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(54) A casting form system consisting of modular members for the construction of buildings, storey by storey.

(57) A casting form system formed by modular members for the construction of buildings, storey by storey, each story comprising curtain walls (1, 2, 4 and 5), embodying pillars (16) and horizontal carrying beams (23), made of reinforced concrete, casted on the place, and floors (26) made by prefabricated elements (26A), said form system comprising decomposable forms (7, 7A) for the construction of the portions of the peripheral walls (2) which define, at least at one of their ends, an opening (3) for a window or a window-door and which is covered by a prefabricated window lintel member (11), and decomposable forms (12) for the casting of intermediate main walls (1), of the peripheral walls (4) without any opening, and of the peripheral walls (5) provided with doors (6), said forms (7, 7A) and (12) respectively having supporting members (19 and 46 respectively) carrying upper inverted U-shaped metal sections (37 and 47 respectively), designed to temporarily support the carrying beams (23) as well as prefabricated floor members (26A) for obtaining each floor (26) until the dismantly thereof, while all the other components (7, 7A and 17) of the form system are disassembled.

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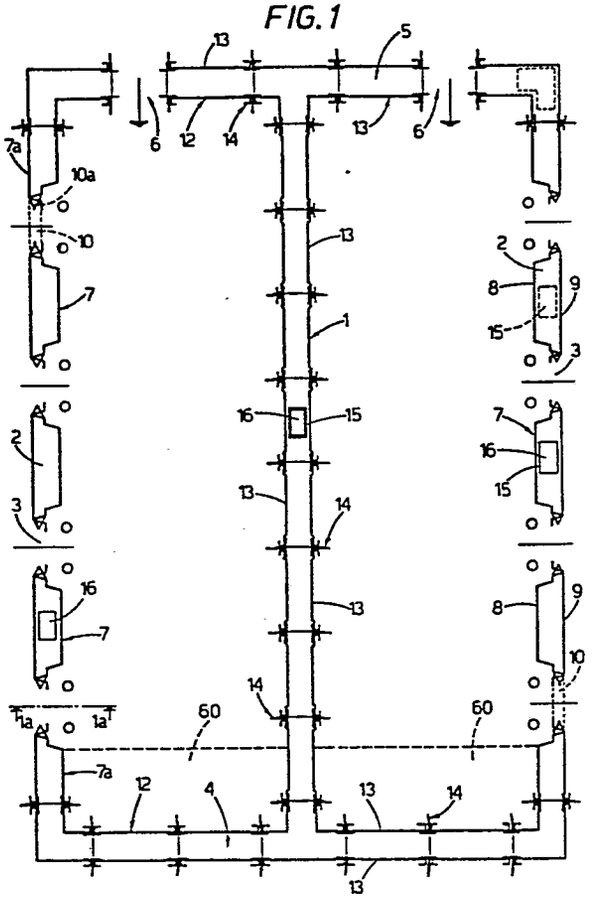
FIG. 1


13
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7a
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2
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7a
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A CASTING FORM SYSTEM CONSISTING OF MODULAR MEMBERS FOR THE CONSTRUCTION OF BUILDINGS, STOREY BY STOREY

DESCRIPTION

The present invention relates to a casting form system comprising modular elements, system which permits to carry out a non-conventional system of construction of multi-stored buildings for civil houses, in which the stories of each building will be constructed, storey by storey, and wherein each storey comprises curtain walls embodying reinforced concrete pillars, while the floors are made by the use of prefabricated elements and will be constructed only after that all the walls embodying the pillars have been completed, i.e. at the same time in which takes place the casting of the concrete for the construction of the horizontal carrying beams and of the floor slabs.

Therefore the casting form system of this invention

enables to carry out a non-conventional construction method, according to which a building is constructed, storey by storey, in such a way that in each storey the pillars are constructed according to the conventional technics and with standard mixes, while the curtain walls and the inner main walls are constructed on the place by means of special thermo-insulating and/or sound proofing, lightweight materials, said walls embodying the pillars which are integrally embedded therein.

Several construction methods are already known for the construction of multi-stored buildings by the use of modular structural elements, which are, in part prefabricated, and in part constructed on the place. Some of said construction methods provide to construct, first of all, the carrying skeleton of the building which includes the pillars, the floors and the curb beams, and in which the rooms are defined by peripheral and partition walls consisting of prefabricated panels or elements which have only the function of curtain walls for the thermo-and sound-insulation of said rooms, these latter walls being obtained after the construction of said carrying skeleton of the building already completed by all its floors.

