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## Description

This invention concerns permanent building structures and methods of making such building structures.

More particularly, the invention provides a permanent, non-transportable building structure of adjustable dimensions and a method of making such a building structure.

Such a structure has application in various types of building. For example, it may be used in industrial buildings offering office or warehouse space. It may also be employed in buildings for commercial, domestic, horticultural, or leisure purposes.

There are considerable advantages in being able to vary the dimensions of a permanent building as desired. Since the size of the building can be adapted to suit the needs of the occupier, the building will appeal to a wide range of prospective tenants in the first instance and should be easy to sell or let. And, as far as the inhabitants of such a building are concerned, they can alter its size as their requirements change and thereby avoid the problems of finding and moving to different premises.

According to one aspect of the present invention we provide a method of making a permanent, non-transportable building structure characterised by:

constructing on site and from component materials a building comprising a rigid lower frame defining a lower shell portion which is permanently mounted in foundations, and a rigid upper frame defining an upper shell portion, the upper shell portion being vertically movable relative to the lower shell portion between a lowered position in which the two shell portions overlap to a substantial extent and a raised position in which the two shell portions overlap to a lesser extent wherein the upper and lower shell portions are designed to permit use of the building in both the raised and the lowered position of the upper shell portion, the upper shell portion being arranged in one of its lowered or raised positions.

According to another aspect of the present invention we provide a permanent non-transportable building structure which is constructed on site from component materials characterised by an outer shell arranged to define a substantially enclosed usable space of adjustable dimensions, a section at least of the outer shell having a rigid lower frame permanently mounted in foundations and defining a lower shell portion, a rigid upper frame defining an upper shell portion, the upper shell portion being vertically movable relative to the lower shell portion and being arranged in one of a lowered position in which the two shell portions overlap to a substantial extent and a raised position in which the two shell portions overlap to a lesser extent wherein the upper and lower shell portions are designed to permit use of the building in both the raised and the lowered position of the upper shell portion and means for fixing the upper shell portion relative to the lower shell portion in the raised position at least.

The outer shell may have only one adjustable section constituting either the whole or simply a part of the shell. Alternatively, it may have a plurality of independently adjustable sections.

Preferably, the lower and upper portions have structural beams, with the beams of one portion slideably engaging those of the other. In the embodiments described below, the beams of the upper portion are provided by portal frames and the beams of the lower portion constitute stanchions mounted in foundations.

It is a feature of these embodiments that the portal frames and the foundations are so arranged that jacks can be temporarily inserted between them for raising and lowering the upper portion of the outer shell.

The beams may conveniently be H-section in form and, in each engaged pair, the side of one may be held in slideable engagement with the side of the other by one or more guides. For example, the free end of at least one of the two beams may have one, or more than one, guide fixed to it which embraces the other beam in sliding or rolling engagement. Preferably, each guide has a U-shaped section and fits over respective edges of the two beams.

Turning to the means for securing the upper and lower portions relative to one another, these are advantageously employed in the lowered position as well as the raised position for stability. Bolts and/or clamps can conveniently be used for the purpose.

In addition to the structural beams, either or both of the upper and lower portions may also include wind bracing, together with some form of cladding.

The invention is described further by way of example with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a first building embodying the invention;

Figures 2 and 3 are fragmentary side views of the building in different conditions;

Figures 4 and 5 are sectional views of the building in different conditions;

Figures 6 and 7 are more detailed sectional views of a portion of the building in different conditions;

Figures 8 and 9 are sections taken along the line X—X in Figure 6 in different conditions of the building;

Figure 10 is a side view of one of the guides illustrated in Figures 8 and 9;

Figure 11 is a perspective view of another building embodying the invention;

Figure 12 is perspective view of a further building embodying the invention; and

Figures 13 to 15 are detailed sectional views of a portion of the building shown in Figure 12 in different conditions.

Referring initially to Figures 1 to 10, these show a building comprising an outer shell 10 which is adjustable as a whole to alter the dimensions of the building. The shell 10 has a fixed, rigid lower portion 12, and a rigid upper portion 14 supported

by the lower portion for movement between a lowered position and a raised position.

In the lowered position, represented in Figures 1, 2, 4 and 6, the two portions overlap to a substantial extent. They still overlap in the raised position, as illustrated in Figures 3, 5 and 7, but only to a much lesser extent. Consequently, they define an interior space which remains permanently substantially enclosed apart from points of access such as doors and windows.

The lower portion 12 of the building comprises a plurality of rolled steel stanchions 16 embedded in concrete foundations 18 (see Figures 6 and 7). Braces 20 are mounted between the stanchions 16 to provide stability, and a conventional form of cladding 22 is supported against the interior sides of the stanchions 16 for weatherproofing.

Appropriately positioned openings 3 in the cladding 22 serve for doors and windows.

The stanchions 16 are H-shaped in section and arranged with one side 24 of the H supporting the cladding and with the other side 26 projecting outwardly beyond the cladding. The sides 26 are maintained in slideable engagement with corresponding rolled steel beams 28 forming the limbs of a plurality of portal frames 30. Like the stanchions 16, the beams 28 are H-shaped in section and they are arranged so that one side 32 of the H overlies the side 26 of the associated stanchion 16. The other, exterior, side 34 and the outer edge of the overhead member 36 of the portal frame 30 carry a conventional form of cladding 38.

The upper portion 14 may have braces 40 permanently provided between the beams 28 to give it stability; or it may be devoid of such braces when lowered and only have them fixed in place when it is in the raised condition.

Openings 42 in the cladding 38 are supplied for windows and doors. These openings may be permanent or they may be covered over with cladding 38 and opened up according to the current needs of the occupier. In any event, however, when the upper portion 14 is in the lowered condition, suitably sited openings 42 are provided to coincide with the access openings to the lower portion 12.

In order to locate the portal frames 30 relative to the stanchions 16 at all times, at least one pair of guides 44 is arranged to act between each stanchion 16 and the associated beam 28. Since the arrangement is the same in each case, only one will be described.

In this instance, the guides 44 are situated at the lower end of the beam 28 so as to co-operate with its inner side 32 and the outer side 26 of the stanchion 16. Each guide 44 is in the form of a U-shaped slide as shown in Figures 8 to 10. The slides 44 embrace the sides 26, 32 and are secured to the sides 32 as by welding, but are not in any way attached to the sides 26.

Consequently, the slides 44 are arranged to guide the beam 28 for sliding along the stanchion 16, and to facilitate such movement the longitudinal ends 46 of the portion of each slide embracing the side 26 are raised away from that

side. Additionally, the slides 44 serve not only to limit movement of the beam 28 outwardly from the stanchions 16 but also to restrict lateral movement of these elements relative to one another.

For fixing the upper portion 14 in its position, either raised or lowered, one or more sets of bolts or clamps 48 are fixed between the stanchions 16 and the beams 28 to engage their sides 26 and 32.

When the upper portion 14 is in its lowered position, the portal frames 30 are supported on the free upper ends of the stanchions 16, and the bolts or clamps 48 secure the limbs 28 against the tops and the bottoms of the stanchions 16. In this condition, the lower ends of the beams 28 are spaced a short distance above portions of the foundations 18.

In order to raise the upper portion 14, the following procedure is adopted:

Braces are fixed between the portal limbs, if not already present. And any cladding that needs altering or removing is dealt with.

Jacks are then temporarily inserted between the foundations 18 and the portal limbs 28 at some or all of the available points around the building. These jacks are fixed in position, connected up to power supplies and fully tested. Following this, they are inflated to take the load of the upper portion 14, but not further.

