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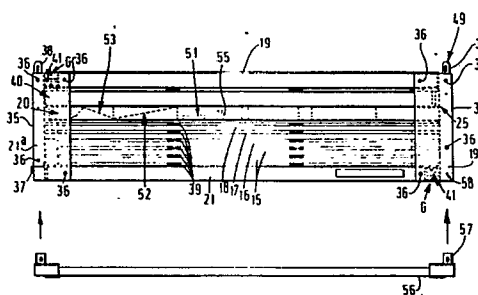
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**Portable building units.**

A portable building unit (11-14); comprises a roof structure (29, 30, 31) and at least one wall structure (15-18), in the form of a knocked-down pack.

The pack may have two floor structure elements (19, 21) each having an upright (19a, 21a) at two adjacent corners, one of said floor structures (21) providing a base part of a frame of the pack and the other of the floor structures (19) being located in an inverted orientation above the one floor structure (21), the upper ends of the uprights (21a) being connected to the floor structure (19) and the lower end of the uprights (19a) being connected to the floor structure (21) to provide the frame of the pack.

Alternatively, the pack may not be provided with any floor structure, the frame of the pack comprising a base frame (101) which is not a component of the building unit, a column support upright (100) at each corner of the base frame (101) and extending upwardly therefrom.



Title: "Portable Building Units"

Description of Invention

This invention relates to portable building units of the kind which are intended to be transported in compact packs ready for erection when delivered to a suitable site.

According to the present invention we provide a portable building unit, comprising a roof structure and at least one wall structure, in the form of a knocked-down pack wherein at least some of the components of at least one of said structures provides at least part of a frame of the pack, the other components of the structures being located within the volume bounded by the frame.

Preferably, the components which provide at least part of the frame together with the other components located in said volume provide all the components of said building unit.

Each pack may provide components for a unit which is potentially a complete part building with roof and walls, together with appropriate means for assembling the unit.

Preferably the unit is complete with all necessary doors, windows and the like.

The pack may comprise roof beams, purlin elements and roof sheets to provide the roof structure.

Where the pack is to provide an end part building, the pack may include gable end components.

The pack may comprise a plurality of wall elements to provide said wall structure.

The pack may comprise two floor structure elements each having an upright at two adjacent corners, one of said floor structures providing a base part of a frame of

the pack and the other of the floor structures being located in an inverted orientation above said one floor structure with its uprights depending downwardly, and at the opposite side of the pack to the upright of the one floor structure, means being provided to connect the upper ends of the uprights of said one floor structure to the other floor structure and the lower end of the uprights of the other floor structure to said one floor structure so that said floor structures and uprights provide the frame of the pack.

The pack preferably includes corner columns adapted to be connected to the uprights at one end so that, when the pack is erected, the uprights provide a bottom support for the corner columns and the corner columns are connected at their upper ends with the roof structure to support the roof structure.

Each floor structure may comprise a floor panel adapted to provide a load bearing floor as well as serving to provide a location for the uprights and an anchorage for the wall structure.

Alternatively, each floor structure may comprise a frame adapted to be positioned on a prepared foundation which will provide the floor proper, the frame serving to provide a locating means for the uprights and anchorage for the wall structure.

The pack may include an additional floor structure or structures to said two floor structures, said additional floor structure not being provided with uprights.

Alternatively, the pack may be unprovided with any floor structure, the frame of the pack comprising a base part, which is not a component of the building unit, a column support upright at each corner of the base frame and extending upwardly therefrom, means to connect the column support uprights to the base frame and a plurality of purlins connected to the upper ends of the column support uprights, said purlins and column support uprights comprising components of the building unit.

Preferably, the pack includes corner columns adapted to be connected to the column support uprights at one end so that, when the pack is erected, the uprights provide a bottom support for the corner columns and the corner columns are connected at their upper ends with the roof structure to support the roof structure.

The pack may comprise three end wall elements and two side wall elements, in which case the pack would provide a complete end part building.

Where the building unit is to have a floor structure as an integral part of the building unit, then the pack would comprise three floor structures.

Alternatively, the pack may include side wall elements and a roof structure but no end wall elements, in which case it would provide a complete intermediate part building.

The complete building may be erected from, for example, two packs which provide complete end part buildings or if desired, one or more packs to provide intermediate part buildings may also be provided.

The invention will now be described in more detail by way of example, with reference to the accompanying drawings wherein:-

FIGURE 1 is a side elevation of a building erected from packs embodying the invention;

FIGURE 2 is an end elevation of the building of Figure 1 in the direction of the arrow A;

FIGURE 3 is a section on the line 3-3 of Figure 1;

FIGURE 4 is a side elevation of a pack embodying the invention and including the components of an end part of the building of Figures 1 to 3;

FIGURE 5 is an end view of the pack of Figure 4;

FIGURE 6 is a plan view of the pack of Figure 4;

FIGURE 7 is a side elevation of another pack embodying the invention;

FIGURE 7a is a perspective view of a column support;

FIGURE 8 is an end view of the pack of Figure 7;

FIGURE 9 is a plan view of the pack of Figure 7;

FIGURE 10 is a section on the line 10-10 of Figure 7; and

FIGURE 11 is an end view of another building erected from packs embodying the invention.

Referring to Figures 1 to 3 of the drawings, there is shown a building 10 assembled from four building units 11-14. Each building unit 11-14 has been erected from a knocked-down pack which includes all the components necessary to provide the relevant unit which itself provides a complete part building.

