufweist, dessen Querschnittsfläche geringer ist als diejenige des Hauptkörperabschnitts (24), dadurch, dass der Endabschnitt (25) des Balkens (20) eine Fläche umfasst, welche bezüglich einer longitudinalen Achse des Balkens (20) schräg abgewinkelt ist, wobei der Hauptkörperabschnitt (24) des Balkens (20) I-förmig im Querschnitt ist; und eine Unterstützung/Verstärkung (1340) zum Unterstützen und/oder Verstärken des Balkens (20), wobei die Unterstützung/Verstärkung (1340) eine Unterstützung und/oder Festigkeit für mindestens einen Teil des Endabschnitts (25) des Balkens (20) bereitstellt, wobei die Unterstützung/Verstärkung (1340) umfasst:

- mindestens zwei Seitenflansche (1345, 1346) zum Aufnehmen des Endabschnitts (25) des Balkens (20) und zum Bereitstellen von Festigkeit für den Endabschnitt (25) des Balkens (20), wobei jeder Seitenflansch (1345, 1346) an einer Seite eines Stegs (23) des Balkens (20) angesetzt ist und sich zwischen oberen und unteren Flanschen (21, 22) des Balkens (20) aufspannt; und jeder

- Seitenflansch (1345, 1346) umfasst ferner mindestens einen lateralen Flansch (1347, 1348), welcher sich im Wesentlichen senkrecht zu dem Seitenflansch (1345, 1346) erstreckt und welcher an der inneren Fläche des unteren Flanschs (22) des Balkens (20) angesetzt ist.
2. Fußboden- oder Balkenunterstützungs-/Balkenverstärkungssystem (1500) umfassend:
- einen Balken (20) zum Unterstützen eines Fußbodens, wobei der Balken einen Hauptkörperabschnitt (24) mit im Wesentlichen einheitlicher Querschnittsfläche und einen Endabschnitt (25) aufweist, dessen Querschnittsfläche geringer ist als diejenige des Hauptkörperabschnitts (24), dadurch, dass der Endabschnitt (25) des Balkens (20) eine Fläche umfasst, welche bezüglich einer longitudinalen Achse des Balkens (20) schräg abgewinkelt ist, wobei der Hauptkörperabschnitt (24) des Balkens (20) rechteckig im Querschnitt ist; und eine Unterstützung/Verstärkung (1540) zum Unterstützen und/oder Verstärken des Balkens (20), wobei die Unterstützung/Verstärkung (1540) eine Unterstützung und/oder Festigkeit für mindestens einen Teil des Endabschnitts (25) des Balkens (20) bereitstellt, wobei die Unterstützung/Verstärkung (1540) umfasst:
- zwei im Wesentlichen L-förmige Klammern (1544a, 1544b) zum Aufnehmen des Endabschnitts (25) des Balkens (20) und zum Bereitstellen von Festigkeit für den Endabschnitt (25) des Balkens (20), wobei die L-förmige Klammer (1544r, 1544b) einen sich aufwärts erstreckenden Flansch (1545a, 1545b) umfasst, welcher sich zwischen den oberen und unteren Regionen des Balkens (20) erstreckt, wobei jeder sich aufwärts erstreckende Flansch (1545a, 1545b) an seinem unteren Ende an einem Basisabschnitt (1547a, 1547b) angebracht ist, wobei die Basisabschnitte (1547a, 1547b) sich lateral, im Wesentlichen horizontal, unterhalb und auf das Zentrum des Balkens (20) zu erstrecken.
3. Fußboden- oder Balkenunterstützungs-/Balkenverstärkungssystem nach einem der vorhergehenden Ansprüche, wobei die Unterstützung/Verstärkung (1340) einen Festmachabschnitt zum Festmachen der Unterstützung an einem Gebäude oder einer anderen Struktur umfasst.
4. Fußboden- oder Balkenunterstützungs-/Balkenverstärkungssystem nach Anspruch 5, wobei der Festmachabschnitt einen Rückkehrflansch umfasst.
5. Fußboden- oder Balkenunterstützungs-/Balkenverstärkungssystem nach einem der vorhergehenden Ansprüche, wobei der Balken (20) gestreckt ist und der Balken im Wesentlichen denselben Querschnitt entlang der gesamten Länge des Balkens, abgesehen von dem Endabschnitt (25), aufweist, wobei der Endabschnitt eine reduzierte Querschnittsfläche aufweist.
6. Fußboden- oder Balkenunterstützungs-/Balkenverstärkungssystem nach einem der vorhergehenden Ansprüche, wobei der Endabschnitt (25) des Balkens eine Fläche aufweist, welche im Wesentlichen senkrecht zu der longitudinalen Achse des Körperabschnitts (24) ist.
7. Fußboden- oder Balkenunterstützungs-/Balkenverstärkungssystem nach einem der vorhergehenden Ansprüche, wobei die Unterstützung/Verstärkung (1340) mindestens eine Teilaussparung aufweist, in welcher mindestens der Endabschnitt des Balkens, oder mindestens ein Abschnitt davon, aufgenommen werden kann.
8. Fußboden- oder Balkenunterstützungs-/Balkenverstärkungssystem nach einem der vorhergehenden Ansprüche, wobei die Unterstützung/Verstärkung (1340) eine oder mehrere ebene Platten (1345, 1346) zum Ansetzen und/oder zum Anbringen an der Seitenfläche oder dem Steg des Balkens umfasst.
9. Verfahren zum Bilden von mindestens einem Teil eines Fußboden- oder Balkenunterstützungs-/Balkenverstärkungssystems (1300) nach einem der vorhergehenden Ansprüche, wobei das Verfahren den Schritt einer Verwendung von mindestens einer Unterstützung/Verstärkung (1340, 1540) zusammen mit mindestens einem Balken (20) umfasst.

Revendications

1. Système de support/renfort de plancher ou de solive (1300) comprenant :

une solive (20) pour supporter un plancher, la solive comprenant une partie corps principal (24) à superficie en section transversale sensiblement uniforme, et une partie extrémité (25) dont la superficie en section transversale est inférieure à celle de la partie corps principal (24), la partie extrémité (25) de la solive (20) comprenant une face qui est angulaire obliquement par rapport à un axe longitudinal de la solive (20), la partie corps principal (24) de la solive (20)

ayant une section transversale en forme de I ; et un support/renfort (1340) pour supporter et/ou renforcer la solive (20), le support/renfort (1340) offrant un support et/ou une résistance à au moins une portion de la partie extrémité (25) de la solive (20), le support/renfort (1340) comprenant :

- au moins deux rebords latéraux (1345, 1346) pour recevoir et offrir une résistance à la partie extrémité (25) de la solive (20), chaque rebord latéral (1345, 1346) s'offrant jusqu'à un côté d'une âme (23) de la solive (20) et s'étendant entre des rebords supérieur et inférieur (21, 22) de la solive (20) ; et

chaque rebord latéral (1345, 1346) comprend, en outre, au moins un rebord latéral (1347, 1348) qui s'étend sensiblement perpendiculairement au rebord latéral (1345, 1346) et s'offre jusqu'à la face interne du rebord inférieur (22) de la solive (20).

2. Système de support/renfort de plancher ou de solive (1500) comprenant :

une solive (20) pour supporter un plancher, la solive comprenant une partie corps principal (24) à superficie en section transversale sensiblement uniforme, et une partie extrémité (25) dont la superficie en section transversale est inférieure à celle de la partie corps principal (24), la partie extrémité (25) de la solive (20) comprenant une face qui est angulaire obliquement par rapport à un axe longitudinal de la solive (20), la partie corps principal (24) de la solive (20) ayant une section transversale rectangulaire ; et un support/renfort (1540) pour supporter et/ou renforcer la solive (20), le support/renfort (1540) offrant un support et/ou une résistance à au moins une portion de la partie extrémité (25) de la solive (20), le support/renfort (1540) comprenant :

deux consoles sensiblement en forme de L (1544a, 1544b) pour recevoir et offrir une résistance à la partie extrémité (25) de la solive (20), les consoles en forme de L (1544a, 1544b) comprenant un rebord s'étendant vers le haut (1545a, 1545b) qui s'étend entre les régions supérieure et inférieure de la solive (20), chaque rebord s'étendant vers le haut (1545a, 1545b) étant fixé, au niveau de son extrémité inférieure, à une partie base (1547a, 1547b), les parties bases (1547a, 1547b) s'étendant latéralement, sensiblement horizontalement, en dessous et vers le centre de la

solive (20).

3. Système de support/renfort de plancher ou de solive selon l'une quelconque des revendications précédentes, dans lequel le support/renfort (1340) comprend une partie de fixation pour fixer le support à un bâtiment ou une autre structure.

4. Système de support/renfort de plancher ou de solive selon la revendication 5, dans lequel la partie de fixation comprend un rebord à retour.

5. Système de support/renfort de plancher ou de solive selon l'une quelconque des revendications précédentes, dans lequel la solive (20) est allongée et la solive a sensiblement la même section transversale sur toute la longueur de la solive à l'exception de la partie extrémité (25), la partie extrémité ayant une superficie en section transversale réduite.

6. Système de support/renfort de plancher ou de solive selon l'une quelconque des revendications précédentes, dans lequel la partie extrémité (25) de la solive comprend une face qui est sensiblement perpendiculaire à l'axe longitudinal de la partie corps (24).

