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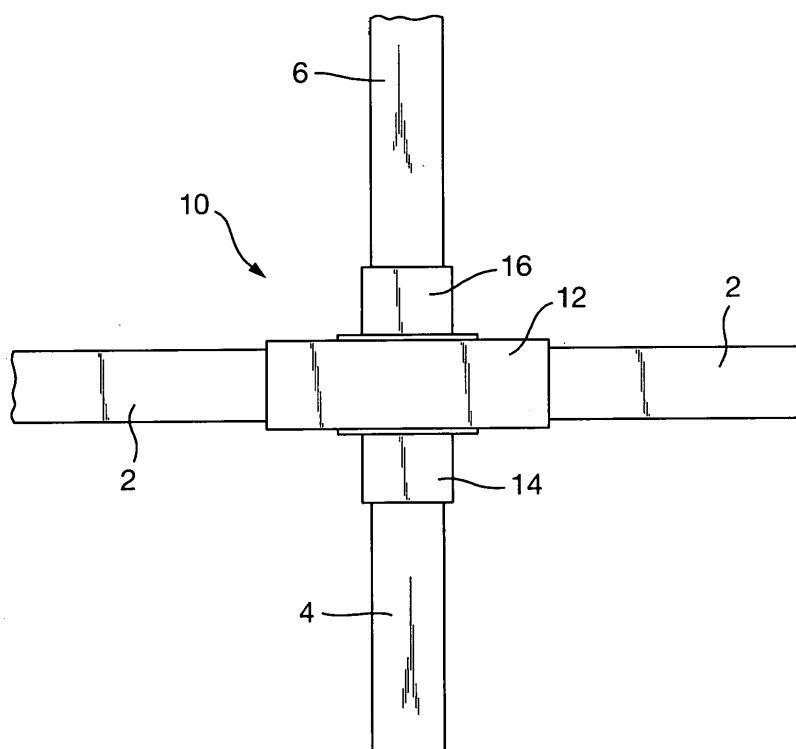
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(54) **Joint structure for building frame**

(57) A joint structure for connecting beams in a building frame is disclosed, the joint structure comprising a sleeve adapted to accommodate a first beam of a building frame passing therethrough and a first beam support including a first socket and a first flange portion attached

to the first socket. The first socket is adapted to accommodate an end of a second beam of the building frame therein, and the first flange portion is attachable to the sleeve so as to fix the second beam relative to the first beam. A joint and a building frame using the joint structure are also disclosed.

Fig.1.



Description

[0001] The present invention relates to a joint structure used to connect load-bearing beams in the frame of a building.

[0002] Timber frame construction of buildings is increasingly being used as a more environmentally friendly alternative to steel frame construction. Timber is a renewable material and a timber frame has a carbon footprint around 75% smaller than an equivalent steel frame.

[0003] Glued laminated timber (glulam) is a particularly strong and versatile timber material, which is seen as a good alternative to steel in building frames. However, there are problems associated with replacing steel frames by timber frames.

[0004] In current building techniques, timber beams are cut so as to fit together and form joints between them. These joints are then fixed in place using screws or other mechanical fasteners. However, timber is more difficult to shape precisely than steel, so performing this process accurately is expensive. In addition, timber can expand or deform due to absorbing moisture. Hence, even if the timber beams are cut to provide a good fit at source, by the time they are transported to a building site they may no longer fit each other precisely enough. This can result in timber needing to be worked at the building site itself, which is undesirable and may delay construction.

[0005] Timber beams are also susceptible to being crushed or deformed when they are subjected to loads across their width rather than along the length of the beam. This causes problems in multi-storey construction, where it is necessary to join horizontal beams to vertical load-bearing columns. In current techniques, the load passing through the vertical column in this type of joint also passes through the horizontal beam. The strength of the horizontal beam against being crushed at these joints is a limiting factor, as a result of which timber-framed buildings are generally limited to three storeys at present.

[0006] According to a first aspect of the invention, there is provided a joint structure for connecting beams in a building frame, the joint structure comprising:

a sleeve adapted to accommodate a first beam of a building frame passing therethrough; and
a first beam support including a first socket and a first flange portion attached to the first socket; wherein the first socket is adapted to accommodate an end of a second beam of the building frame therein; and
wherein the first flange portion is attachable to the sleeve so as to fix the second beam relative to the first beam.

[0007] According to a second aspect of the invention, there is provided a joint for a building frame comprising:

the joint structure described above;

the first beam passing through the sleeve; and
the second beam accommodated in the first socket of the first beam support;
wherein the first flange portion is attached to the sleeve.

[0008] According to a third aspect of the invention, there is provided a building frame comprising the joint described above.

[0009] Preferably, the joint structure is for connecting timber beams in a timber building frame. Suitably, the joint structure is made of metal.

[0010] Preferably, mechanical fastening means are provided for attaching the first socket to the second beam. More preferably, at least one screw hole is formed in the first socket so as to allow the first socket to be attached to the second beam by a screw.

[0011] In one embodiment, at least one screw hole is formed in the sleeve so as to allow the sleeve to be attached to the first beam by a screw.

[0012] Suitably, an insert is formed at a corner of the sleeve. Preferably, the insert has an L-shaped cross-section.

[0013] Suitably, the first flange portion is attachable to a first face of the sleeve and the second flange portion is attachable to a second face of the sleeve, the first face being opposite to the second face.

[0014] In one embodiment, the third flange portion extends along an edge of the third socket and a row of screw holes is formed in the third flange portion in a direction parallel to the edge. Conveniently, a row of screw holes is formed in a face of the sleeve at the same pitch as the row of screw holes in the third flange portion.

[0015] Preferably, the second and third beams are substantially parallel.

[0016] Suitably, the first beam is a lateral beam and the second beam is a vertical column. It is preferred that the third beam is also a vertical column and the joint structure is adapted to transfer load from the third beam to the second beam through the sleeve.

[0017] The second flange portion can be attached to the sleeve and the first beam in the same ways as the first flange portion.

[0018] In the same way as the sleeve, the sockets of the first, second and third beam supports may have one or more inserts with the features described above.

[0019] Embodiments of the present invention will now be described by way of further example only and with reference to the accompanying drawings, in which:

Fig. 1 shows a side view of a joint structure according to the invention;

Fig. 2 shows a side view of another joint structure according to the invention;

Fig. 3 is a perspective view of a sleeve forming part of the invention;

Fig. 4 is a side view of the sleeve;

Fig. 5 is an end-on view of the sleeve;

Fig. 6 is a perspective view of a beam support forming part of the invention;

Fig. 7 is a plan view of the beam support of fig. 6;

Fig. 8 is an end-on view of the beam support of fig. 6;

Fig. 9 is a perspective view of another beam support forming part of the invention; and

Fig. 10 is an end-on view of the beam support of fig. 9.