The unit 11 comprises two side wall elements 15, three end wall elements 16, 17, 18 and three floor structure elements 19, 20, 21. The unit 12 comprises only two side wall elements 22 and three floor structure elements 23, 24, 25 identical to the floor structure elements 19-21. The components of the unit 13 are essentially identical to those of the unit 12 except as hereinafter to be described and likewise the components of the unit 14 are identical to those of the unit 11 except as hereinafter to be described.

The side and end walls of the various units may be provided as desired with windows and/or doors or the like. For example, in the building illustrated the side wall elements 15 of the unit 11 are provided with a window as indicated at 26 whilst one of the side wall elements 22 of the unit 12 is provided with a door 27, whilst the other side wall element 22 is not provided with any window or door. The side wall elements of the units 13 and 14 are each identical to those of the unit 11.

Similarly, the end wall elements of the unit 11 comprise plain elements 16, 18 whilst the element 17 is provided with a double door 28. The end wall elements of the unit 14, in the present example comprise three plain elements identical to the elements 16, 18.

It should be appreciated that each wall element may be provided with any other desired arrangement of window and/or door or the like but in each case each element is of the same overall dimensions namely, in the present example, eight feet square.

The unit 11 has two floor structure elements 19, 21 which are identical and comprise a load bearing floor of any desired construction of square configuration, in the present example eight feet square, and having at two adjacent corners, uprights 19a, 21a respectively comprising box section members approximately two feet high. The other floor structure element 20 is again of eight feet square load bearing configuration but is not provided with any uprights.

The floor structure elements 23-25 of the unit 12 are identical to the floor structures 19-21 respectively of the unit 11 and likewise the floor structures of the units 13 and 14 are similarly identical to those previously described.

Each of the units 11-14 is provided with roof beams and purlin elements which can be assembled together and connected to the roof beams to provide the building with purlins upon which the roofing sheets 32 are mounted.

The units 11 and 14 include three gable end elements 29, 30, 31 which, when assembled, provide a gable end to the building above the eaves. If desired, structures similar to the gable ends 29-31 may be provided for one or more of the units 12, 13.

Although in the example illustrated each end unit 11-14 has been described as comprising three floor structure elements and five wall elements, if desired each unit may comprise only the two end floor structure elements i.e. the floor structure 20 being omitted from, for example, the unit 11 in which case only two end wall elements would be provided. Alternatively, the units may comprise four or more floor structure elements i.e. one or more additional floor structure elements identical to

the floor structure elements 20 and 24 would be provided, in which case six or more end wall elements would be provided.

Referring now to Figures 4 to 6 which illustrate a pack of the components necessary to provide the unit 11. The pack comprises a base part constituted by the floor structure element 21 and consequently has two uprights 21a projecting upwardly therefrom. The other end floor structure element 19 is positioned in the pack in an inverted condition so that it is on top of the pack with its uprights 19a depending downwardly.

Four pack connection plates 35 are bolted, as shown at 36, to the uprights and the floor structure elements to connect them together and so provide a rigid frame of the pack. A floor protection member 37 of Z-section is provided to protect the edge of the floor structure element 21 having the upright 21a thereat.

Each upright 21a, at its upper end, and each upright 19a at its bottom end, is provided with a lifting eye 38 removably secured in position diagonally of the upright by means of the bolt 36.

The panel connection plates 35, the floor protection member 37, and lifting eyes 38 are the only parts of the pack which are not components of the building unit except for sundry fasteners, packing material and containers such as a woven sack and a cardboard box to hold various small components of the building unit.

Since the panels of the floor structures 19, 21 are eight feet square and the uprights are four inches square, they are located in the pack so that there is a gap G of four inches between the end of a panel 19 or 21 and the adjacent upright 21a or 19a respectively, thereby providing a clear distance of eight feet between the uprights. Thus the uprights bound longitudinally a volume eight feet long and the floor structure elements bound vertically a volume approximately two feet high.

Within this volume is positioned, at the bottom, the five wall elements 15-18 with packing 39 therebetween, and then the intermediate floor structure element 20 and then the two roof beams each in three parts 40; three gable end components 29-31; together with the roof sheets 32; four roof purlins 41; four columns 42; (to be connected to the uprights 19,21 to support the roof beams); two column purlins 43, two trims 44 for the top of the wall (positioned within the columns 42 within the roof beams 40); two corner trim 45; two gable end interior trim 46; gable end joint trims (three exterior 47, two interior 48); two floor plates 49; exterior wall-to-wall trims 50; two exterior trim extension pieces 51 (positioned between the floor joists of the intermediate floor structure element 20); three roofing ridge pieces 52; four gable end roof trims 53 (positioned between the floor joists of the intermediate floor structure element 20); together with a cardboard box 54 and a woven sack 55 containing other components of the building unit such as fasteners and the like.

If desired, a forklift adaptor 56 may be provided having lugs 57 to be secured in the ends of the uprights 19a and 21a at the bottom of the pack by means of bolts 58 so as to raise the pack above the ground and thus permit the tines of a forklift truck to engage with the underside of the pack for transport. The bolt 58 may also serve to secure a lifting eye 38 of a similar pack upon which the first mentioned pack is stacked to permit the lifting eyes of the first mentioned pack to be used to lift the assembly of two packs. Of course, if desired, further similar packs may be attached in sequence below the second mentioned pack and all the packs lifted using the lifting eyes of the topmost i.e. first mentioned pack.

The pack for the unit 12 is essentially similar to that for the unit 11 except that three of the wall panels 15-18 and the gable end components 29-31, corner trim 45,

gable end interior trim 46, gable end roof trim 53, exterior and interior gable end joint trims 47, 48 are omitted.