7. Système de support/renfort de plancher ou de solive selon l'une quelconque des revendications précédentes, dans lequel le support/renfort (1340) prévoit au moins une fente partielle dans laquelle la partie extrémité de la solive au moins, ou au moins une portion de celle-ci, peut être reçue.

8. Système de support/renfort de plancher ou de solive selon l'une quelconque des revendications précédentes, dans lequel le support/renfort (1340) comprend une ou plusieurs plaques planes (1345, 1346) pour s'offrir jusqu'à et/ou se fixer à la face latérale ou l'âme d'une solive.

9. Procédé pour la formation d'au moins une partie d'un système de support/renfort de plancher ou de solive (1300) selon l'une quelconque des revendications précédentes, le procédé comprenant l'étape d'utilisation d'au moins l'un des supports/renforts (1340, 1540) conjointement à au moins une solive (20).

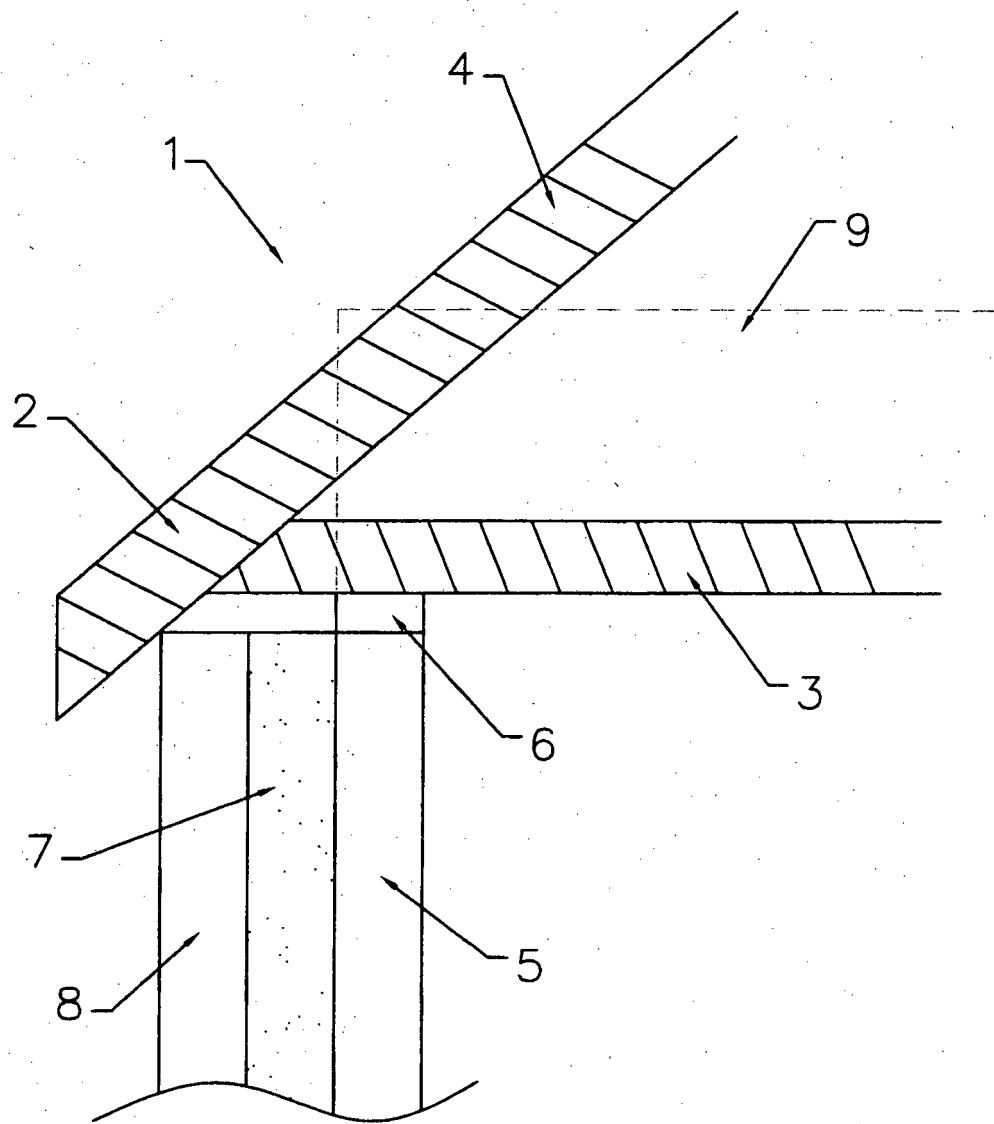


FIG 1.

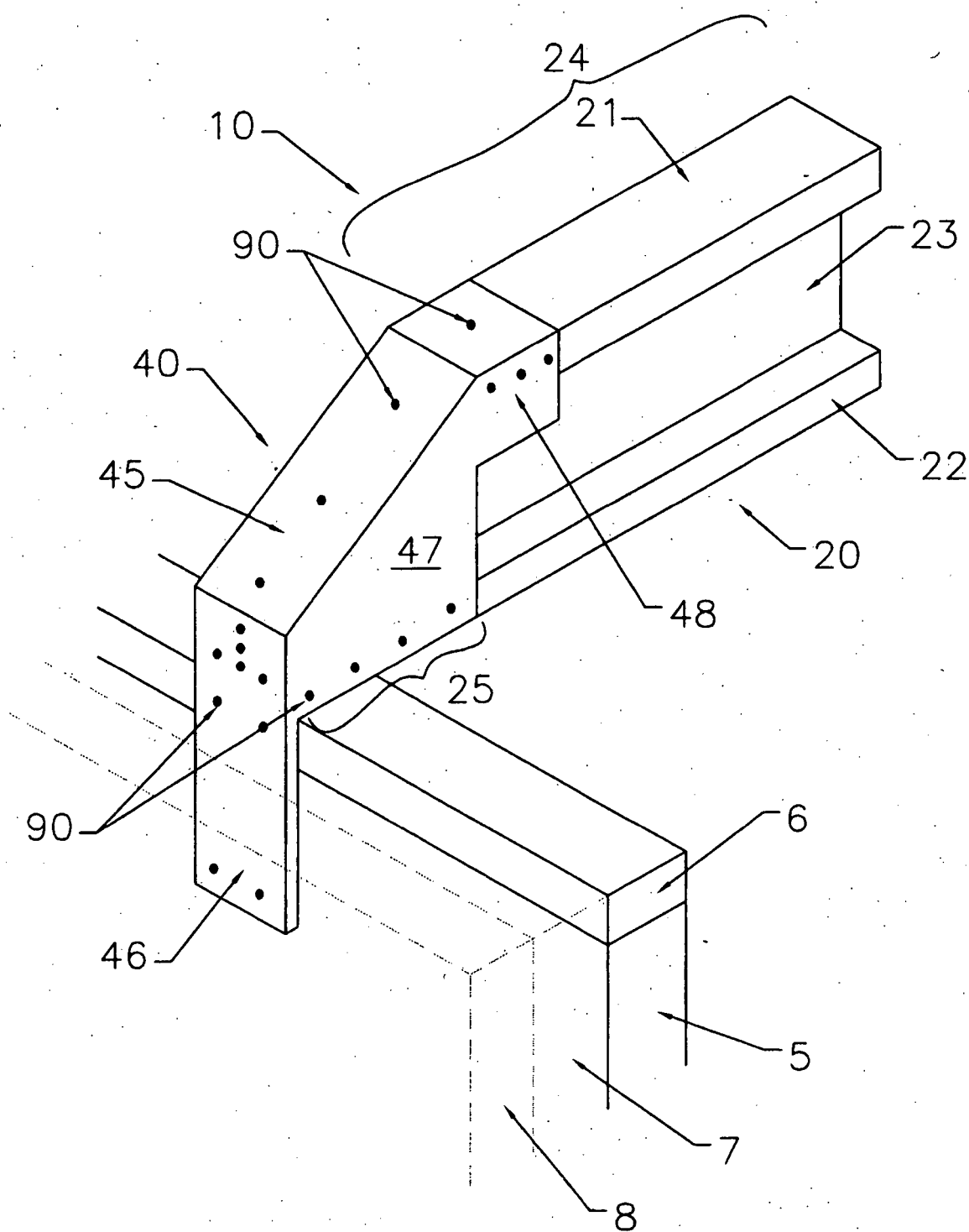


FIG 2.

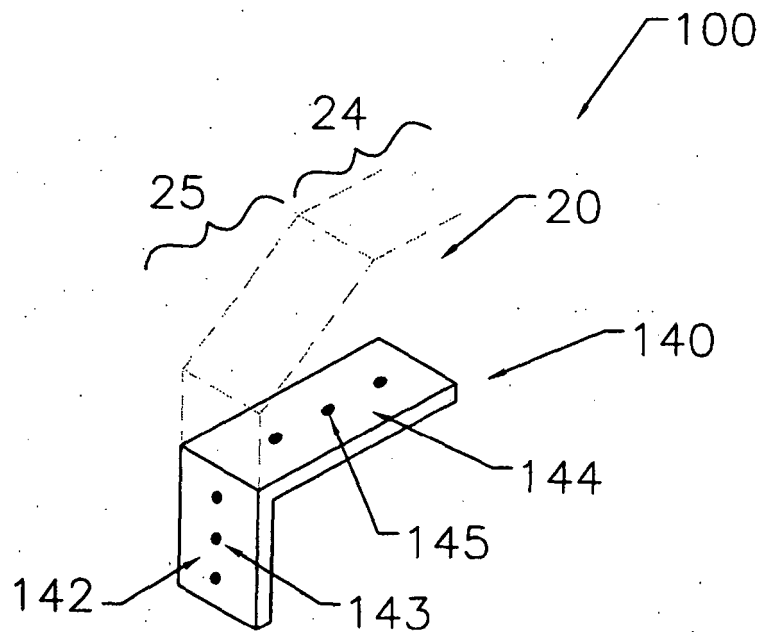


FIG 3.