According to other constructive methods the peripheral walls, and, in general, at least an inner longitudinal main wall consist of carrying walls and are totally or

partially prefabricated, or they are constructed according to the standard construction technics, but also intermediate pillars can be provided, when required. The floors can be also constructed at least partially by means of prefabricated floor elements. All the construction methods known up to the date have the inconveniences that they are very expensive and that they require a complicate equipment for the hoisting and the transport of materials and apparatus, thus requiring very high running costs and also a large skilled labor.

The present invention relates to a construction method which is very simple to be carried out and which requires workers of a modest skill and the use of a simple equipment which includes at least a crane or the like, at least an apparatus for the hoisting and the distribution of the concrete or other mixes, necessary for the construction of the pillars, the beams or girders the slabs and the curtain walls, since the building will be constructed, storey by storey, so that before the construction of the floors and of the curb beams of each storey, the work can be carried out entirely in the open. Therefore the crane or cranes can be used also for the transport and for co-operating in the assembly of all the form members as well as of other required equipments and devices.

The casting form system of the present invention

comprises:

first modular forms for the construction of the portions of the peripheral walls comprised between two windows and/or window-doors; second modular forms for the construction of inner main walls or of the peripheral walls without windows or provided only with doors, said first and second modular forms also including or co-operating with support means which are or can be separated from the modular members of the first and second modular casting forms and which are designed to support the floors and the horizontal carrying beams during their casting and setting and which remain in their operative position until the hardening of the concrete or the like, while the other components of said casting forms are disassembled and removed just after the first phase of the setting of the concrete or the like. For the casting of the pillars made of standard concrete can be used box-like tubular probe-like forms of an extractable type, or special forms designed to be left in the place.

As has been aforementioned, the casting form system of this invention enables to carry out a non-conventional construction method, according to which the pillars are at least partially embedded into the curtain walls and are constructed at the same time as these walls. Further said curtain walls are not constructed by means of prefabricated blocks or panels, but, on the contrary, they are casted on the place so as to be integraly connected to the pillars, by employing a

lightweight, thermo-insulating and soundproofing mix. For such a purpose could be utilized, for istance, the mixture, which is the object of the Italian Patent Application No. 50086-A/80 filed on November 5, 1980 of the same Applicant, said mixture including cement, foamed clay, ground tuff or the like and vermiculite. This mixture has been proved to be very adapted for such a purpose, since it permits to construct lightweight curtain walls, which also prevent any backwater towards the inner surfaces which are permeable to the steam. By the use of such a special mixture the building which will be constructed, using the casting form system of this invention, present remarkable advantages as compared with any other building which has been constructed using the conventional construction methods. The construction method of this invention, inter alias, presents facility, rapidity and accuracy of execution and can be carried out by workers also little skilled in the art. Further the casting forms, by means, of which said method is carried out, can be used for the construction of each storey of a building and also can be used again for the construction of other buildings, since they can be quickly and easily adapted to building projects of different types of houses for civil use, either of intensive or semi-intensive character.

It is to be pointed out that in the construction method, which can be performed by means of the casting form system of this invention, the pillars which are

placed in the peripheral walls and which are more exposed to the changes of the climatic conditions are perfectly insulated from the atmosphere on the thermic point of view, because they are entirely embedded into the mixture which is used for obtaining the curtain walls, thus making said carrying structures extremely protected against any steam imbibition, thus, more in particular, preventing any rusting of the reinforcing irons thereof. In such a way the advantage is attained that a building can be costructed which has a total resistance to the static and dynamic stresses which is clearly higher than that of the buildings constructed according to the conventional methods or of those which are constructed according to the methods of a partial or total prefabrication.

In fact the construction method which can be carried out with the use of the casting form system of this invention, permits the simultaneous casting of two different mixes, i.e. the standard concrete for the construction of the reinforced concrete pillars and beams, and the mix which serves for obtaining the curtain walls, as, for istance, the mix which has been disclosed in the aforementioned Italian Patent Application.

On account of the fact that the curtain walls and the pillars embedded therein are integrally interconnected to one another so as to form a sole body, the constructive method, which can be performed with the use of the casting form system of this invention, can

be considered as particularly adapted to be applied for the construction of building in the seismic zones.