[0020] As shown in fig. 1, the joint structure of the first embodiment includes a sleeve adapted to accommodate a first beam passing through it. The first beam is a horizontal beam of a building in this embodiment.

[0021] The sleeve is shown in more detail in figs. 3, 4 and 5. As can be seen in these figures, the sleeve forms a rectangular tube through which the first beam can pass. Screw holes are formed in two rows through each of two opposing walls of the sleeve. This allows the sleeve to be attached to first and second beam supports, as described below.

[0022] The sleeve also features ribs attached to its inner surface as inserts. The ribs extend longitudinally from one opening of the sleeve to the other in this embodiment. A rib is formed at each corner of the sleeve and each rib has an L-shaped cross section. However, it will be appreciated that other shapes of inserts are possible. The function of the inserts is to contact the first beam when it is mounted in the sleeve so as to form a good fit.

[0023] Timber beams can expand and contract over time depending on the proportion of moisture contained within them. If the first beam is transported to a site in damp conditions, it may be slightly thicker than when it was originally dimensioned and as a result it may not fit into the sleeve as intended. The ribs of the present invention make it easier to compensate for this expansion because it is only necessary to thin parts of the beam that contact the ribs. The parts of the surface of the beam that do not contact the ribs do not need to be removed, as long as the thickness of the ribs gives sufficient clearance between the inner surface of the ribs and the inner surface of the rest of the sleeve to compensate for the expansion. Thus, the sleeve of this embodiment reduces the work required to fit the beams to the joint on-site and also reduces the timber wasted as off cuts. This applies equally to the other beams making up a building frame.

[0024] The joint structure also comprises a first beam support designed to fit over the end of a second beam, which is a vertical load-bearing column of the building. The first beam support is shown in detail in figs. 6, 7 and 8. The first beam support includes a socket that accommodates an end part of the second beam. The socket in this embodiment is a tube having a rectangular cross section. Flange portions are formed at opposing edges of the socket on the other side of the socket from the opening into which the end of the second beam is inserted. Screw holes are provided on at least one side of the socket to allow the socket to be fixed to the second beam.

[0025] Screw holes are also provided in the flange portions. When a joint between the first and second beams

is formed, the first beam support is fitted to the sleeve so that the flange portions abut the sleeve. Screw holes are formed in the sleeve at locations matching the screw holes in the flange portions. The first beam support can be attached to the sleeve and the first beam by screws passing through the screw holes in the flange portions and the sleeve and into the first beam.

[0026] As shown in fig. 6, the first beam support includes ribs similar to those of the sleeve. The ribs contact the second beam when it is mounted in the first socket so as to provide a good fit, and serve the same purpose as the ribs of the sleeve.

[0027] A third beam, which is another vertical load-bearing column of the building, can be joined to the first beam using a second beam support. This is achieved in the same way as the second beam is joined to the first beam above. The second beam support is attached to the opposite side of the sleeve from the first beam support. The second beam support can have the same features as the first beam support. Figs. 6, 7 and 8 and the above description of the first beam support apply equally to the second beam support.

[0028] The first beam support, the sleeve and the second beam support form a bridge between the end of one column, i.e. the second beam, and the end of another column, i.e. the third beam. Thus, load is transferred from one column to the next via the components of the joint structure rather than via a horizontal beam such as the first beam. In contrast to the beams making up the frame of the building, the much smaller joint components can be made from a material strong enough to bear the necessary load without great expense or environmental impact. In one embodiment, the sleeve and beam supports are made from steel, but any suitably strong material can be used.

[0029] Furthermore, using the joint structure described above removes the need to cut the beams to form a precise joint. Simple rectangular beams can be used, provided that they are suitably dimensioned to fit the sleeve and beam supports. This reduces working of the beams and avoids any reduction in strength of the beams due to portions being cut out at the joints.

[0030] Third and fourth beam supports may also be provided to attach horizontal floor supporting beams to the joint. The third and fourth beam supports are attached to the faces of the sleeve that are not already attached to the first and second beam supports. The resulting joint structure is shown in fig. 2. Aside from the third and fourth beam supports, this joint structure has the same features as that shown in fig. 1.

[0031] The floor supporting beams are each arranged substantially perpendicular to the first beam and also substantially perpendicular to the second and third beams. The floor supporting beams are attached to opposite sides of the joint.

[0032] An example of a third or fourth beam support is illustrated in figs. 9 and 10. The third and fourth beam supports each include a socket into which a floor beam

can be inserted and flange portions formed at opposing edges of the socket. The flange portions have screw holes at locations corresponding to screw holes on the face of the sleeve to which the third or fourth beam support is attached. Thus, screws can be driven through the flange portions and the sleeve into the first beam to secure the joint.

[0033] In this embodiment, the third beam support has a row of screw holes formed along each flange portion. Corresponding rows of screw holes are formed in one or both free faces of the sleeve. As a result, the vertical position of the third beam support relative to the sleeve can be adjusted by selecting which of the screw holes in the flange portions and the screw holes in the sleeve are aligned with each other. Adjusting the position of the third beam support adjusts the height of the associated floor beam relative to the first beam and the other floor beams. This adjustment does not require any modification of the components of the joint or the beams. In particular, two adjacent floor beams can be provided at different heights from each other and from the first beam without having to provide a break in the first beam, which could otherwise weaken the frame.

[0034] A joint that allows floor beams to be fixed to it at adjustable heights is highly advantageous. Using the joint of this embodiment, the same components can be employed throughout a building frame including floors at various different heights. This increases design flexibility and reduces the cost of the build. Furthermore, the heights of floors can be modified on-site if necessary.

[0035] As shown in fig. 9, the third and fourth beam supports include ribs similar to those of the sleeve. The ribs contact the floor beams when they are mounted in the third and fourth sockets respectively so as to provide a good fit, and serve the same purpose as the ribs of the sleeve.

[0036] The sleeve and the first beam support can be fixed together without a beam being present. Specifically, driving screws through the screw holes in the sleeve and the corresponding screw holes in the flange portions of the first beam support attaches these two components of the joint structure together securely regardless of whether any beams are present. The sleeve can be attached to each of the second, third and fourth beam supports in the absence of beams in the same way. Thus, the strength of the joint structure is independent of the beams joined by it. The joint structure of the invention may also be used without beams being inserted into all of the available apertures. Fastening means other than screws may be used to attach the sleeve and the beam supports together in alternative embodiments.

