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Van Der Lely

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[45] **June 24, 1975**

[54] **APPARATUS FOR THE CONSTRUCTION AND OR ASSEMBLY OF PREFABRICATED BUILDING SECTIONS OR ROOM UNITS**

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[52] **U.S. Cl.** ..... **29/200 R;** 29/200 P; 52/745; 214/1 H; 214/1 S

[51] **Int. Cl.** **B23p 19/00**

[58] **Field of Search** ..... 29/200 R, 200 A, 200 J, 29/200 P, 464, 469, 428; 52/741, 745, 746, 747, 749; 214/1 H, 1 S

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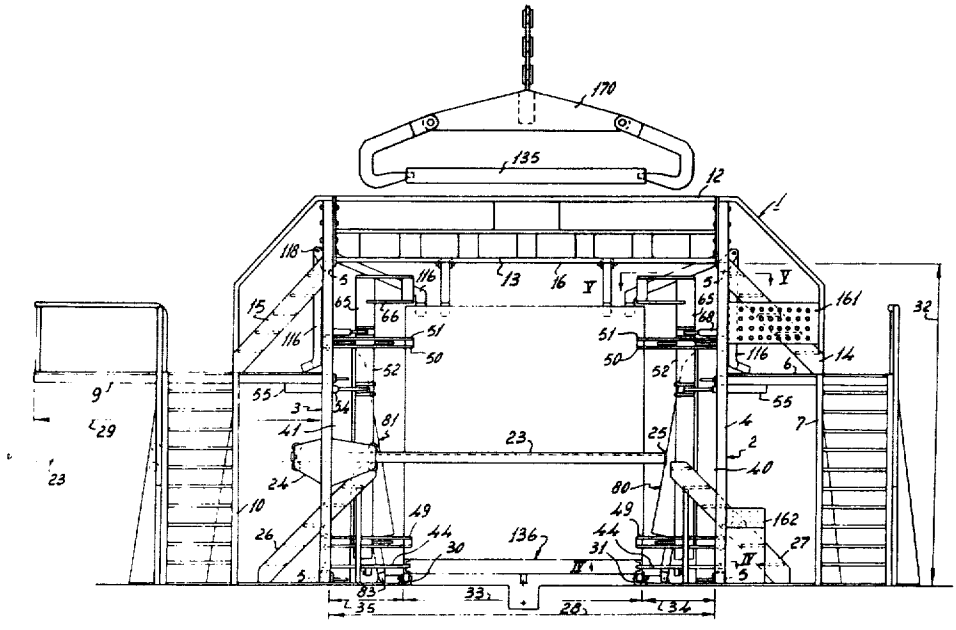
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Assistant Examiner—James R. Duzan
Attorney, Agent, or Firm—Mason, Mason & Albright

[57] **ABSTRACT**

An apparatus and method for the manufacture of elongated parallelepiped prefabricated sections intended to be joined by like sections to form a building, the apparatus having a rectangular framework for surrounding the section which being fabricated, the framework having an opening on top for receiving a roof or ceiling panel and rollers on the framework's supporting floor or the underlying ground for conveying floor panels into the framework and the fabricated section from the framework. Supports for side walls are pivotally connected to supports for the rollers within the framework so that they are pivoted outward relative to each other and the adjacent floor panel for receiving the sidewalls and pivoted with the supported sidewalls therein to a vertical position for connection to the floor panel. Positioning means are interconnected to the framework for positioning the floor panels, sidewalls, transverse walls and ceiling or roof panels into their desired positions for connection by welding — steel beams being provided at the peripheries of each of these panels.

52 Claims, 10 Drawing Figures



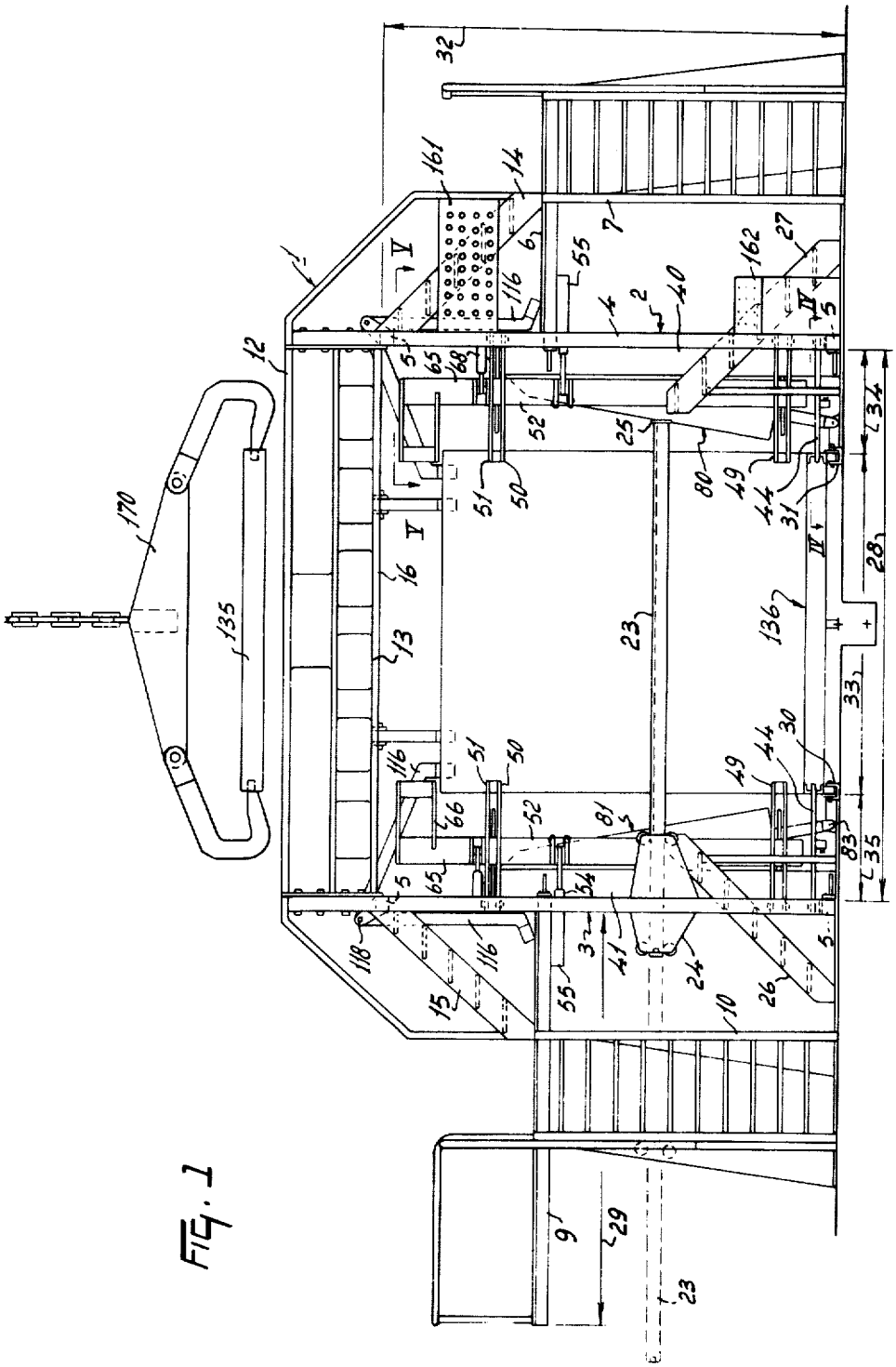
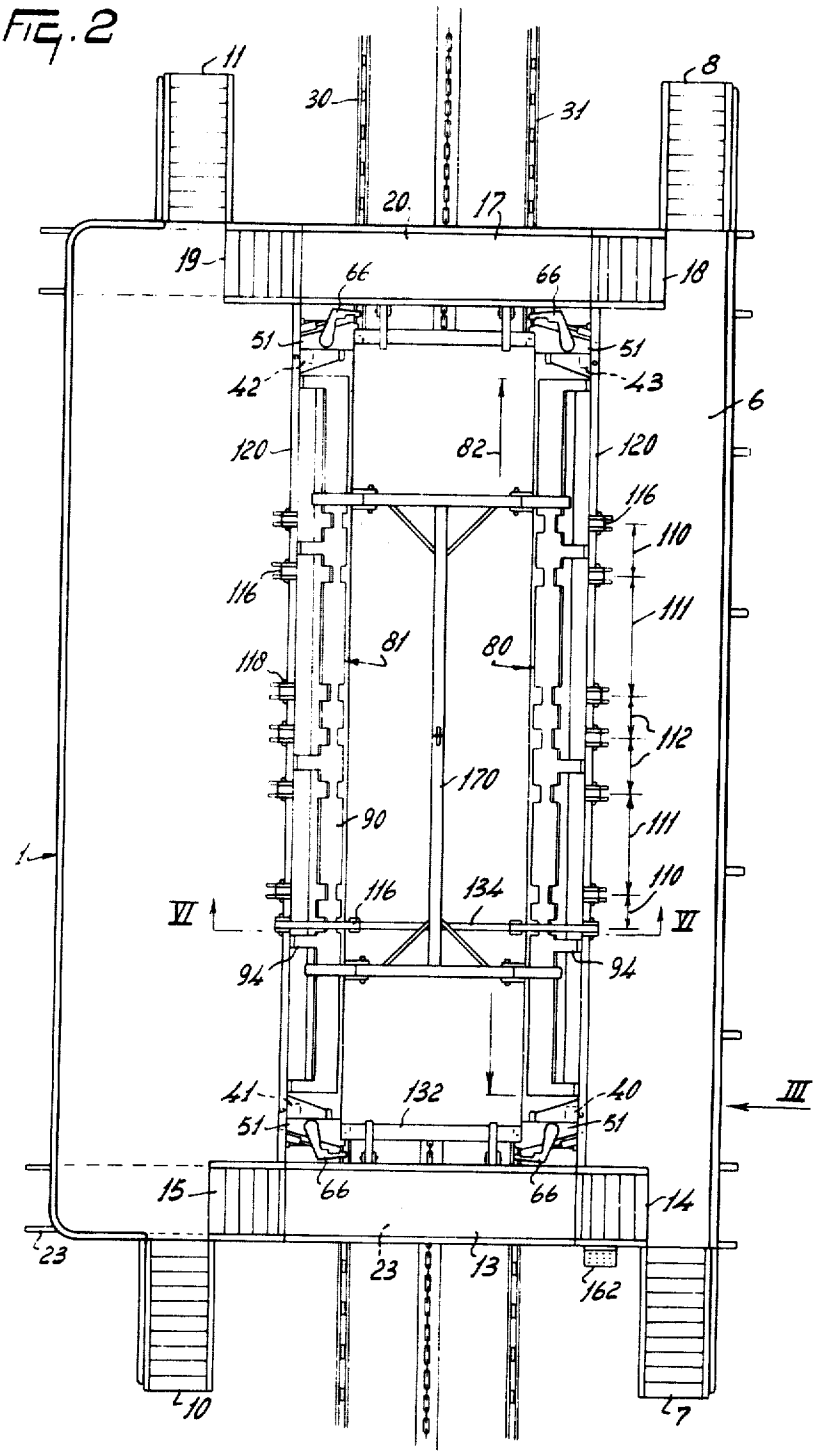