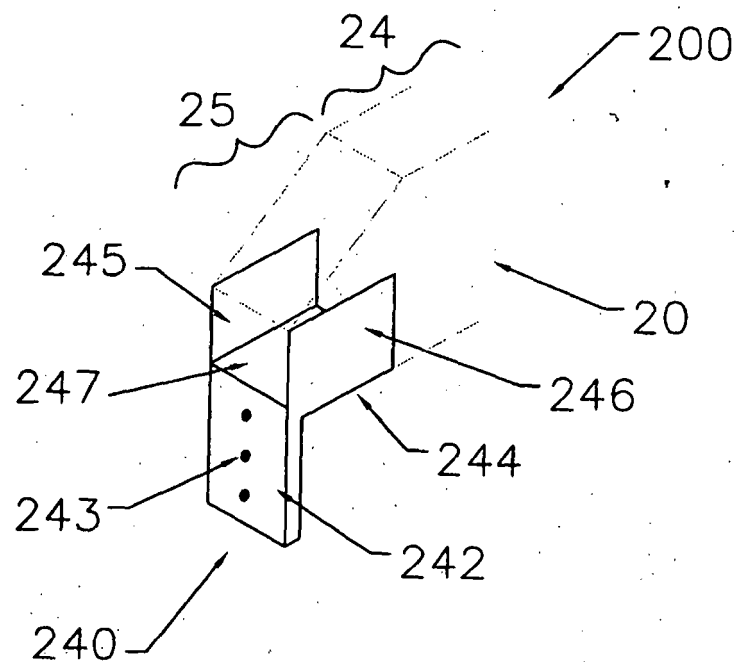
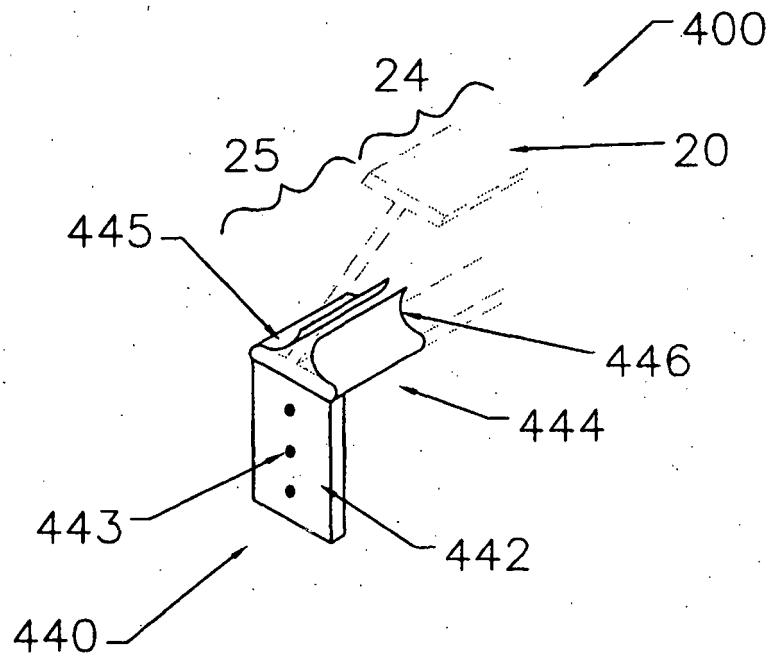
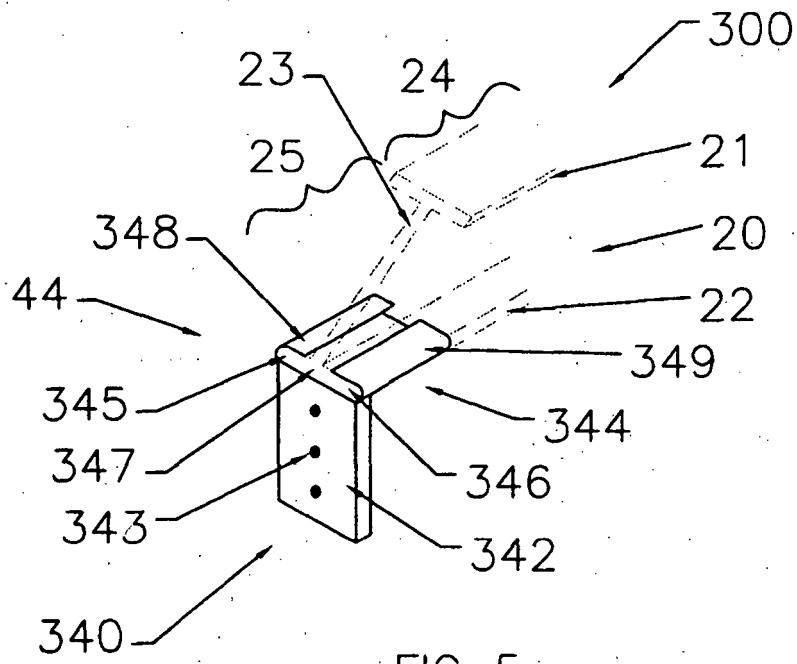
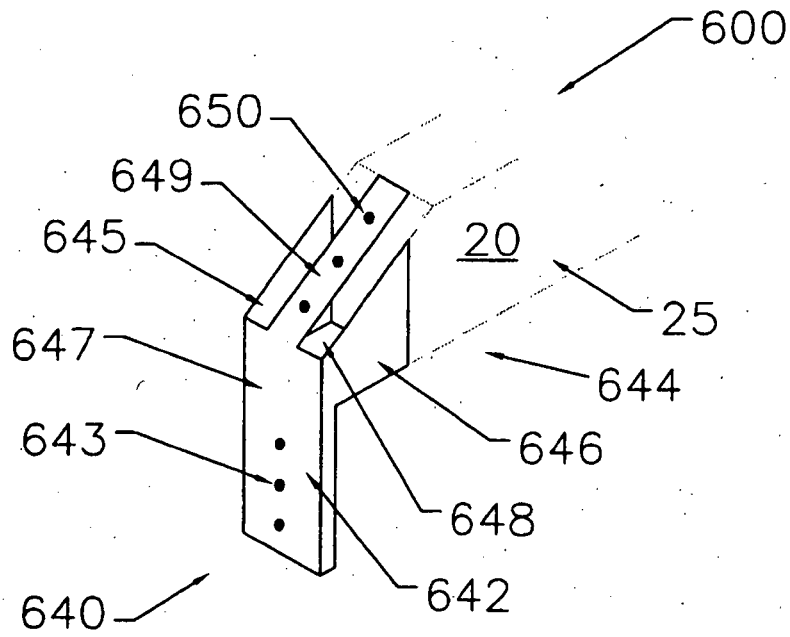
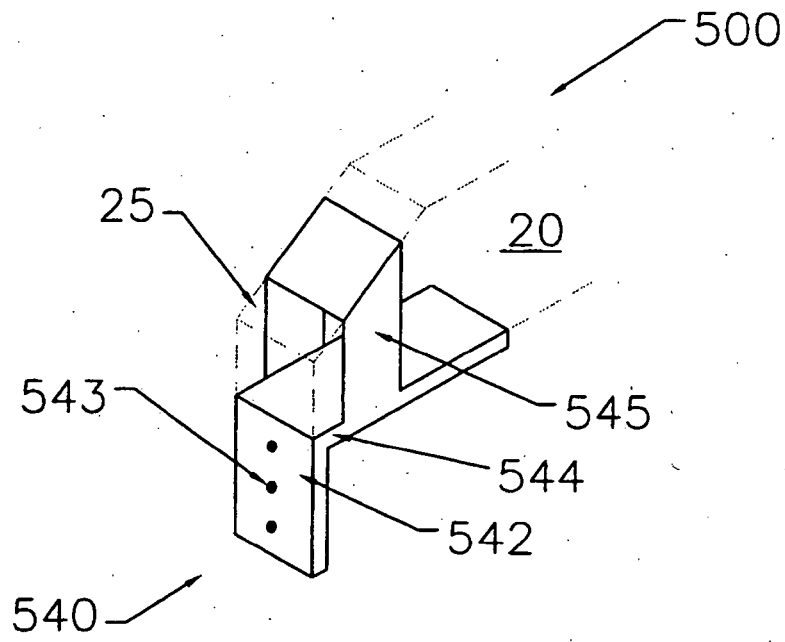
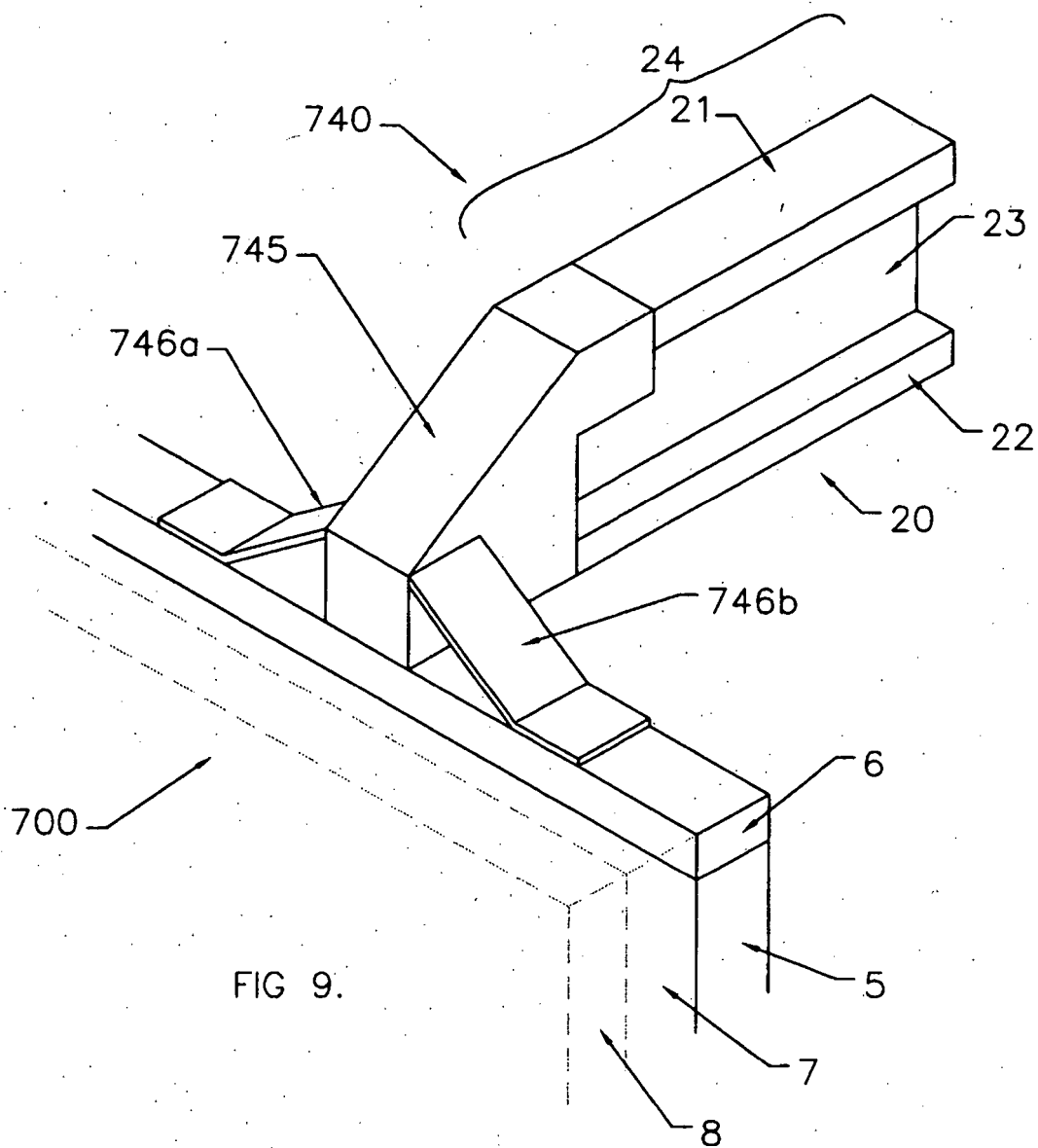