[0037] In an alternative embodiment, the flange portions of the third and fourth beam supports can be attached to the first and/or second beam supports in addition to, or instead of, being attached to the sleeve. For example, screw holes may be formed in the side of the socket of the first beam support facing the third beam support, these screw holes being formed at locations cor-

responding to those on the flange portions of the third beam support. Screws can then be passed through the flange portions of the third beam support and the socket of the first beam support into the second beam to secure the joint.

[0038] The foregoing description has been given by way of example only and it will be appreciated by a person skilled in the art that modifications can be made without departing from the scope of the present invention.

Claims

1. A joint structure for connecting beams in a building frame, the joint structure comprising:

a sleeve adapted to accommodate a first beam of a building frame passing therethrough; and a first beam support including a first socket and a first flange portion attached to the first socket; wherein the first socket is adapted to accommodate an end of a second beam of the building frame therein; and wherein the first flange portion is attachable to the sleeve so as to fix the second beam relative to the first beam.

2. A joint structure according to claim 1, further comprising mechanical fastening means for attaching the sleeve to the first beam.
3. A joint structure according to any preceding claim, further comprising mechanical fastening means for attaching the first flange portion to the sleeve.
4. A joint structure according to any preceding claim, wherein screw holes are formed in the first flange portion and the sleeve at corresponding locations so as to allow a screw to pass through the first flange portion and the sleeve into the first beam, thereby attaching the first flange portion to the sleeve and the first beam.
5. A joint structure according to any preceding claim, wherein at least one insert is disposed over part of an inner surface of the sleeve.
6. A joint structure according to claim 5, wherein the insert is a rib extending in a longitudinal direction of the sleeve.
7. A joint structure according to claim 5 or claim 6, wherein an insert is formed at each corner of the sleeve.
8. A joint structure according to any preceding claim, further comprising a second beam support including a second socket and a second flange portion at-

tached to the second socket,
 wherein the second socket is adapted to accommo-
 date an end of a third beam of the building frame
 therein; and
 wherein the second flange portion is attachable to 5
 the sleeve so as to fix the third beam relative to the
 first beam.

9. A joint structure according to claim 8, wherein the
 joint structure is adapted to transfer load from the 10
 third beam to the second beam through the sleeve.
10. A joint structure according to any preceding claim,
 further comprising a third beam support including a
 third socket and a third flange portion attached to the 15
 third socket,
 wherein the third socket is adapted to accommodate
 an end of a fourth beam of the building frame therein;
 and
 wherein the third flange portion is attachable to the 20
 sleeve so as to fix the fourth beam relative to the first
 beam.
11. A joint structure according to claim 10, wherein the
 third flange portion is attachable to a face of the 25
 sleeve at a plurality of locations on the face.
12. A joint structure according to claim 11, wherein a
 plurality of screw holes are formed in one of the third
 flange portion and the face and at least one screw 30
 hole is formed in the other of the third flange portion
 and the face, so as to allow a screw to pass through
 the third flange portion and the sleeve into the first
 beam with the third flange portion at a plurality of
 locations relative to the sleeve. 35
13. A joint for a building frame comprising:

 the joint structure of any preceding claim;
 the first beam passing through the sleeve; and 40
 the second beam accommodated in the first
 socket of the first beam support;
 wherein the first flange portion is attached to the
 sleeve. 45
14. A joint according to claim 13, wherein the joint struc-
 ture is a joint structure according to claim 8 or claim 9,
 the joint further comprising the third beam accom-
 modated in the second socket of the second beam
 support, 50
 wherein the second flange portion is attached to the
 sleeve.
15. A building frame comprising the joint according to
 claim 13 or claim 14. 55

Fig.1.

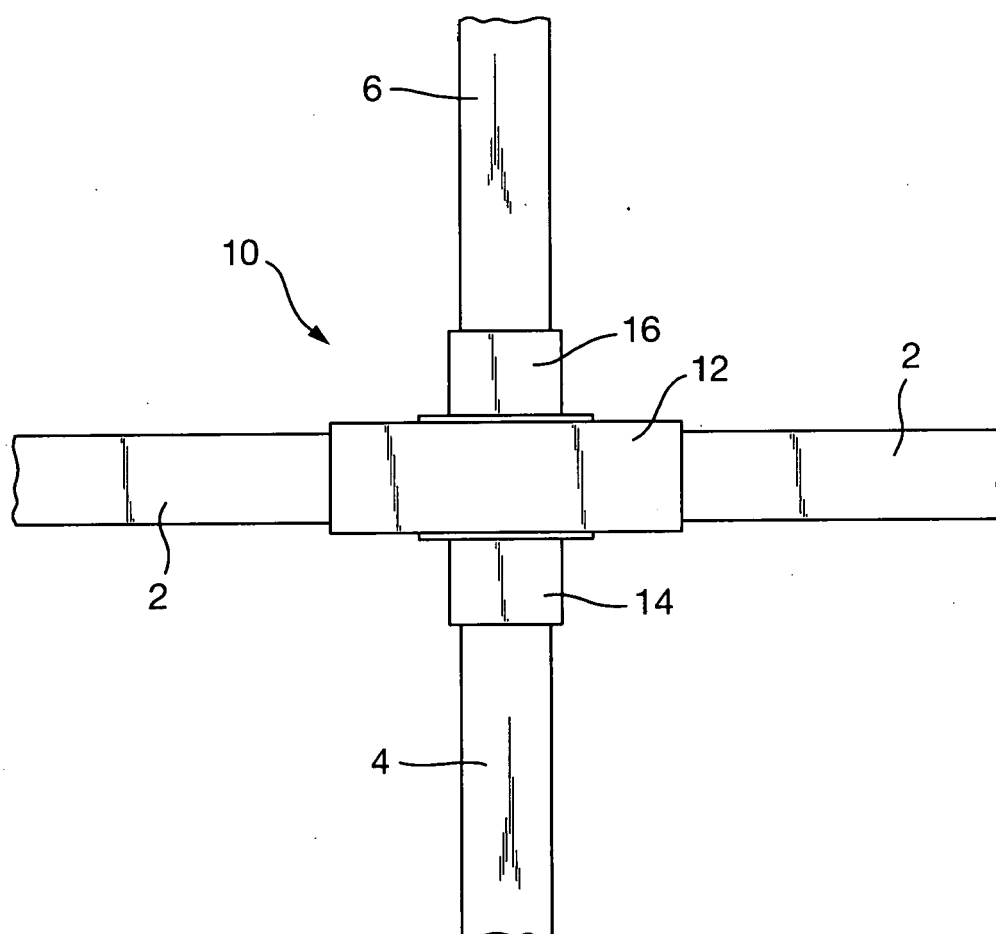


Fig.2.