The guides 44 are then lubricated for ease of sliding and any potential obstructions are removed.

Next, the means securing the portal frames 30 to the stanchions 16 are eased, at the top first, and then at the bottom, after which they are removed.

The jacks are now inflated simultaneously in one or more stages to raise the upper portion 14 to the desired position, whereupon the portal frames 30 and stanchions 16 are fixed together again. Finally, the jacks are released.

Lowering of the upper portion 14 is a similar exercise, although it is preferable to make any adjustments required in the cladding and bracing at the end.

The height of the building can thus be adjusted as desired and by making appropriate alterations in the interior, the building can be converted for example from one to two stories or from a small to a much increased storage volume.

Any services are preferably arranged on a ring system, either with freely connectable extensions or with spare line capacity as appropriate to accommodate alterations. Additional cladding is also provided to seal between the upper and lower portions of the building.

Turning to Figure 11, this illustrates a modified form of the building which has two independently adjustable sections 50, 52.

Each of these is constructed in a manner similar to that described with reference to Figures 1 to 10 and so further explanation is not required except to say that the upper portion of one section is raised while that of the other remains lowered, as shown, additional cladding will have to be added to close the vertical gap created between the two.

The buildings shown in Figures 1 and 11 each have only a single span. Figures 12 to 15 concern a multispans building, having as many as four independently adjustable sections 60, 62, 64 and 66.

The principle of construction and the manner of raising and lowering the upper portions remains the same, but the region 68 defining the join between the two spans is adapted to permit alterations in height of sections of one span independently of sections of the other (see Figures 13 to 15).

In this region 68, there are a plurality of free standing stanchions 70, which are H-shaped in cross-section, embedded centrally within foundations 72. Respective limbs 28 of the portals 30 of one span are located by their guides 44 against the stanchions 70 on one side. Likewise, respective limbs 28 of the portals 30 of another span are located by the guides 44 against the stanchions 70 on the other side. As before, bolts or clamps 48 serve to secure each limb 28 against the adjacent side of the associated stanchion 70 in the desired position.

Each span can be raised or lowered independently of the other simply by placing jacks on the foundations 72 under some of all of the relevant portal limbs 28. Of course, if one span is raised while the other remains lowered, it will be necessary to apply cladding 74 to the raised span as illustrated in Figure 14 for weatherproofing.

The described structures have a high degree of adaptability, but can still be constructed simply in a weather-tight manner. They remain rigid and stable in all conditions and are consequently suitable for industrial, leisure and indeed many other uses.

### Claims

1. A permanent building structure which is constructed on site from component materials characterised by an outer shell (10) arranged to define a substantially enclosed usable space of adjustable dimensions, a section at least of the outer shell (10) having a rigid lower frame (12) permanently mounted in foundations (18) and defining a lower shell portion and a rigid upper frame (14) defining an upper shell portion, the upper shell portion being vertically movable relative to the lower shell portion and being arranged in one of a lowered position in which the two shell portions overlap to a substantial extent and a raised position in which the two shell portions overlap to a lesser extent wherein the upper and lower shell portions are designed to permit use of the building in both the raised and the lowered position of the upper shell portion, and means (48) for fixing the upper shell portion relative to the lower shell portion in the raised position at least.

2. A structure as claimed in claim 1, characterised in that the upper frame includes structural beams (28) arranged slidably to engage the structural beams (16) of the lower frame.

3. A structure as claimed in claim 2, characterised in that the beams (28) of the upper frame are provided by portal frames (30).

4. A structure as claimed in claim 3, characterised in that the portal frames (30) and the foundations (18) are arranged for receiving jacks therebetween for raising and lowering the upper shell portion (14).

5. A structure as claimed in any of claims 2 to 4, characterised in that the beams (16, 28) comprise H-section beams, and in that the beams are arranged in pairs each comprising a respective beam of the lower frame and a respective beam of the upper frame, and in that the side (26) of one beam (16) in each pair is held in slidable engagement with the side (32) of the other beam (28) in the same pair by guide means (44).

6. A structure as claimed in claim 5, characterised in that a free end of at least one of the two beams in each pair is held in slidable engagement with the other beam in the same pair of the guide means (44).

7. A structure as claimed in claim 5 or 6, characterised in that the guide means (44) comprise a plurality of guides, each having a substantially U-shaped section and being arranged to fit over respective edges of the two beams in the associated pair.

8. A structure as claimed in claim 7, characterised in that each guide has one limb fixed to one (28) of the two beams in the associated pair and the other limb disposed for sliding or rolling engagement with the other beam (16) in the associated pair.

9. A structure as claimed in any preceding claim, characterised in that the fixing means (48) are arranged to fix the upper frame (14) relative to the lower frame (12) in the lowered position.

10. A structure as claimed in any preceding claim, in which the outer shell bracket (10) has only a single adjustable section providing either a part or the whole of the outer shell.

11. A structure as claimed in any of claims 2 to 9, in which the outer shell (10) has a plurality of independently adjustable sections.

12. A method of making a permanent, non-transportable building structure characterised by: constructing on site and from component materials a building comprising a rigid lower frame (12) defining a lower shell portion which is permanently mounted in foundations (18), and a rigid upper frame (14) defining an upper shell portion, the upper shell portion being vertically movable relative to the lower shell portion between a lowered position in which the two shell portions overlap to a substantial extent and a raised position in which the two shell portions overlap to a lesser extent wherein the upper and lower shell portions are designed to permit use of the building in both the raised and the lowered position of the upper shell portion, the upper shell portion being arranged in one of its lowered or raised positions.

13. A method according to claim 12 characterised by:

moving the upper shell portion from its arranged position to the other of its lowered or raised positions, and

altering the number of storeys in the building structure.

#### Patentansprüche

1. Feste Gebäudekonstruktion, die am Bauplatz aus Einzelteilmaterialien aufgebaut wird, gekennzeichnet durch einen äußeren Gebäudekörper (10), der so ausgebildet ist, daß er einen im wesentlichen geschlossenen nutzbaren Raum mit einstellbaren Abmessungen begrenzt, wobei wenigstens ein Teil des äußeren Gebäudekörpers (10) einen starren unteren Rahmen (12), der fest in Fundamenten aufgebaut ist und einen unteren Gebäudekörperteil begrenzt, und einen starren oberen Rahmen (14) aufweist, der einen oberen Gebäudekörperteil begrenzt, wobei der obere Gebäudekörperteil relativ zum unteren Gebäudekörperteil vertikal bewegbar und in einer abgesenkten Lage, in der die beiden Gebäudekörperteile sich in einem erheblichen Maß überlappen, oder einer angehobenen Lage angeordnet ist, in der sich die beiden Gebäudekörperteile in einem geringeren Maß überlappen, und wobei der obere und untere Gebäudekörperteil so ausgelegt sind, daß eine Benutzung des Gebäudes sowohl in der angehobenen als auch in der abgesenkten Lage des oberen Gebäudekörperteils möglich ist, und Einrichtungen (48) zum Festlegen des oberen Gebäudekörperteils relativ zum unteren Gebäudekörperteil wenigstens in der angehobenen Lage.

2. Konstruktion nach Anspruch 1 dadurch gekennzeichnet, daß der obere Rahmen Baukonstruktionsträger (28) enthält, die gleitend verschiebbar angeordnet sind, um die Baukonstruktionsträger (16) des unteren Rahmens in Eingriff zu nehmen.

3. Konstruktion nach Anspruch 2 dadurch gekennzeichnet, daß die Träger (28) des oberen Rahmens von Portalrahmen (30) geliefert werden.