FIG. 1

FIG. 2


11
8
30
31
20
17
19
18
66
66
51
51
42
43
6
120
82
120
116
110
116
111
118
81
80
112
170
90
111
1
116
134
110
VI
VI
94
94
41
132
40
III
51
51
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66
66
14
23
23
13
162
10
7

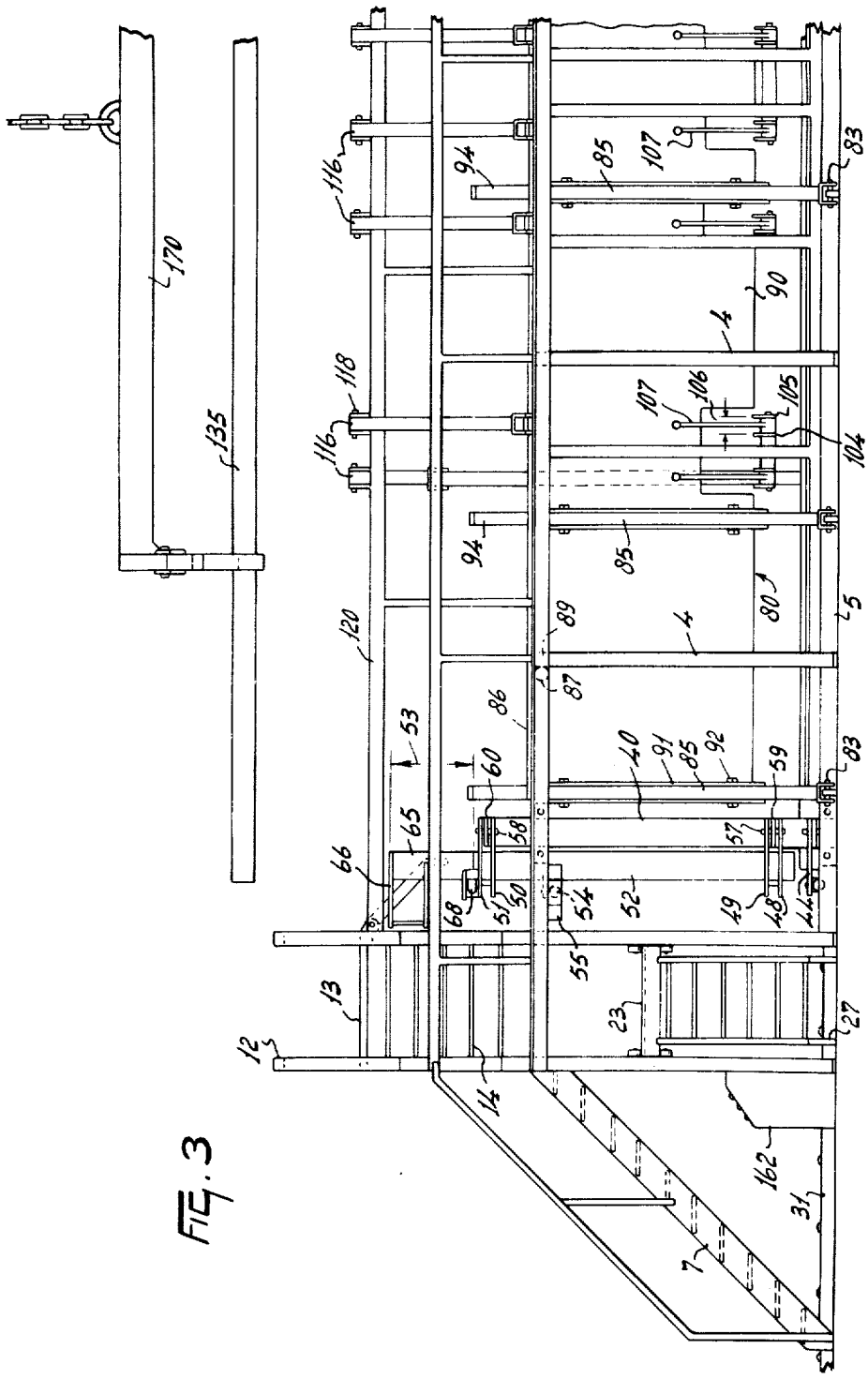

170
135
116
118
116
120
94
94
85
107
83
90
4
107
106
105
104
85
80
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89
4
87
86
53
60
40
91
85
92
59
83
65
66
68
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50
54
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48
44
55
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13
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162
31
7