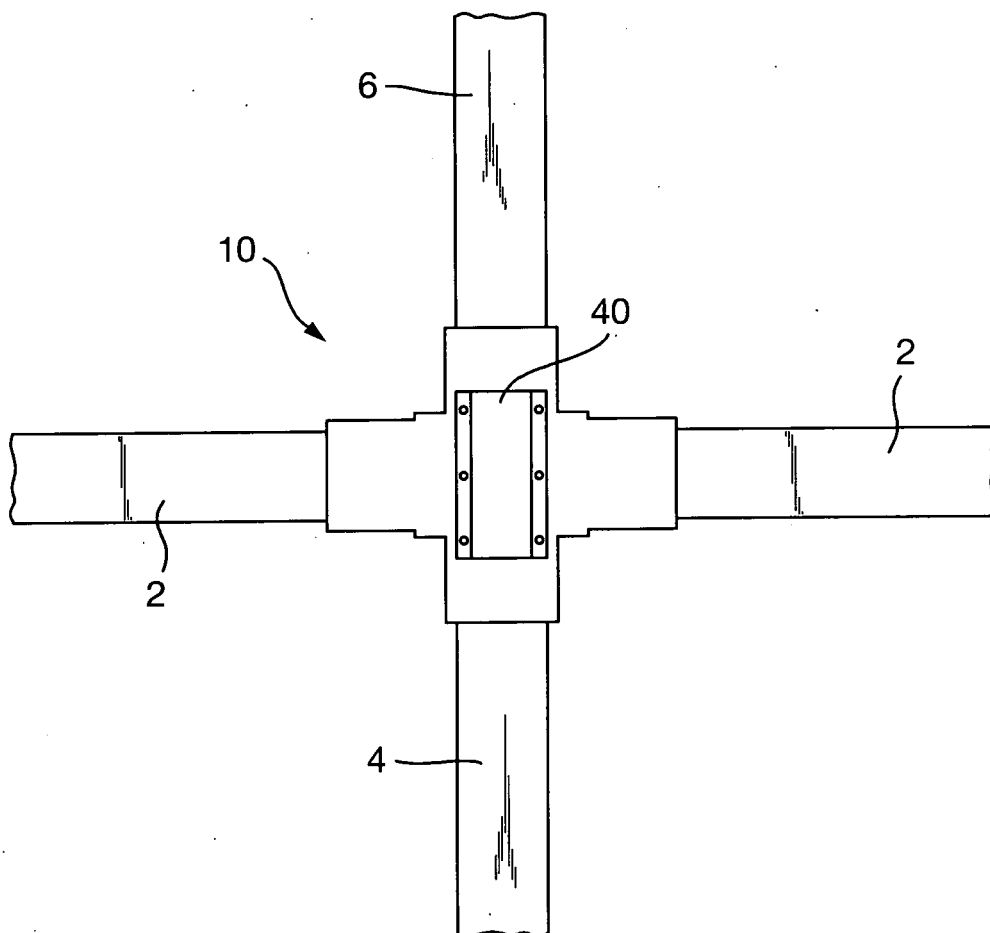


Fig.3.

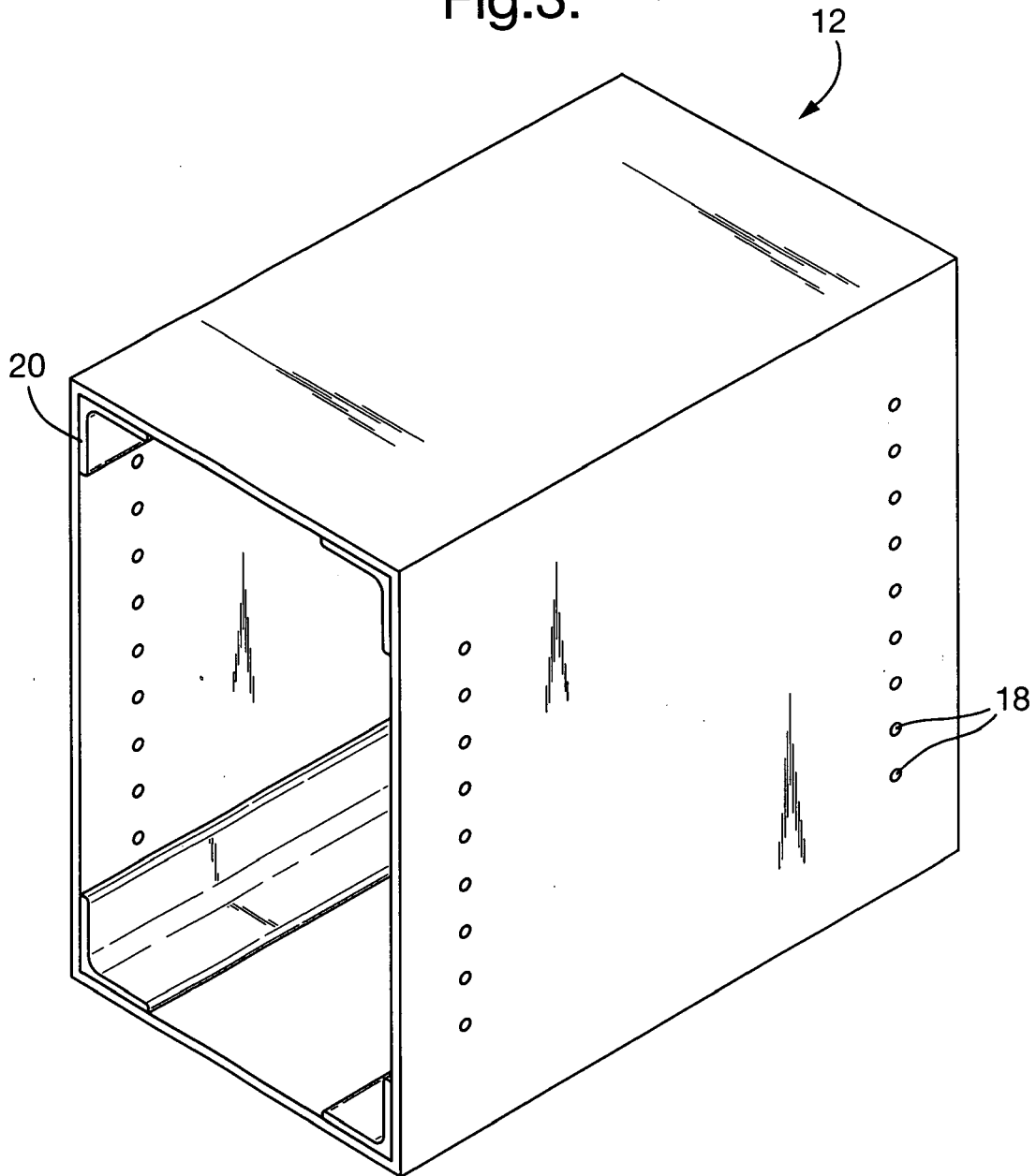


Fig.4.