The packs for the units 13 and 14 are similar to that for the units 12 and 11 except for differences arising from differences in the components thereof, for example, the presence or absence of a door 27 of a double door 28.

It is important to note that by virtue of arranging that each unit is made up from modules, three in the present example, and as explained hereinbefore, two to five, or if desired, more, of eight foot square configuration, in the present example, so that the wall elements and floor structure elements are of the same overall size, and the various roof components of similar size, all the components may be located in a pack such as described hereinbefore and illustrated in Figures 4 to 6. It is also to be noted that there is no space in the pack, with uprights approximately two feet high, to accommodate the additional floor structure element and wall element necessary for a four module unit, and in this case the additional modules can be incorporated by increasing the length of the uprights.

Although in the present example the floor structure elements are intended to be load carrying so that they need to be supported only at spaced positions on a suitable foundation, if desired, the floor structure elements could comprise an open frame arranged to be located on a prepared foundation/floor such as a concrete slab, in which case the frame would serve, when the building is erected, to locate and support the columns and also to provide an anchorage for the lower ends of the wall elements.

Referring now to Figures 7 to 9, there is illustrated the pack of an end unit similar to the unit 11 but of an alternative embodiment wherein the unit is not provided with floor structure elements. In this

embodiment, when the unit is erected, this is done on a prepared site which is provided with column supports 100, see Figure 7a, and the prepared site itself provides the floor of the building unit. For example, the prepared site may comprise a concrete slab which provides the floor of the building unit and to which the column supports are anchored by any desired means such as by embedding a lower part thereof in the concrete of the slab during casting thereof.

When the building is erected, columns are connected at their lower ends to the column support 100 and the roof structure supported on the upper ends of the columns.

Since the unit has no structural floor elements they cannot provide a part of the frame of the pack as is the case in the first described embodiment. Consequently, in this embodiment a base frame 101, not a component of the building unit, is provided to comprise a base part of the frame of the pack and the remainder of the frame of the pack being provided by pack connector plates 102, 103, also not components of the building unit, and four roof purlins 141 which are components of the building unit.

Each column support comprises a base part 100a of generally square configuration except for an inclined corner part 100b, and a square section upright part 100c at the corner of the base part opposite the part 100b. Gussets 100d extend between the upright part 100c and the base 100a. A column support 100 is positioned at each of the corners of the base frame 101 and one of the connection plates 102, which is a rectangular plate, is bolted to the column support by bolts 104 and to the frame by bolts 104a. The other connection plate 103, which is of angle section, is bolted by bolt 105 to the base frame 101 and by bolt 106 to the column support 100. The ends of the roof purlins 141 are bolted to the upper ends of the connector plate 103 by bolts 107 and to the connector plates 102 by bolts 108.

The pack thus has a frame of right parallelopiped configuration providing a volume bounded at top and bottom by the purlins 141 and base frame 101 respectively and at the ends by the column supports 100 and the pack connection plates 102, 103. Within this volume are positioned the other components of the building unit namely at the bottom, five wall elements 115-118 with appropriate packing therebetween, then two roof beams each in three parts 140, three gable end components 129-131; then ten roof sheets 132; two further roof purlins 141b; four column purlins 143; four columns 142 located within the roof beams 140 at the left hand side of the pack as viewed in Figure 8; and trim and other components similar to those provided in connection with the first embodiment.

In addition, four retaining angles 145 are provided to be secured to the prepared base to act as an anchorage for the wall elements. These members also serve to retain the roof beams etc. in the pack.

The pack above described is for an end unit, a similar pack containing the appropriate components is provided for the intermediate unit. If more than one intermediate unit is required, then all the components for two intermediate units can be assembled in a single pack. If only one intermediate unit is required, then the pack must be provided with similar wall components to retain the smaller components.

It will also be appreciated that whilst the wall elements in the present examples comprise a sandwich construction of foam sandwiched between steel sheets, of, for example, the construction described and claimed in our Patent No. 1,520,272 the wall elements may be of other construction. The means whereby the various components of the building unit are connected together, are not described herein since any conventional means may be provided as will be readily apparent to those skilled in the art and such connecting means do not form any part

of the present invention and would lead only to a prolix description. An example of a suitable fixing means for the wall elements is the fixing arrangement described and claimed in our Specification Serial No. 2,202,786A whilst the roofing sheets may be attached to the purlins with conventional J-bolts.

If desired, a plurality of buildings constructed as hereinbefore may be connected together in side-by-side relationship as illustrated in Figure 11, and of course in the appropriate packs the necessary additional components in particular valley gutter V and means C for fixing adjacent columns together would be provided and the wall units not required omitted.

## CLAIMS:

1. A portable building unit (11-14), comprising a roof structure (29,30,31) and at least one wall structure (15-18), in the form of a knocked-down pack characterised in that at least some of the components (19a, 21a, 100,141) of at least one of said structures (15) provides at least part of a frame of the pack, the other components of the structures being located within the volume bounded by the frame.

2. A unit according to Claim 1 wherein the components (19a, 21a, 100, 141) which provide at least part of the frame together with the other components located in said volume provide all the components of said building unit (11-14).

3. A unit according to Claim 1 or Claim 2 wherein each pack comprises a plurality of wall elements (15-18) to provide the wall structure, and the pack comprises roof beams (40), purlin elements (41) and roof sheets (32) to provide the roof structure and provides components for a unit (11-14) which is potentially a complete part building with roof and walls, together with appropriate means for assembling the unit (11-14).