4. Konstruktion nach Anspruch 3 dadurch gekennzeichnet, daß die Portalrahmen (30) und die Fundamente (18) so ausgebildet sind, daß dazwischen Hubeinrichtungen zum Anheben und Absenken des oberen Gebäudekörperteils (14) aufgenommen werden können.

5. Konstruktion nach einem der Ansprüche 2 bis 4 dadurch gekennzeichnet, daß die Träger (16, 28) H-Träger umfassen und daß die Träger in Paaren angeordnet sind, von denen jedes einen jeweiligen Träger des unteren Rahmens und einen Träger des oberen Rahmens umfaßt, und daß die Seite (26) eines Trägers (16) in jedem Paar in einer Gleitineingriffnahme mit der Seite (32) des anderen Trägers (28) im selben Paar über eine Führungseinrichtung (44) gehalten ist.

6. Konstruktion nach Anspruch 5 dadurch gekennzeichnet, daß ein freies Ende wenigstens eines der beiden Träger in jedem Paar in einer Gleitineingriffnahme mit dem anderen Träger im selben Paar der Führungseinrichtung (44) gehalten ist.

7. Konstruktion nach Anspruch 5 oder 6 dadurch gekennzeichnet, daß die Führungseinrichtung (44) eine Vielzahl von Führungen umfaßt, von denen jede einen im wesentlichen U-förmigen Querschnitt hat und so angeordnet ist, daß sie über die jeweiligen Ränder der beiden Träger im zugehörigen Paar paßt.

8. Konstruktion nach Anspruch 7 dadurch gekennzeichnet, daß jede Führung mit einem Schenkel an einem (28) der beiden Träger ihm zugehörigen Paar befestigt und mit dem anderen Schenkel für eine Gleit- oder Rollineingriffnahme mit dem anderen Träger (16) im zugehörigen Paar angeordnet ist.

9. Konstruktion nach einem der vorhergehenden Ansprüche dadurch gekennzeichnet, daß die Festlegungseinrichtungen (48) so angeordnet sind, daß sie den oberen Rahmen (14) relativ zum unteren Rahmen (12) in der abgesenkten Lage festlegen.

10. Konstruktion nach einem der vorhergehenden Ansprüche, bei der der äußere Gebäudekörperträger (10) nur einen einzigen einstellbaren Teil hat, der entweder einen Teil des äußeren Gebäudekörpers oder den gesamten äußeren Gebäudekörper bildet.

11. Konstruktion nach einem der Ansprüche 2 bis 9, bei der der äußere Gebäudekörper (10) eine Vielzahl von unabhängig einstellbaren Teilen hat.

12. Verfahren zum Erstellen einer festen nicht transportierbaren Gebäudekonstruktion dadurch gekennzeichnet, daß am Bauplatz und aus Einzelteilmaterialien ein Gebäude aufgebaut wird, das einen starren unteren Rahmen (12), der einen unteren Gebäudekörperteil begrenzt, der fest in Fundamenten (18) aufgebaut ist, und einen starren oberen Rahmen (14) umfaßt, der einen oberen Gebäudekörperteil begrenzt, wobei der obere Gebäudekörperteil relativ zum unteren Gebäudekörperteil zwischen einer abgesenkten Lage, in der beide Gebäudekörperteile sich in einem erheblichen Maß überlappen, und einer angehobenen Lage vertikal bewegbar ist, in der sich die beiden Gebäudekörperteile in einem geringeren Maß überlappen, und wobei der obere und der untere Gebäudekörperteil so ausgelegt sind, daß eine Benutzung des Gebäudes sowohl in der angehobenen als auch in der abgesenkten Lage des oberen Gebäudekörperteils möglich ist, während sich der obere Gebäudekörperteil in seiner abgesenkten oder in seiner angehobenen Lage befindet.

13. Verfahren nach Anspruch 12 dadurch gekennzeichnet, daß der obere Gebäudekörperteil von seiner Anordnungslage in seine andere abgesenkte oder angehobene Lage bewegt und die Anzahl der Stockwerke in der Gebäudekonstruktion geändert wird.

#### Revendications

1. Structure de bâtiment permanente qui est construite sur le site à partir de matériaux constitutifs, caractérisée par une enveloppe extérieure (10) conçue de façon à définir un espace utilisable

substantiellement fermé et de dimensions ajustables, une partie au moins de l'enveloppe extérieure (10) ayant une ossature inférieure rigide (12) montée de façon permanente dans des fondations (18) et définissant une partie d'enveloppe inférieure, et une ossature supérieure rigide (14) définissant une partie d'enveloppe supérieure, la partie d'enveloppe supérieure étant mobile verticalement par rapport à la partie d'enveloppe inférieure et étant disposée dans une position abaissée dans laquelle les deux parties d'enveloppe se chevauchent de manière substantielle ou une position élevée dans laquelle les deux parties d'enveloppe se chevauchent dans une moindre mesure, les parties d'enveloppe supérieure et inférieure étant conçues pour permettre l'utilisation du bâtiment tant dans la position élevée que dans la position abaissée de la partie d'enveloppe supérieure, et des moyens (48) pour fixer la partie d'enveloppe supérieure par rapport à la partie d'enveloppe inférieure au moins dans la position élevée.

2. Structure selon la revendication 1, caractérisée en ce que l'ossature supérieure comprend des poutres structurelles (28) prévues coulissantes pour qu'elles s'accouplent avec les poutres structurelles (16) de l'ossature inférieure.

3. Structure selon la revendication 2, caractérisée en ce que les poutres (28) de l'ossature supérieure sont munies d'ossatures en portique (30).

4. Structure selon la revendication 3, caractérisée en ce que les ossatures en portique (30) et les fondations (18) sont disposées de façon à recevoir entre elles des vérins pour élever et abaisser la partie d'enveloppe supérieure (14).

5. Structure selon l'une quelconque des revendications 2 à 4, caractérisée en ce que les poutres (16, 28) comprennent des poutres à section en H, en ce que les poutres sont disposées par paires comprenant chacune une poutre respective de l'ossature inférieure et une poutre respective de l'ossature supérieure, et en ce que le côté (26) d'une poutre (16) de chaque paire est accouplée par coulisement avec les côtés (32) de l'autre poutre (28) de la même paire par des moyens de guidage (44).

6. Structure selon la revendication 5, caractérisée en ce qu'une extrémité libre d'au moins l'une des deux poutres de chaque paire est accouplée par coulisement avec l'autre poutre de la même paire par des moyens de guidage (44).

7. Structure selon la revendication 5 ou 6, caractérisée en ce que les moyens de guidage (44)

comprennent plusieurs dispositifs de guidage, chacun présentant une section transversale en forme de U et étant disposé de façon à recouvrir les bords respectifs des deux poutres de la paire associée.

8. Structure selon la revendication 7, caractérisée en ce que chaque dispositif de guidage a une branche fixée à l'une (28) des deux poutres de la paire associée et l'autre branche disposée pour s'accoupler par coulisement ou roulement avec l'autre poutre (16) de la paire associée.

9. Structure selon l'une quelconque des revendications précédentes, caractérisée en ce que les moyens de fixation (48) sont disposés de façon à fixer l'ossature supérieure (14) par rapport à l'ossature inférieure (12) en position abaissée.

10. Structure selon l'une quelconque des revendications précédentes, dans laquelle l'enveloppe extérieure (10) ne possède qu'une seule section ajustable constituant tout ou partie de l'enveloppe extérieure.

11. Structure selon l'une quelconque des revendications 2 à 9, dans laquelle l'enveloppe extérieure (10) possède plusieurs sections ajustables séparément.