FIG. 3

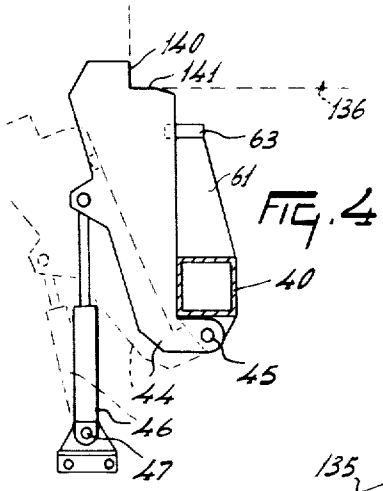


FIG. 4

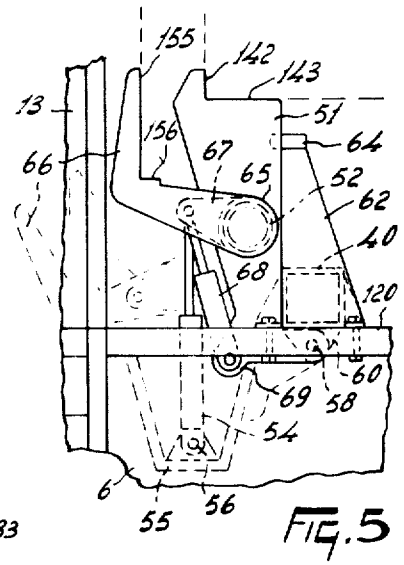


FIG. 5

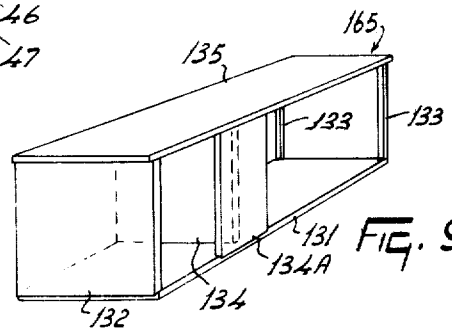


FIG. 9

FIG. 10

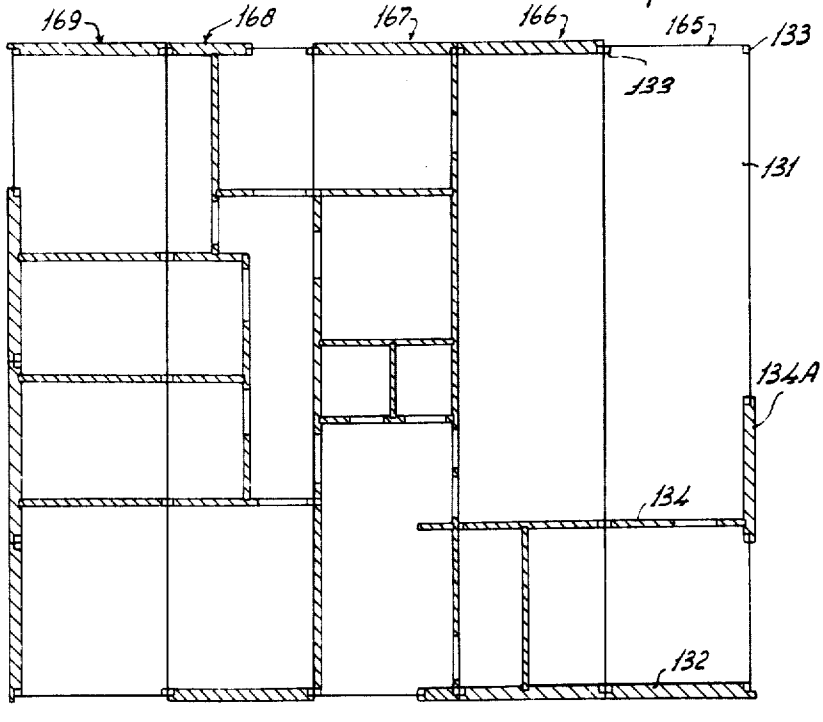
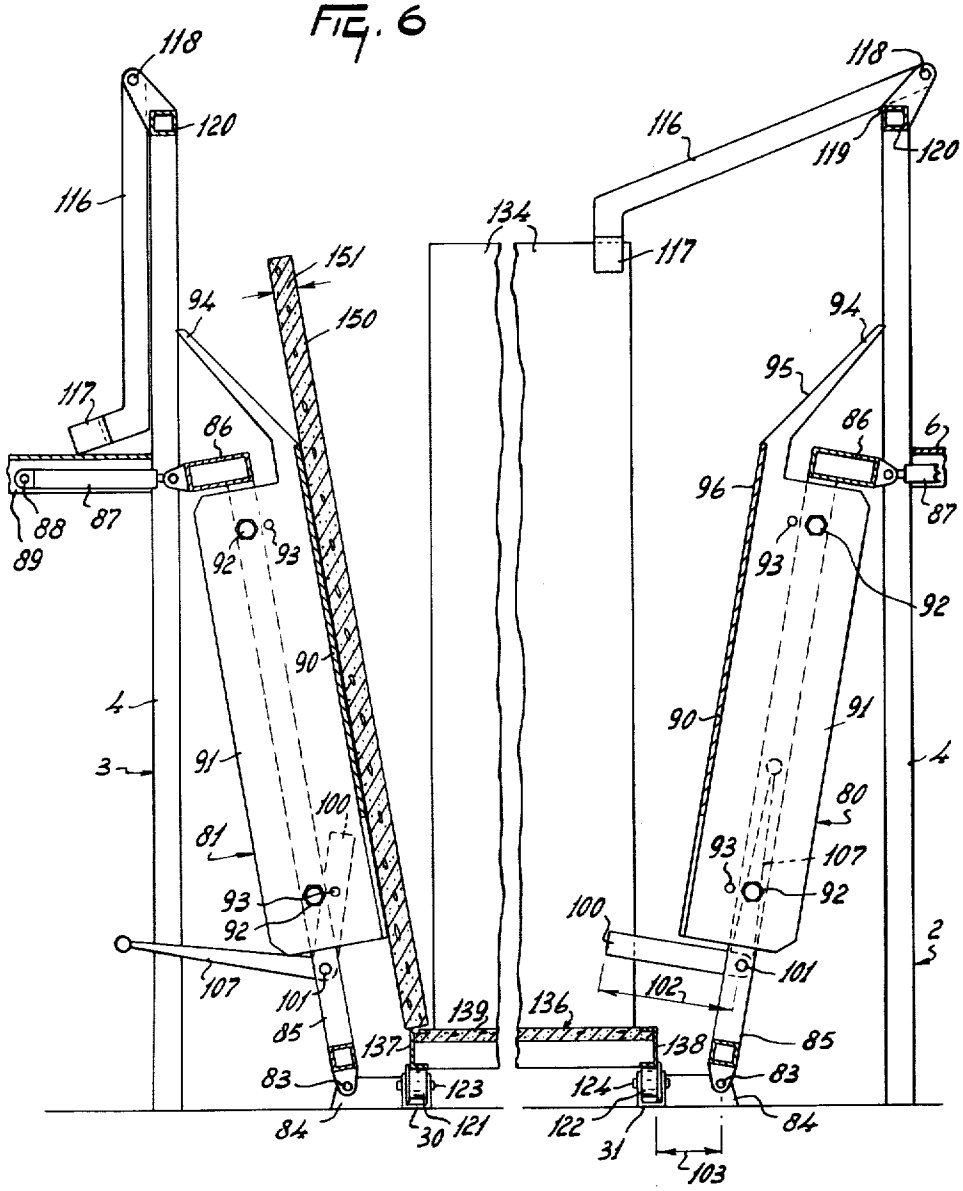


FIG. 6


118
120
116
117
86
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89
94
151
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92
93
90
4
3
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100
81
107
101
85
83
84
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139
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124
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119
95
96
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80
2

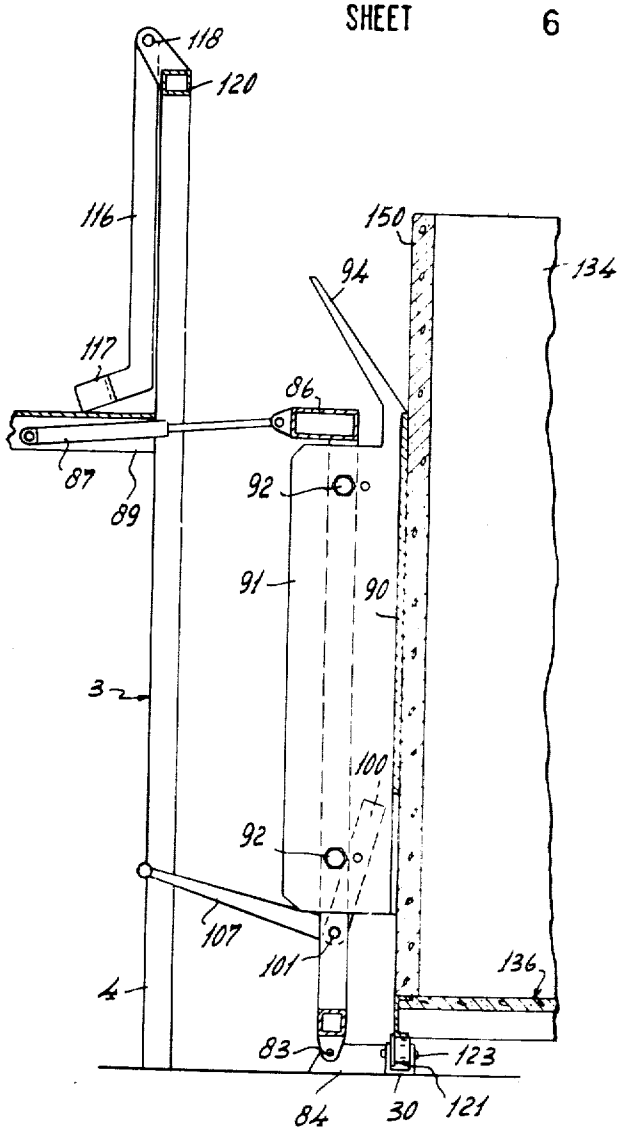
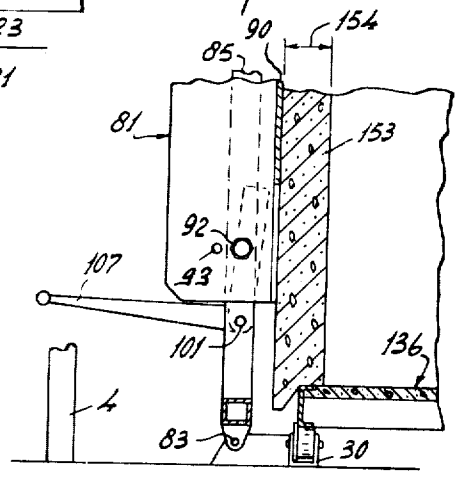

