

(12) UK Patent Application (19) GB (11) 2 334 745 (13) A

(43) Date of A Publication 01.09.1999

(21) Application No 9912310.1

(22) Date of Filing 19.07.1996

Date Lodged 26.05.1999

(30) Priority Data

(31) 08512645 (32) 08.08.1995 (33) US

(62) Divided from Application No 9615192.3 under Section 15(4) of the Patents Act 1977

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(51) INT CL⁶
E04G 17/04

(52) UK CL (Edition Q)
E1S SSG S111 S127

(56) Documents Cited

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(58) Field of Search

UK CL (Edition Q) E1S SSG
INT CL⁶ E04G 17/00 17/02 17/04 17/14 17/16 17/18
ONLINE: EPODOC, WPI, PAJ

(54) Abstract Title

Fastening apparatus for use with a floor form assembly

(57) A fastening apparatus (700) for removably interconnecting two floor form assembly units (4,5) comprises: first and second connecting plates (710,720) having hook portions (711,721) that engage removably with each other so that they are superimposed one on top of the other; and a clamping lever (730) having a handle portion and a jaw portion, the jaw portion having a hook like jaw (731) and a curved supporting jaw (732) with a space (733) confined between the two; whereby after said hooked portions (711,721) are superimposed upon each other their distal ends are positioned between the two jaw portions (731,732) of the clamping lever (730), with rotation of the clamping lever causing the secure and removable interconnection of the hook portions (711,721) between the two jaw portions (731,732) of the clamping lever (730).

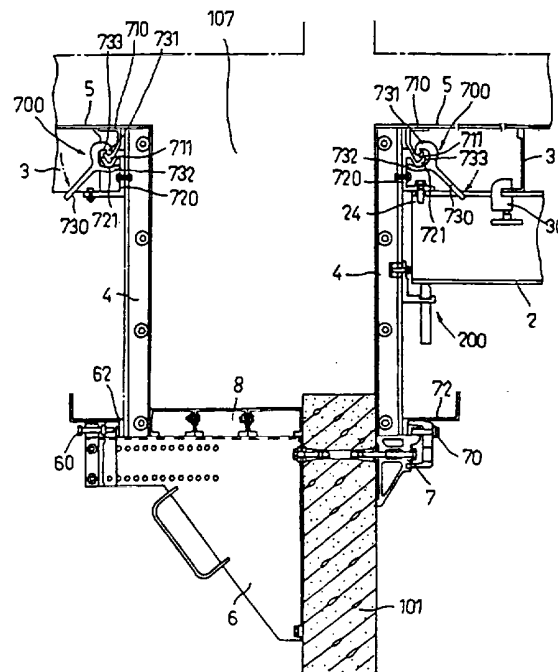


FIG. 20

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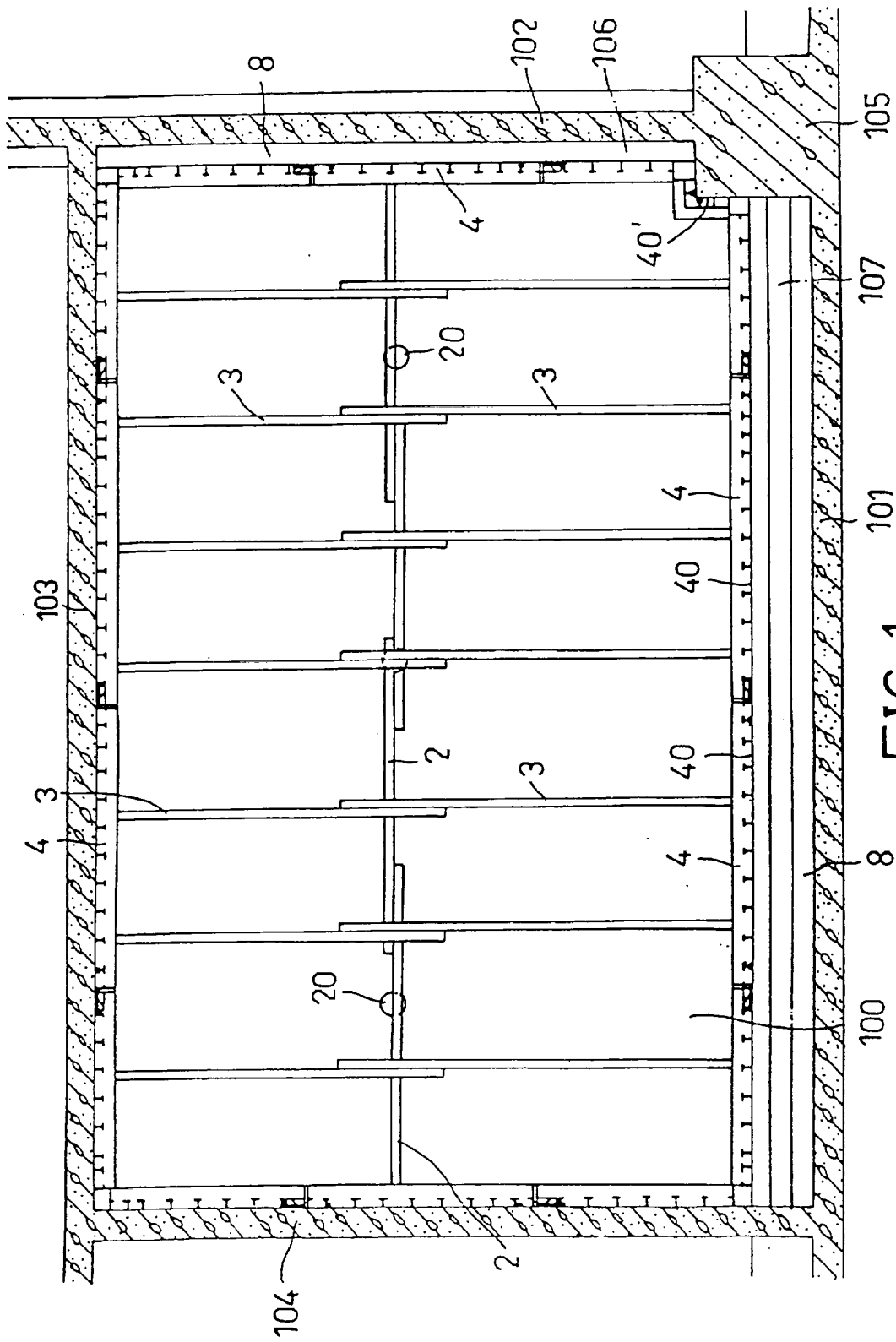