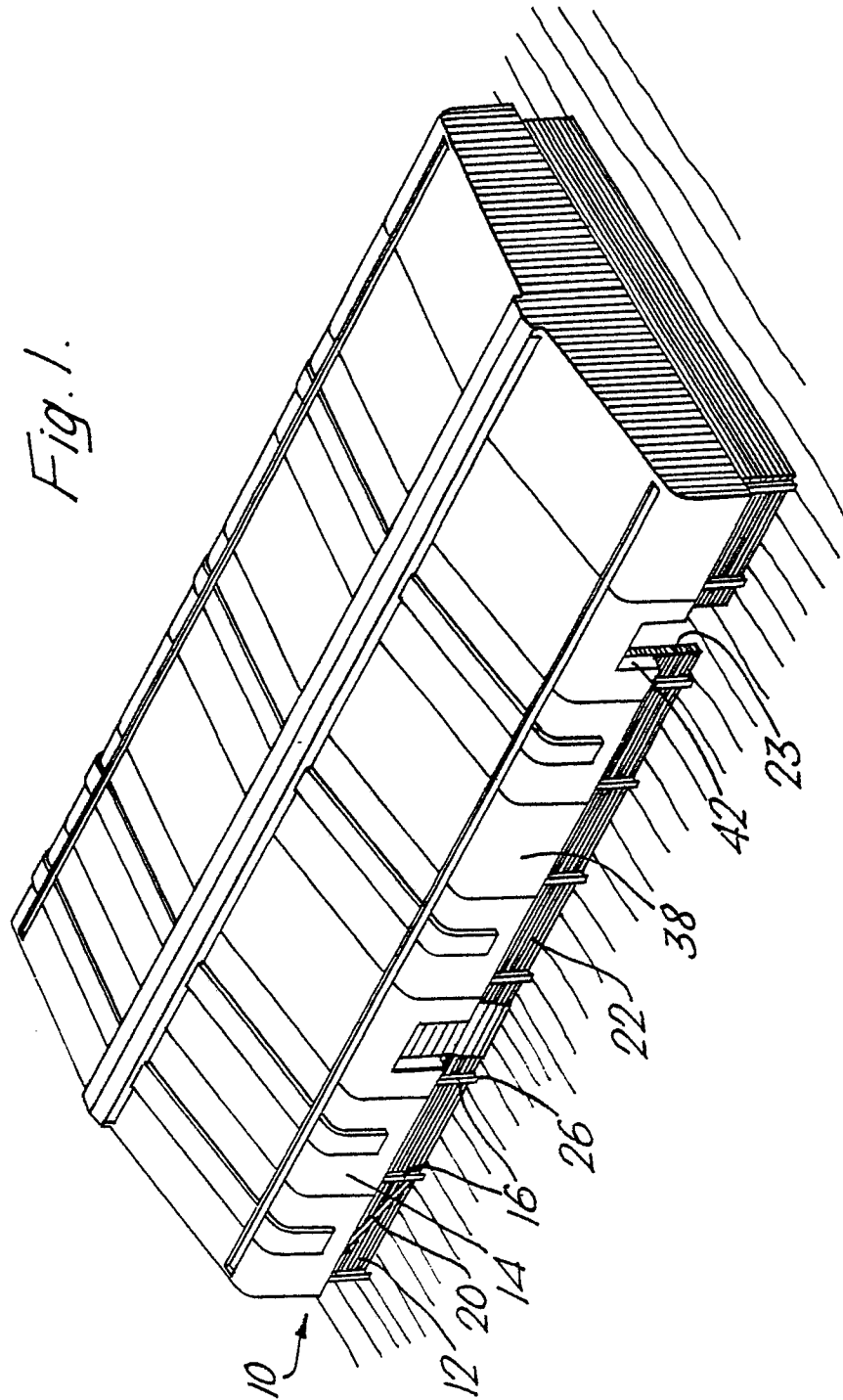
12. Méthode de construction d'une structure de bâtiment permanente et non transportable, caractérisée par:

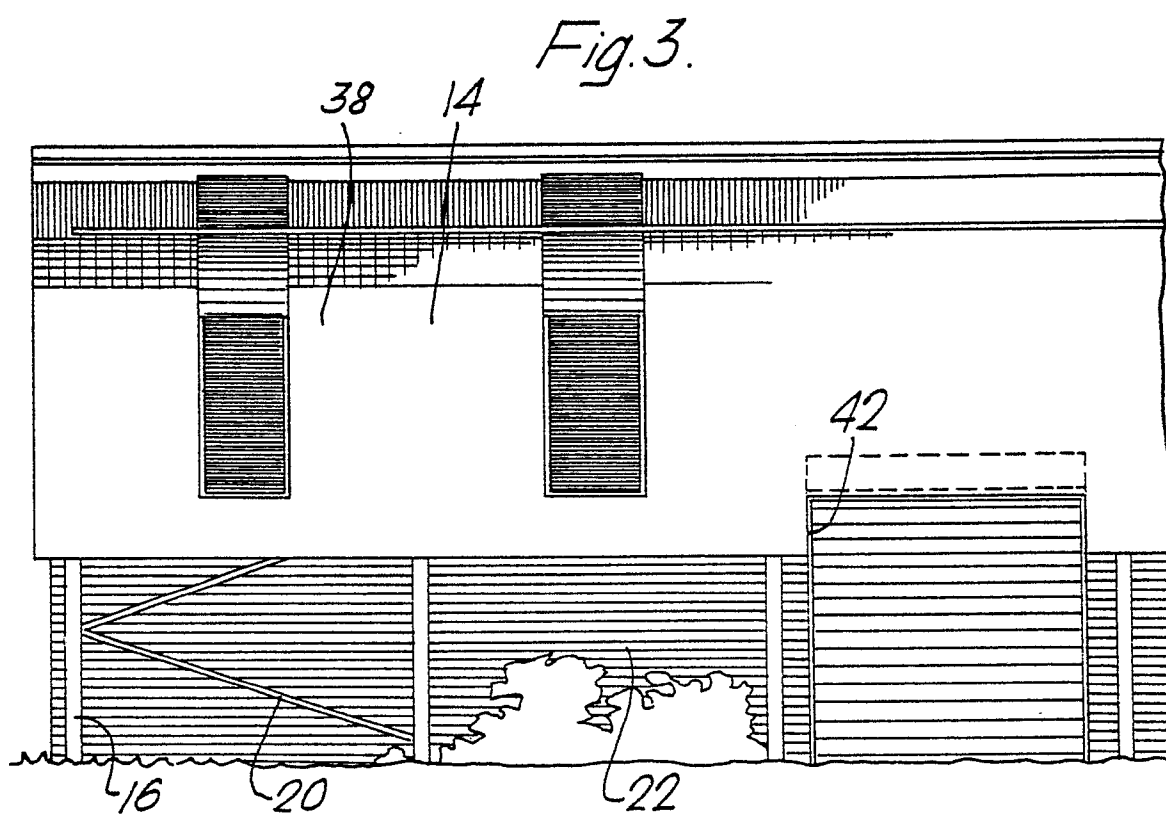
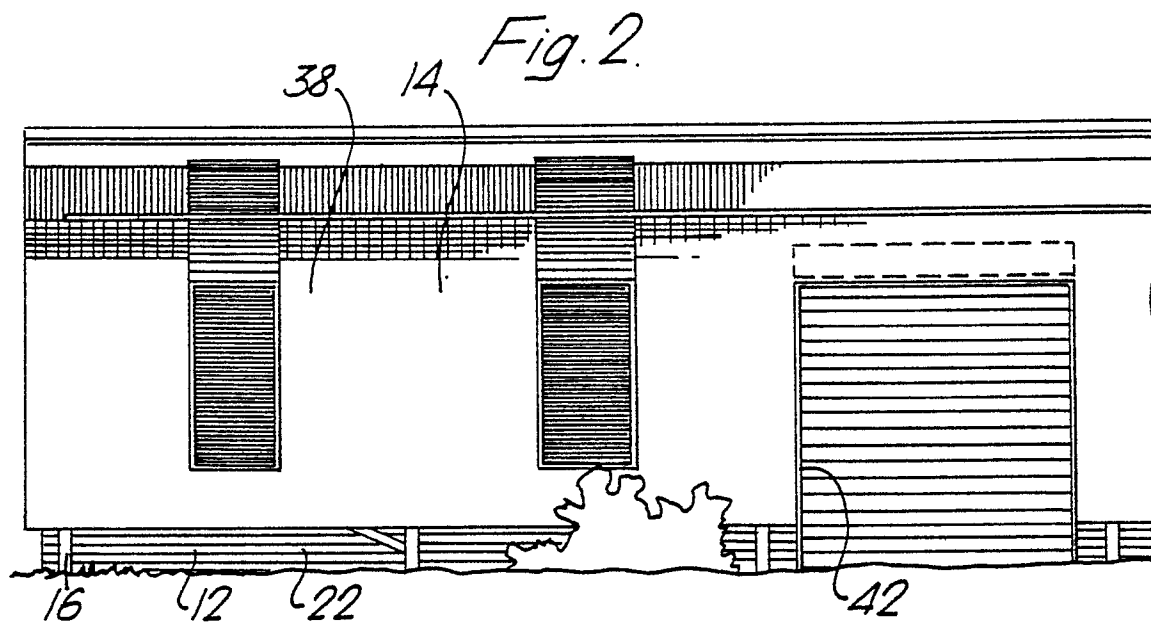
la construction, sur le site et avec des matériaux constitutifs, d'un bâtiment comprenant une ossature inférieure rigide (12) définissant une partie d'enveloppe inférieure qui est montée de manière permanente dans des fondations (18), et une ossature supérieure rigide (14) définissant une partie d'enveloppe supérieure, la partie d'enveloppe supérieure étant mobile verticalement par rapport à la partie d'enveloppe inférieure entre une position abaissée dans laquelle les deux parties d'enveloppe se chevauchent de manière substantielle et une position élevée dans laquelle les deux parties d'enveloppe se chevauchent dans une moindre mesure, les parties d'enveloppe supérieure et inférieure étant conçues pour permettre l'utilisation du bâtiment tant dans la position élevée que dans la position abaissée de la partie d'enveloppe supérieure, la partie d'enveloppe supérieure étant disposée dans l'une de ses positions abaissée ou élevée.