4. A unit according to any one of the preceding claims wherein the pack comprises two floor structure elements (19, 21) each having an upright (19a, 21a) at two adjacent corners, one of said floor structures (21) providing a base part of a frame of the pack and the other of the floor structures (19) being located in an inverted orientation above said one floor structure (21) with its uprights (19a) depending downwardly, and at the opposite side of the pack to the uprights (21a) of the one floor structure (21), means (35) being provided to connect the upper ends of the uprights (21a) of said one

floor structure (21) to the other floor structure (19) and the lower end of the uprights (19a) of the other floor structure (19) to said one floor structure (21) so that said floor structures (19, 21) and uprights (19a, 21a) provide the frame of the pack.

5. A unit according to Claim 4 wherein the pack includes corner columns (42) adapted to be connected to the uprights (19a, 21a) at one end so that, when the pack is erected, the uprights (19a, 21a) provide a bottom support for the corner columns (42) and the corner columns (42) are connected at their upper ends with the roof structure (29,30,31) to support the roof structure (29,30,31).

6. A unit according to Claim 4 or Claim 5 wherein the floor structure (19,21) comprises a floor panel adapted to provide a load bearing floor as well as serving to provide a location for the uprights (19a, 21a) and an anchorage for the wall structure (15-18).

7. A unit according to Claim 4 or Claim 5 wherein each floor structure comprises a frame adapted to be positioned on a prepared foundation which will provide the floor proper, the frame serving to provide a locating means for the uprights (19a, 21a) and anchorage for the wall elements (15-18).

8. A unit according to any one of Claims 4 to 7 wherein the pack includes an additional floor structure (20) or structures to said two floor structures (19,21), said additional floor structure (20) not being provided with uprights (19a, 21a).

9. A unit according to any one of Claims 1 to 3 wherein the pack is unprovided with any floor structure, the frame of the pack comprising a base frame (101) which is

not a component of the building unit, a column support upright (100) at each corner of the base frame (101) and extending upwardly therefrom, means (102,103) to connect the column support uprights (100) to the base frame (101) and a plurality of purlins (141) connected to the upper ends of the column support uprights (100), said purlins (141) and column support uprights (100) comprising components of the building unit.

10. A unit according to Claim 9 wherein the pack includes corner columns (143) adapted to be connected to the column support uprights (100) at one end so that, when the pack is erected, the uprights (100) provide a bottom support for the corner columns (143) and the corner columns (143) are connected at their upper ends with the roof structure (140,129-131) to support the roof structure (140,129-131).