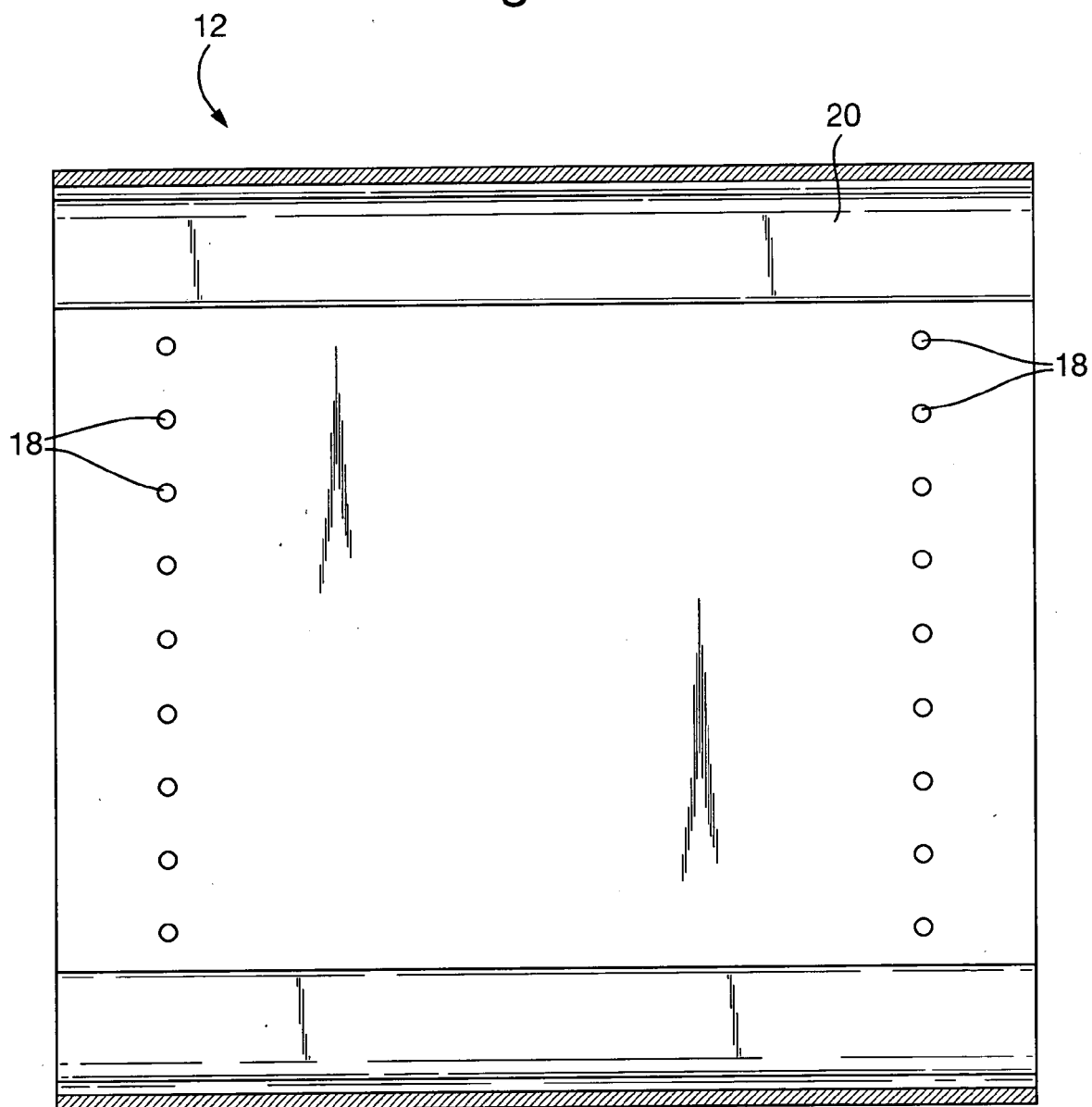


Fig.5.