13. Méthode selon la revendication 12, caractérisée par:

le déplacement de la partie d'enveloppe supérieure depuis sa position arrangée jusqu'à l'autre de ses positions abaissée ou élevée, et

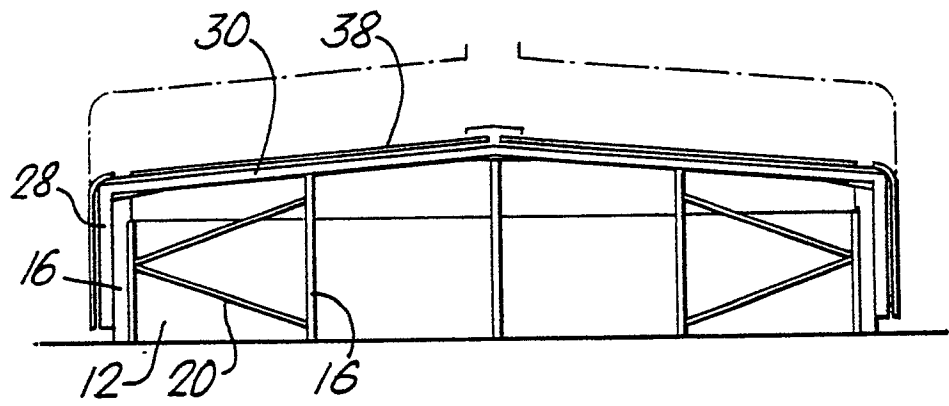
la modification du nombre des niveaux dans la structure du bâtiment.