FIG 4.







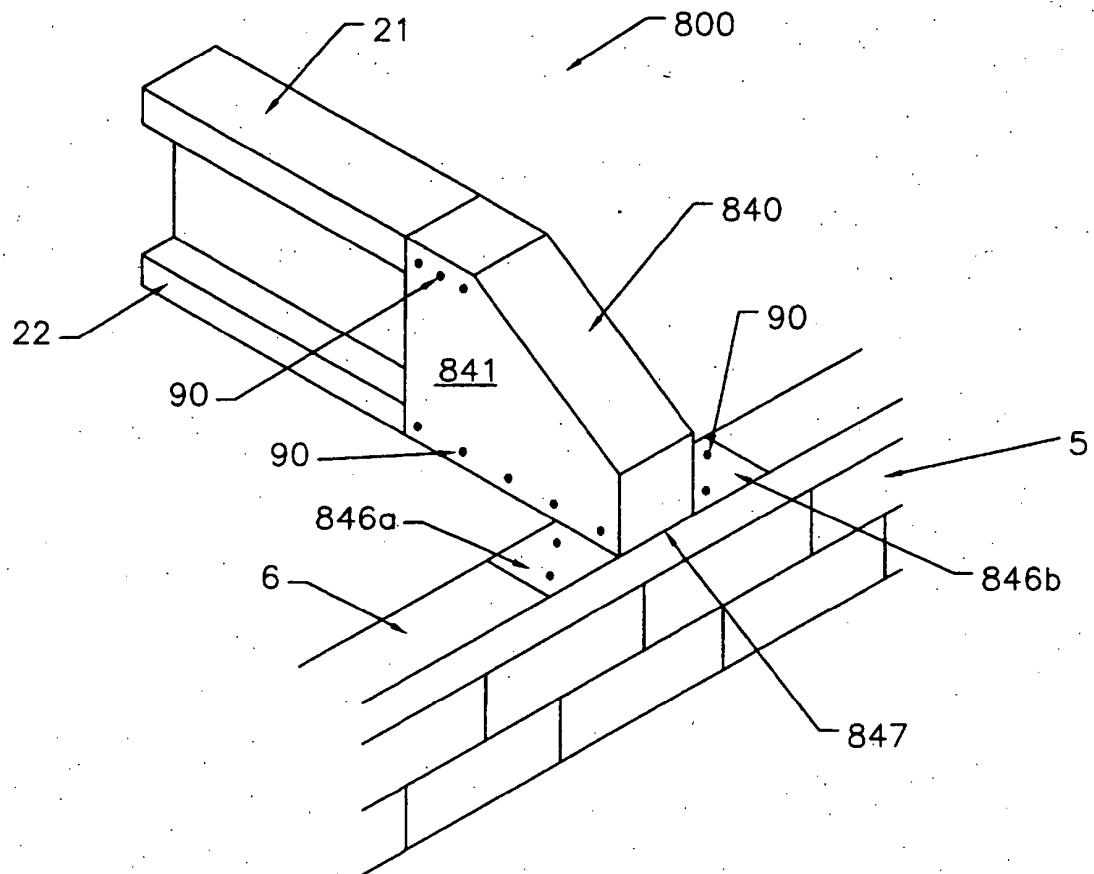


FIG. 10.