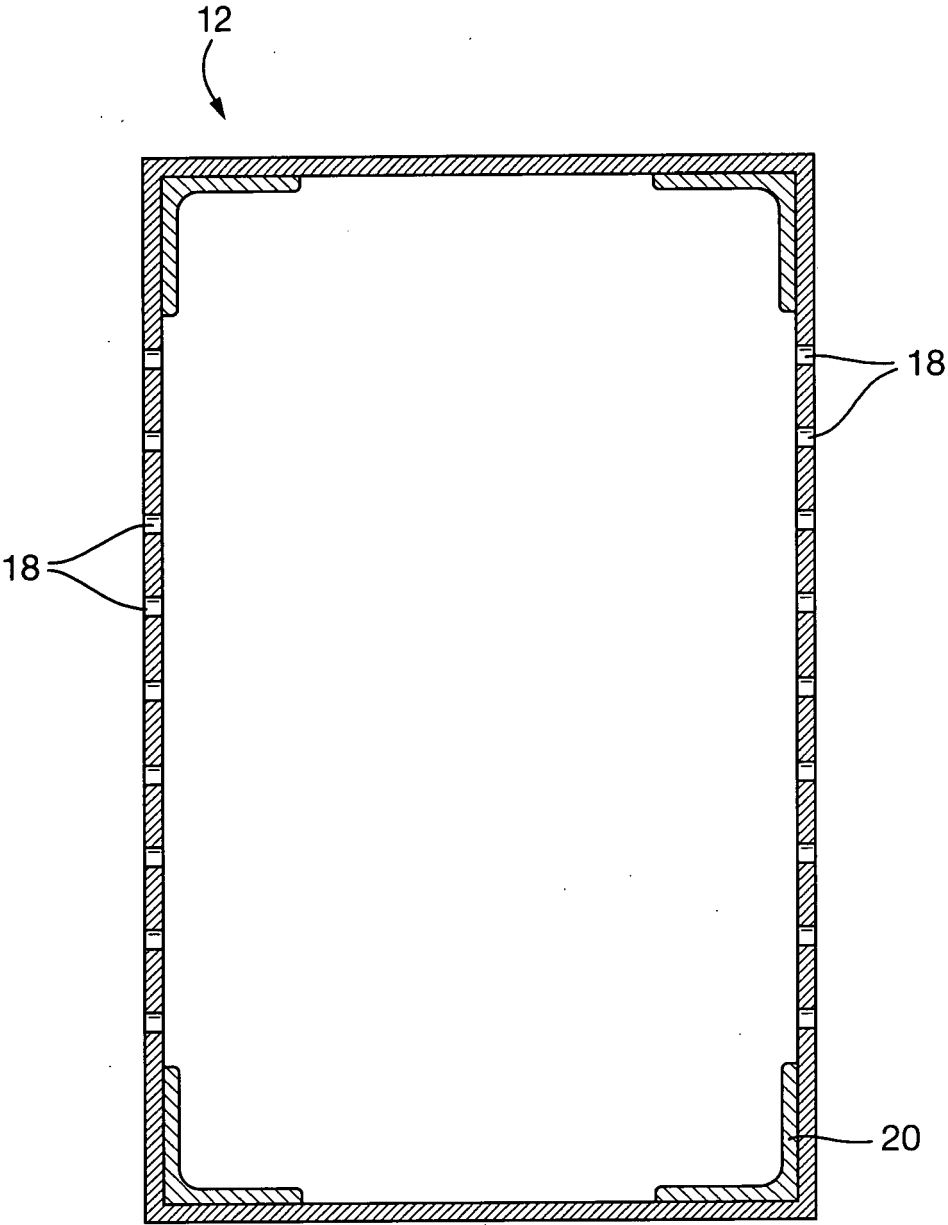


Fig.6.

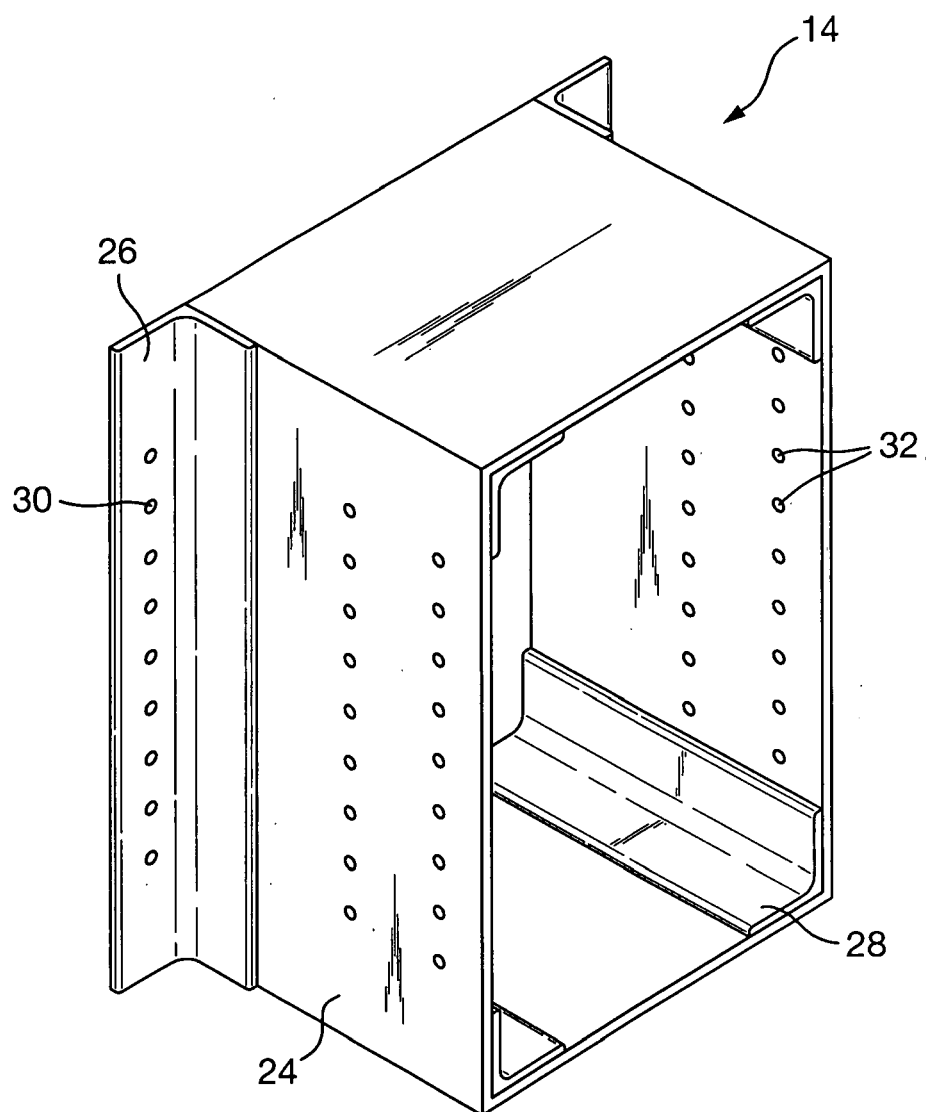


Fig.7.

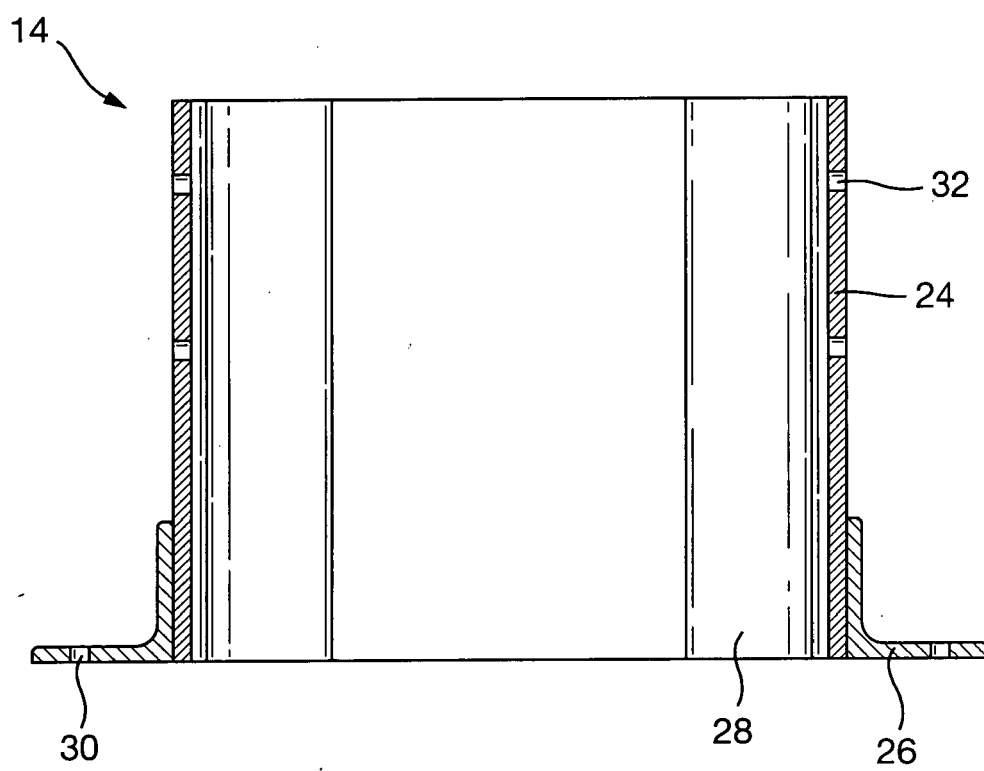


Fig.8.