These and other objects and advantages of the casting form system according to the present invention will be better understood from the following description of an embodiment of the invention, taking in consideration the accompanying drawings, in which:

Figure 1 is a plan view of the casting form system for the construction of the typical storey of a building;

Figure 2 shows a partial cross section taken on the line 1a-1a of Figure 1, in enlarged scale, after the casting of the curb beam and of the floor slab, but before the beginning of the disassembly of the components of the casting form:

Figures 3 and 4 show the horizontal sections, taken on the lines 2a-2a and 2b-2b of the Figure 2 respectively;

Figure 5 is a partial top view of the casting form, shown in the Figure 2 before the mix casting therein;

Figure 6 is a view, taken from the inside of the room, of a portion of the casting form, shown in Figures 2 to 6;

Figure 7 shows a perspective view with some parts in partially exploded position of the end portion of the casting form for the construction of an

inner main wall;

Figure 8 is a cross section of the casting form for a main wall, which is shown in Figure 7; and

Figure 9 is a perspective view of the upper portion of a casting form designed to be left on place, for the construction of the pillars, as an alternative to the use of an extractable form of a probe-type.

The Figure 1 shows diagrammatically the plan view of the casting form system provided for the construction of a typical storey of a multi-stored building, which storey will be obtained completed of the peripheral walls, the center main wall as well as of the pillars and of the beams designed to carry the respective floor; this latter will be constructed by means of prefabricated plate elements or by means of latticed metal girders and juxtaposed hollow clay blocks, tiles or the like.

For completing each storey it is only necessary to construct the partition walls for defining the various rooms of each suite of rooms, as well as to perform the finishing operation of the building. In the typical storey, which has been given merely by way of example, two areas are provided which are separated by a longitudinal center main wall 1, said areas being divided in rooms so as to form two suite of rooms or flats, each having an entrance door 6 which opens in the stairs (not shown).

In this embodiment the longitudinal peripheral walls 2 are provided with openings 3 for windows or window-doors, while the transversal peripheral wall 4 does not include any window opening and the opposite transversal wall 5, adjacent to the stairs comprises the entrance doors 6 of the two respective flats. Of course, the configuration of the typical storey is not binding. In fact an example of a typical storey has been given only for the purpose of a better understanding of the characteristics of the casting system as well as of the advantages of the constructive method which can be performed by the use thereof. Said casting form system comprises casting forms, generally indicated 7 in Figure 1, of a box-like prismatic shape, which are composed by an inner wall element 8 and by an outer wall element 8 which will define respectively the inner and outer surfaces of each wall portion of the peripheral wall 2 of the building, while said form 7 together with an other form 7 defines an opening 3 for a window or a window-door, also providing the engaging seats for supporting the prefabricated member 10 forming the window sill (only one of which has been shown by slotted lines in Figure 1) and for the window lintel members 11 which are so shaped so as to define also the space adapted to receive the caisson housing the roller which supports a roller blind or the like. The main walls 1, the peripheral walls 4 without doors and the peripheral walls 5 provided with doors 6 opened on the stairs and optional the portions of the outer

walls 2 near the corners are constructed using casting forms generally marked 12 and consisting of pairs of plate wall elements 13 supported in a mutual and spaced relationship by vertical side portal frames of a disassemblable type. As auxiliary means, are further provided corner pieces 53, 54 and casting forms to be left on the place 56 (Figure 9) or, preferably, tubular extractable casting forms of a probe-type 15 (Figures 1 and 7) for the construction of reinforced concrete pillars 16 (only some of which have been shown in Figure 1), said pillars 16 being at least partially embodied into the walls (1, 2, 4 and 5 respectively) which are casted by means of a cement mix 58, which is lightweight, thermo-insulating and sound proofing, at same time in which takes place the casting into the forms 15 or 56 of the standard concrete 57 for obtaining the reinforced concrete pillars 16 which contain the conventional reinforcing irons, and which will be constructed according to the method which will be hereinafter described.