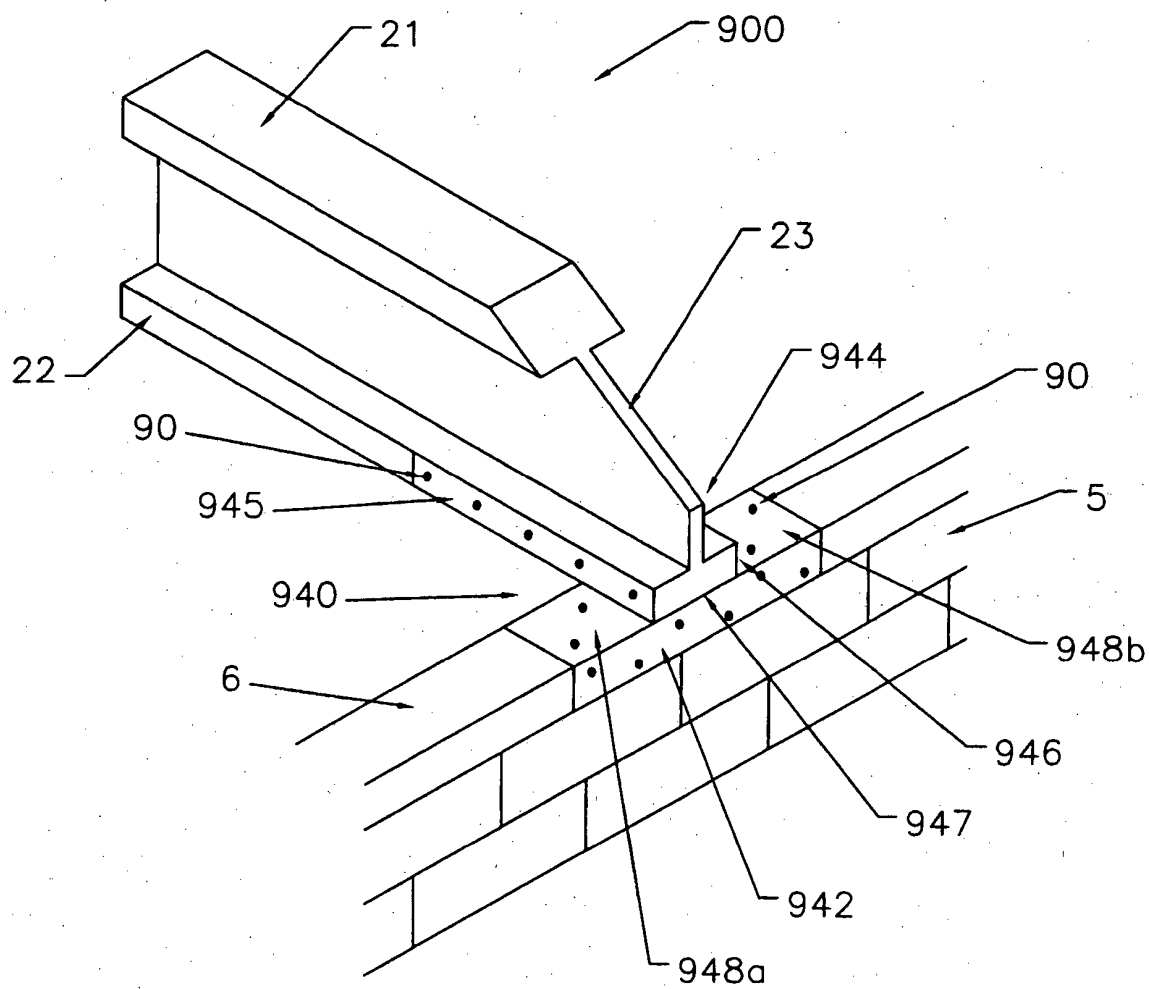


FIG 11.

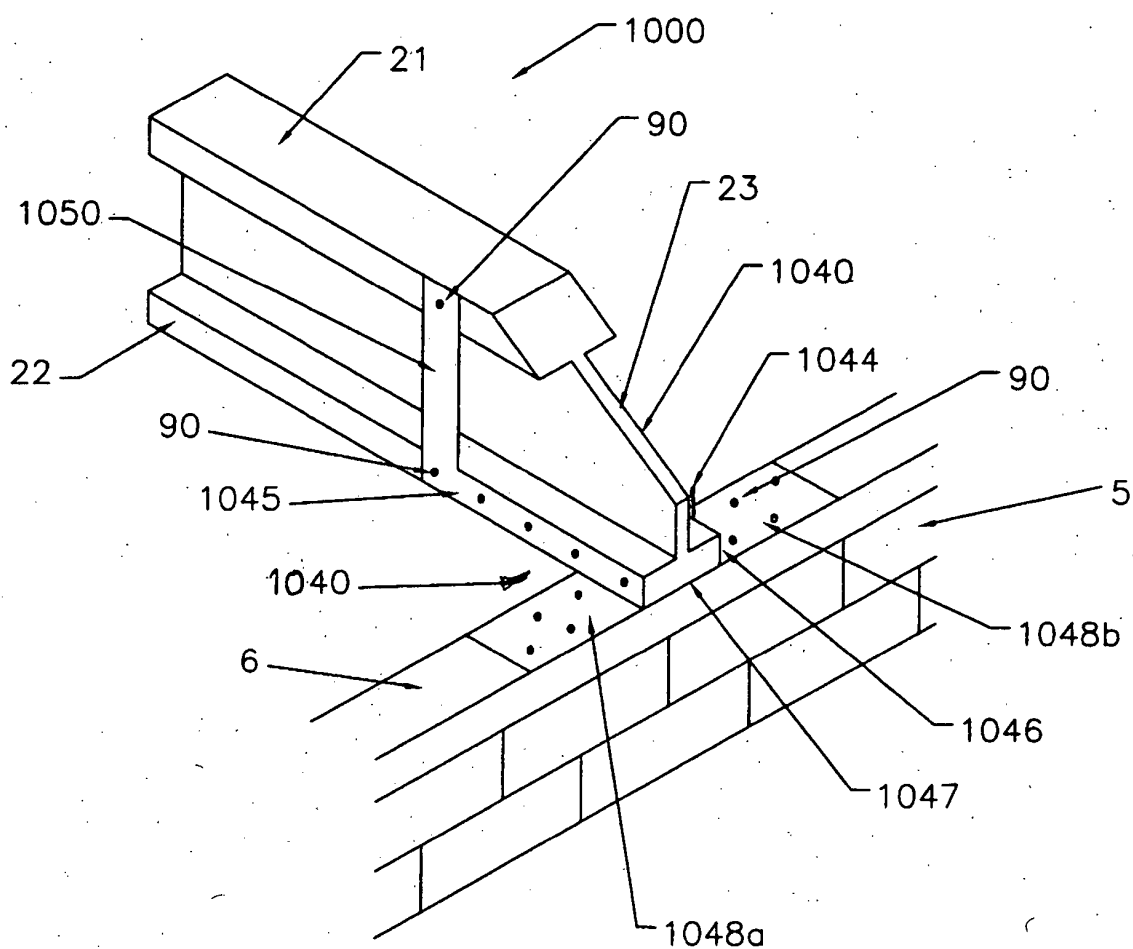


FIG. 12.

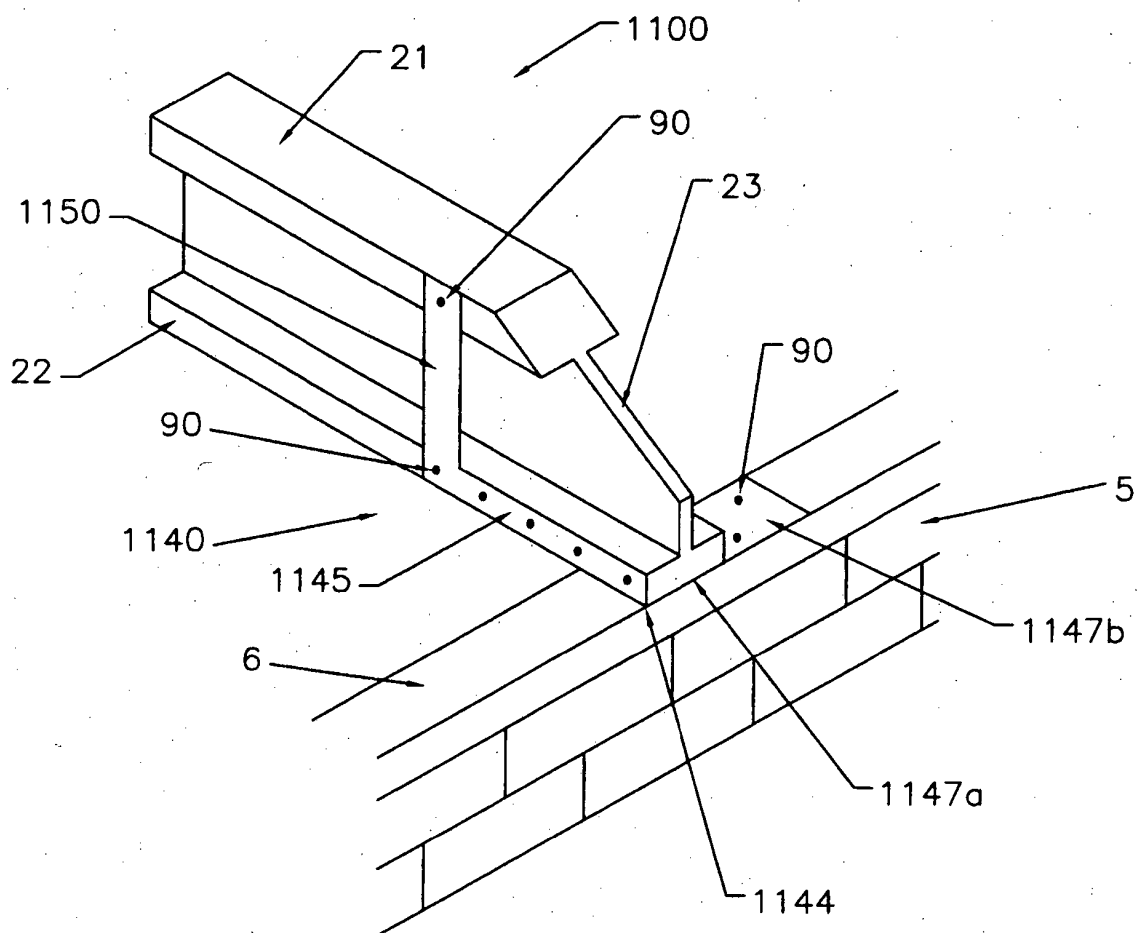
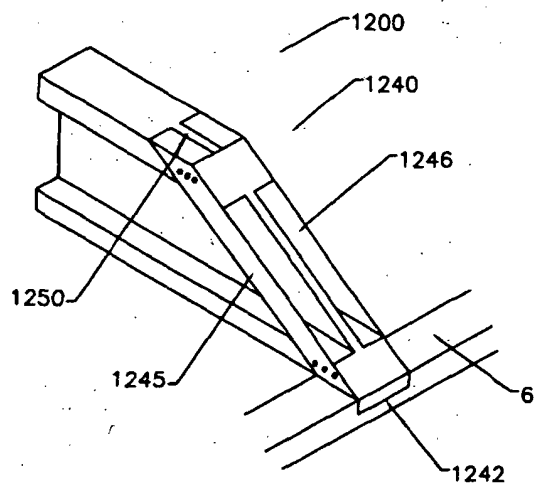
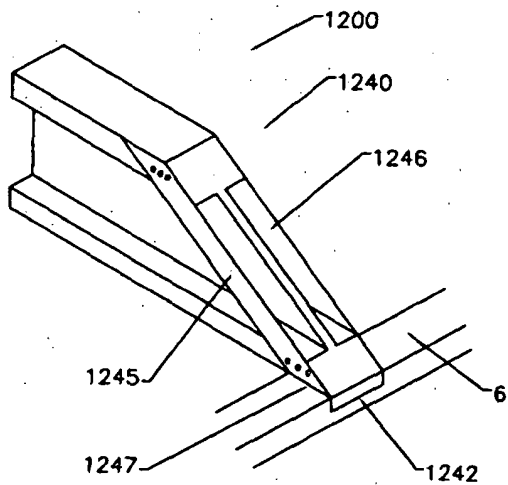
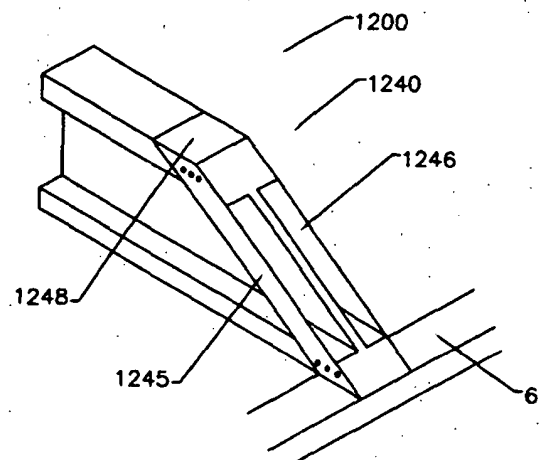
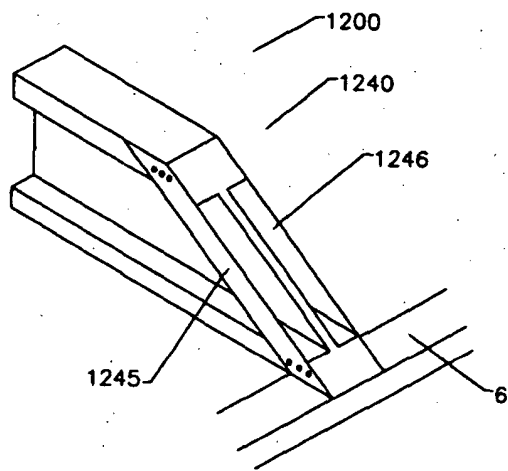
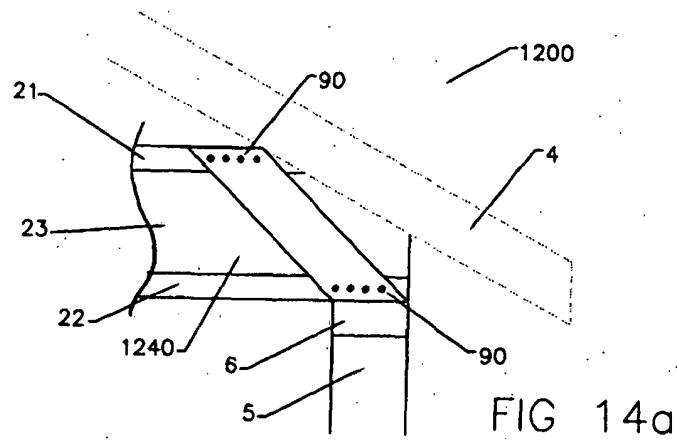