FIG. 1

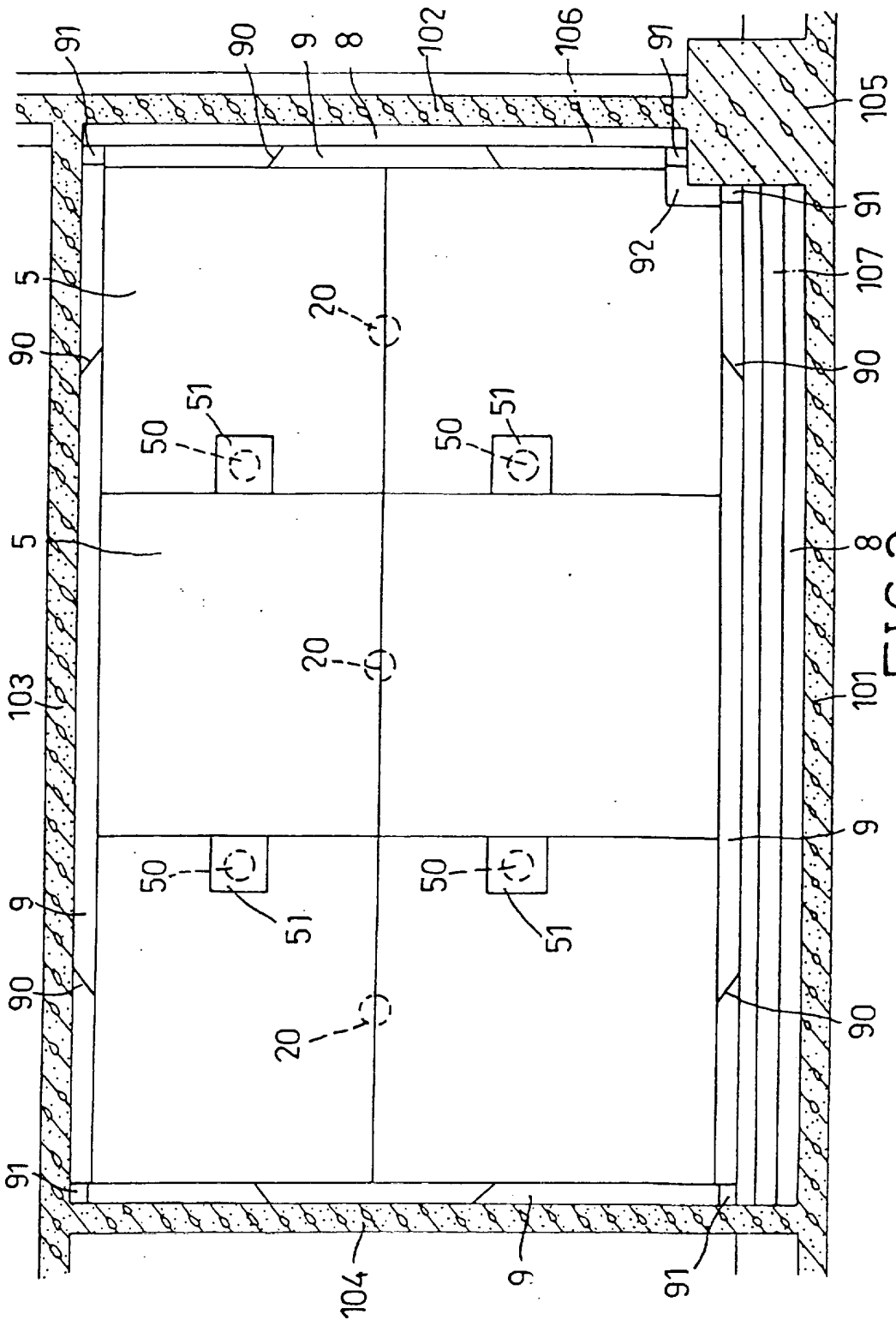


FIG.2

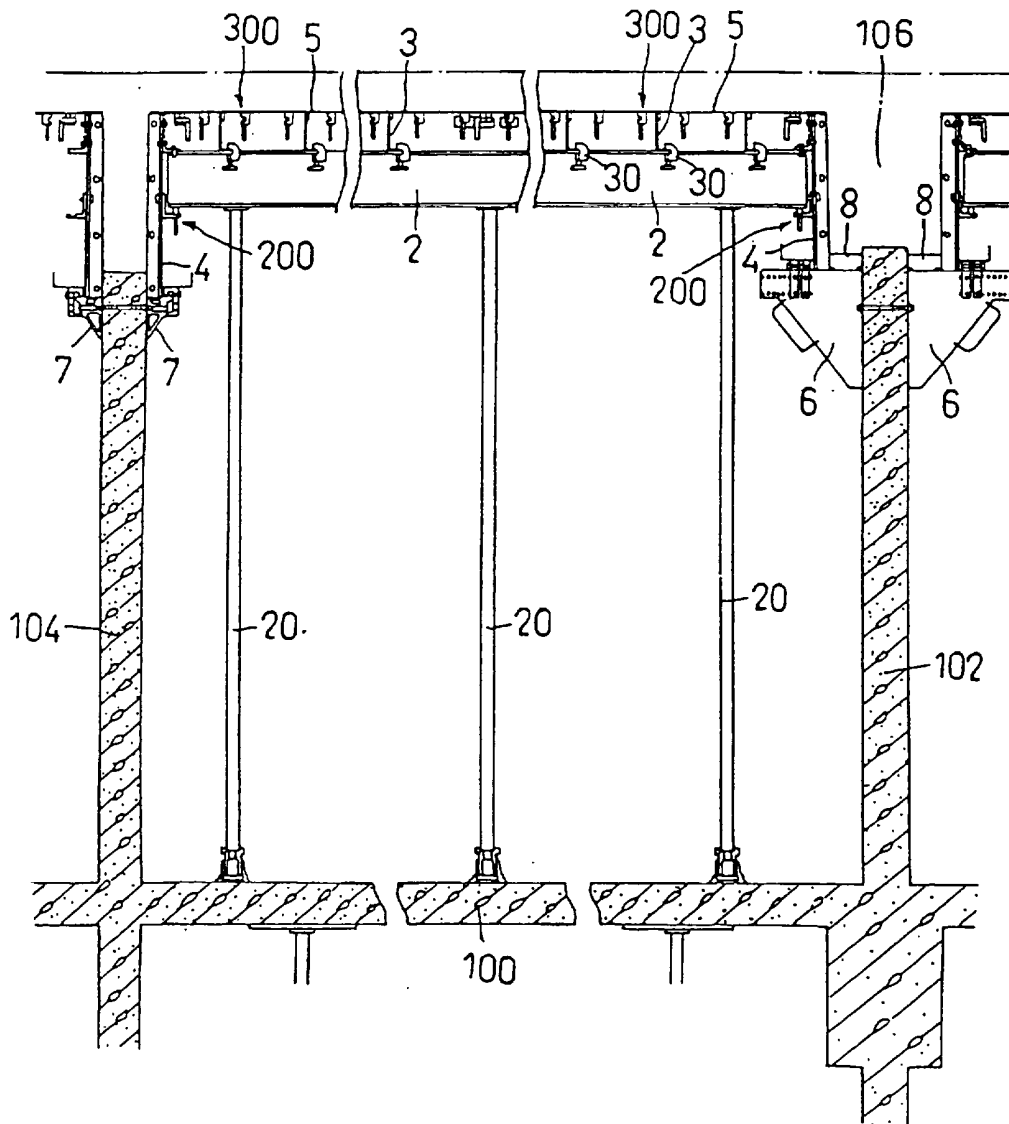


FIG. 3

4/18

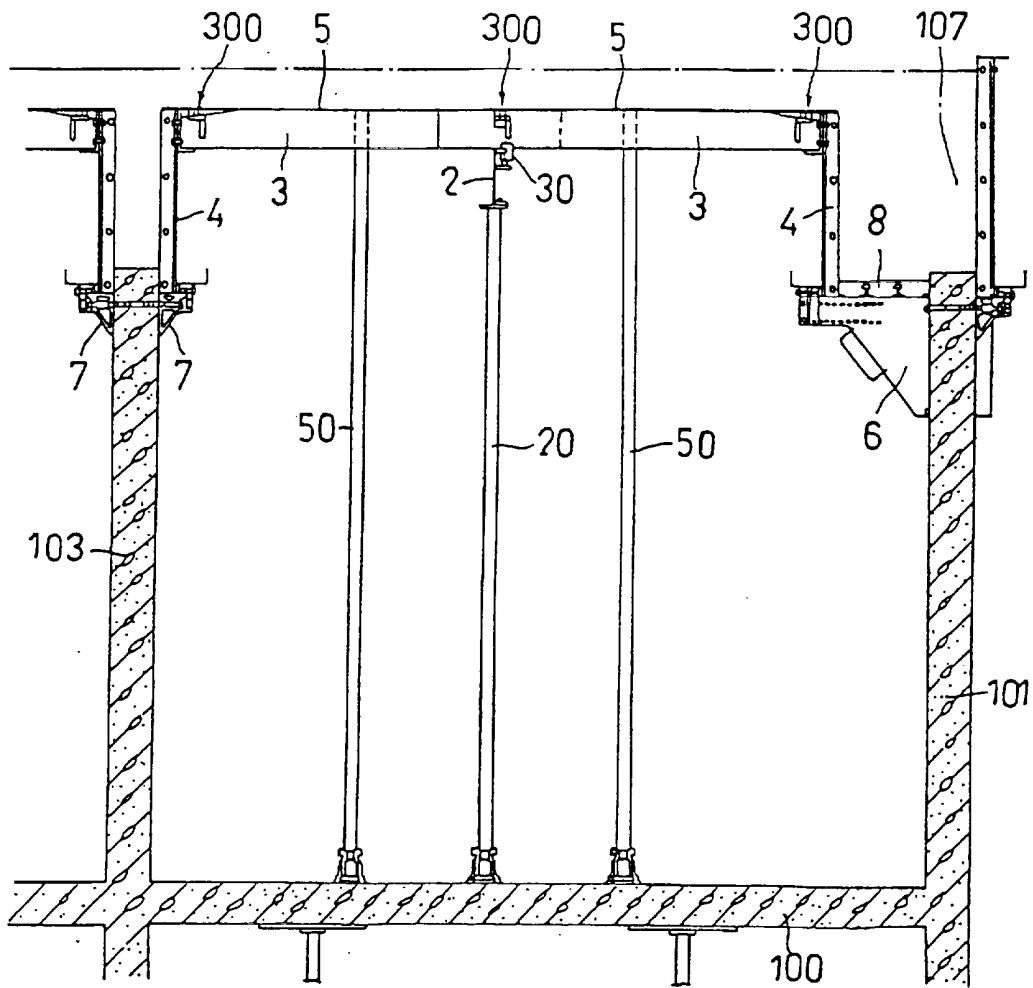


FIG. 4

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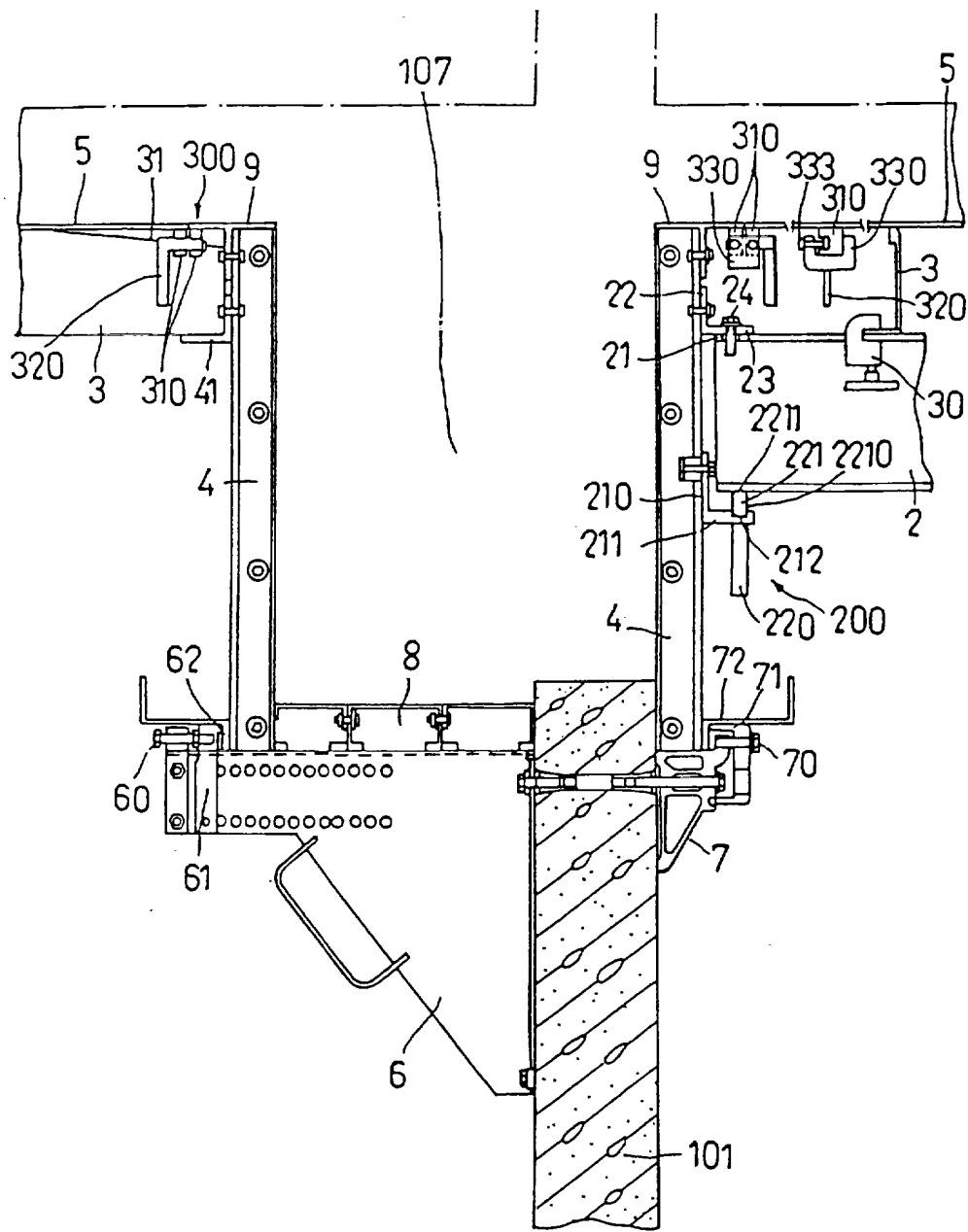