Now will be described, in more detail,the characteristics of the forms 7 for the construction of the wall portions 2 defined by two adjacent openings 3 for obtaining windows or window-doors. As has been already said, each casting form 7 comprises two box-like main elements 8 and 9 designed to define the outer facing surface and the inner facing surface respectively of each wall portion 2, as well as the reveal or doorport of each opening 3 for a window or a window-door

respectively. Each of the box-like elements 8 and 9 comprises a central portion formed by a metal plate 20 provided with an outer peripheral stiffening frame 17 and with outer horizontal stiffening ribs 18. Each of the vertical sides of a metal plate 20 of the part 9 of each form 7 extends towards the opening 3 with a vertical flange 21, the vertical edge of which is bent towards said opening 3 so as to form a channel-like end portion 21A of a U-shaped cross section (Figure 4), the bottom wall of which is parallel to the plate 20. At the upper part said flange 21, 21A is cut out horizontally at the level of the lowest part of the prefabricated window lintel member 11 so as to form an edge 19 on which can rest the respective end of said lintel member 11. Said lintel member 11 consists of a prefabricated shaped body on the back of the lowest part of which (Figure 2) a longitudinal recess 11C is provided which opens downwardly and rearwardly so as to define a space for housing the caisson of a roller blind or the like, while at the upper part of the lintel member 11, this latter forms an outer vertical longitudinal flange 11A so as to create on the back thereof a shoulder 11B which serves to define the bottom surface of a curb beam 23 during the casting of the superposed portion of said beam 23, at the zone, where said beam passes over of an opening 3, so that the flange 11A and the shoulder 11B act in this zone as form elements for that portion of beam 23 during the casting of the beam 23 in the zone placed over an

opening 3; on the contrary, the outer surface of the other portions of the beam 23 are shaped by the upper portions of the outer plates 20 of the form elements 9, which, for such a purpose, are higher than the plates 20 of each inner form element 8, thus acting as form elements for the casting of said outer side surface of the beam 23. Each inner form element 8 along each vertical side extends sidewards with a shaped flange 24, 24A, 24B of a slightly less height than that of the respective plate 20 which is integral therewith and which is shaped so as to define the surface of the splay of the opening 3 and the reveal, if required, on which will abut the casing mounted into the opening 3 adapted to receive a window-door for the access to a terrace placed at the level of the room ground. On the contrary, when the opening 3 is designed to receive a window, as in the shown embodiment, the flange 21, 21A will be substituted, from its lower end until the height of the window sill, by a flange 22A, and the lower portion 24A of the flange 24, 24A is substituted by a flange 22B. In this case the two flanges 22A and 22B serve to form in the wall 2 a vertical rib of a triangular cross section, extending outwardly from the wall portion 3 on each side of the opening 3: in said ribs will be inserted the vertical edges provided with complemental longitudinal grooves 10A (Figure 1) of each prefabricated window sill panel 10 and which will be mounted inserting this latter from the top of said ribs and moving it donwwardly. The flanges 22A are

shaped according to the same configuration as that of the flanges 21A, 21B but they extend much more towards the opening 3. The flanges 21, 21A or 22A support with their end portions the latch locking devices 25 and 25A respectively which abut on the shoulder 24B of each flange 24, so as connect the two main parts 8 and 9 of the form 7 in their operative position, in which the interengaging parts are seal connected to one another. The forms 7 are held in their correct operative position with regard of the ground plane of the floor 26 which covers the storey placed below by means of pairs of lower horizontal metal beams 27 pivotally inserted at 36 into hollow tubular members 28 extending outwardly from the vertical sides of the frame 17 into the space 3, near the lower end of each form element 9. To each of said frames 17 is also fixedly connected, at an intermediate point of their height, a tubular member 30, to which a rod 31 is hinged (Figures 2 and 5): in said rod 31 a screw coupling 32 of an adjustable length is inserted; at the other end the rod 31 is hinged to the beam 27 in proximity of its inner end. The screw couplings 32 permit to obtain the perfect verticality of the plates 20 of the form elements 8 and 9, while during the disassembling step they permit to cause the respective form element 9 to be inclined outwardly for making easier its hooking to the hook of the hoisting crane. Near each flange 24 of each form element 9 is mounted a column 29 provided with a head 33 having beveled side surfaces, said head 33 being mounted in a

freely rotatable manner on the upper end of the column 29, the lower end of which is screwed on a base 29A (Figure 3) which is connected by means of removable connections 34 to the adjacent beam 27. Each column 29 is supported with the interposition of adjusting means by pairs of stirrups 35A and 35B, respectively supported by the flanges 21 and 24 by means of arms 63A and 63B respectively (Figure 5).