118
120
116
150
134
94
117
86
87
89
92
91
90
3
100
92
107
101
136
4
83
123
84
30
121

FIG. 7

FIG. 8


90
154
85
81
153
92
93
107
101
136
4
83
30

APPARATUS FOR THE CONSTRUCTION AND OR ASSEMBLY OF PREFABRICATED BUILDING SECTIONS OR ROOM UNITS

SUMMARY OF THE INVENTION

This invention relates to methods and apparatus for the construction and/or assembly of prefabricated building sections or room units.

According to one aspect of the invention, there is provided apparatus for the construction and/or assembly of prefabricated building sections or room units, the apparatus comprising a frame having at least one stop or support arranged for directing prefabricated floor and/or wall and/or ceiling/roof panels into their correct relative positions for subsequent interconnection to form the required sections or room units.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation of apparatus in accordance with the invention,

FIG. 2 is a plan view of the apparatus of FIG. 1 to a reduced scale,

FIG. 3 is a partial side elevation of the apparatus to the same scale as FIG. 1 and as seen in the direction indicated by an arrow III in FIG. 2,

FIG. 4 is a section, to an enlarged scale, taken on the line IV—IV of FIG. 1,

FIG. 5 is a section, to an enlarged scale, taken on the line V—V of FIG. 1,

FIG. 6 is a section, to an enlarged scale, taken on the line VI—VI of FIG. 2 but omitting centrally located parts of the apparatus,

FIG. 7 corresponds to the left-hand side of FIG. 6 but shows various parts located in different positions,

FIG. 8 corresponds to a lower region of FIG. 7 but shows the apparatus in use in connection with a different wall structure to that shown in FIG. 7,

FIG. 9 is a diagrammatic perspective view of a typical prefabricated building section or room unit to be formed by a method and apparatus in accordance with the invention, and

FIG. 10 is a diagrammatic plan view of a prefabricated building comprising five building sections or room units one of which is shown in perspective view in FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings, the apparatus for the construction and assembly of prefabricated building sections or room units comprises a frame generally indicated by the reference numeral 1 which frame includes upright side frames 2 and 3 disposed towards the opposite lateral sides of the apparatus. Each of the two side frames 2 and 3 comprises a plurality of vertical beams 4 that are interconnected at various levels by horizontal beams 5. The side frame 2 is provided with a platform 6 that is located at a level substantially midway between the top and the bottom of the apparatus and, similarly, the side frame 3 is provided with a platform 9 disposed at the same level as the platform 6. The platform 9 has a greater lateral width than the platform 6, the width of the wider platform 9 being equal to the approximately two-thirds of the distance 28 that separates the two side frames 2 and 3. The opposite ends of the platform 6 are provided with flights of steps 7 and 8 giving access to and from ground or floor level and the opposite ends of the platform 9 are provided with similar flights of steps 10 and 11 for the same purpose. The tops of the two side frames 2 and 3 are interconnected adjacent the front of the apparatus by a frame of horizontal beams 12 that together afford a bridge 13. Flights of steps 14 and 15 provide access to the bridge 13 from the platforms 6 and 9 respectively. The tops of the two side frames 2 and 3 are also interconnected adjacent the rear of the apparatus by a frame of substantially horizontal beams 16 that together afford a platform 17. Flights of steps 18 and 19 give access to the platform 17 from the platforms 6 and 9 respectively. The bridge 13 and platform 17 are located at a vertical height 32 above ground or floor level of 3.2 meters.

The side frames 2 and 3 are also interconnected adjacent the rear of the apparatus by a few substantially horizontal beams that together afford a bridge 20 which is disposed beneath the platform 17 at a height above the ground or floor which is slightly less than half the height 32 of the platform 17. A similar bridge or platform 23 is disposed near the front of the apparatus beneath the bridge 13 at the same height above the ground or floor as the bridge 20. However, as can be seen in FIG. 1 of the drawings, the bridge or platform 23 is carried by a support 24 so as to be longitudinally displaceable (i.e. laterally of the apparatus) between the positions thereof that are shown in full and broken lines in FIG. 1. Flights of steps 26 and 27 give access from the ground or floor to the bridge or platform 23 in the region of the support 24 and to that ends 25 of the bridge or platform 23 which will be farthest remote from the support 24 when the bridge or platform occupies the position thereof that is shown in full lines in FIG. 1. Further flights of steps (not shown) that are similar to the steps 26 and 27 provide access between the ground or floor and the opposite ends of the bridge 20 that is located adjacent the rear of the apparatus.

The apparatus includes longitudinally extending and relatively parallel supports in the form of substantially horizontal rails 30 and 31 that are spaced apart from one another by a horizontal distance 33 of substantially 250 centimeters. The side frames 2 and 3 are anchored to the ground or to a floor at horizontal distances 34 and 35 from the rails 31 and 30 respectively, the distances 34 and 35 being equal and of fixed magnitude due to the rails 30 and 31 also being anchored to the ground or to the same floor as the side frames 2 and 3. As seen in plan (FIG. 2), the frame 1 is of oblong configuration and bears against the ground surface or floor by way of the longer sides of the oblong which longer sides are afforded primarily by the two side frames 2 and 3 that extend parallel to the rails 30 and 31. The shorter sides of the oblong that interconnect the side frames 2 and 3 are afforded principally by parts that are spaced from the ground surface or floor. The side frames 2 and 3, the bridge 13 and the platform 17 together enclose a central region of the apparatus that is open at the top inside which region assembly of prefabricated box-shaped building sections or room units can be undertaken. The side frames 2 and 3 are interconnected at the rear of the apparatus by supports in the form of both the upper platform 17 and the underlying bridge 20 whereas, adjacent the front of the apparatus,

the side frames are interconnected only by a support in the form of the bridge **13.** It will be seen from FIG. **2** of the drawings that the rails **30** and **31** extend beyond the apparatus at both the shorter sides thereof, those portions of the rails **30** and **31** that are inside the frame **1** constituting, however, part of the apparatus itself.