FIG.5

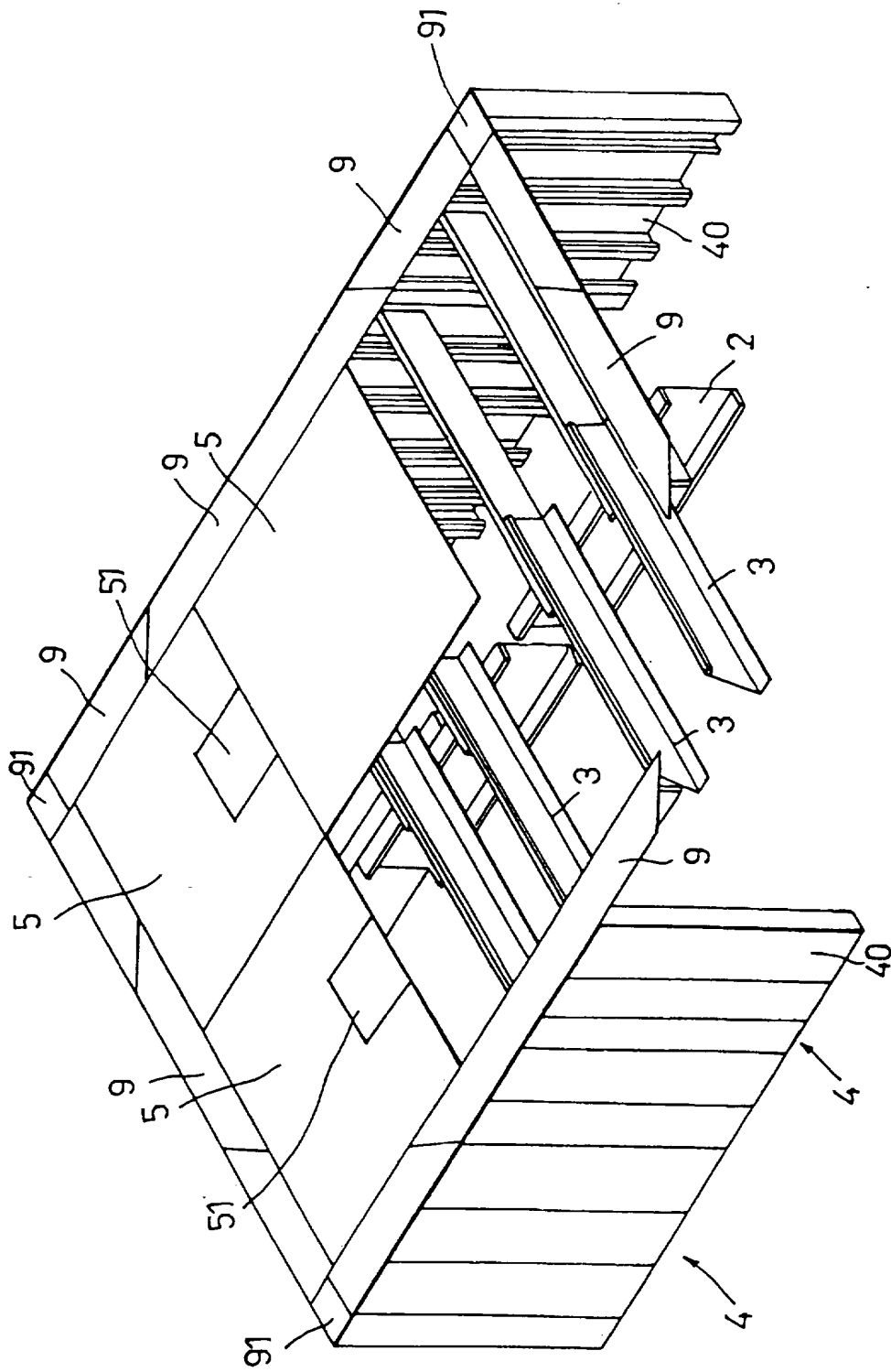


FIG.6

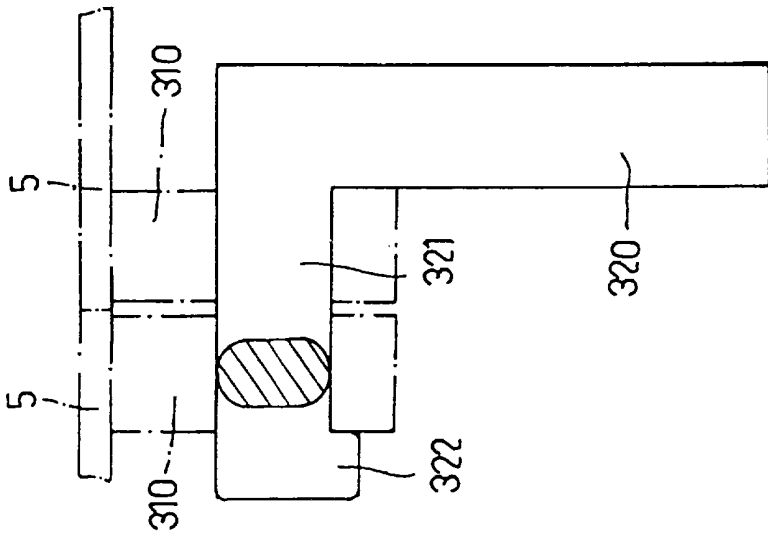


FIG. 7

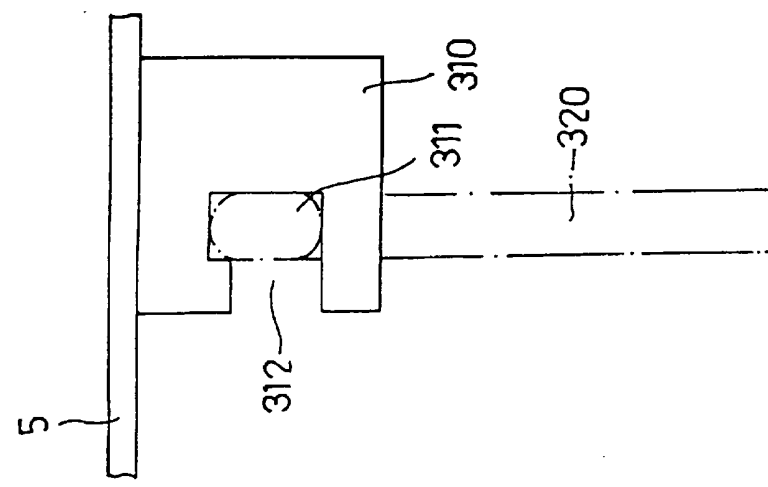


FIG. 8

7/18

87,8

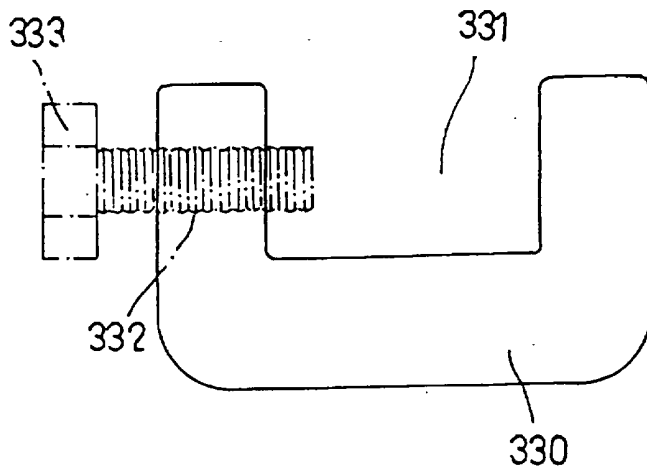


FIG. 9

9/18

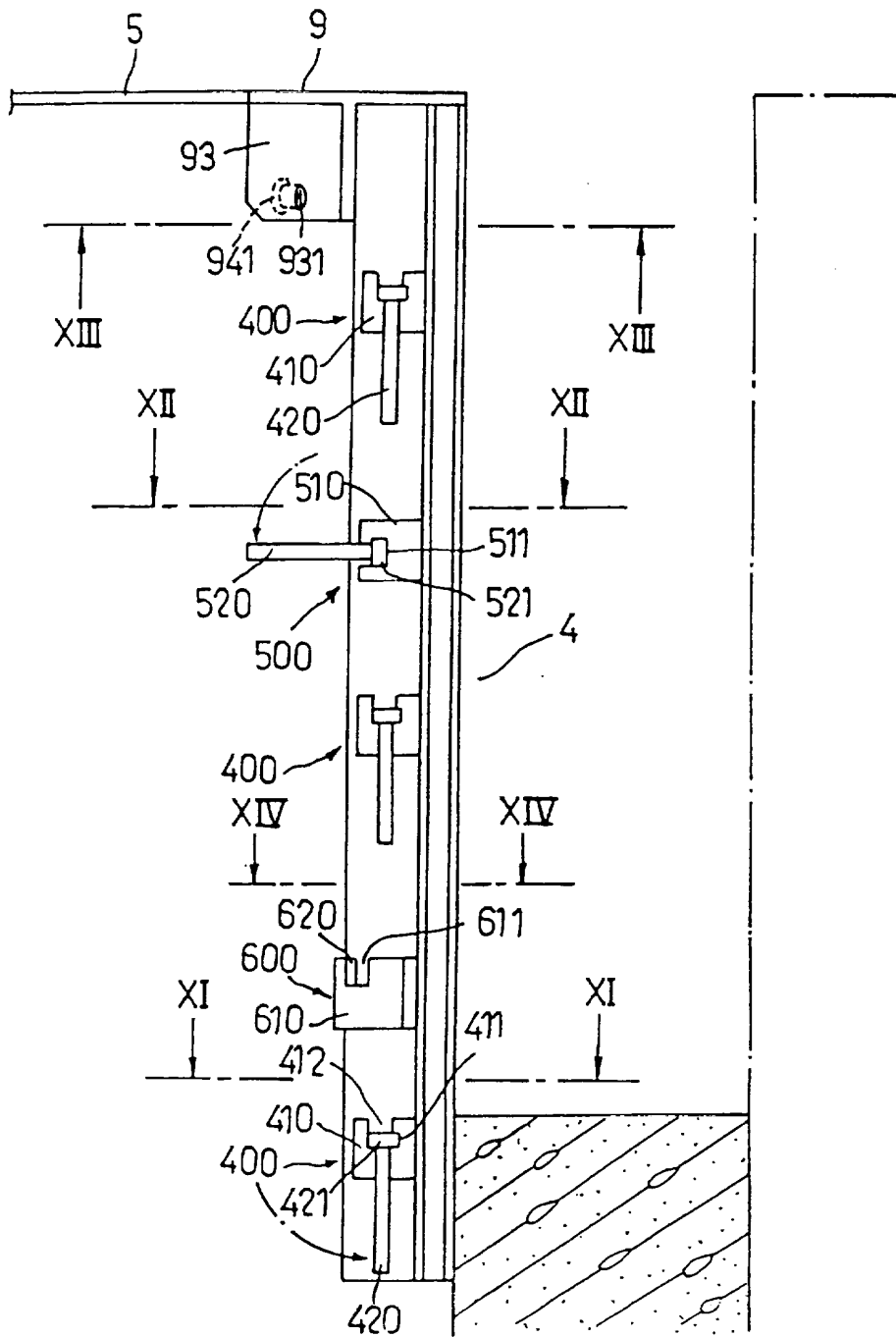


FIG. 10

10/18

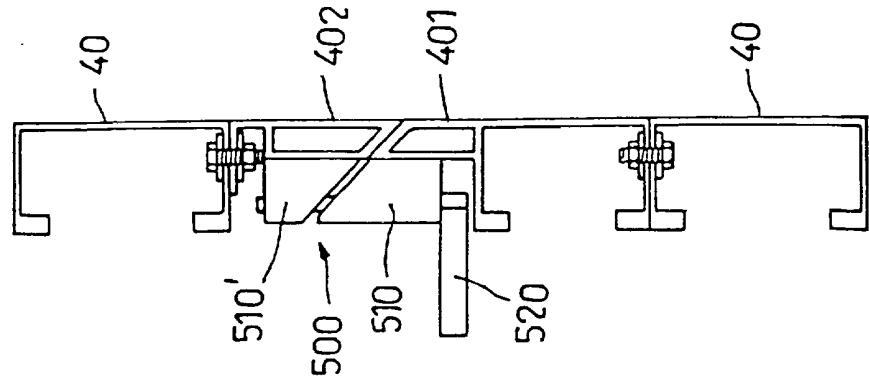


FIG.12

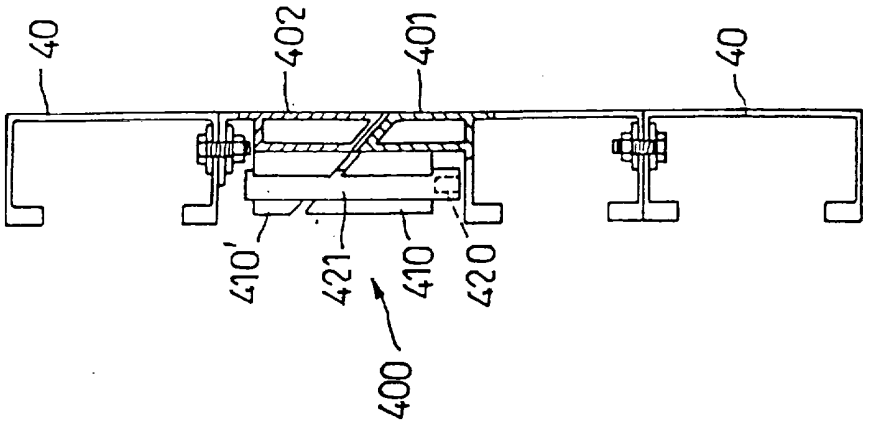