*Fig. 4.*



*Fig. 5.*

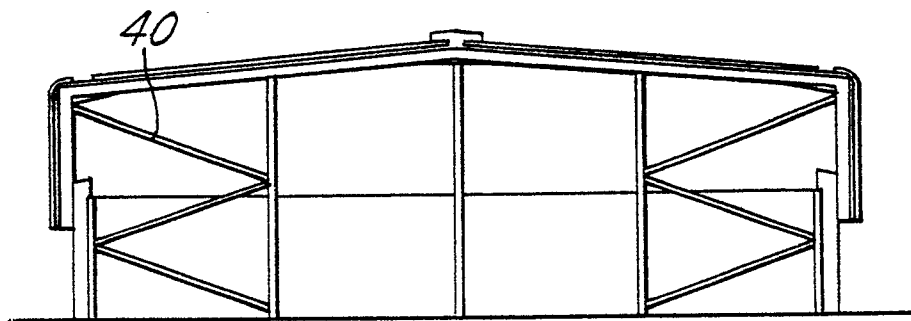
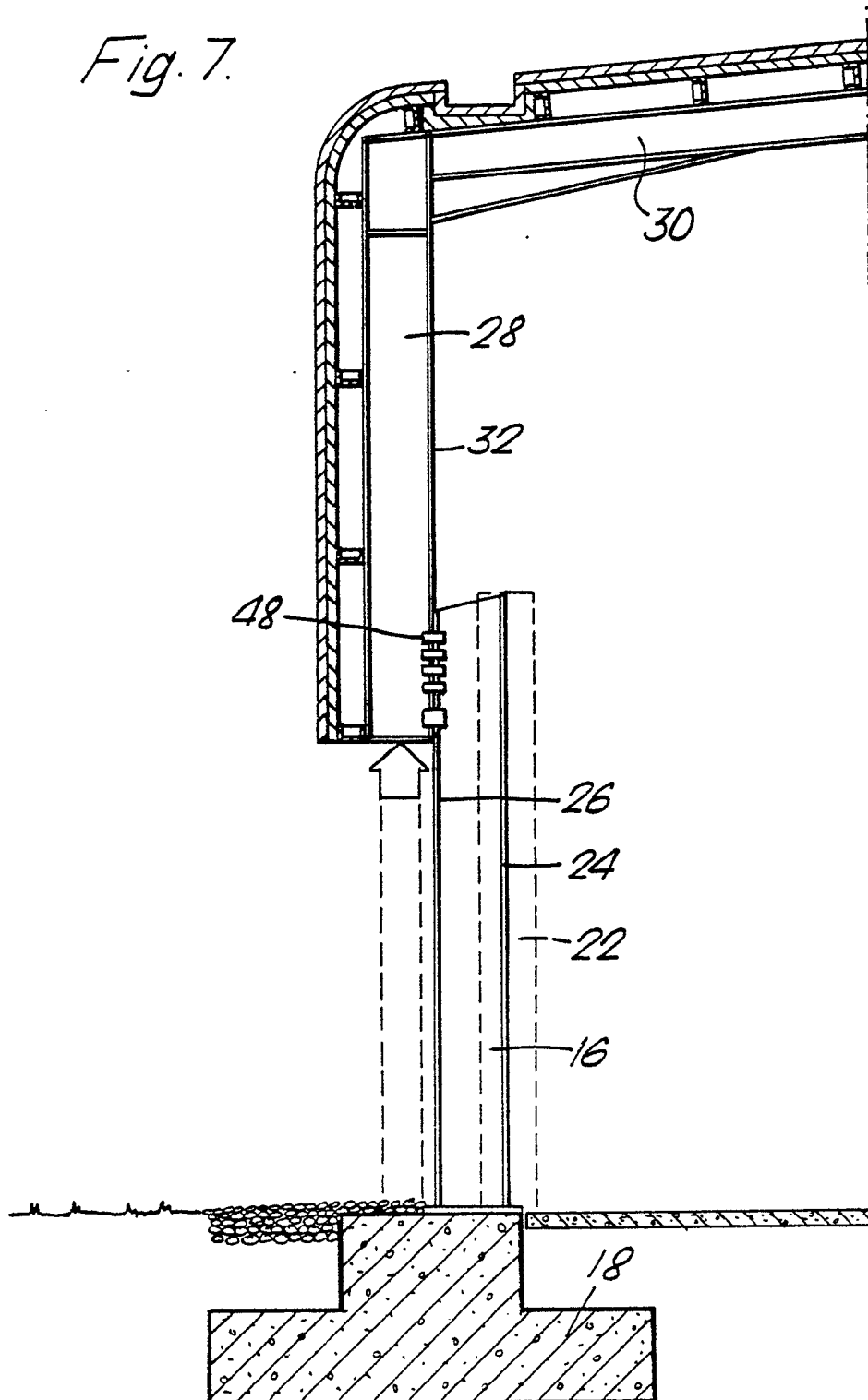
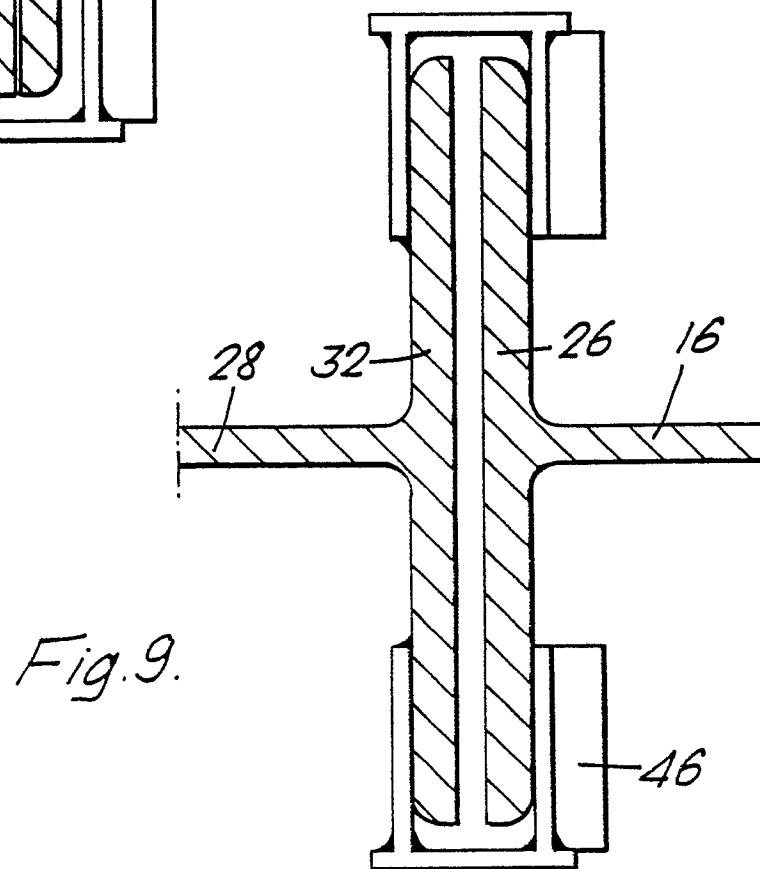
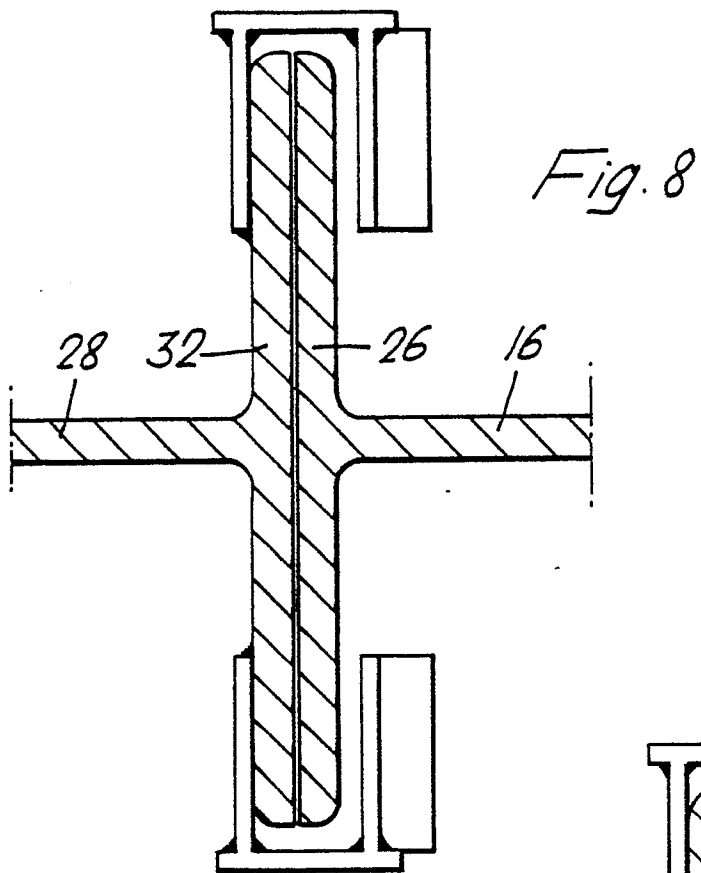