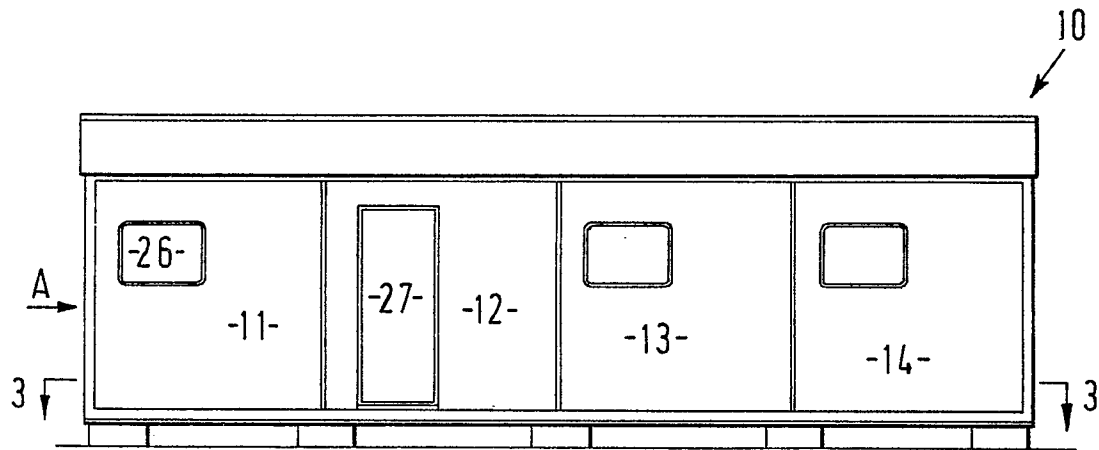


FIG 1

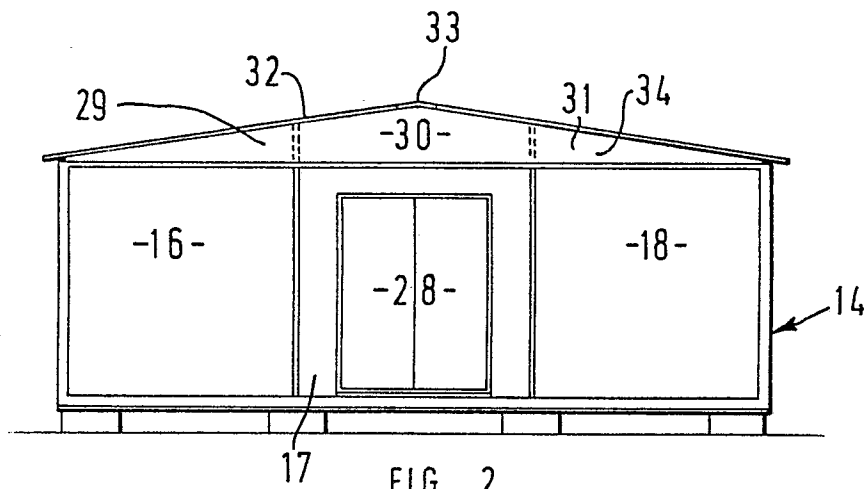