FIG.11

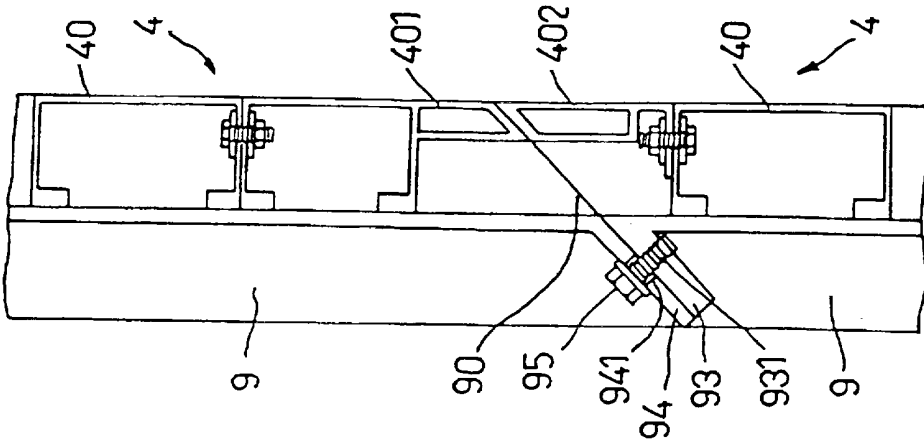


FIG.13

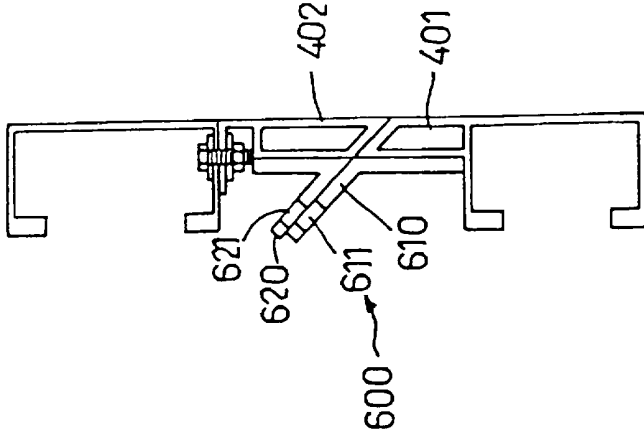


FIG.14

12/18

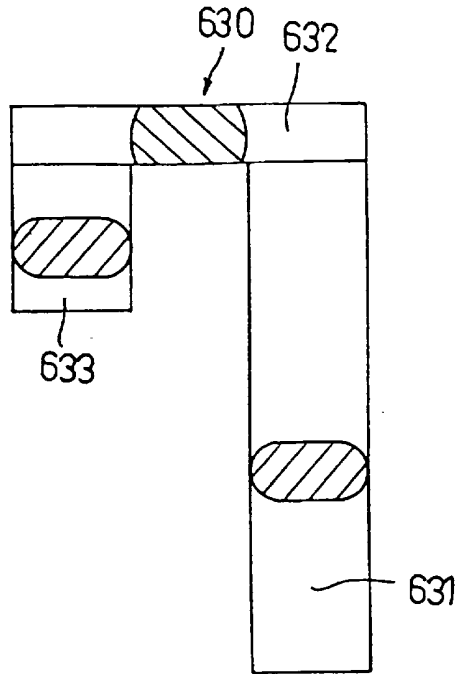


FIG.15

13/18

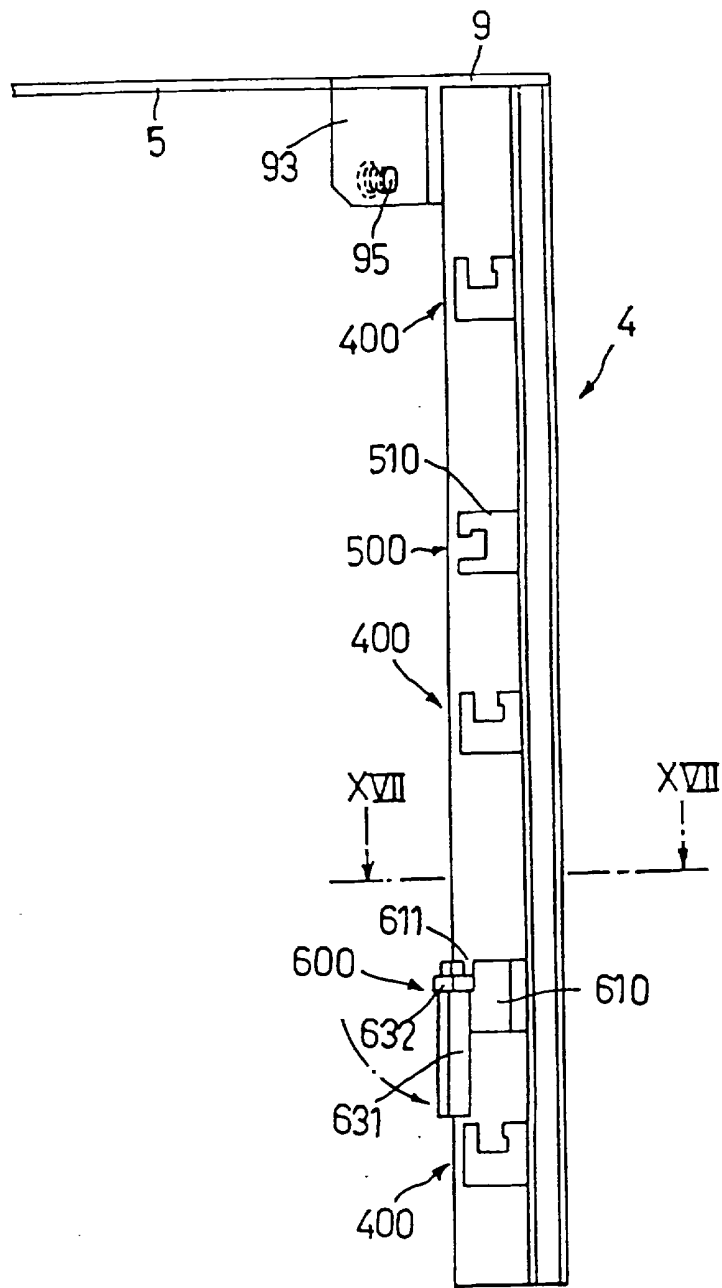


FIG.16

14/18

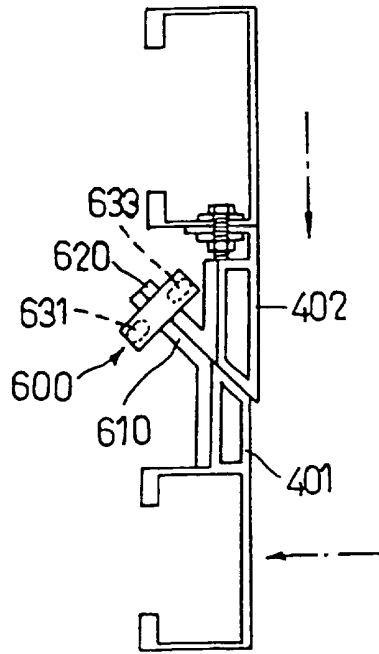


FIG. 17

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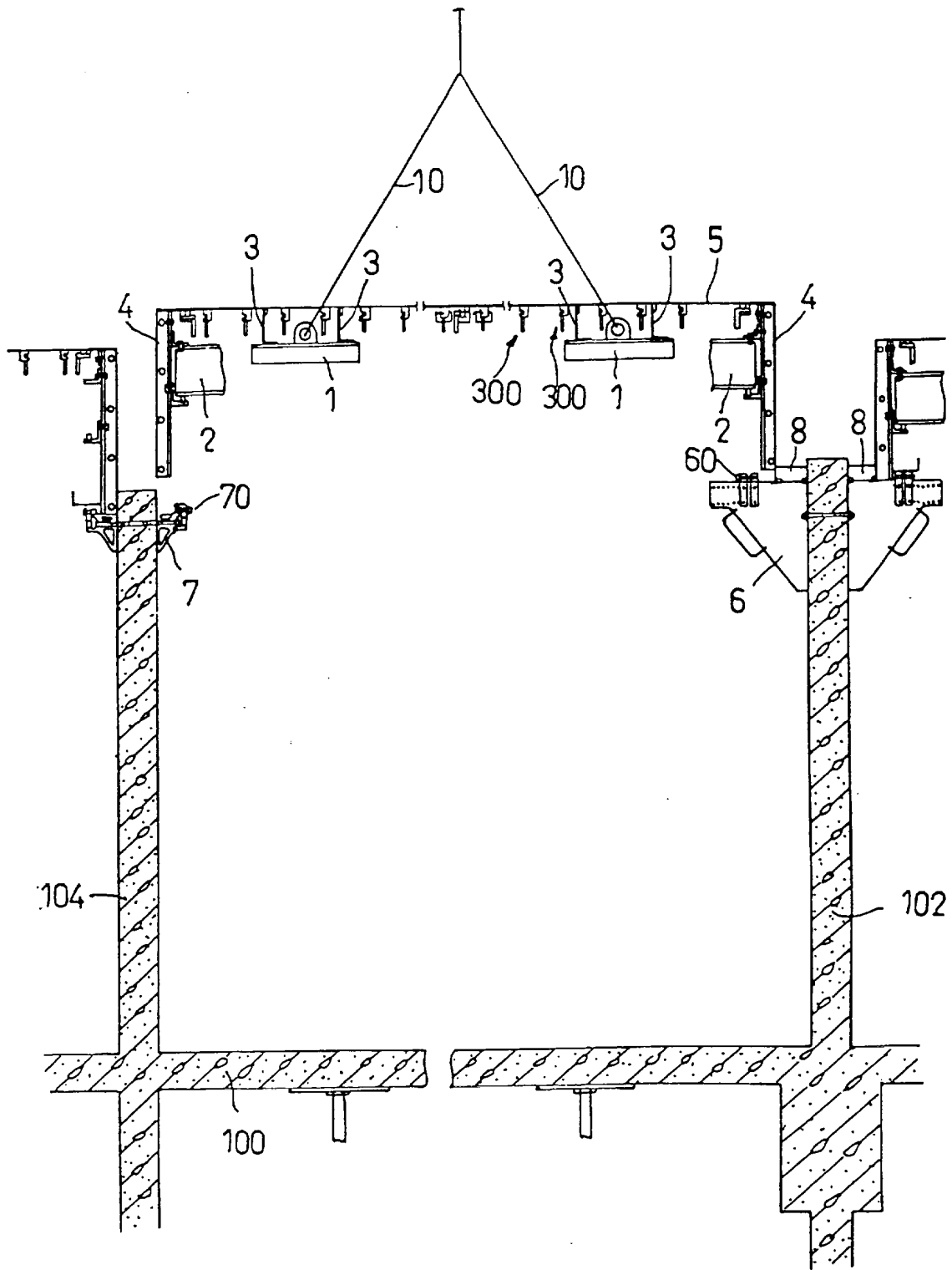