FIG. 13.



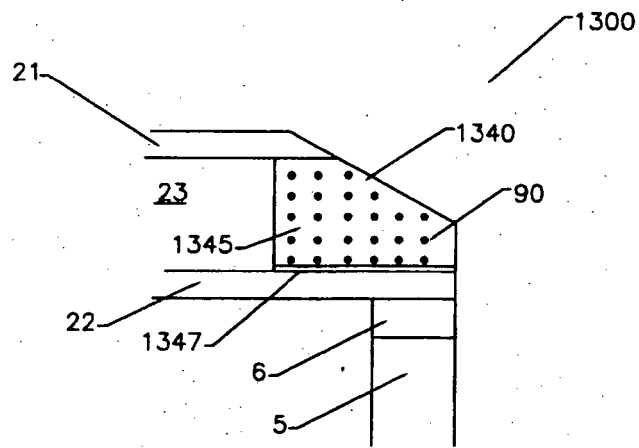


FIG 15a

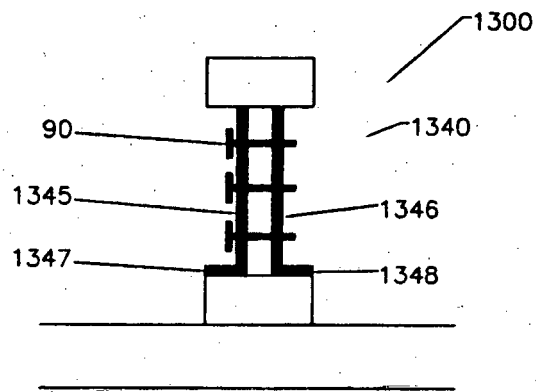


FIG 15b

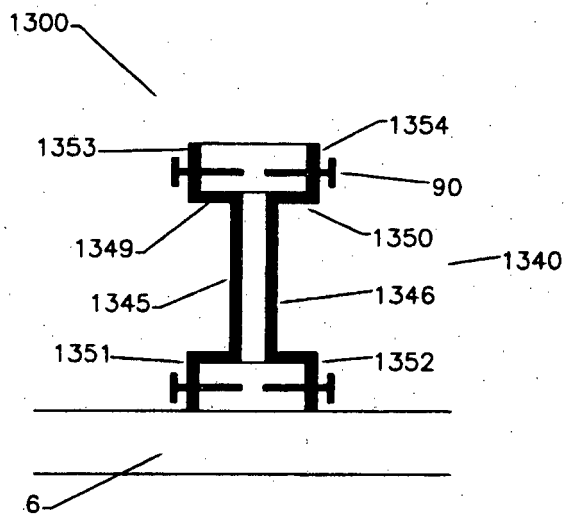


FIG 15c

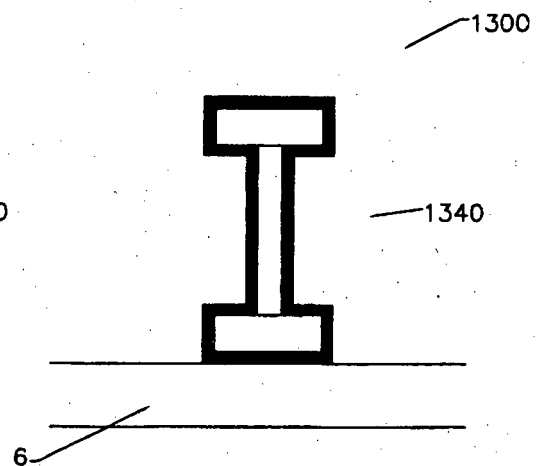