Vertical beams **40, 41, 42** and **43** are provided adjacent the opposite ends of the side frames **2** and **3,** said beams **40** to **43** forming supports for stops, arrangements for which are shown in the drawings only in relation to the stops that are associated with the beam **40.** The stops that are associated with the other beams **41** to **43** are arranged in a similar, or symmetrically similar, manner. A floor stop **44** (FIGS. **1, 3** and **4**) is arranged close to the foot of the beam **40** so as to be pivotable about a vertical pin or shaft **45.** Such pivotal movements are effected by the operation of a hydraulic piston and cylinder assembly **46,** the piston rod of which is pivotally connected to the stop **44** and whose cylinder is connected by a pivot **47** to a bracket on the side frame **2.** The beam **40** is provided, at a level above that of the floor stop **44,** with four side wall stops **48,** 49, 50 and **51.** These side wall stops **48** to **51** are arranged in pairs towards the upper and lower ends of the beam **40** as can be seen best in FIG. **3** of the drawings. The four side wall stops **48** to **51** are coupled together by a connecting beam **52** which projects upwardly beyond the uppermost flat plate-shaped stop **51** through a distance **53** (FIG. **3**). The beam **52** is pivotally connected to the piston of a hydraulic piston and cylinder assembly **54** at substantially the level of the platform **6,** the opposite end **55** of the assembly **54** being turnable about a substantially vertical pivot **56** (FIG. **5**) relative to the side frame **2.** The two pairs of side wall stops **48/49** and **50/51** are turnable relative to horizontal lugs **59** and **60** carried by the beam **40** about substantially vertically aligned pivot pins **57** and **58.** The beam **40** is provided, close to the floor stop **44,** with a projecting lug **61** (FIG. **4**) and with further lugs **62** that are located close to the two pairs of stops **48/49** and **50/51.** The free ends of the lugs **61** and **62** carry microswitches **63** and **64** respectively or alternative mechanisms designed to sense, and thus be capable of indicating, contact. As previously mentioned, the stops associated with the three beams **41, 42** and **43** are indentical, or symmetrically identical, with those that have been described in association with the beam **40** and the same reference numerals are therefore used to indicate all of them throughout the drawings.

A bearing **65** (FIG. **5**) is provided at the upper end of the beam **52** and a roof stop **66** is carried by that bearing. A lug **67** projects horizontally outwardly from the lower end of the bearing **65** and its outer end is pivotally connected to the piston rod of a hydraulic piston and cylinder assembly **68,** the cylinder of which, in turn, is pivotally connected to a lug **69** forming part of the side wall stop **51.** A side wall or facade support **80** is arranged close to the side frame **2** towards one of the longer sides of the apparatus and a further side wall or facade support **81** is substantially symmetrically arranged close to the side frame **3** towards the opposite side of the apparatus. Since the two supports **80** and **81** are substantially symmetrically identical, it is only necessary to describe the side wall support **80** in detail. The support **80** has a length **82** (FIG. **2**) which is only marginally less than the length of one side of the apparatus, the support **80** being pivotally connected to ground or floor anchorages **84** (FIG. **6**) at a plurality of locations along its length by corresponding substantially horizontally aligned pivot pins **83.** The anchorages **84** are rigidly connected to the rail **31.** The side wall support **80** has a frame which comprises generally upright beams **85,** the lowermost ends of which are connected to the anchorages **84** by the pivot pins **83.** The upper ends of the beams **85** are interconnected by a substantially horizontal beam **86** of oblong cross-section. The beam **86** is pivotally connected to the piston rods of two hydraulic piston and cylinder assemblies **87** which latter are spaced apart from one another by a considerable distance along the length of the beam **86.** The cylinders of the assemblies **87** are pivotally connected by horizontal pins **88** to a horizontal beam **89** that is rigidly fastened to the side frame **2.** The assemblies **87** are so constructed and arranged that the top of the side wall support **80** is adequately and uniformly sustained thereby. The side of the support **80** which faces the support **81** is provided with a stop **90** in the form of one or more flat plates backed by relatively perpendicular stiffening ribs **91.** The ribs **91** are fastened to the upright beams **85** by bolts **92** and it will be seen from FIG. **6** of the drawings that the ribs are formed with at least two holes **93** for alternative cooperation with the various bolts **92** so that the stop shall be capable of occupying at least two different fixed positions relative to the beams **85.** The tops of the stiffening ribs **91** are formed as guide arms **94** (FIGS. **2** and **6**) having downwardly inclined surfaces **95** whose lowermost ends make junctions with the operative surface **96** of the stop **90** itself.

Further partition or wall stops **100** are provided beneath the stop **90** and are pivotally connected to the beams **85** by horizontal pivot pins **101** although it is noted that it is also possible to provide additional stops **100** at locations between the beams **85.** The stops **100** project away from their pivot pins **101** through a distance **102** (FIG. **6**) which is approximately twice the distance **103** by which the pivot pins **83** are spaced from the rail **31.** As can be seen in FIG. **3** of the drawings, each stop **100** includes two arms **104** and **105** that are horizontally spaced apart from one another by a distance **106** that preferably has the same magnitude as the thickness of the building section or room unit walls or partitions that are to be assembled. The distance **106** may, for example, be 11 centimeters but other values can be substituted when required. Each of the stops **100** is provided with a corresponding adjusting or operating lever **107** by which it can be turned about the corresponding pin **101** for retention in any chosen one of at least two different angular settings about that pivot pin. In the angular setting that is shown at the right-hand side of FIG. **6,** the stops **100** project substantially perpendicularly from the general plane of the side wall support **80** whereas, in an alternative position, that is shown at the left-hand side of FIG. **6,** the stops **100** are inclined at only a few degrees to the beams **85** and to the general plane of the side wall support **81.** In the last-mentioned positions of the stops **100,** the levers **107** extend very approximately perpendicular to the general plane of the corresponding side wall support whereas, in the first-mentioned position illustrated at the right-hand side of FIG. **6,** the levers **107** are substantially parallel to the general plane of the corresponding side wall support. In the apparatus which is being described by way of example, each of the two

side wall supports **80** and **81** has seven of the partition or wall stops **100** (see FIG. **2**) which stops are spaced apart from one another by differing distances **110, 111** and **112.** It is noted that a different number of the stops **100** may be provided if desired and that the distances **110** to **112** may be greater or smaller than those shown in FIG. **2.**

The tops of both of the side frames **2** and **3** have stop arms **116** connected to them by horizontal pivot pins **118.** The ends of the stop arms **116** that are remote from the pins **118** carry generally U-shaped stops **117** which are so constructed that the distance between the limbs of each stop **117** is the same as the distance **106** (FIG. **3**). A horizontal frame beam **120** of rectangular cross-section interconnects the tops of the beams **4** of the side frame **2** and has an upper corner **119** (FIG. **6**) that forms a restraining abutment for the arms **116.** If desired, cams or other members may be secured to the beam **120** for adjustable co-operation with the arms **116.** The rails **30** and **31** are provided with flanged roller **121** and **122** that are freely rotatable about horizontal axle pins **123** and **124.**

The apparatus which has been described may be employed for the simple and rapid assembly of building sections or room units from prefabricated panels. A section or room unit will usually comprise panels affording a floor, walls and a ceiling and/or roof and the apparatus which has been described is employed in rapidly and correctly bringing these panels to their proper relative positions at which time they are permanently secured to one another by, for example, welding together skeletal metal beams thereof. FIG. **9** of the drawings illustrates a typical example of one box-shaped building section or room unit that can be assembled in apparatus in accordance with the invention. The section or room unit shown in FIG. **9** has the general shape of a rectangular parallelepiped and comprises a floor **131,** an outer side wall **132** at one short end, upright skeletal beams **133** at the opposite short end, an internal partition wall **134** and a portion **134A** of an external wall or facade that is located at one longer side of the section or unit. A top panel **135** is also provided and this top panel may be furnished with a ceiling on its lower surface and with a floor or roof on its upper surface as appropriate to the prefabricated building of which the section or room unit is intended to form a part. Clearly, if the section or room unit is to be part of a single story building or is to form, or be part of, the upper story of a building, then the upper surface of the panel **135** will need to be provided with a roof. The apparatus which has been described will normally be located on a factory floor and the various prefabricated panels can conveniently be introduced downwardly into the apparatus in substantially vertical dispositions (when required) through the open central region of the apparatus from a traveling crane movable along a track extending over the apparatus. The prefabricated panels may conveniently be made in the same factory and be stored at a location which is also accessible to the travelling crane.

In the assembly of a building section or room unit in the apparatus which has been described, a floor panel, such as the panel **136** shown in FIG. **6,** is lowered through the open central region of the apparatus onto the rollers **121** and **122** of the rails **30** and **31** by, for example, a crane-operated hoist **70** of the kind shown in FIGS. **1** to **3** of the drawings. The floor panel **136** is afforded by a rectangular framework of beams **137** and **138** between which a concrete slab **139** has been cast. As shown in FIG. **6** of the drawings. the lower flanges of the beams **137** and **138** are free of the concrete slab **139** and rest on the rollers **121** and **122** between the opposed flanges thereof. The four floor stops **44** that are associated with the corresponding four beams **40,** 41, 42 and **43** are employed to arrange and maintain the floor panel **136** in its correct position on the rails **30** and **31** during the assembly of the building section or room unit and, to this end, the piston rods of the assemblies **46** are extended to turn the stops **44** about the pins or shafts **45** once the panel **136** has been placed in an initial approximately correct position on the rails **30** and **31.** The stops **44** are thus brought from the position thereof that is shown in respect of one of them in broken lines in FIG. **4** of the drawings to the position thereof that is shown in full lines in the same Figure in which latter position relatively perpendicular guide sides or edges **140** and **141** engage a corner of the panel **136,** the four stops **44** acting in unison to bring the panel to exactly its appointed position on the rails **30** and **31.** The stops **44** subsequently serve as locking members to hold the floor panel **136** in that position while the further steps in the assembly take place.