FIG.18

16/18

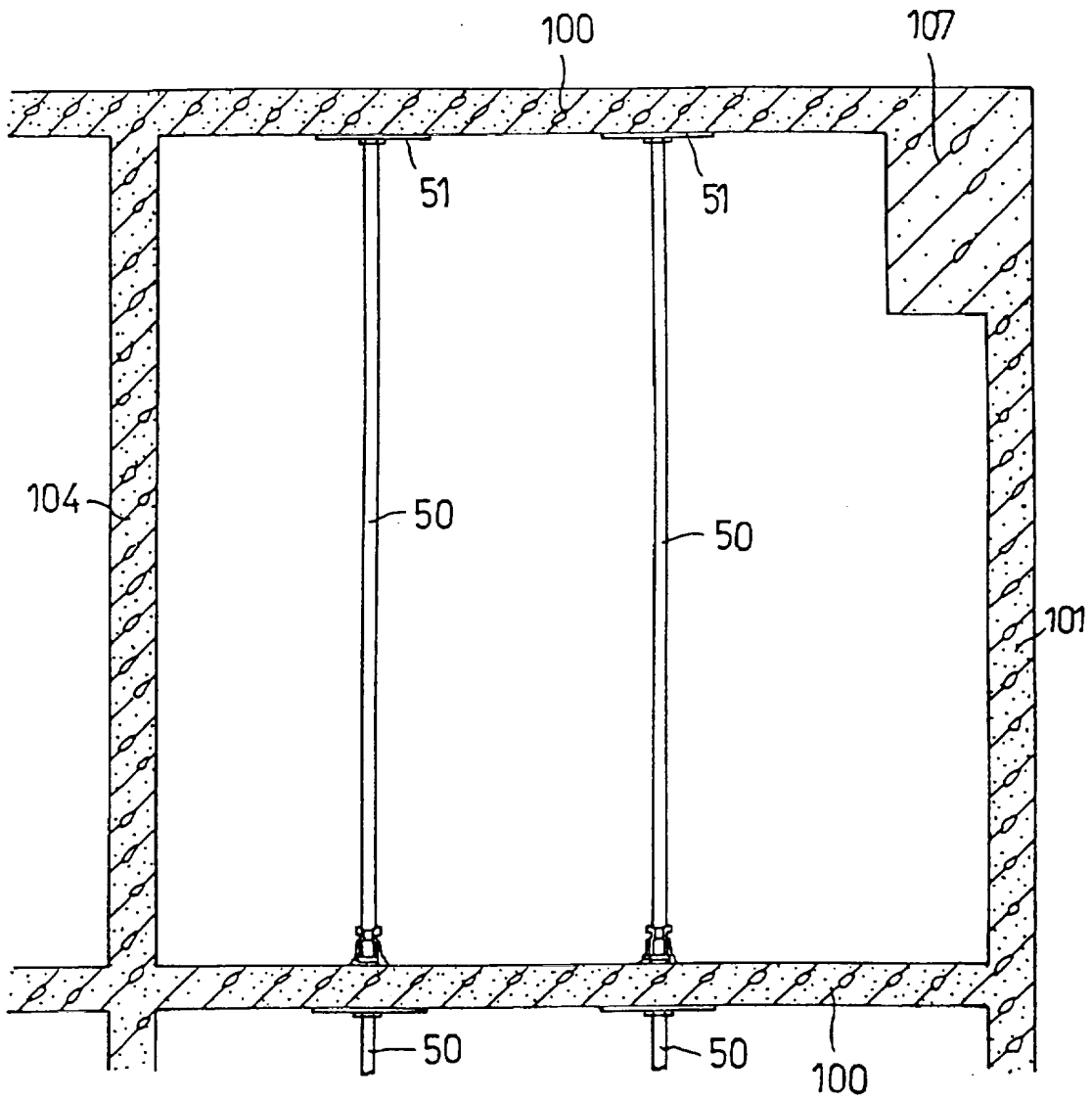


FIG. 19

17/18

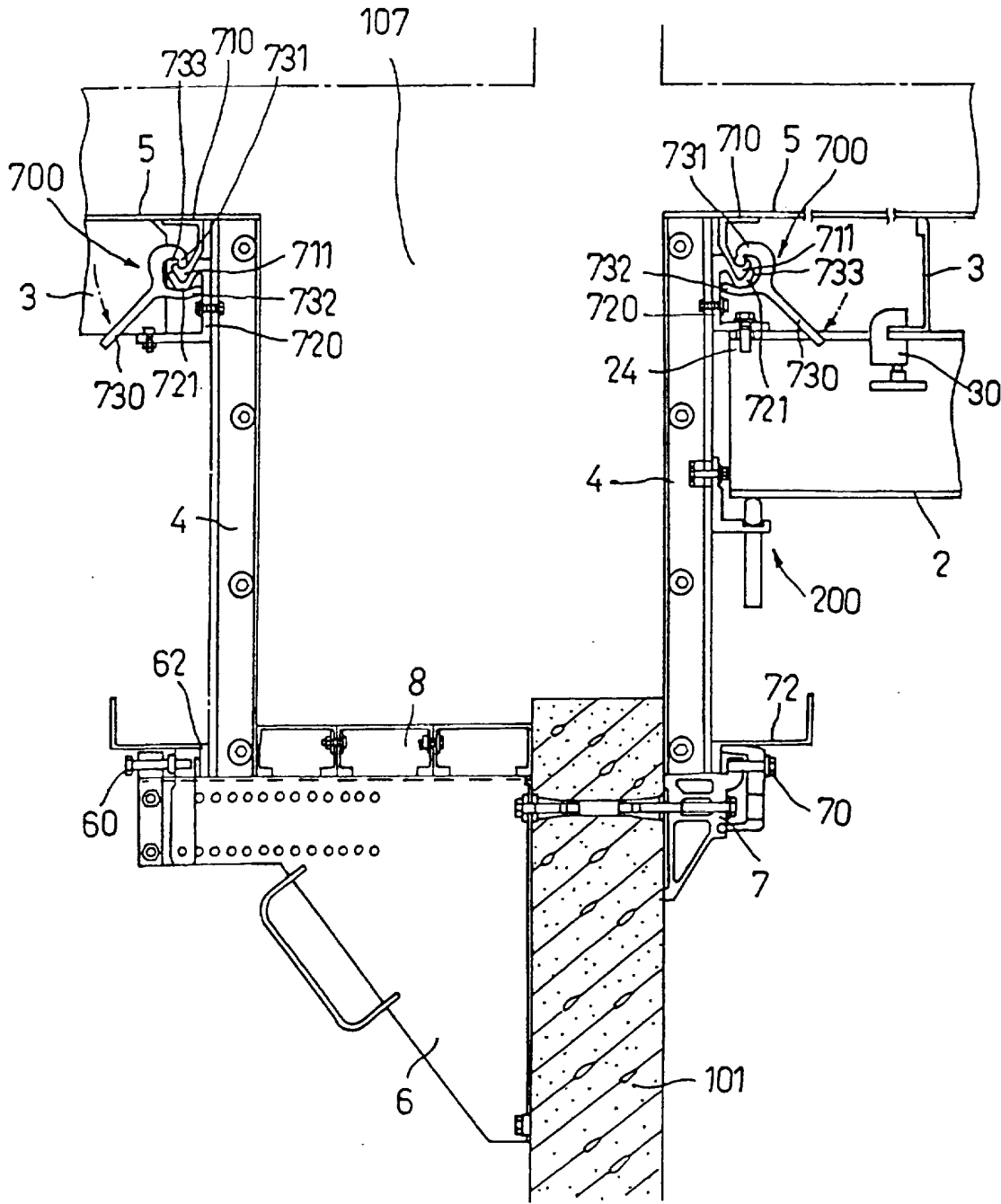


FIG. 20

189/18

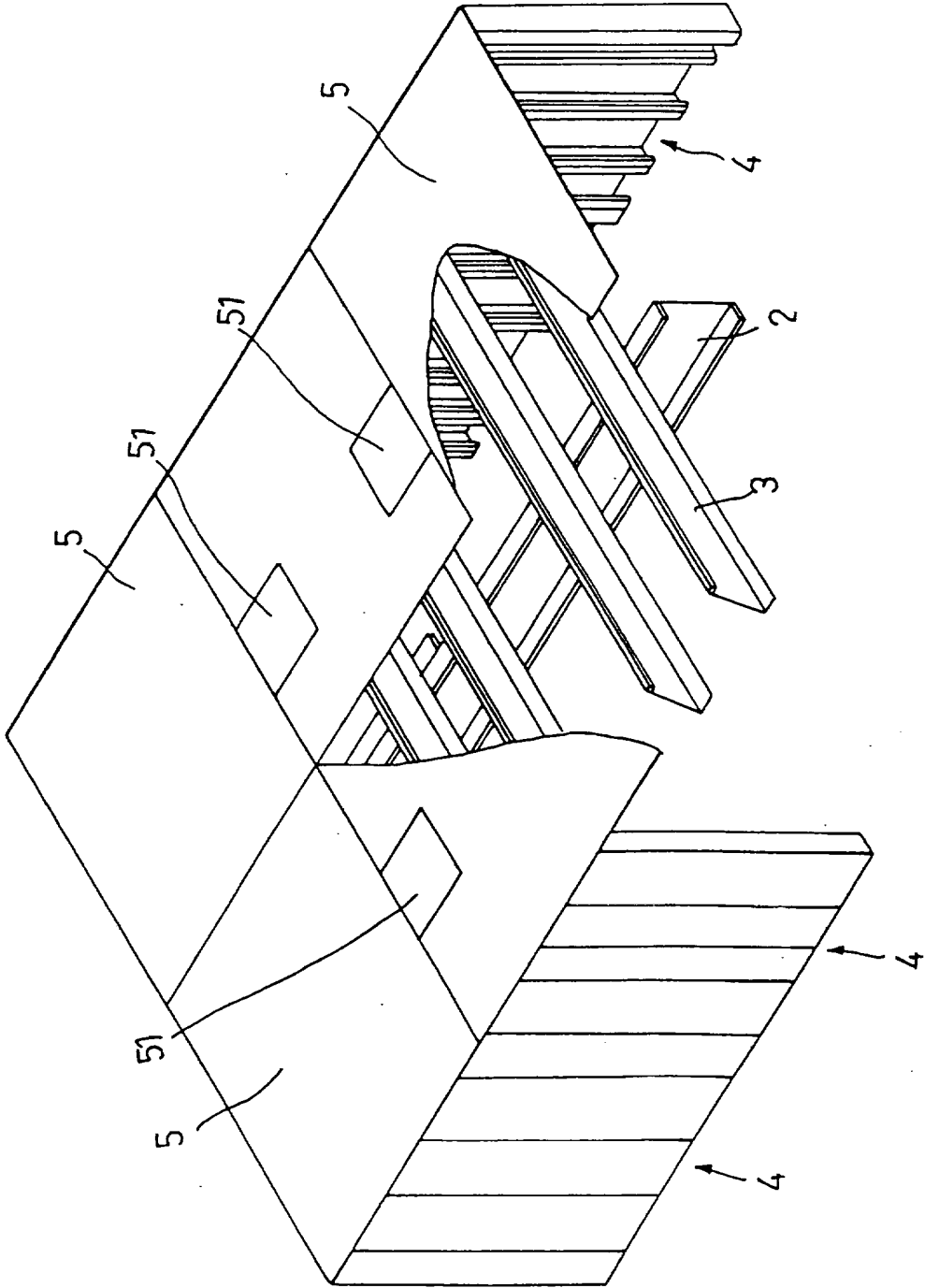


FIG. 21

**FASTENING APPARATUS
FOR USE WITH A FLOOR FORM ASSEMBLY**

The invention relates to a fastening apparatus for use
5 with a floor form assembly, more particularly to a modular
floor form assembly which is adapted for use in the
construction of a concrete floor of a structure that is
enclosed by surrounding walls.