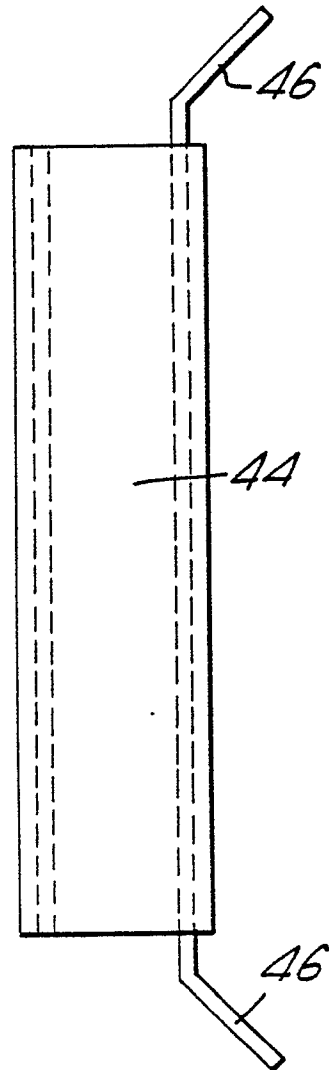


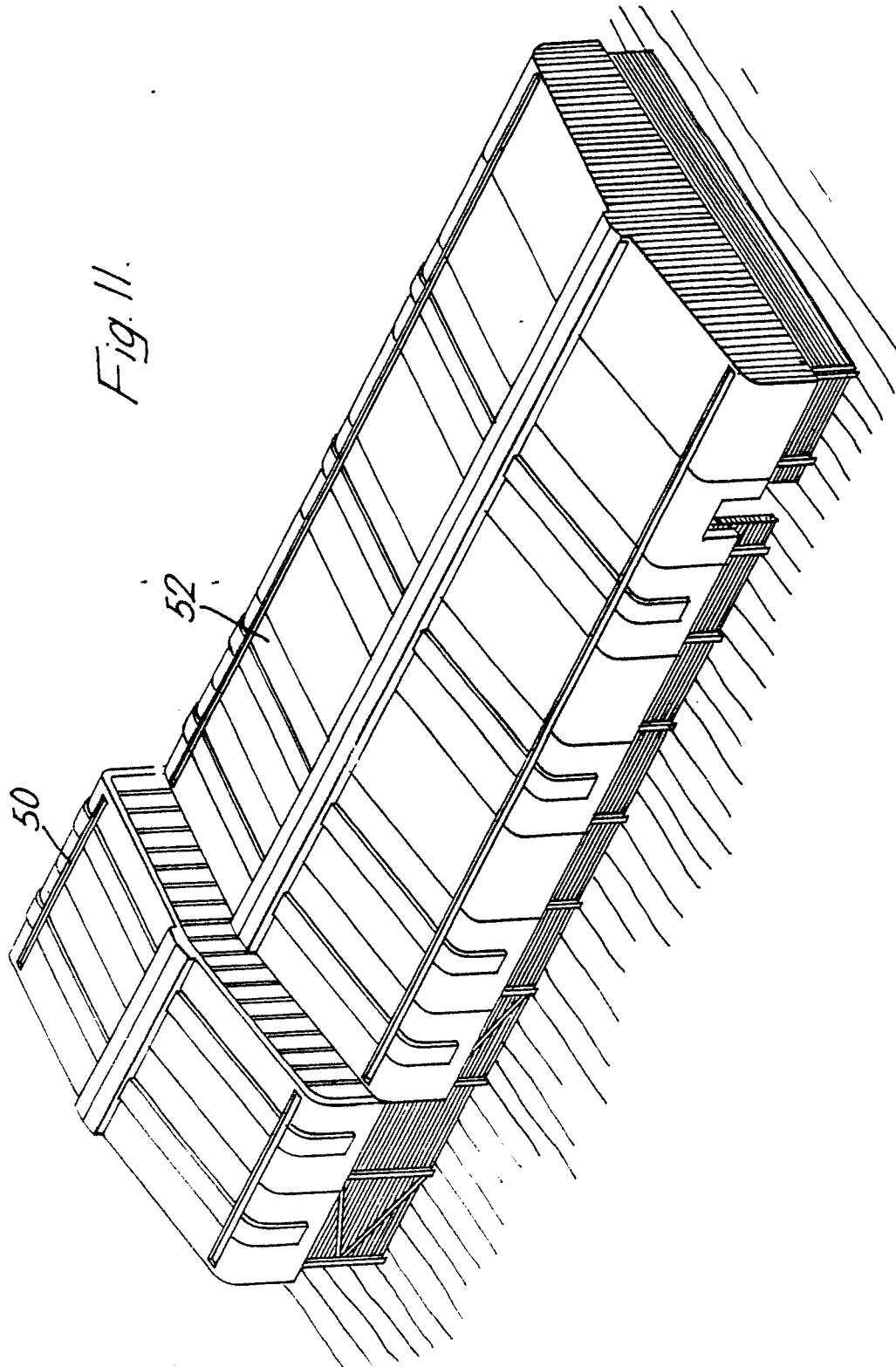
Fig. 7.