Wall panels such as those constituting the outer side wall **132,** the internal partition wall **134** and the facade or outer wall portion **134A** are next placed in their correct positions on the floor panel **136** using the side wall stops **48, 49, 50** and **51.** These stops **48** to **51** are first retracted by the assemblies **54** to the positions thereof that are shown in respect of one of them in broken lines in FIG. **5** and the panels are then lowered into the open central region of the apparatus by the co-operating overhead travelling crane, said panels occupying substantially vertical positions. When the panels are in approximately their correct positions, the assemblies **54** are operated to bring the stops **48** to **51** to positions corresponding to the position that is shown in full lines in respect of the stop **51** in FIG. **5.** Each of the stops has two relatively perpendicular sides or edges **142** and **143** and these sides or edges contact the outer surfaces and edges of the wall panels concerned urging them into exactly correct positions. FIG. **6** of the drawings shows the panel that affords the internal partition wall **134** occupying an upright position on the floor panel **136** after it has been lowered into that position by the travelling crane. The panel is located between the limbs of two opposite stops **100** that are connected to the opposed side wall or facade supports **80** and **81.** The uppermost edge of the panel affording the partition wall **134** is engaged and held by two of the U-shaped stops **117** although it is noted that FIG. **6** of the drawings does not show the left-hand stop **117** in its operative position but in a withdrawn inoperative position. The distance **106** (FIG. **3**) and the equal distance between the limbs of each stop **117** is, of course, chosen to fit the thickness of the panel affording the partition wall **134** and said panel is thus both located and subsequently maintained in exactly its correct disposition in the building section or room unit that is being assembled. It should be noted that, although not illustrated in the accompanying drawings, additional generally U-shaped stops **117** may be provided for co-operation with the tops of end wall panels such as the panel that affords the outer side wall **132** in FIG. **9.** The stops **100** are preferably provided with adjustable means (not shown) for moving panels

such as that affording the partition wall **134** laterally across the floor panel **136** in order to be able to position such panels in a laterally correct manner as well as a longitudinally correct manner with regard to the length of the apparatus and the building section or room unit that is being formed therein. Once a correct position of the various wall panels has been attained by the use of the stops, those panels are permanently secured to the floor panel **136** by, for example, welding. The wall panels will normally incorporate vertically disposed metal beams and the lowermost ends of those beams can readily be welded to, for example, the horizontal beams **137** and **138** of the floor panel **136** that can be seen in FIG. **6** of the drawings.

When a building section or room unit is to include external or internal walls along one or both of its longer sides, then the prefabricated panels affording such walls are brought to their correct assembly positions by employing the side wall or facade support **80** and **81**. The left-hand side of FIG. **6** and the whole of FIG. **7** of the drawings illustrate the positioning of an internal partition wall panel **150** at one longer side of a section or room unit that is being assembled. The panel **150** is lowered into the open central region of the apparatus by the aforementioned co-operating overhead crane and, during such lowering, it is directed into approximately its correct position by bearing against the inclined surface **95** of at least one, and preferably at least two, of the guide arms **94**. The partition or wall stops **100** are arranged in the upwardly tilted inoperative positions shown at the left-hand side of FIG. **6** and in FIG. **7** at this time so that the stops **100** can in no way impede the correct positioning of the panel **150**. Stops, which are preferably adjustable but which are not shown in the drawings, are provided for moving panels such as the panel **150** to their correct position lengthwise of the apparatus (i.e. in a direction perpendicular to the plane of FIG. **6**), such stops being connected to the supports **80** and **81**. Once the correct longitudinal position of a panel, such as the panel **150**, has been attained by the use of the stops which have just been mentioned, the support **81** is turned about the pivot pins **83** at its foot by operation of the corresponding pair of piston and cylinder assemblies **87**, such opererating bringing the support **81** and the panel **150** from the positions thereof that are shown at the left-hand side of FIG. **6** to the positions illustrated in FIG. **7**. The panel **150** will then occupy exactly its correct position in the section or room unit under assembly in longitudinal, lateral and vertical directions. Vertical beams of the skeleton of the panel **150** can then be secured to at least one horizontal beam, such as the beam **137**, of the floor panel **136**. Further welded connections can, if considered necessary, be established between vertical skeletal beams of the panel **150** and similar beams of the panels affording the outer side wall **132** and the internal partition wall **134**.

If one of the longer sides of a section or room unit under assembly has to be provided with at least one wall panel which is to form part of an outer wall of the eventual building, then such panel will normally have a greater thickness than the thickness **151** (FIG. **6**) of the panel **150**. FIG. **8** shows such an outer wall panel **153** whose thickness **154** is appreciably greater in magnitude than the thickness **151**. In order to be able to use the same side wall supports **80** and **81** for the correct positioning of thicker panels, such as the panel **153**, the previously mentioned alternative holes **93** are employed for co-operation with the bolts **92** to fasten the ribs **91** to the upright beams **85**. The supports **80** and **81** are thus adjustably mounted in the apparatus and it will be noted that it is, of course, possible to provide more than two holes **93** in each set thereof so that said supports **80** and **81** can be used correctly with panels of more than two different thicknesses. Once the bolts **92** have been entered through the correct holes **93** for co-operation of the supports **80** or **81** or both with at least one thicker panel, such as the panel **153**, such panel is brought to exactly its correct appointed position in the same way as has been described with reference to FIGS. **6** and **7** of the drawings in respect of the thinner internal partition wall panel **150**. Securing of each such panel to the floor panel **136** and, where required, to further internal partition wall panels, is also effected, preferably by welding, in the manner that has previously been described.

Once all of the internal partition walls and external walls are permanently secured in their appointed positions on the floor panel **136**, the top panel **135** that is shown in FIGS. **1**, **3** and **9** of the drawings is placed in its correct position to complete the basic structure of the building section or room unit. The hoist **170** is employed to bring the top panel **135** to approximately its correct position in a substantially horizontal disposition and, subsequently, the roof stops **66** are used for the final correct positioning operation. The top panel **135** is afforded principally by a concrete slab that closes the top of all or part of the corresponding section or room unit and, if an overlying roof is necessary, it can be arranged on the upper surface of the panel **135**. It is not always necessary to provide the lower surface thereof with ceiling material such as ceiling tiles. The stops **66** are brought into operation by the hydraulic piston and cylinder assemblies **68** which move them from the inoperative position shown in broken lines in respect of one of them in FIG. **5** to operative positions corresponding to the full line position that is illustrated in FIG. **5** in respect of the same stop. Relatively perpendicular sides or edges **155** and **156** co-operate with the corners of the panel **135** and bring that panel to exactly its correct assembly position. The panel **135** preferably includes a skeleton of metal beams and these beams are welded, or otherwise rigidly secured, to the upper ends of skeletal beams of the various internal partition wall panels and external wall panels.