Usually, when constructing concrete structures such as
10 houses and the like, a large amount of time and manpower is
wasted on the nailing of wooden panels to assemble mould
forms prior to pouring of the concrete and on the
dismantling of the mould forms when the concrete hardens.
The use of wooden panels as mould forms has become obsolete
15 in the construction of concrete buildings since recent
developments in the field of construction have resulted in
the development of reusable or modular steel forms which
permit fast and efficient construction of concrete
structures at a lower manpower requirement.

20 In a known method for constructing a concrete floor of
an upper storey of a structure having a lower storey
enclosed by surrounding walls that are formed with window
openings and that confine an internal space with an open
top, a floor form assembly is hoisted into the lower storey
25 of the structure through the open top. The floor form
assembly is then secured to a ground surface of the lower
storey, and concrete is poured on top of the floor form
assembly to form the concrete floor of the upper storey of
the structure. Since the surrounding walls are formed only
30 with window (or door) openings, the floor form assembly is
dismantled into small pieces which can be passed manually
through the various openings in the surrounding walls so as
to be assembled anew once the concrete has hardened. Thus,
there is always a need to improve the construction of the
35 floor form assembly and the apparatus used therewith to
facilitate installation and removal of the floor form

assembly so as to achieve faster and more efficient construction at a lower manpower requirement.

Therefore, the main object of the present invention is to provide a fastening apparatus which facilitates
5 connection and disconnection of two form units of a floor form assembly, such as a modular floor form assembly which is easy to install and dismantle and which is adapted for use in the construction of a concrete floor of a structure that is enclosed by surrounding walls.

10 According to the present invention, a fastening apparatus is adapted to interconnect removably two form units of a floor form assembly, and comprises:

a first connecting plate adapted to be secured to one of the form units and formed with a hook portion;

15 a second connecting plate adapted to be secured to the other one of the form units and formed with a hook portion that engages fittingly and removably said hook portion of said first connecting plate such that said hook portion of said first connecting plate is superimposed thereon; and

20 a clamping lever having a handle portion and a jaw portion formed on one end of said handle portion, said jaw portion including a hook-like jaw and a curved supporting jaw, said hook-like jaw and said supporting jaw confining a space therebetween, said hook-like jaw having a distal
25 end which forms a clearance with said supporting jaw, said clearance serving as an entry into said space and having a width equal to the combined thickness of said hook portions of said first and second connecting plates;

whereby, after said hook portion of said first
30 connecting plate is superimposed on said hook portion of said second connecting plate, distal ends of said hook portions can be inserted into said space confined by said jaws of said jaw portion of said clamping lever via said clearance, rotation of said clamping lever thereafter
35 causing said hook-like jaw and said supporting jaw to clamp said hook portions therebetween to achieve tight connection

between said first and second connecting plates and to interconnect securely and removably the form units.

A fastening apparatus in accordance with the present invention, for use with a floor form assembly, will now be described in more detail with reference to the accompanying drawings, in which:

Figure 1 is a top view which illustrates girders and supporting ribs of a first floor form assembly;

Figure 2 is a top view which illustrates horizontal form units and edge form units of the first floor form assembly;

Figure 3 is a side view of the first floor form assembly;

Figure 4 is another side view of the first floor form assembly;

Figure 5 is an enlarged view which illustrates the connection among mounting devices, vertical form units, girders and supporting ribs of the first floor form assembly;

Figure 6 is a perspective view of the first floor form assembly;

Figure 7 is a side view which illustrates a fastening seat of apparatus for interconnecting adjacent horizontal form units of the first floor form assembly;

Figure 8 is a side view which illustrates a fastening lever of the apparatus of Figure 7;

Figure 9 is a side view which illustrates a clamping unit of the apparatus of Figures 7 and 8;

Figure 10 is a side view which illustrates the connection between adjacent form plates of a horizontal form unit of the first floor form assembly;

Figure 11 is a sectional view of the first floor form assembly, taken along line XI-XI in Figure 10, which illustrates apparatus for interconnecting adjacent vertical form units of the first floor form assembly;

Figure 12 is a sectional view of the first floor form assembly, taken along line XII-XII in Figure 10, which

illustrates another apparatus for interconnecting adjacent vertical form units of the first floor form assembly;

Figure 13 is a sectional view of the first floor form assembly, taken along line XIII-XIII in Figure 10, which illustrates the connection between adjacent form plates of an edge form unit of the first floor form assembly;

Figure 14 is a sectional view of the first floor form assembly, taken along line XIV-XIV in Figure 10, which illustrates joining plates of a form contracting apparatus;

Figure 15 is a side view of an operating lever of the form contracting apparatus;

Figure 16 is a side view which illustrates the operation of the form contracting apparatus;

Figure 17 is a sectional view taken along line XVII-XVII in Figure 16, illustrating a form contracting operation of the form contracting apparatus;

Figure 18 illustrates how the first floor form assembly is hoisted into the top portion of a structure that is to be formed with a concrete floor;

Figure 19 illustrates how a newly constructed concrete floor is supported after the first floor form assembly has been dismantled;

Figure 20 is an enlarged view illustrating fastening apparatus according to the present invention when interconnecting vertical and horizontal form units of a second floor form assembly; and

Figure 21 is a perspective view of the second floor form assembly of Figure 20.

Referring to Figures 1 to 4, a first floor form assembly is shown to be used in the construction of a concrete floor of an upper storey of a structure which has a lower storey with a ground surface 100 (or floor). The lower storey is enclosed by

four surrounding walls 101, 102, 103, 104 that are formed with window and door openings and that confine a room with an open top. The surrounding walls 101, 102, 103, 104 may be provided with vertical pillars 105 and horizontal structural beams 106, 107.

The floor form assembly comprises girders 2, supporting ribs 3, vertical form units 4, horizontal form units 5, mounting devices 6, 7 secured to top portions of the surrounding walls 101, 102, 103, 104, and props 20 connected to bottom portions of the girders 2.

The girders 2 are elongated beams that are U-shaped in cross section. For a room that is 4 meters long, each of the girders 2 preferably has a length of 1.2 to 1.5 meters. Adjacent girders 2 are connected removably and longitudinally at their end portions by means of screw fasteners. The total length of interconnected girders 2 must be sufficient to enable the latter to extend fully along a lengthwise direction of the top portion of the room.

The supporting ribs 3 are elongated beams that are L-shaped in cross section. For a room that is 3 meters wide, each of the supporting ribs 3 preferably has a length of 1.6 to 2 meters. The supporting ribs 3 are connected removably to the girders 2. In this embodiment, the supporting ribs 3 are mounted removably

on the girders 2 by means of C-type clamps 30. The supporting ribs 3 extend transversely from opposite longitudinal sides of the girders 2 and are disposed spacedly on the girders 2 such that the supporting ribs 3 extend fully along a transverse direction of the top portion of the room.

Each of the vertical form units 4 includes a plurality of elongated form plates 40 that are equal in length and that are U-shaped in cross section. The form plates 40 are parallel to one another and are arranged side-by-side so that adjacent form plates 40 can be interconnected by means of screw fasteners. The form plates 40 may be selected to have different widths, ranging up to 20 cm, to obtain the desired width of the vertical form unit 4 that is required for the intended application. Some of the vertical form units 4 may include an angled form plate 40', which complements a corner portion of a vertical pillar 105, as shown in Figure 1. The vertical form units 4 are interconnected to form an enclosing frame that is inserted into the room via the open top of the latter so as to be disposed beside top portions of the surrounding walls 101, 102, 103, 104.

Each of the horizontal form units 5 includes a plate body with a specified size and strength. The horizontal form units 5 are arranged side-by-side on top of the

supporting ribs 3 and form a supporting surface for concrete. Some of the horizontal form units 5 are formed with rectangular holes at appropriate locations. Each of the rectangular holes is covered by a small cover plate 51. The bottom of each cover plate 51 is connected to a respective post 50.

The mounting devices 6, 7 are mounted spacedly and securely to top portions of the surrounding walls 101, 102, 103, 104 by means of bolts which engage sockets or holes formed in the surrounding walls 101, 102, 103, 104. Each of the mounting devices 6, 7 has a top portion with a horizontal support face for supporting one of the vertical form units 4 thereon. The mounting devices 6 further support a beam form unit 8 at locations where the horizontal structural beams 106, 107 are to be formed. The beam form unit 8 includes a plurality of elongated form plates that are arranged longitudinally and successively on the mounting devices 6. The beam form unit 8 has dimensions which correspond with those of the structural beam 106, 107 to be formed, and are disposed between bottom edges of the vertical form units 4 and one of the surrounding walls 101, 102, 103, 104 so as to form a concrete receiving space therewith.

Referring to Figure 5, an edge form unit 9 is installed on top ends of the vertical form units 4. The

edge form unit 9, which includes a plurality of elongated form plates that are T-shaped in cross section, has a flat top end that is flush with the horizontal form units 5 and that abuts tightly with the same. Adjacent form plates of the edge form unit 9 abut at their adjoining ends. As shown in Figure 2, the form plates of the edge form unit 9 have inclined ends 90 to facilitate installation. At corners of the edge form unit 9, a small rectangular plate 91 and/or an L-shaped plate 92 may be installed. An assembled view of the floor form assembly can be found in Figure 6.

As shown in Figure 5, the mounting devices 6, 7 are mounted respectively on opposite sides of the top portion of the surrounding wall 101. Screw fasteners 60, 70 secure positioning units 61, 71 onto the mounting devices 6, 7. The positioning units 61, 71 urge horizontal pressing strips 62, 72 toward the surrounding wall 101 in order to abut tightly against the bottom edge of the vertical form units 4 so as to position properly the latter and cause the beam form unit 8 to abut tightly against the surrounding wall 101. A plurality of angled mounting pieces 41 are secured by means of screw fasteners on the top end of the vertical form units 4 so that the vertical form units 4 can support the distal end portion of the

supporting ribs 3. Preferably, without affecting the load bearing capacity of the supporting ribs 3, the distal end portion of each of the supporting ribs 3 is formed with a downwardly inclining top edge 31 that forms a clearance to facilitate movement and slight rotation of the supporting ribs 3 during disassembly.