FIG 2

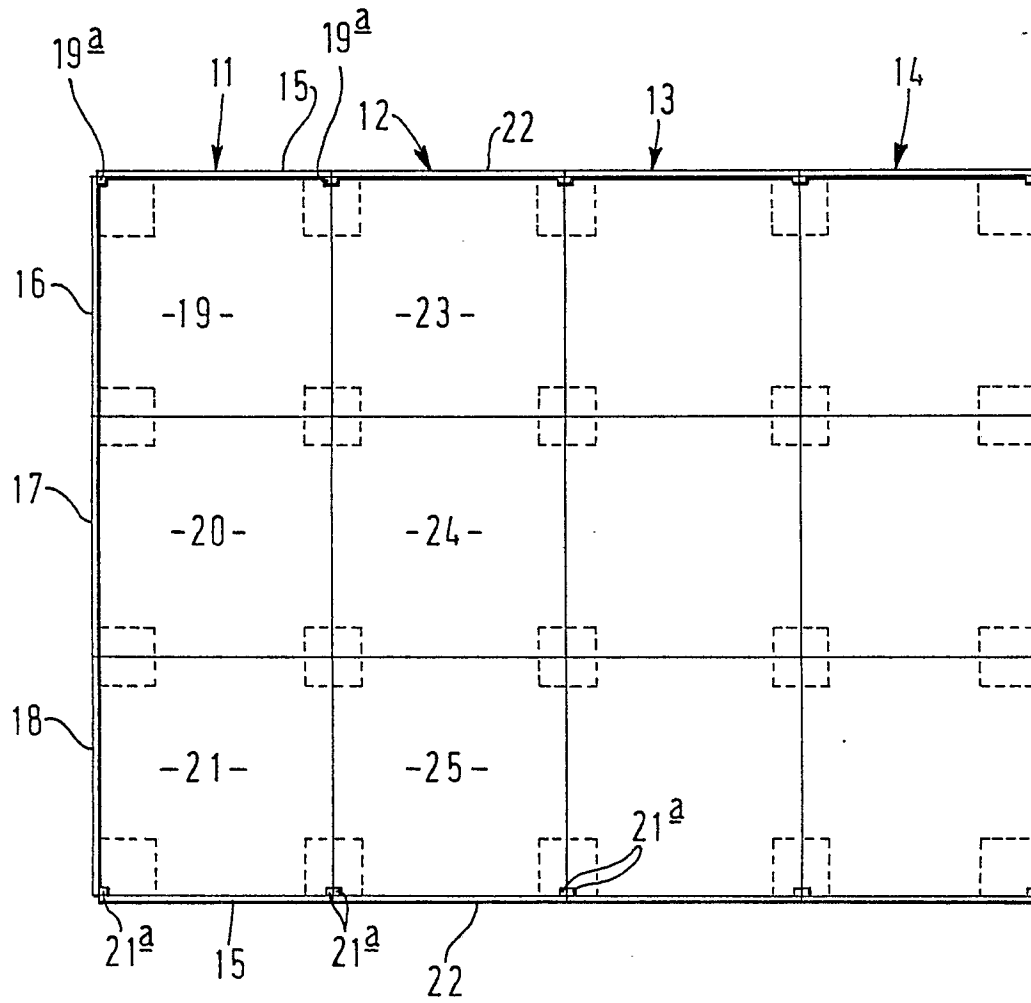
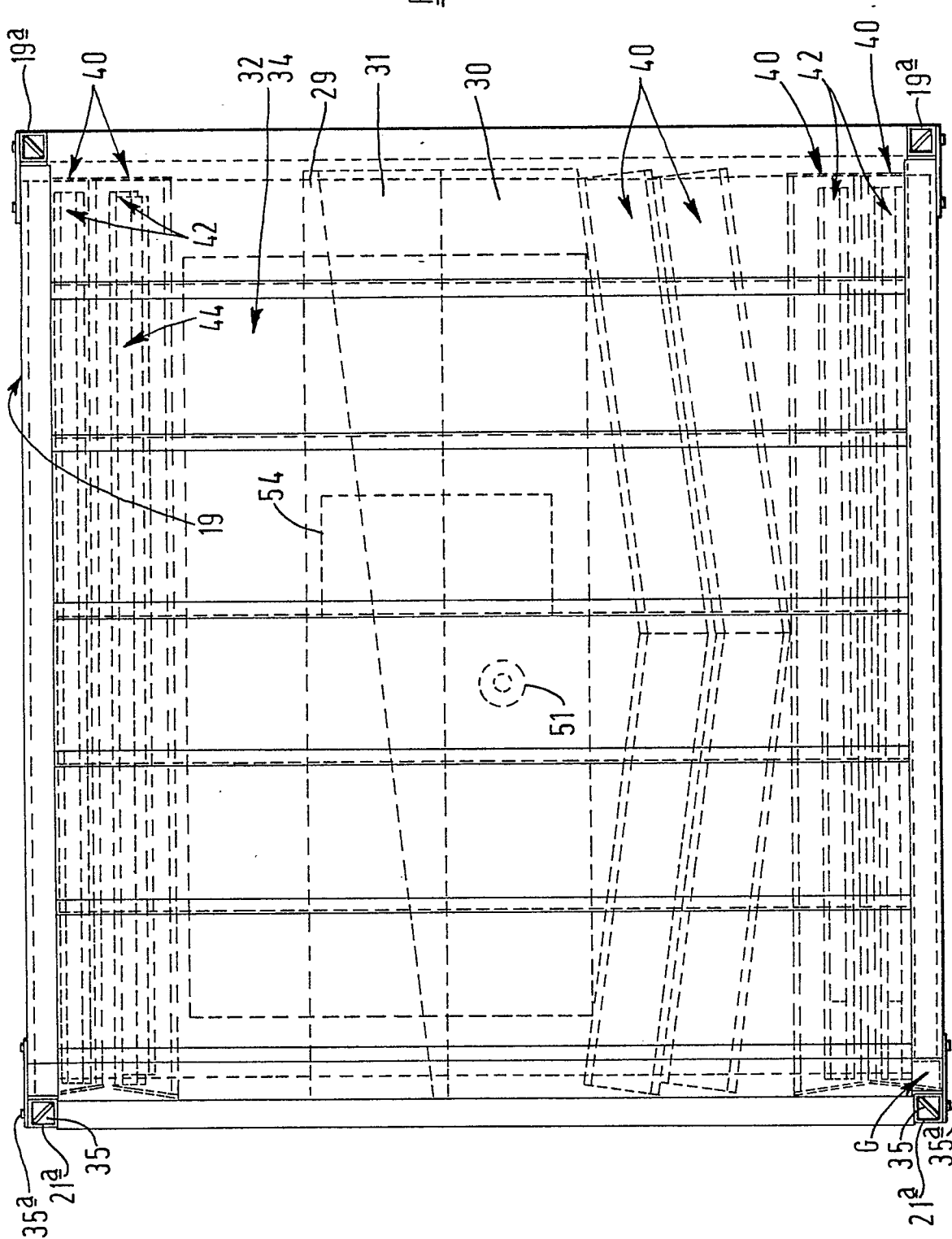
FIG 3