It will be apparent from the preceding description and from the accompanying drawings that the various prefabricated panels that are employed to form the floor, walls and ceiling and/or roof of a building section or room unit can all be introduced into the apparatus through the open top of its central region by employing a co-operating overhead travelling crane or other appropriate hoisting gear, the apparatus preferably being located in the same factory as that in which the panels themselves are formed. The described and illustrated apparatus very greatly facilitates bringing the panels quickly and easily to their appointed positions in which they can be maintained during their permanent interconnection to form the basic structure of a building section or room unit. The various platforms and bridges of the apparatus can be used during the positioning and interconnection of the panels and thus effectively afford working floors. When a section or room unit has been completed in the apparatus, the floor stops **44** are

brought to the inoperative broken line positions thereof shown in FIG. **4**, the side wall stops **48** to **51** and the roof stops **66** are brought to the broken line positions shown in FIG. **5** by retracting the piston and cylinder assemblies **54** and the supports **80** and **81** are moved to the inclined positions thereof that are shown in respect of the support **81** at the left-hand side of FIG. **6**. It should be noted that the piston and cylinder assemblies **54** move the stops **66** as well as the stops **48** to **51** because the stops **66** are pivotally mounted on the beams **52** and those beams are bodily displaced about the axes of the pivot pins **57** and **58** upon operating the assemblies **54**. The levers **107** are operated to bring the stops **100** to the retracted inoperative positions thereof that are shown at the left-hand side of FIG. **6** and in FIG. **7**. The stops **117** are also brought to the inoperative positions thereof that are shown at the left-hand side of FIG. **6** and in FIG. **7** and the basically completed building section or room unit is then left supported only from beneath by the rails **30** and **31**. Upon moving the bridge **23** to the retracted position thereof that is shown at the left-hand side of FIG. **1** in broken lines, the front of the apparatus is completely opened and the completed section or room unit can be moved slowly out of the front of the apparatus along the rails **30** and **31** preferably by employing a travelling chain in the manner indicated in outline in FIGS. **1** and **2**. It will be realized that the height **32** of the bridge **13** above the ground or floor level is such that the completed building section or room unit will pass beneath it with ample clearance.

The various stops that have been described may all be provided with sensing means such as the microswitches **63** and **64** that are shown in FIGS. **4** and **5** of the drawings and these microswitches or other sensing means may be connected to indicating means, such as electric lamps, carried by a control panel **161** (FIG. **1**). The indicating means on the control panel **161** will thus show whether or not the various panels and stops have reached their correct relative positions. The various stops and side wall or facade supports that have been described may have different shapes to enable them to be used for the assembly of other building sections or room units but the various hydraulic piston and cylinder assemblies by which they are operated are preferably all controlled from a single point which, in the embodiment that is being described, is a control panel **162** (FIGS. **1** and **3**) that is located at the front of the apparatus at ground or floor level. The control panel **162** may, in addition to its controls, be provided with indicating means such as electric lamps or the like that are also connected to the microswitches **63** and **64** or other sensing means. It can then be seen on the control panel **162** whether the operation of different controls has produced the required result or whether some manual assistance is required. If desired, the two control panels **161** and **162** may be similar to one another and may be arranged for alternative employment so that the operation of the apparatus can be controlled and supervised at either chosen panel. The stops **100** that are carried by the side wall support **80** and **81** are arranged at different points so that they may be used, as required, for the assembly of differing sections and room units in which, for example, internal partition walls occupy various locations lengthwise of such sections or units.

FIG. **10** diagrammatically illustrates the construction of a building in the form of a bungalow formed from five juxtaposed building sections or room units **165**, 166, 167, 168 and **169**. The section or room unit **165** substantially corresponds to the one that is illustrated in FIG. **9**. It can be seen from FIG. **10** of the drawings that, whereas all five of the sections or room units are of substantially the same overall dimensions, the number and arrangement of internal partition walls varies considerably from one section or unit to another. The apparatus is provided with the necessary complement of appropriately positioned stops so that all of the different sections or room units **165** to **169** can be assembled therein without major re-arrangement of the apparatus. If desired, the apparatus may be employed in providing at least internal partition walls of some sections or room units with finishes during the presence of the corresponding panels in the apparatus. For example, wall tiles and the like may be fastened to internal partition walls where required. Guide marks can be provided in the apparatus to indicate the correct locations of wall tiles or other wall coverings so that operators installing such tiles or other coverings shall be assisted in their work to the greatest possible extent. It has already been mentioned that the various stops can have different shapes to those illustrated or may be replaced by alternative stops of completely different forms for co-operation with prefabricated panels of different shapes. The bridges **20** has been described as being a stationary bridge but, if desired, it may be laterally displaceable in the same manner as the bridge or platform **23** so that basically completed building sections or room units can be removed from the apparatus through either the frnt or the rear thereof.

Although certain features of the apparatus and its method of use that have been described and/or illustrated in the accompanying drawings will be set forth in the following claims as inventive features, it is emphasized that the invention is not necessarily limited to those features and that it includes within its scope all of the parts of the apparatus and the steps in its method of use that have been described or illustrated both individually and in various combinations.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the U.S. is:

1. Apparatus for manufacturing prefabricated building sections from prefabricated top, bottom and side components constructed at least in part of metal beams and concrete, the apparatus comprising:

lower positioning means adapted to carry in a horizontal disposition a said bottom component;

a frame which includes vertically disposed frame parts, one of said frame parts located on each side of said lower positioning means;

side component positioning means mounted on each said frame part for performing the function of receiving and positioning a side component relative to said bottom component carried by said lower positioning means, side component stop means associated with said side component positioning means for performing the function of maintaining each said side component for securing in its desired position relative to said bottom component;

top component positioning means and top component stop means associated with said top component positioning means mounted on the upper aspect of each said frame part for performing the function of positioning and maintaining a said top

component for being rigidly secured to said side component.

2. Apparatus as claimed in claim 1, wherein said frame has a top which is open and is arranged to receive said prefabricated components.

3. Apparatus as claimed in claim 2, wherein said frame is of substantially oblong configuration when seen in plan view and has an open central region.

4. Apparatus as claimed in claim 3, wherein said frame is generally rectangular when seen in plan, having longer and shorter sides.

5. Apparatus as claimed in claim 4, wherein securing means are provided to secure said frame to the underlying surface at two opposite sides thereof, said opposite sides being interconnected by bridging means, said bridging means forming parts on further sides of said frame.

6. Apparatus as claimed in claim 5, wherein said frame is provided on at least one side thereof with a working floor disposed at a level above that of said surface on which the apparatus is secured.

7. Apparatus as claimed in claim 6, wherein said working floor is located at one said longer side of said frame at a level substantially midway between the bottom and top thereof.

8. Apparatus as claimed in claim 7, wherein another working floor is provided on at least one said shorter side of said frame, said another working floor being located at a higher level than said first mentioned working floor located on said longer side of said frame.

9. Apparatus as claimed in claim 8, wherein one said shorter side of said frame is provided with a further working floor which is located at a lower level than said first mentioned working floor provided on said longer side of said frame.

10. Apparatus as claimed in claim 9 wherein at least one of said working floors is displaceable at least in part with respect to the remainder of said frame.

11. Apparatus as claimed in claim 10, wherein said displaceable working floor is located on a said shorter side of said frame.

12. Apparatus as claimed in claim 11, wherein said displaceable working floor is said further working floor.

13. Apparatus as claimed in preceding claim 1, wherein at least one said stop means is adjustably arranged in said frame.

14. Apparatus as claimed in claim 11 including pivot means connected to said frame, wherein said one stop means is pivotally arranged by said pivot means in said frame.

15. Apparatus as claimed in claim 14, wherein said top component stop means is provided on at least one corner of said frame.

16. Apparatus as claimed in claim 15, said frame having a substantially elongated rectangular configuration as seen in plan, wherein each corner of said frame is provided with a plurality of said stop means which are angularly displaceable about said pivot means, said pivot means having substantially vertical axes.

17. Apparatus as claimed in claim 15, wherein said stop means are connected through said pivot means to upright beams located substantially at the corners of said frame.

18. Apparatus as claimed in claim 17, wherein at least one said stop means is arranged at each corner of said frame proximate the surface supporting said frame and is pivotally connected to the corresponding said upright beam to be movable about a said pivot means relative thereto by a corresponding positioning mechanism.

19. Apparatus as claimed in claim 18, wherein each said upright beams is provided with at least one side component stop means which extends along a major portion of the height of each said upright beam.

20. Apparatus as claimed in claim 19, wherein a plurality of said side component stop means are provided for each said upright beam which are coupled to one another by a connecting beam to be displaceable in common relative to the corresponding upright beam for each plurality of said side component stop means.

21. Apparatus as claimed in claim 17, wherein each said upright beam is provided with at least one end stop means adapted to position longitudinally said components received in the apparatus.

22. Apparatus as claimed in claim 21, wherein stop means are displaceably arranged at the upper ends of said upright beams.

23. Apparatus as claimed in claim 20 wherein said connecting beams are coupled to said positioning mechanisms for the displacement of said stop means carried by said connecting beams.

24. Apparatus as claimed in claim 1, and comprising at least one side component support in each side component positioning means.

25. Apparatus as claimed in claim 24, wherein said side component support extends throughout a major portion of the length of a corresponding side of said frame.