Two supporting apparatus 200 connect the vertical form units 4 to two ends of the interconnected girders 2. Each supporting apparatus 200 includes a stationary mounting seat 210 which is secured on one of the vertical form units 4 and which has a horizontal support portion 211 that extends parallel to the girders 2 and that is formed with a shallow positioning notch 212, and an L-shaped operating lever 220 with a handle portion and a carrying portion 221 that extends transversely from one end of the handle portion. The carrying portion 221 has a generally rectangular cross section with rounded corners, opposite longer sides 2210 and opposite shorter sides 2211 that adjoin the longer sides 2210. Preferably, the longer and shorter sides 2210, 2211 of the carrying portion 221 form a predetermined height difference, such as about 2 cm. The carrying portion 221 is to be disposed between the support portion 211 of the mounting seat 210 and the interconnected girders 2 so that, when the longer sides 2210 are disposed uprightly, one of the shorter sides

2211 of the carrying portion 221 can be received in the positioning notch 212 of the support portion 211, while the other one of the shorter sides 2211 supports one of the distal end portions of the interconnected girders 2 on the mounting seat 210. When the operating lever 220 is turned by a 90° angle such that the longer sides 2210 are disposed horizontally, one of the longer sides 2210 supports the interconnected girders 2 on the mounting seat 210, thereby causing slight downward movement of the latter. From the foregoing, it can be understood that the operating lever 220 is operated so that a selected one of the longer and shorter sides 2210, 2211 of the carrying portion 221 abuts the interconnected girders 2, thereby resulting in a slight vertical movement of the girders 2 to facilitate dismantling of the floor form assembly.

The distal end portions of the interconnected girders 2 are formed with a through hole 21 on a top end. The vertical form units 4 which are adjacent to the distal end portions of the interconnected girders 2 have a respective mounting piece 22 secured thereon. The mounting piece 22 has a lower end with a horizontal extension 23 that extends parallel to the girders 2. A locking pin 24 extends threadedly through the horizontal extension 23 and has a length sufficient so as to extend through the through hole 21 in one of the

distal end portions of the interconnected girders 2 to prevent lateral movement of the latter. The locking pin 24, however, permits slight vertical movement of the girders 2 when the operating lever 220 of the supporting apparatus 200 is turned.

5

A plurality of fastening apparatus 300 are employed to interconnect removably adjacent ones of the horizontal form units 5, the cover plates 51 and the form plates of the edge form unit 9. Each fastening apparatus 300 includes two fastening seats 310 disposed respectively on two sides of the mating edges of an adjacent pair of the horizontal form units 5, the cover plates 51 and the form plates of the edge form unit 9. As shown in Figure 7, each of the fastening seats 310 is formed as a rectangular block with a top side that is welded on the bottom face of a respective one of the horizontal form units 5, the cover plates 51 and the form plates of the edge form unit 9. The fastening seat 310 is formed with a rectangular hole 311 and a notch 312 located on a longer side of the rectangular hole 311 and extending to the rectangular hole 311 to serve as an entry into the latter. The notch 312 should be shorter than the rectangular hole 311. Each fastening apparatus 300 further includes an L-shaped fastening lever 320. As shown in Figure 8, the fastening lever 320 has a handle portion and a fastening portion 321

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that extends transversely from one end of the handle portion. The fastening portion 321 has a generally rectangular cross section with rounded corners and corresponds in size with the rectangular holes 311 in the fastening seats 310. The fastening portion 321, however, should be thinner than the length of the notches 312 to permit insertion or removal of the fastening portion 310 from the rectangular holes 311. The fastening portion 321 has a distal end section 322 which is opposite to the handle portion and which extends in a same direction of the handle portion. The distal end section 322 is displaced from the handle portion by a distance equal to the combined thickness of the fastening seats 310.

When the fastening apparatus 300 is used to connect removably two adjacent horizontal form units 5, the horizontal form units 5 are initially arranged side-by-side on the supporting ribs 3 such that the notches 312 of two fastening seats 310 disposed respectively on two sides of the mating edges of the horizontal form units 5 are fully aligned with one another. The fastening lever 320 is initially placed in a horizontal position. That is, the handle portion is disposed horizontally so that the longer sides of the fastening portion 321 are parallel to the horizontal form units 5 to permit partial extension of the fastening portion 321 into the

rectangular holes 311 of the fastening seats 310 via the aligned notches 312. The fastening lever 320 is then turned by a 90° angle such that the fastening portion 321 extend fully into the rectangular holes 311 to connect the fastening seats 310. The fastening seats 310 are clamped between the distal end section 322 of the fastening portion 321 and the handle portion of the fastening lever 320 to prevent movement of the fastening seats 310 along the fastening portion 321 when the fastening portion 321 extends fully into the rectangular holes 311 of the fastening seats 310.

Each fastening apparatus 300 may further include a clamping unit 330, as shown in Figure 5. Referring to Figure 9, the clamping unit 330 includes a generally U-shaped clamping block that is formed with a recess 331 for receiving the fastening seats 310 therein such that the latter are clamped by the clamping block. One side of the clamping block is formed with two screw holes 332 (only one is shown) that extend to the recess 331. Screws 333 extend threadedly through the screw holes 332 and are extendible through the notch 312 of a respective one of the fastening seats 310. After the fastening portion 321 of the fastening lever 320 has been extended fully into the rectangular holes 311 of the fastening seats 310, the clamping unit 330 is installed such that the fastening seats 310 are clamped

by the clamping block. The screws 333 are then extended through the notches 312 of the fastening seats 310 so as to abut tightly against the fastening portion 321 of the fastening lever 320, thereby preventing undesired rotation of the fastening lever 320 to ensure stable connection of the adjacent horizontal form units 5. From the foregoing, it can be understood that the fastening apparatus 300 can be easily operated to interconnect adjacent ones of the horizontal form units 5, the cover plates 51 and the form plates of the edge form unit 9, thereby facilitating dismantling of the floor form assembly. Installation of the clamping unit 330 ensures stable connection to prevent untimely disassembly of the floor form assembly due to the presence of external lateral forces.

Referring to Figure 10, a plurality of fastening apparatus 400 are employed to interconnect removably adjacent ones of the vertical form units 4. Each fastening apparatus 400 includes two fastening blocks 410, 410' disposed respectively on two sides of the mating edges of an adjacent pair of vertical form units 4, and an L-shaped fastening lever 420. Referring to Figure 11, each of the vertical form units 4 has a connecting plate 401, 402. The connecting plates 401, 402 have inclined mating edges similar to the inclined ends 90 of the form plates of the edge form unit 9 to

facilitate installation. The connecting plates 401, 402 have a rear side formed with a respective one of the fastening blocks 410, 410'. The fastening blocks 410, 410' have complementary adjoining sides and are trapezoidal in shape when viewed from above. The fastening blocks 410, 410' are formed with aligned rectangular holes 411 and notches 412 located on one side of the rectangular holes 411 and extending to the rectangular holes 411 to serve as an entry for the latter. Thus, the fastening blocks 410, 410' have cross sections substantially similar to that of the fastening seats 310 described beforehand. In the fastening blocks 410, 410', however, the vertical length of the rectangular hole 411 is shorter than the horizontal length of the same. The fastening lever 420 has a handle portion and a fastening portion 421 that extends transversely from one end of the handle portion. The fastening portion 421 has a generally rectangular cross section with rounded corners and corresponds in size with the rectangular holes 411 of the fastening blocks 410, 410'. The fastening portion 421 is thinner than the length of the notches 412 of the fastening blocks 410, 410'.

In order for the fastening lever 420 to interconnect the fastening blocks 410, 410', the fastening portion 421 of the fastening lever 420 is inserted partially

into the rectangular holes 411 via the notches 412 of the fastening blocks 410, 410'. The fastening lever 420 is then turned by a 90° angle such that the fastening portion 421 extends fully into the rectangular holes 411 to connect the fastening blocks 410, 410', thereby firmly connecting the connecting plates 401, 402.

Referring again to Figure 10, a plurality of fastening apparatus 500, which are similar to the fastening apparatus 400 in construction, may be used to interconnect the upper portions of the connecting plates 401, 402. As shown in Figure 12, each fastening apparatus 500 includes two fastening blocks 510, 510' formed respectively on the connecting plates 401, 402 and having a rectangular hole 511 and a notch 512 that serves as an entry for the rectangular hole 511. Unlike the rectangular holes 411 formed in the fastening blocks 410, 410', the vertical length of the rectangular hole 511 is longer than the horizontal length of the same. A fastening lever 520 has a handle portion and a fastening portion 521 that extends transversely from the handle portion. In order for the fastening lever 520 to interconnect the fastening blocks 510, 510', the fastening portion 521 of the fastening lever 520 is inserted partially into the rectangular holes 511 via the notches 512 of the fastening blocks 510, 510'. The fastening lever 520 is

then turned by a 90° angle such that the fastening portion 521 extends fully into the rectangular holes 511 to connect the fastening blocks 510, 510', thereby firmly connecting upper portions of the connecting plates 401, 402. The fastening apparatus 500 ensure that the top ends of the connecting plates 401, 402 remain flush so that the edge form unit 9 can be positioned properly thereon.

Referring to Figures 10 and 13, the inclined ends 90 of adjacent form plates of the edge form unit 9 have a pair of connecting plates 93, 94 secured thereon. The connecting plate 93 is formed with a screw hole 931, while the connecting plate 94 is formed with a through hole 941 that is aligned with the screw hole 931. A screw 95 extends through the through hole 941 and engages the screw hole 931, thereby interconnecting the adjacent form plates of the edge form unit 9. In addition, a form contracting apparatus 600 is provided on a lower portion of an adjacent pair of the vertical form units 4.

Referring to Figure 14, the form contracting apparatus 600 includes a pair of joining plates 610, 620 that extend rearwardly and inclinedly from the inclined mating edges of the connecting plates 401, 402. Preferably, the joining plates 610, 620 extend at the same angle as that of the mating edges of the

connecting plates 401, 402 and are in sliding contact with each other. The joining plates 610, 620 are formed with rectangular notches 611, 621 that have equal widths. When the flat surfaces of the connecting plates 401, 402 are flush with one another, the rectangular notches 611, 621 are only partially aligned.

Referring to Figure 15, the form contracting apparatus 600 further includes an L-shaped operating lever 630. The operating lever 630 has a handle portion 631 and a fastening portion 632 which extends transversely by a 90° angle from the handle portion 631. The fastening portion 632 has a distal end section 633 which is opposite to the handle portion 631 and which extends in a same direction as the handle portion 631. The fastening portion 632 has a generally rectangular cross section with longer and shorter sides that form a predetermined height difference. The shorter sides of the fastening portion 632 have a length which is sufficient to permit insertion of the fastening portion 632 into the rectangular notches 611, 621 of the joining plates 610, 620 when the latter are not partially aligned. The longer sides of the fastening portion 632 have a length equal to the width of the rectangular notches 611, 621. The distal end section 633 is displaced from the handle portion 631 by a distance equal to the combined thickness of the

joining plates 610, 620. Thus, the fastening portion
632 can be extended into the rectangular notches 611,
621, and the operating lever 630 can be used to clamp
tightly the joining plates 610, 620 to prevent untimely
5 disengagement of the same.