FIG. 6



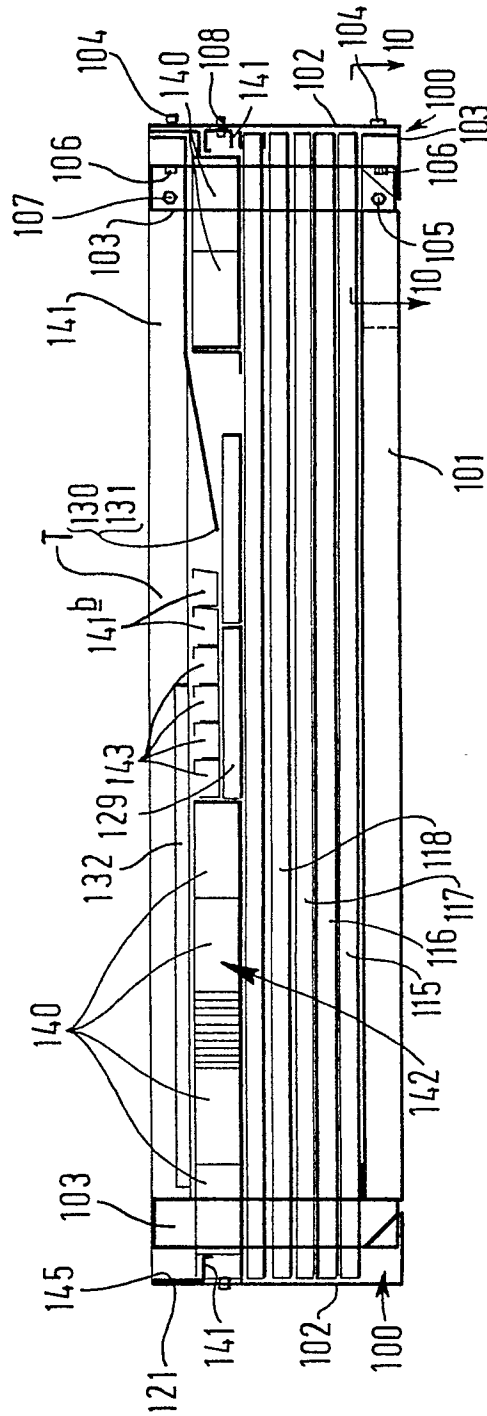


FIG 7

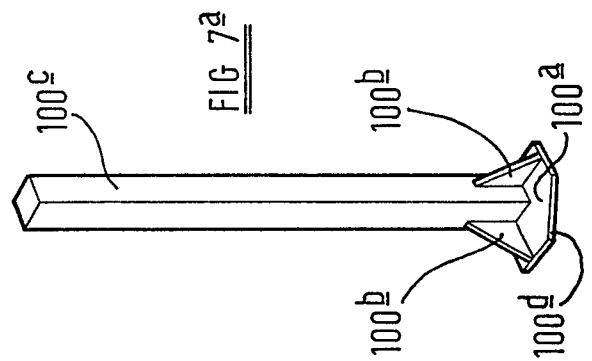
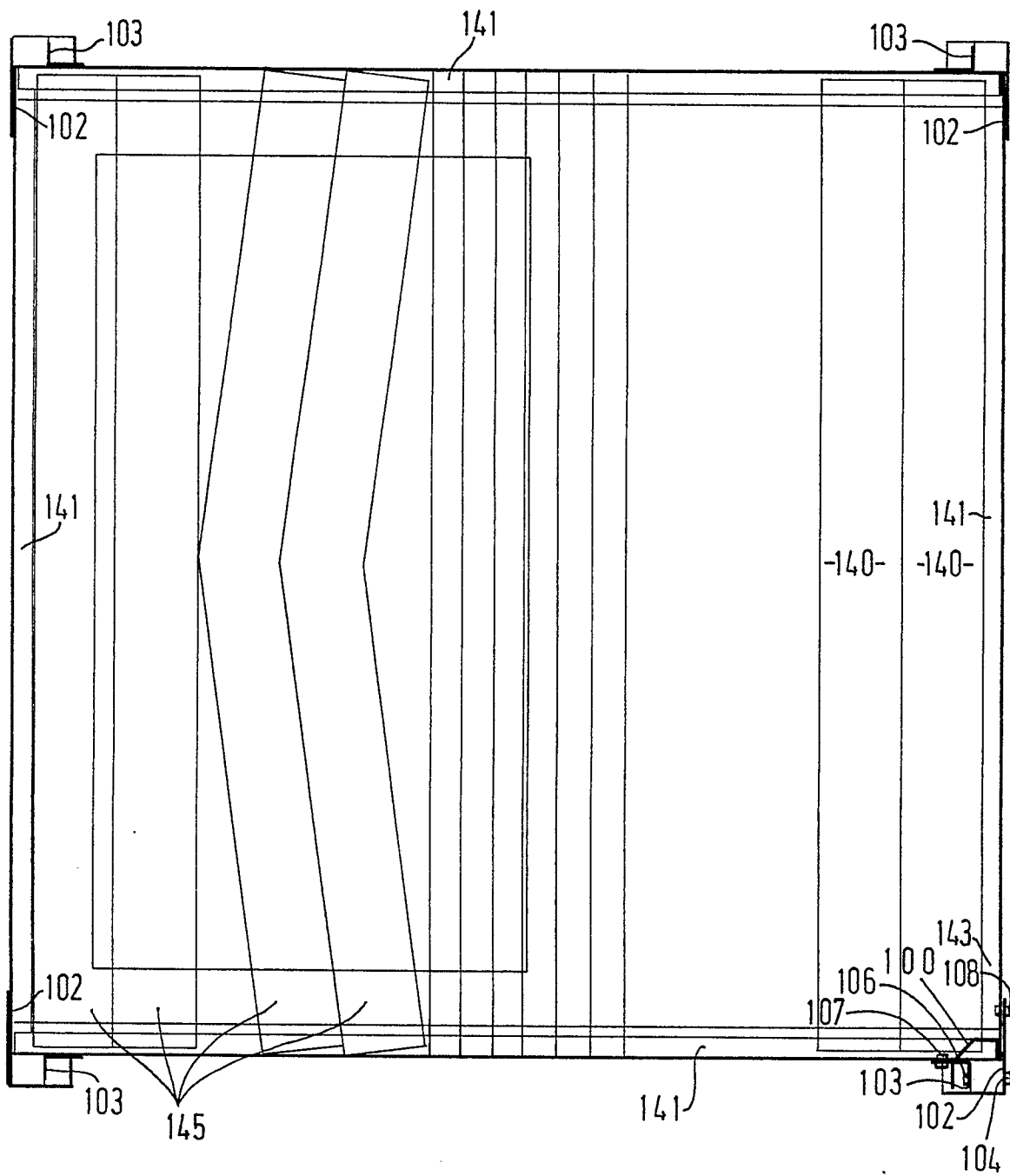