26. Apparatus as claimed in claim 24, wherein said side component support is afforded primarily by at least one plate.

27. Apparatus as claimed in claim 24, wherein said side component support is adjustably connected to its corresponding side component positioning means.

28. Apparatus as claimed in claim 24, wherein the top of said side component support is provided with at least one guide member.

29. Apparatus as claimed in claim 24, wherein said side component support is turnable relative to said frame about a substantially horizontal axis located proximate the lowermost end of said side component support.

30. Apparatus as claimed in claim 29, wherein a supporting frame is provided for said side component support which is pivotally connected at its lower end to part of said side component support arranged about said axis to sustain a building section in the apparatus from beneath.

31. Apparatus as claimed in claim 24, wherein a lower region of the apparatus comprises at least one sustaining support included in said track means by which a building section located in the apparatus can be sustained from beneath.

32. Apparatus as claimed in claim 31, wherein two said sustaining supports are provided in the form of a pair of spaced apart rails.

33. Apparatus as claimed in claim 24, wherein said side component support has a further stop means movably connected thereto.

34. Apparatus as claimed in claim 33, wherein said further stop means includes two arms spaced apart from one another by a distance such that the clearance between them is equal to the thickness of wall panels to be held thereby during the use of the apparatus.

35. Apparatus as claimed in claim 1, wherein the top of said frame is provided with at least one upper stop means which is turnable about a substantially horizontal axis.

36. Apparatus as claimed in claim 35, wherein said uppper stop means is carried by an arm pivotally connected to a beam provided at the top of said frame.

37. Apparatus as claimed in claim 35, wherein said upper stop means is of generally U-shaped configuration, the limbs of the U being spaced apart by the same distance as the thickness of said panels which are to fit between them.

38. Apparatus as claimed in claim 1, wherein the apparatus comprises at least one stop means displaceable by a corresponding positioning mechanism.

39. Apparatus as claimed in claim 38, wherein said positioning mechanism is of fluid pressure operated construction.

40. Apparatus as claimed in claim 38, wherein a plurality of said positioning mechanisms are arranged to be controlled from a panel which is operatively associated with said apparatus.

41. Apparatus as claimed in claim 38, wherein at least one said stop means is provided with sensing means, said sensing means being operatively connected to indicating means.

42. Apparatus as claimed in claim 41, wherein said indicating means are provided at a control panel provided for said positioning mechanisms.

43. Apparatus for the manufacture of prefabricated building sections from a prefabricated floor and prefabricated wall panels which comprises

a framework which is rectangular in plan and is provided with an opening of sufficient size on its top to receive said wall panels,

hoist means for carrying said well panels separately into said framework,

conveying means for introducing said floor in the lower portion of said apparatus,

positioning means for positioning said floor in a horizontal disposition in a predetermined horizontal position relative to and in the lower portion of said framework,

wall panel support means pivotally connected within said framework, said wall panel support means being selectively pivoted to an inclined position for receiving said wall panels and to a vertical position whereby said wall panels are brought to their desired position relative to said floor for connection thereto.

44. Apparatus in accordance with claim 43, wherein wall panel positioning means are interconnected in said framework for positioning said wall panels relative to said floor prior to effecting the connection thereof.

45. Apparatus for manufacturing prefabricated building sections from prefabricated top, bottom and side components constructed at least in part of metal beams and concrete, the apparatus comprising:

lower positioning means comprising track means adapted to carry in a horizontal disposition a said bottom component;

a frame which includes vertically disposed frame parts, one of said frame parts located on each side of said track means;

side component positioning means mounted on each said frame part for performing the function of receiving and positioning a side component relative to said bottom component carried by said track means, side component stop means associated with said side component positioning means for performing the function of maintaining each said side component in a rigid position for being secured relative to said bottom component, said side component positioning means including a pivot member spaced from said track means and further including guide means whereby said side component positioning means can be moved about said pivot member from an inclined position for receiving said side component to a vertical position for positioning said side component relative to said bottom component.

46. Apparatus for manufacturing prefabricated building sections from prefabricated top, bottom and side components constructed at least in part of metal beams and concrete, the apparatus comprising:

track means adapted to carry in a horizontal disposition a said bottom component, said track means including a pair of parallel rails, said bottom component including a framework of metal beams, said beams bearing against said rails;

side component positioning means mounted on each said frame part for performing the function of receiving and positioning a side component relative to said bottom component carried by said track means, side component stop means associated with said side component positioning means for performing the function of maintaining each said side component for being secured in its desired position relative to said bottom component; and

means for positioning and securing said bottom component in a desired position on said track means for receiving each said side component.

47. Apparatus for manufacturing prefabricated building sections from prefabricated top, bottom and side components constructed at least in part of metal beams and concrete, the apparatus comprising:

track means adapted to carry a said bottom component in a horizontal disposition;

a frame which includes vertically disposed frame parts, one of said frame parts located on each side of said track means;

side component positioning means mounted on each of said frame parts for performing the function of receiving and positioning a side component relative to said bottom component carried by said track means, said side component positioning means including a movable arm with two spaced apart extensions whereby said positioning means is adapted to perform the function of receiving between said extensions said side component and maintaining said side component rigidly in its desired position relative to said bottom component for being secured to said bottom component.

48. Apparatus for manufacturing prefabricated building sections from prefabricated top, bottom, and side components constructed at least in part of metal beams and concrete, the apparatus comprising:

track means adapted to carry in a horizontal disposition a said bottom component, a frame which includes vertically disposed frame parts, one of said frame parts located at each side of said track means;

a pair of bottom component positioning means mounted on each said frame part for performing

the function of receiving and positioning said bottom component, said bottom component positioning means each including movable stop means each having a recess for receiving a corner of said bottom component, said movable stop means performing the function of maintaining said bottom component for the securing of side components thereto.

49. Apparatus for manufacturing prefabricated building sections from prefabricated top, bottom and side components constructed at least in part of metal beams and concrete, the apparatus comprising:

track means adapted to carry in a horizontal disposition a said bottom component;

a frame which includes vertically disposed frame parts, one of said frame parts located on each side of said track means;

top component positioning means, said top component positioning means including movable stop means including a recess for receiving a corner of said top component and performing the function of positioning said top component relative to said bottom component and side components.

50. Apparatus for manufacturing prefabricated building sections from prefabricated top, bottom and side components constructed at least in part of metal beams and concrete, the apparatus comprising:

track means adapted to carry in a horizontal disposition a said bottom component, said track means including a pair of parallel rails, said bottom component including a framework of metal beams, said beams bearing against said rails;

positioning means mounted on each said framework for performing the function of receiving and positioning said side and top components relative to said bottom component carried by said track means, stop means for said components associated with component positioning means for performing the function of maintaining each said side and top component for being securing in its desired position in the section relative to said bottom component;

said track means extending out of said frame whereby completed sections are movable on said track means from between said frame parts and out of said frame.

51. Apparatus for manufacturing box-shaped prefabricated building sections from prefabricated panels which comprises stop means for said panels arranged on said frame for positioning said panels in their correct relative positions for subsequent interconnection to form said sections, said frame being of a substantially elongated rectangular configuration when seen in plan view, securing means being provided to secure said frame to the underlying surface at two opposite sides thereof, said opposite sides being interconnected by bridging means, said bridging means forming parts on further sides of said frame, said frame being further provided on a longer side with a working floor disposed at a level above that of said surface on which the apparatus is secured, a further working floor being provided on a shorter side of said frame, said further working floor being located at a higher level than said first mentioned working floor, a third working floor located on said shorter side which is at a lower level than said first mentioned working floor, said third working floor being displaceable at least in part with respect to the remainder of said frame.

52. Apparatus for manufacturing prefabricated building sections from prefabricated components constructed at least in part of metal beams and a filling material therebetween, the apparatus comprising:

bearing means in its lower side to carry said components;

a frame which includes vertically disposed frame parts, one of said frame parts located on each side of said bearing means;

side component positioning means mounted on said frame part for performing the function of receiving and positioning components forming vertical side components in said section relative to further components carried in said apparatus, side component stop means associated with said side component positioning means for performing the function of maintaining each said side component for securing in its desired position relative to said further components;

top component positioning means and top component stop means associated with said top component positioning means mounted on the upper aspect of each said frame part for performing the function of positioning and maintaining in the upper side of the section to be cnstructed a further component for being rigidly secured to said side component.

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