The form contracting apparatus 600 permits the
formation of a predetermined clearance between the flat
surfaces of the connecting plates 401, 402. As shown in
Figure 16, before the fastening apparatus 400, 500 are
10 installed to fasten together two adjacent vertical form
units 4, the screw 95 on the connecting plates 93, 94
of adjacent form plates of the edge form unit 9 is
initially loosened so that the top portions of the
connecting plates 401, 402 form a movable connection.
15 The fastening portion 632 of the operating lever 630 is
then extended through the rectangular notches 611, 621
such that one of the shorter sides of the fastening
portion 632 rests on the bottom of the rectangular
notches 611, 621 while the rectangular notches are
20 partially aligned. At this time, the handle portion 631
of the operating lever 630 is disposed horizontally,
and the front surfaces of the connecting plates 401,
402 are flush with one another. When the handle portion
631 is turned downwardly by a 90° angle, one of the
25 longer sides of the fastening portion 632 rests on the
bottom of the rectangular notches 611, 621 to align

fully the latter. At this time, the front surfaces of the connecting plates 401, 402 form a clearance therebetween, as shown in Figure 17. The connecting plate 401 pivots about the screw 95 such that slight rearward movement of the bottom portion of the same occurs. Because the mating edges of the connecting plates 401, 402 are inclined, slight rearward movement of the connecting plate 401 will result in slight lateral movement of the connecting plate 402. This illustrates how contraction of the entire bottom portion of the enclosing frame that is formed by the vertical form units 4 can be achieved. Although the degree of contraction is small, the contraction of the bottom portion of the enclosing frame facilitates hoisting of the floor form assembly into the room that is confined by the surrounding walls 101, 102, 103, 104 via the open top of the room. After the floor form assembly has been installed on the top portion of the surrounding walls 101, 102, 103, 104, the operating lever 630 is removed, and the fastening apparatus 400, 500 are installed, as shown in Figure 10. The front surfaces of the connecting plates 401, 402 are flush with each other at this time.

When using the floor form assembly in the construction of a concrete floor of an upper storey of a structure, the mounting devices 6, 7 are initially

secured on the top portions of the surrounding walls 101, 102, 103, 104 of the structure. The girders 2, the supporting ribs 3, the vertical form units 4, the horizontal form units 5 and the edge form unit 9 are then assembled to form a rectangular cover-like member, as shown in Figure 6. The cover plates 51 are not yet installed at this time, and the supporting ribs 3 are disposed on carrying units 1, as shown in Figure 18. After the beam form unit 8 has been provided on the mounting devices 6, the assembly of the girders 2, supporting ribs 3, vertical form units 4, horizontal form units 5 and edge form unit 9 is hoisted into the room so as to be supported on the mounting devices 6, 7 through the use of cables 10 which extend through the rectangular holes in the horizontal form units 5 that have yet to be covered by the cover plates 51 and which are hooked to the carrying units 1. After the vertical form units 4 have been positioned on the mounting devices 6, 7, the screw fasteners 60, 70 on the mounting devices 6, 7 are tightened to retain the floor form assembly on the top portion of the surrounding walls 101, 102, 103, 104. The carrying units 1 are then removed, and the cover plates 51 are positioned below the horizontal form units 5 to cover the rectangular holes in the latter. The fastening apparatus 300, 400, 500 are then installed to connect removably the

different components of the floor form assembly, as shown in Figures 3 and 4. The props 20 are installed to support the girders 2 for bearing the weight of concrete, and the cover plates 51 are supported on the posts 50. Reinforcing steel bars for the floor that is to be constructed may be placed on top of the floor form assembly. Finally, concrete is poured on the floor form assembly to construct the floor 100 of the upper storey and the horizontal structural beams 106, 107.

After concrete has been poured on the floor form assembly, the concrete is left to dry for a period of time so as to harden the same. Once the concrete has hardened to possess sufficient strength, the props 20 are dismantled, and the girders 2, the supporting ribs 3, the vertical form units 4, the horizontal form units 5, the beam form unit 8, the edge form unit 9, and the mounting devices 6, 7 are removed one at a time. As shown in Figure 19, the cover plates 51 and the posts 50 remain to support the newly constructed floor 100 for a longer period of time to avoid any adverse effect to the floor 100 due to quick removal of the floor form assembly. Since the girders 2, the supporting ribs 3, the vertical form units 4, the horizontal form units 5, the beam form unit 8, the edge form unit 9, and the mounting devices 6, 7 can be dismantled at an earlier time, they can be moved to a new location for

reassembly in preparation for the construction of the floor of an upper storey of the structure. The turnover of use of the different components of the floor form assembly can be increased to result in a shorter construction time and in increased construction efficiency.

After the props 20 have been removed when dismantling the floor form assembly, the C-shaped clamps 30 are then removed to disconnect the girders 2 and the supporting ribs 3. The operating levers 220 of the supporting apparatus 200 are then actuated, such that the handle portions of the operating levers 220 are substantially horizontal, in order to cause slight downward movement of the girders 2. This results in the formation of a vertical clearance between the supporting ribs 3 and the horizontal form units 5 to facilitate removal of the supporting ribs 3. As mentioned beforehand, the distal end portion of each of the supporting ribs 3 is formed with a downwardly inclining top edge 31 to facilitate movement and slight rotation of the supporting ribs 3 during disassembly.

The vertical form units 4, the horizontal form units 5 and the form plates of the edge form unit 9 can be easily disassembled after the levers 320, 420, 520 of the fastening apparatus 300, 400, 500 have been operated. By loosening all screw fasteners that are

present, the floor form assembly and the mounting units
6, 7 thereof can be dismantled into a number of smaller
pieces. In order to

5 facilitate transport of the floor form assembly to the
outside of the room after the floor 100 has been
formed, not only should the connection among the
different components be simple and secure, the
different components of the floor form assembly should
10 have an appropriate size and weight to permit carrying
and moving of the same outdoors via window and door
openings that are formed in the surrounding walls 101,
102, 103, 104. Preferably, the different components of
the floor form assembly should be made of a material
15 that is lightweight and that has sufficient structural
strength, such as aluminum alloy. In this embodiment,
the weight of each component should range from 20 to 40
kilos to permit carrying of the same manually. The
floor form assembly is modular so that it can be
20 configured to suit the shape of the room. In addition,
the floor form assembly can be easily assembled and
quickly disassembled, thereby resulting in increased
economic benefits when applied in the construction of
buildings.

As shown in Figures 5 and 6, the form plates of the
25 edge form unit 9 are installed around the horizontal
form units 5. Since the form plates of the edge form

unit 9 are T-shaped in cross section, the bottom ends thereof can be easily secured to the vertical form units 4 by means of screw fasteners in order to ensure tight contact with the horizontal form units 5.

5 Figures 20 and 21 illustrate fastening apparatus 700 according to the present invention. As shown, the floor form assembly does not include an edge form unit, and the horizontal form units 5 are secured directly to the vertical form units 4 by means of fastening apparatus 700. Each
10 fastening apparatus 700 includes first and second connecting plates 710, 720 and a clamping lever 730.

The first connecting plate 710 is an elongated plate that is welded to the periphery of one of the horizontal form units 5 at a bottom side of the latter.
15 The first connecting plate 710 is formed with a downwardly extending hook portion 711.

The second connecting plate 720 is an elongated plate that is secured to the rear side of one of the vertical form units 4 at a top portion of the latter.
20 The second connecting plate 720 is formed with a hook portion 721 that engages fittingly and removably the hook portion 711 such that the latter is superimposed thereon.

25 The clamping lever 730 has a handle portion with a jaw portion formed on a front end. The jaw portion

includes a hook-like jaw 731 and a curved supporting jaw 732. The jaws 731, 732 confine a space 733 therebetween. The jaw 731 has a distal end which forms a clearance with the jaw 732 that serves as an entry
5 into the space 733 and that has a width which is equal to the combined thickness of the hook portions 711, 721. As shown in Figure 20, when the clamping lever 730 inclines at an angle of about 45°, the jaws 731, 732 clamp the hook portions 711, 721 therebetween to
10 interconnect the first and second connecting plates 710, 720.

The purpose of the fastening apparatus 700 is to connect the horizontal form units 5 to the vertical form units 4. When connecting one of the horizontal
15 form units 5 to one of the vertical form units 4, the hook portion 711 of the first connecting plate 710 is superimposed on the hook portion 721 of the second connecting plate 720, and the distal ends of the hook portions 711, 721 are inserted into the space 733
20 confined by the jaws 731, 732 of the clamping lever 730 via the clearance formed between the jaws 731, 732. When the clamping lever 730 is rotated, the jaws 731, 732 clamp the hook portions 711, 721 therebetween to achieve tight connection between the first and second
25 connecting plates 710, 720 to interconnect securely the vertical form unit 4 and the horizontal form unit 5.

When disassembling the floor form assembly, the clamping lever 730 is rotated in the opposite direction to permit removal of the same from the first and second connecting plates 710, 720. The horizontal form unit 5 can be removed from the vertical form unit 4 at this time. A perspective view of the second floor form assembly, which does not incorporate an edge form unit, is shown in Figure 21. Like the first floor form assembly, the second floor form assembly is similarly hoisted into a room when forming the floor of an upper storey of a building structure.

CLAIMS

1. A fastening apparatus adapted to interconnect
removably two form units of a floor form assembly,
5 comprising:

a first connecting plate adapted to be secured to one
of the form units and formed with a hook portion;

a second connecting plate adapted to be secured to the
other one of the form units and formed with a hook portion
10 that engages fittingly and removably said hook portion of
said first connecting plate such that said hook portion of
said first connecting plate is superimposed thereon; and

a clamping lever having a handle portion and a jaw
portion formed on one end of said handle portion, said jaw
15 portion including a hook-like jaw and a curved supporting
jaw, said hook-like jaw and said supporting jaw confining
a space therebetween, said hook-like jaw having a distal
end which forms a clearance with said supporting jaw, said
clearance serving as an entry into said space and having a
20 width equal to the combined thickness of said hook portions
of said first and second connecting plates;

whereby, after said hook portion of said first
connecting plate is superimposed on said hook portion of
said second connecting plate, distal ends of said hook
25 portions can be inserted into said space confined by said
jaws of said jaw portion of said clamping lever via said
clearance, rotation of said clamping lever thereafter
causing said hook-like jaw and said supporting jaw to
clamp said hook portions therebetween to achieve tight
30 connection between said first and second connecting plates
and to interconnect securely and removably the form units.



Application No: GB 9912310.1
Claims searched: 1

Examiner: P. Gardiner
Date of search: 28 June 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.Q): E1S: SSG
Int Cl (Ed.6): E04G
Other: Online: EPODOC, WPI, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 938939 COHEN (e.g. Fig's. 1-3)	
A	GB 428398 HOFFMAN (e.g. Fig.3)	
A	US 5582388 BAXTER (e.g. Fig.9 part 120)	
A	US 5080321 WESTERN FORMS INC. (e.g. Fig.4)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.