FIG 15d

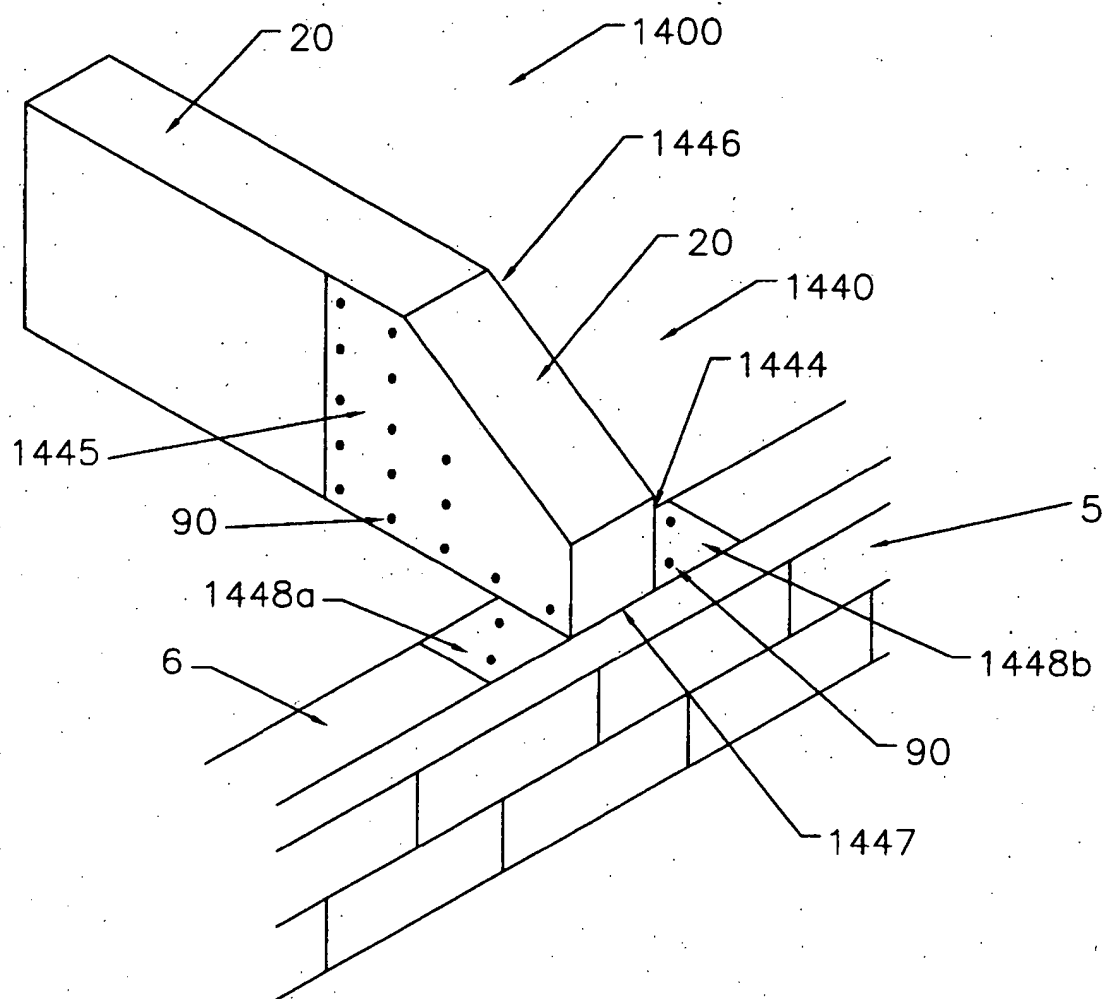
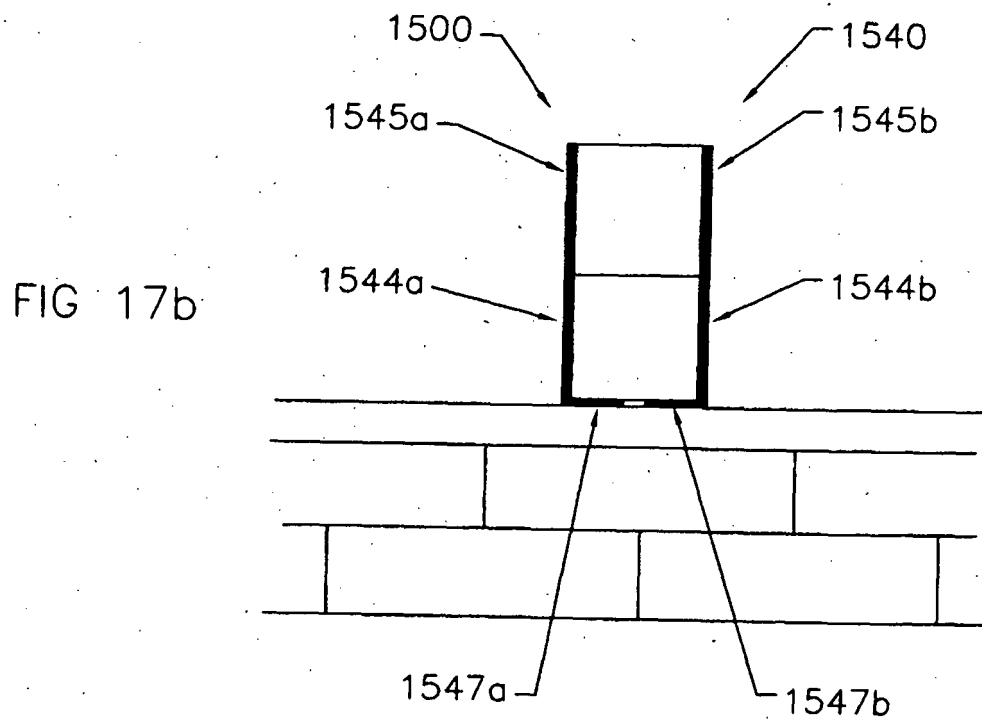
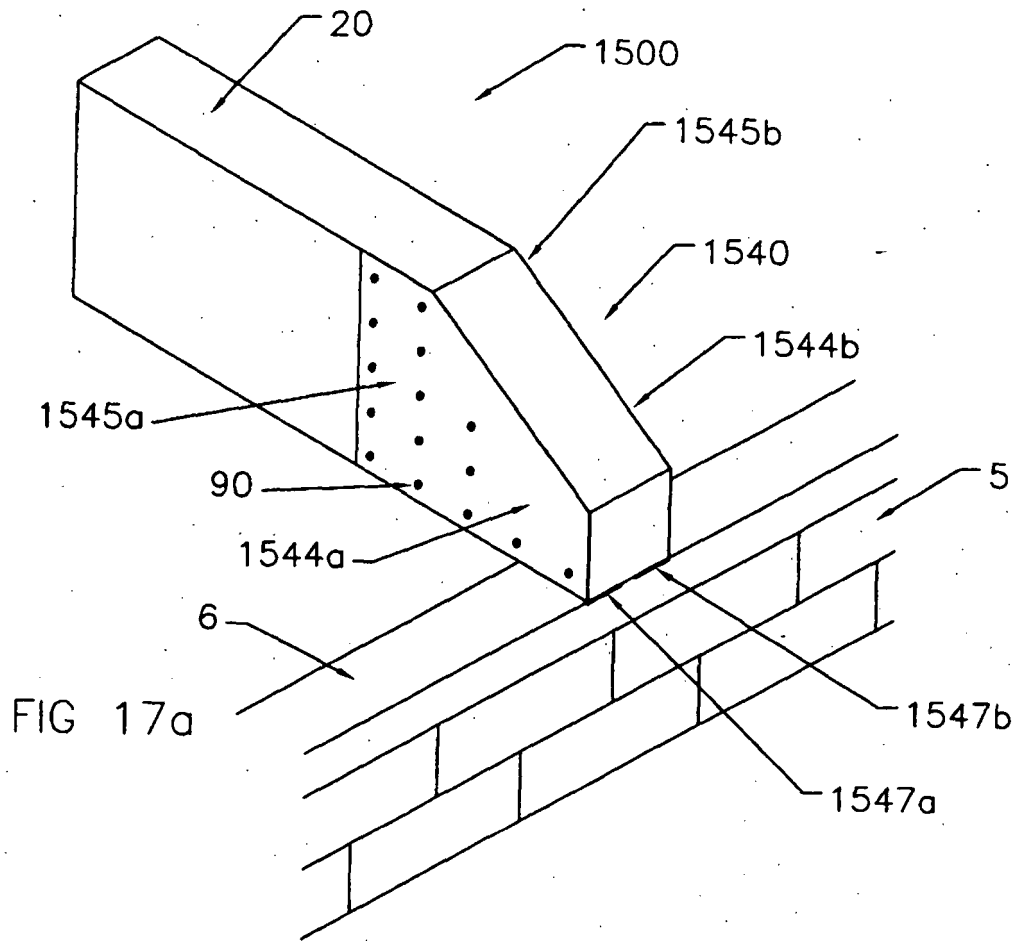
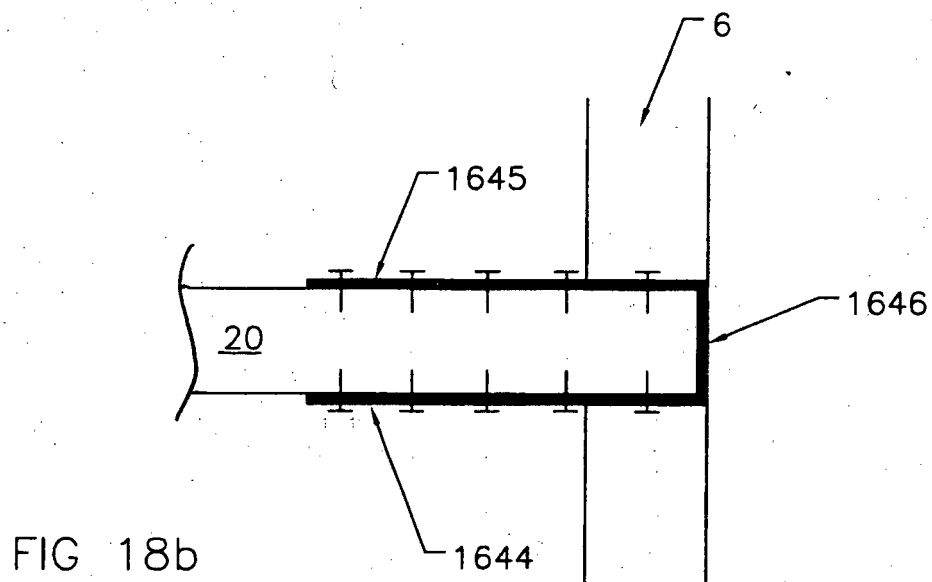
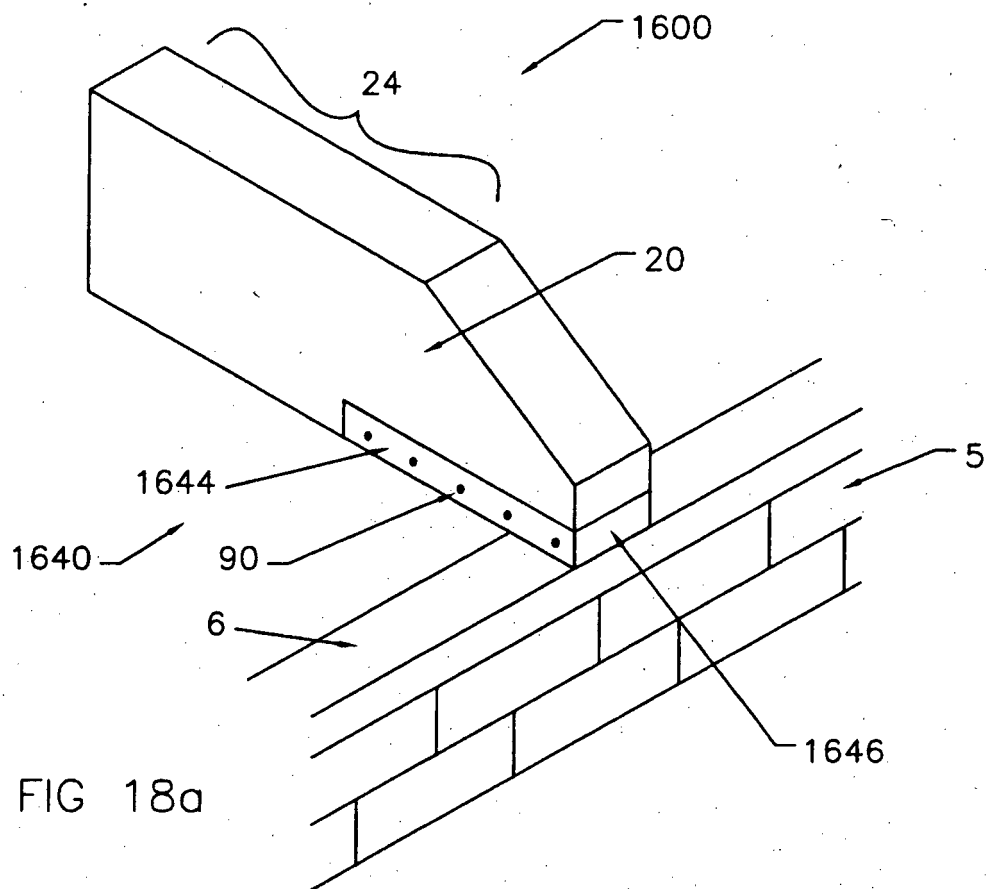