*Fig. 10.*





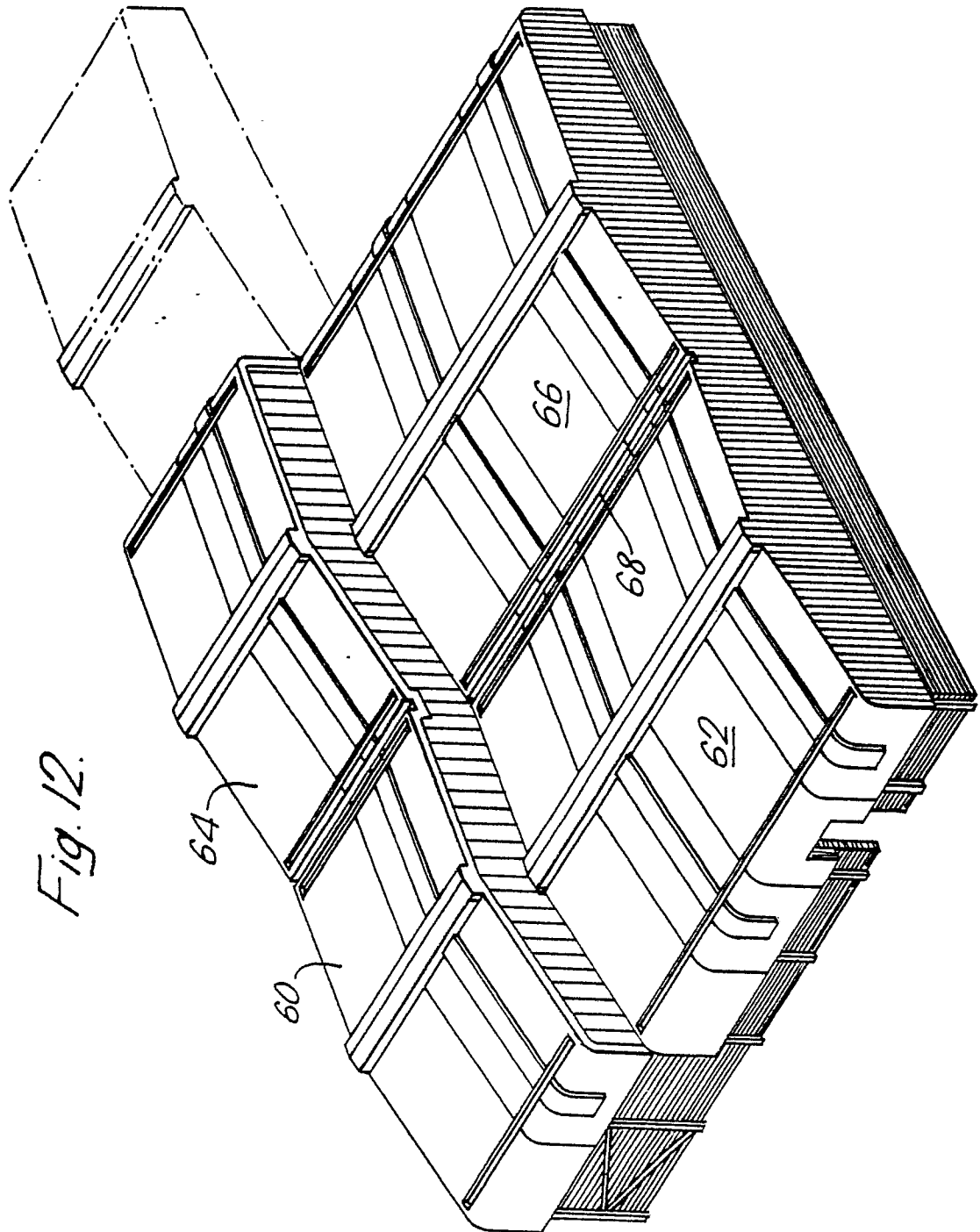
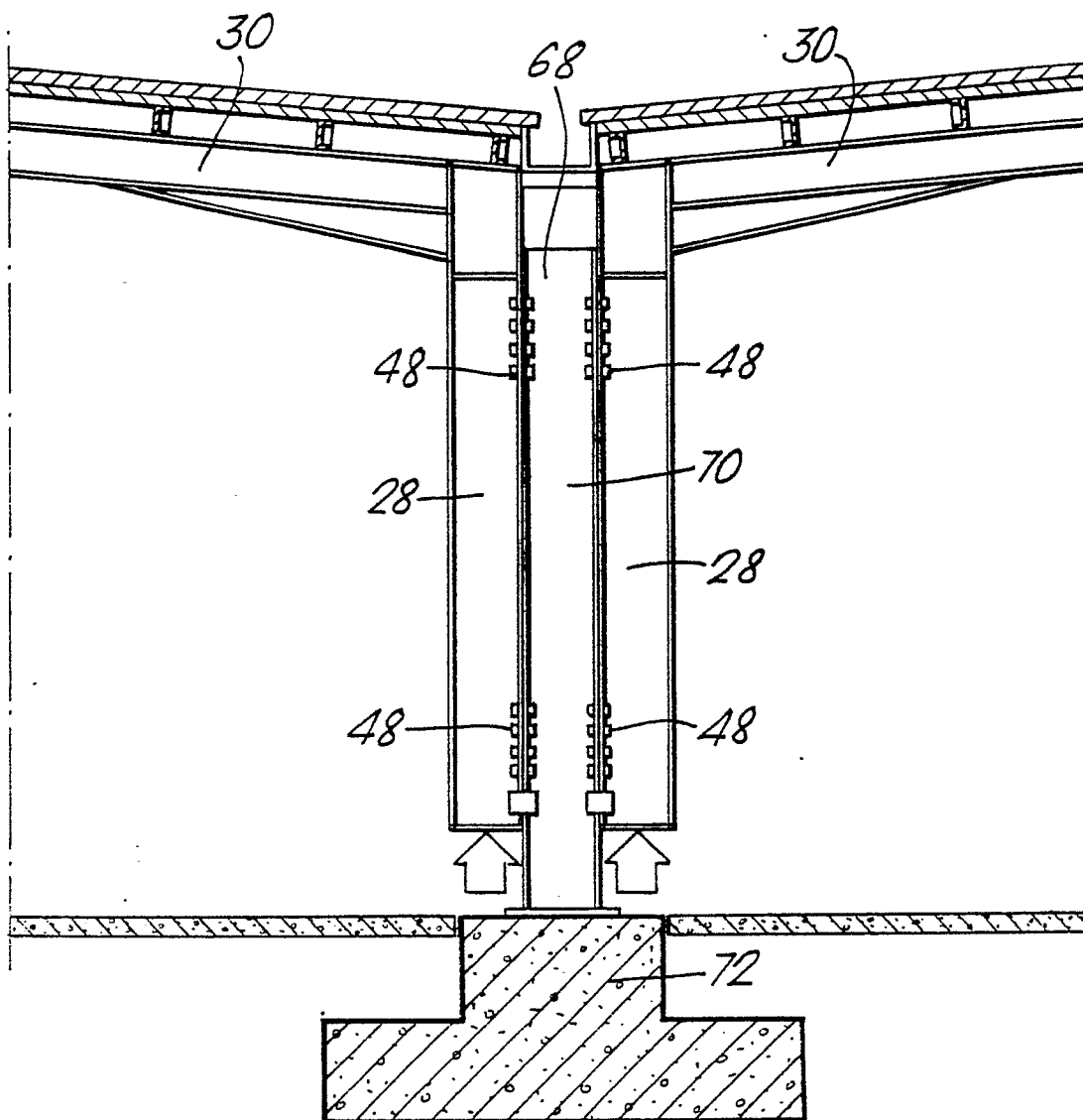
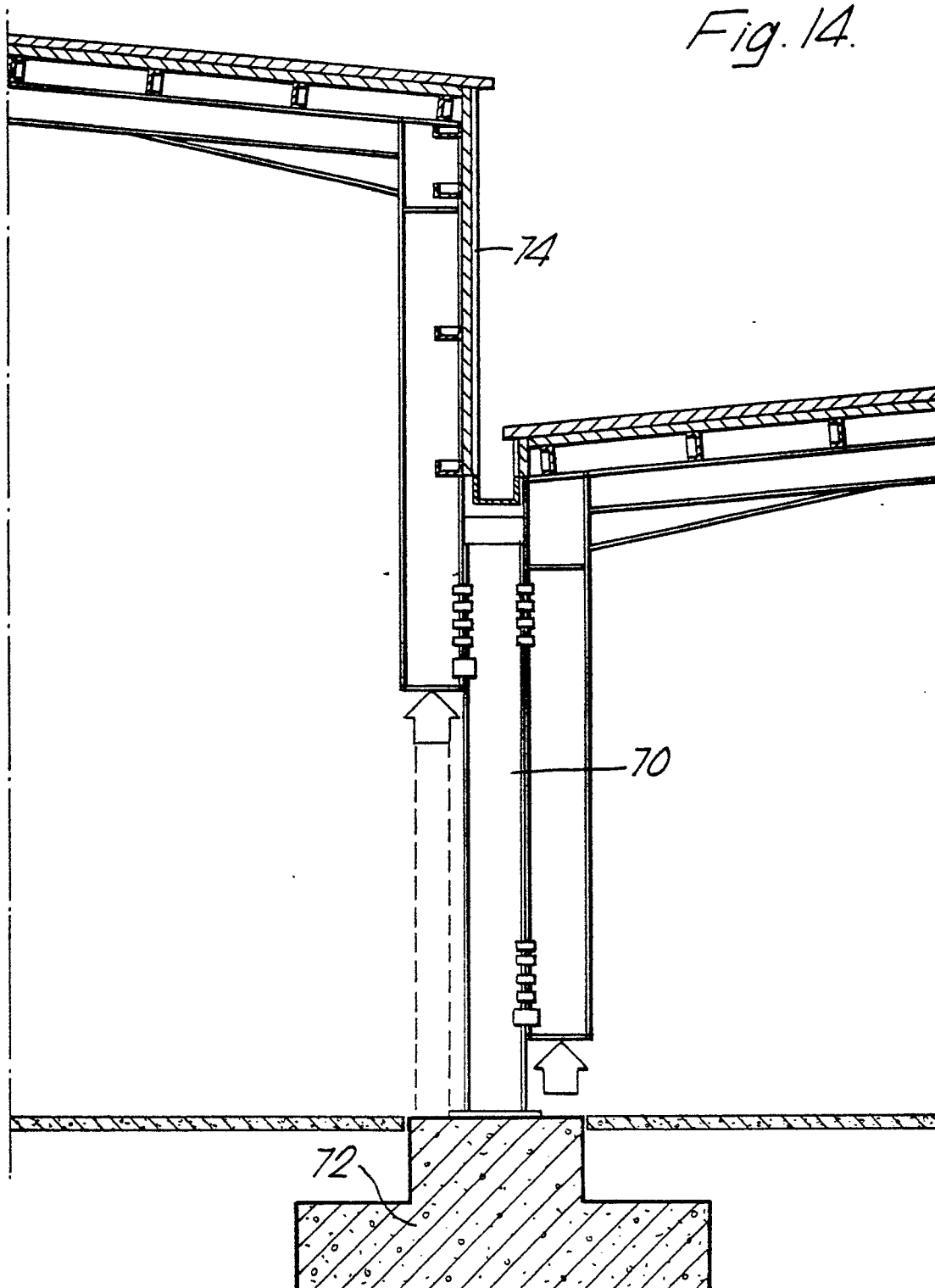


Fig. 13.





*Fig. 14.*



*Fig. 15.*