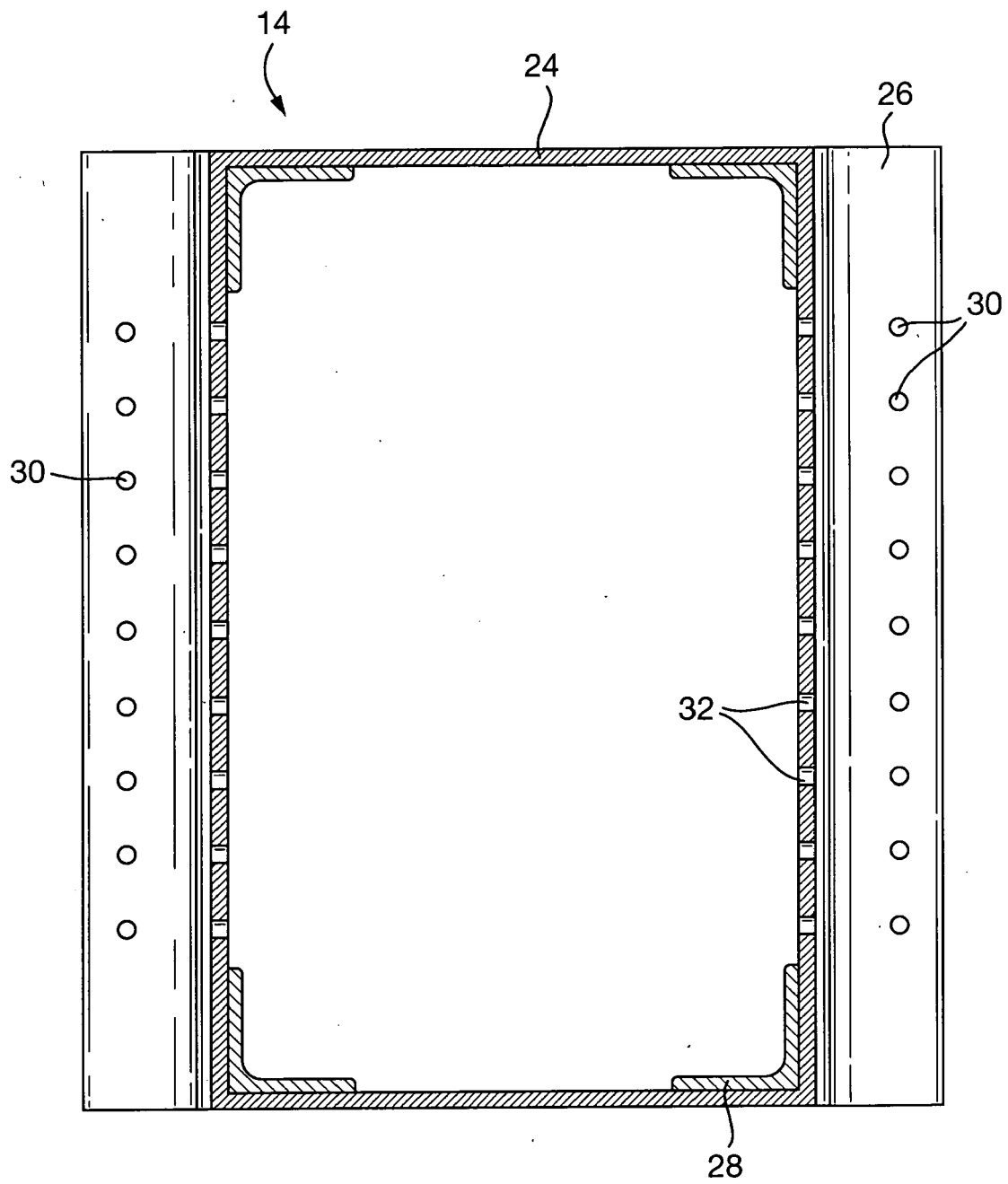


Fig.9.