FIG 7a

FIG 9

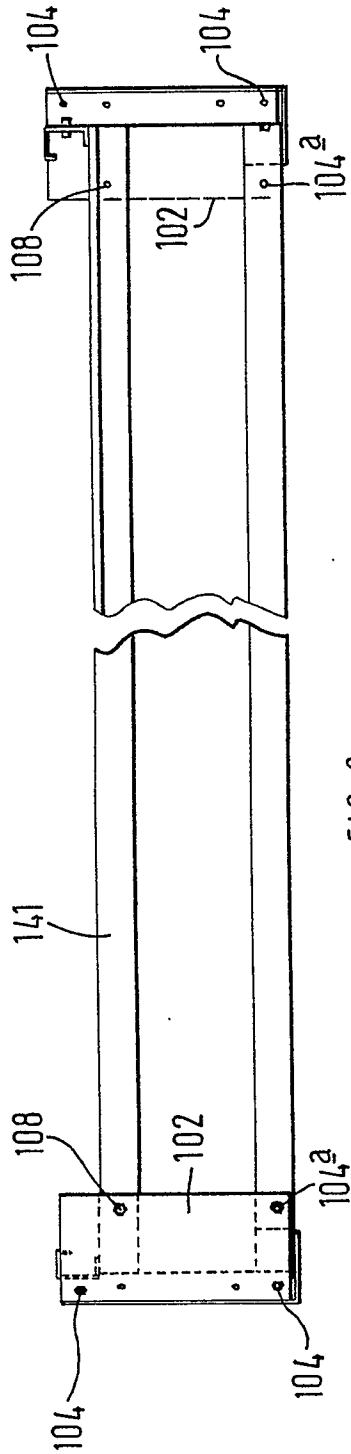


FIG 8

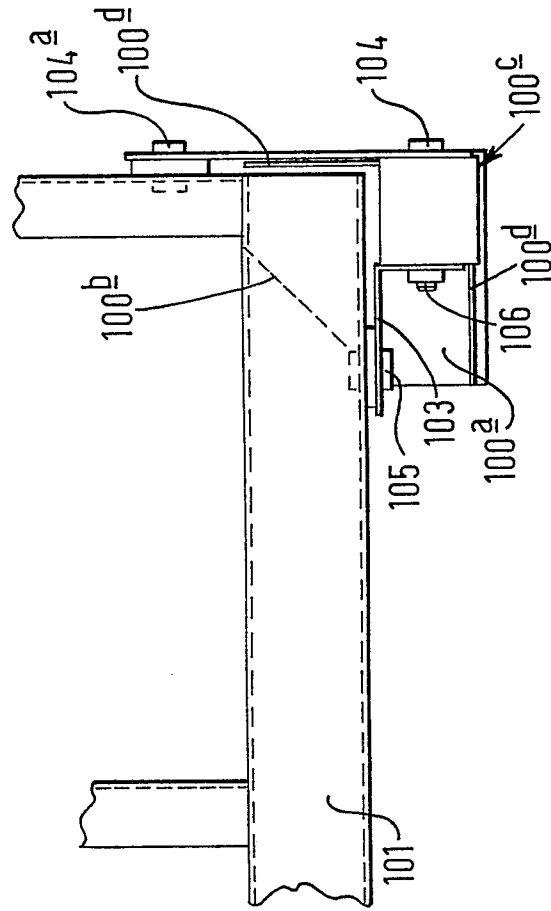


FIG 10

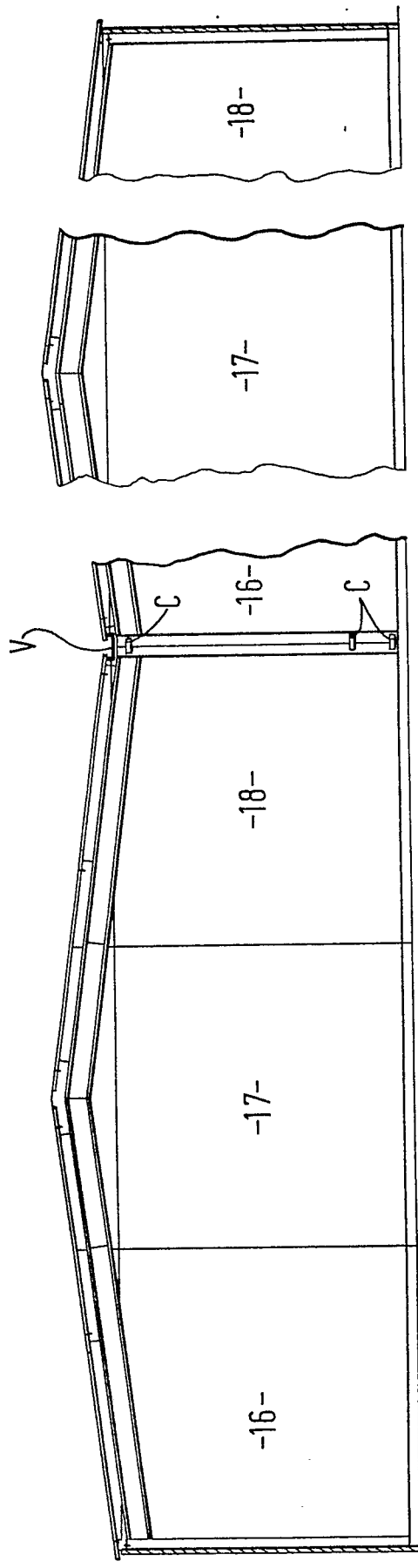


FIG 11



| DOCUMENTS CONSIDERED TO BE RELEVANT                                                            |                                                                                                                                                                           |                          | CLASSIFICATION OF THE APPLICATION (Int. Cl. <sup>3</sup> )                                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Category                                                                                       | Citation of document with indication, where appropriate, of relevant passages                                                                                             | Relevant to claim        |                                                                                                                                                                                                                                                                                                                  |
| X                                                                                              | <u>FR - A - 2 317 447</u> (BIGELOW)<br><br>* The whole document *<br>& US - A - 4 007 833<br>---                                                                          | 1-3                      | E 04 B 1/343<br>E 04 G 21/14                                                                                                                                                                                                                                                                                     |
| X                                                                                              | <u>GB - A - 1 015 866</u> (DEXION)<br><br>* Page 1, lines 10-47; page 2, lines 58-114; figures 1-4 *<br>---                                                               | 1-3,<br>5-7              |                                                                                                                                                                                                                                                                                                                  |
|                                                                                                | <u>GB - A - 1 114 091</u> (TERRAPIN)<br><br>* Page 1, lines 43-48, 56-62; page 2, lines 3-17; page 2, line 114 to page 3, line 43; page 3, lines 60,62; figure 1 *<br>--- | 1-3,<br>5-7              | TECHNICAL FIELDS<br>SEARCHED (Int. Cl. <sup>3</sup> )<br><br>E 04 B<br>E 04 G                                                                                                                                                                                                                                    |
|                                                                                                | <u>FR - A - 2 302 665</u> (HORMANN)<br><br>* Page 8, line 11 to page 9, line 1; figure 10 *<br><br>-----                                                                  | 1-3,9                    |                                                                                                                                                                                                                                                                                                                  |
|                                                                                                |                                                                                                                                                                           |                          | CATEGORY OF<br>CITED DOCUMENTS<br><br>X: particularly relevant<br>A: technological background<br>O: non-written disclosure<br>P: intermediate document<br>T: theory or principle underlying the invention<br>E: conflicting application<br>D: document cited in the application<br>L: citation for other reasons |
| <input checked="" type="checkbox"/> The present search report has been drawn up for all claims |                                                                                                                                                                           |                          | &: member of the same patent family, corresponding document                                                                                                                                                                                                                                                      |
| Place of search<br><br>The Hague                                                               | Date of completion of the search<br><br>11.08.1981                                                                                                                        | Examiner<br><br>CAVALERI |                                                                                                                                                                                                                                                                                                                  |