FIG 16.





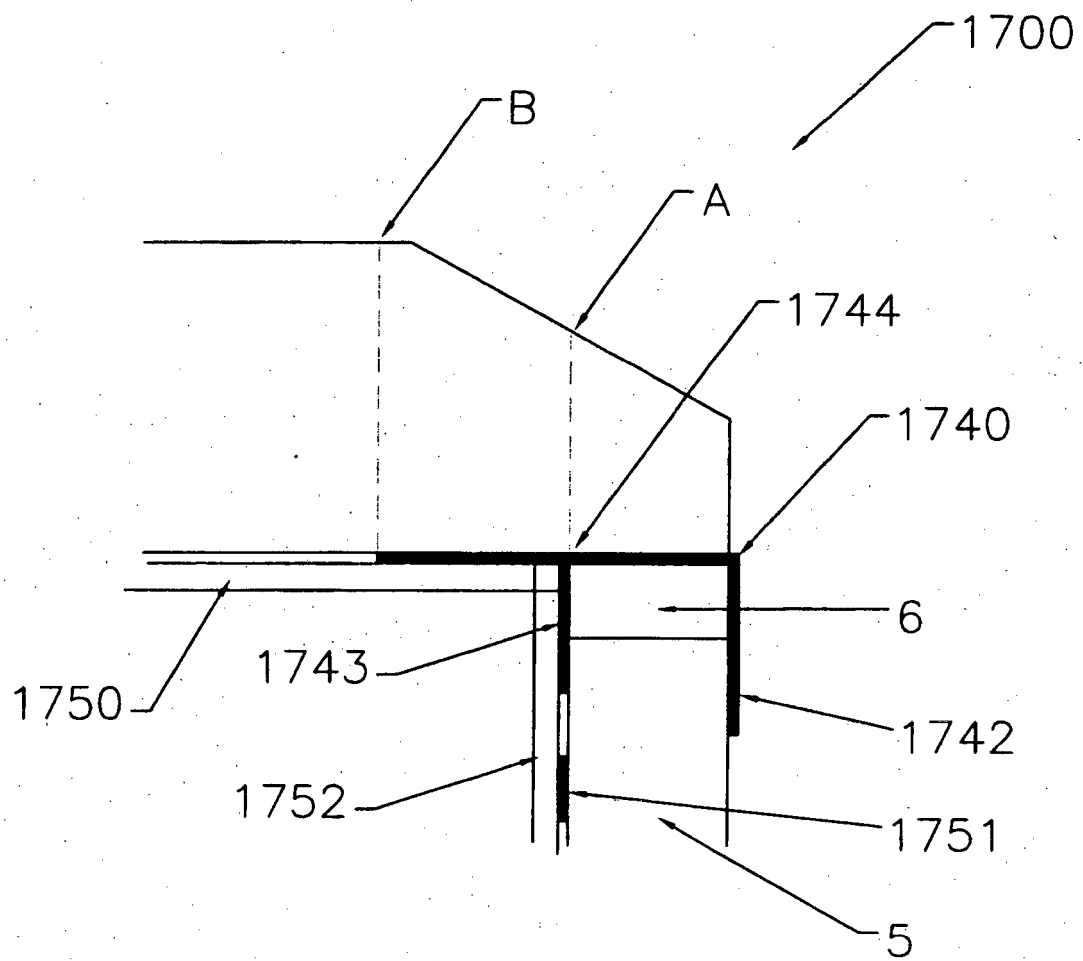


FIG 19

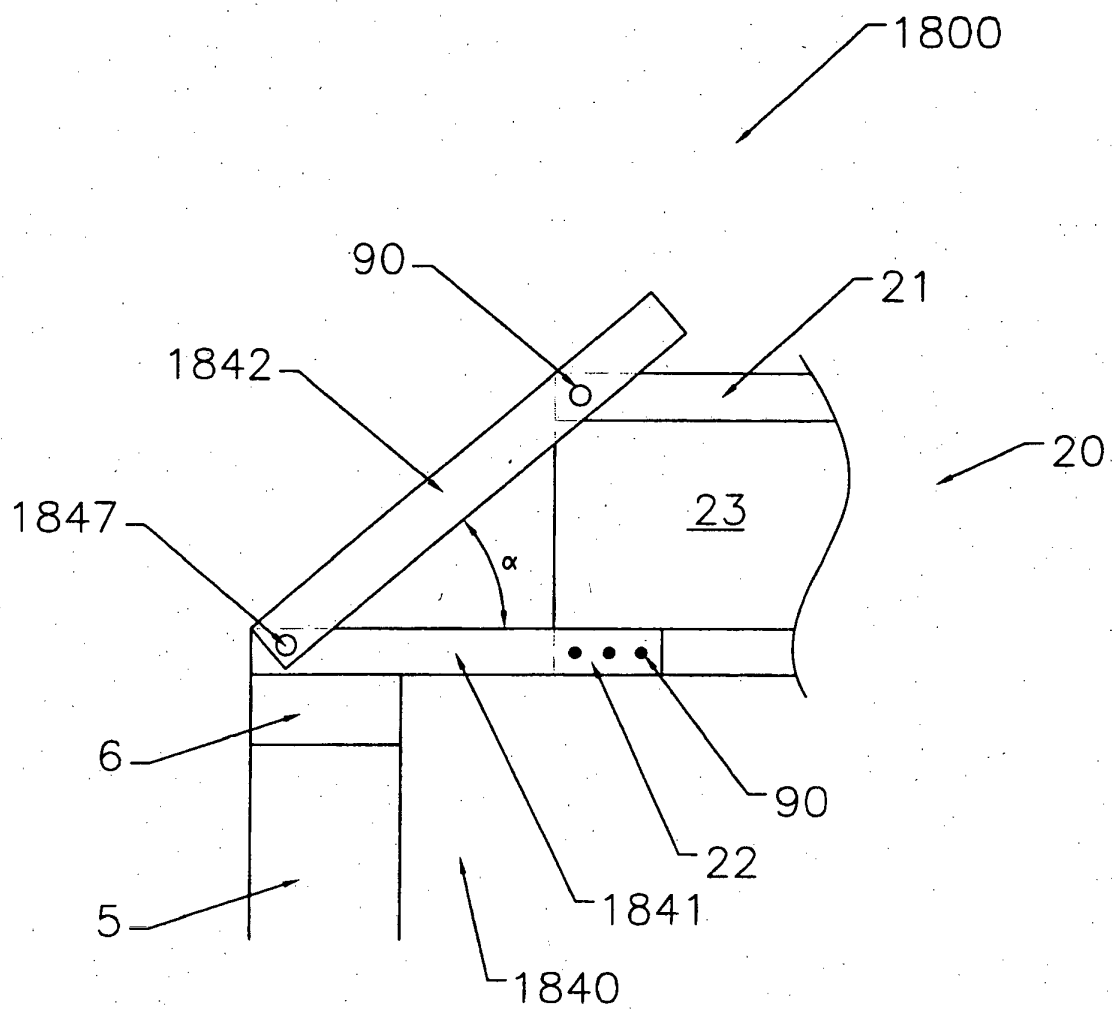


FIG 20

REFERENCES CITED IN THE DESCRIPTION

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