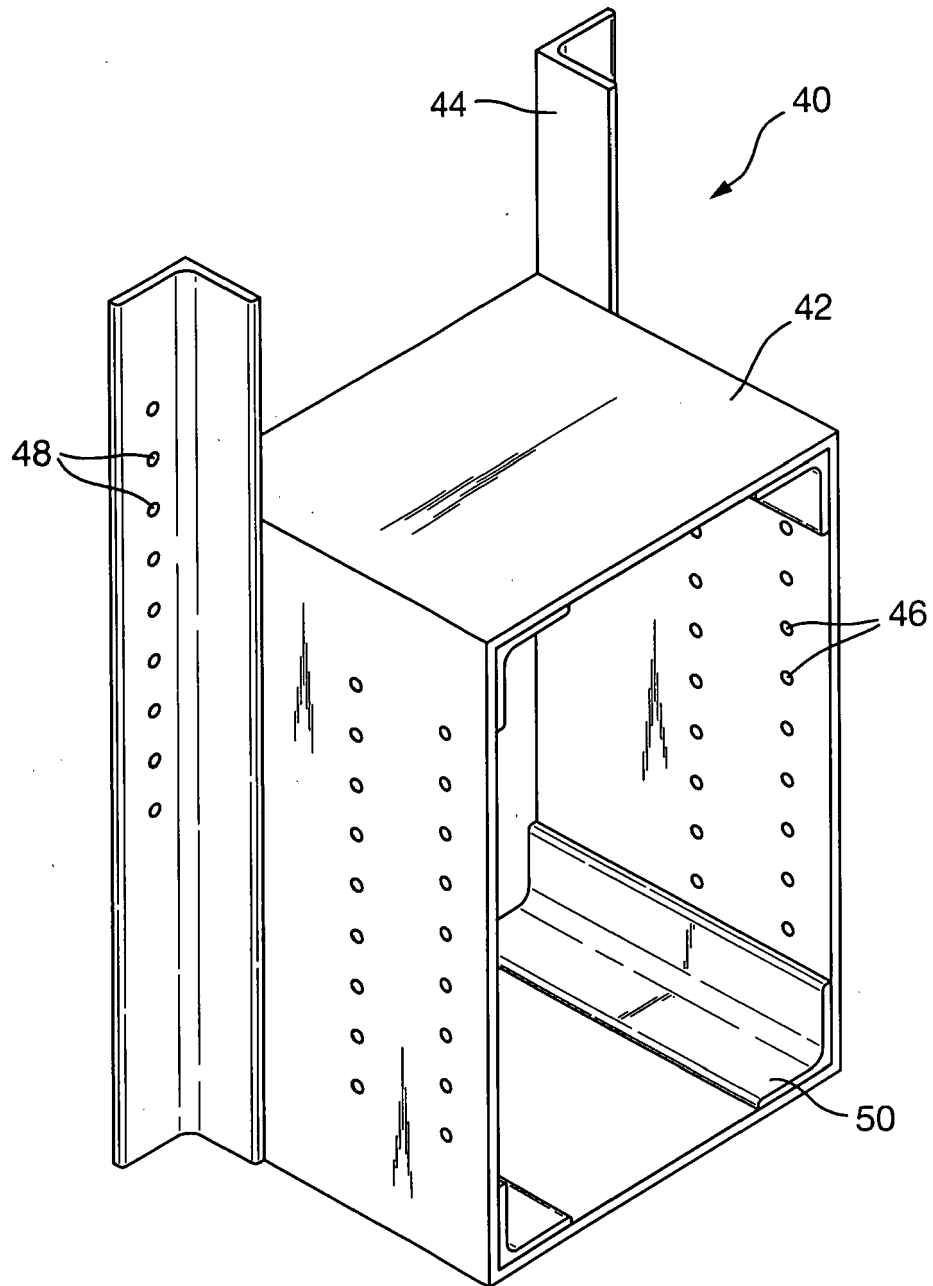
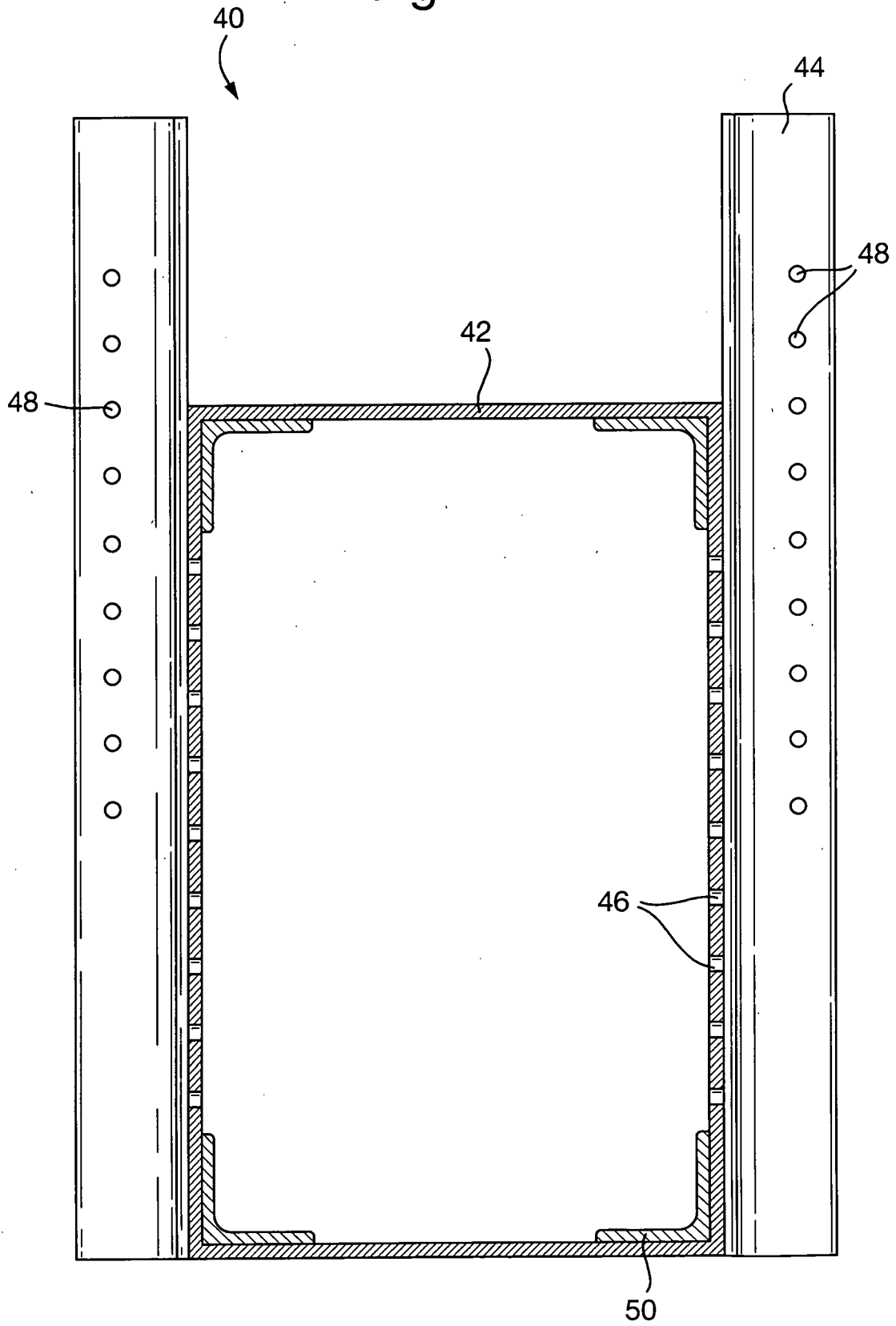


Fig.10.





EUROPEAN SEARCH REPORT

Application Number
EP 11 15 6061

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 238 321 A (JARJOURA MICHAEL [CA]) 24 August 1993 (1993-08-24) * figures 1,2,2A,2B,3,3A,3B,3C * * column 1, lines 6-9 * * column 3, line 33 - column 4, line 45 * * column 5, lines 50-59, 64 - column 6, line 2 * -----	1-15	INV. E04B1/26
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			TECHNICAL FIELDS SEARCHED (IPC)
			E04B E04H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 18 July 2011	Examiner Hellberg, Jan
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 15 6061

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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18-07-2011

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