Upon each form element 8 is mounted an inverted U-shaped section iron 37 which forms an inner channel having its cavity facing downwardly and into which are received the shaped heads 33 of the adjacent columns 29 which serve to carry said section iron 37, which will have the side wall 37A positioned in the front of the wall 2 to be constructed, said side wall 37A having such a height that it can be introduced into the form part 8 with its lower portion in contact with the upper portion of the inner surface of the plate 20 of the form member 8 so that said wall 37 can define the inner surface facing the rooms of the adjacent curb beam 23, while the horizontal portion 37B of the iron 37 forms a horizontal shoulder on which can rest the ends of the plate members 26A provided for the construction of the carrying floor 26. Of course, the section iron 37 may consist also of lengths of iron, which are assembled one after the other. On the portion of the section iron 37 placed over the opening 3, a plate 64 is also mounted for defining all the inner vertical surface of the beam 23, if necessary, in the zones of the

peripheral walls 2, where lintel members 11 are mounted. It is to be noted that the height of the upper edge of the flanges 25 of the form elements 9 is less than that of the plate 20 thereof so as to permit that the flange 37A of the iron 37 can be always in contact with the inner surface of each plate 20 and of the surface of the prefabricated lintel member 11 facing the rooms in the zone where an opening 3 has to be formed in said peripheral wall 2.

In the shown embodiment the longitudinal main wall 1 acts also as a wall which separate two flats one from another, so that it is necessary that this wall must be made thermo-insulating and sound proofing. This wall 1 must also embody pillars 16 and thus it will be constructed using the casting form, generally marked 12 and which comprises, as has been already said, pairs of parallel plates 13 and two juxtaposed disassemblable vertical portal-like frames 14. The plates 13 are stiffened by outer horizontal inserted ribs 38 and along their vertical sides edges 39 are provided which are bent at right angle outwardly. The pairs of plates 13 are held spaced away from one another at a predetermined distance by means of said portal frames 14, each of which includes a pair of body plate sides 40, having specularly identical shapes of a birectangle trapezoid, having horizontal bases and of a height less than that of the wall to be constructed. The oblique side of said trapezoidal plate 40 is positioned outwardly, while the vertical side thereof, which is

set at right angle with regard to the two bases,- extends on each side so as to form two short vertical and complanar flanges 41, set at right angle to the plane of the body sides 40, and which are designed to abut against the inner surfaces of the two adjacent plates 13. On each body side 40 a plurality of horizontal slots 42 are arranged, positioned each upon the other and designed to receive wedge locking members 43 (Figure 7) for locking the plates 13 against the flanges 41 of the two subsequent portal frames 12. The two shaped body sides 40, 41 which are part of each portal frame 14 are connected to one another by trnaversal bars 44 which pass through slots arranged on the flanges 41 and which respectively face in pair each other in a perfectly aligned relationship. On the portions of the bars 44 which will be placed inside each form 12 are mounted protection pieces 45 of an inverted U-shaped in cross section, made of plastics, in particular, polystyrene, which have the task to prevent any contact between each bar 44 and the concrete 58 which will be casted into said casting form 12. The bars 44 are fastened to the body sides 40 in their operative position by locking screws 55. In such a way the bars 44 define the width of the wall 1 to be constructed by means of a casting form 12. On each of the body sides 40 of each portal frame 14 is also mounted a device 46 (Figures 7 and 8) which is able to support, at an adjustable height, an inverted, U-shaped section iron 47 operatively equivalent to and having

the same task as that of each aforementioned section iron 37 associated with the casting forms 7, and which has thus a cross section of a similar shape, thus comprising an inner side flange 47A, the lower edge portion of which is designed to contact the inner surface of the flanges 41 of the portal frames 14 and which is supported by the heads 48A of the vertical bars 48 of the devices 46 which are mounted on one outer side of the casting form 12, while another identical section iron 47 will be mounted in a specularly identical position near the other outer side of the casting form 12 and which is, in turn, supported by the bars 48 of the respective devices 46, which are mounted near the opposite sides of the casting form 12 and are supported by the side plates 40. Since the section irons 47 have the same task as that of the section irons 37 they are not better described in detail and operation. These irons 47 will serve to define the longitudinal sides of a longitudinal beam 23 parallel to the peripheral curb beams 23 in the case of the main wall 1, or said section irons 47 serve to define the inner side surface of the end portions of the longitudinal curb beams 23 in the case of walls 2 as well as of the transversal beams 23 of the walls 4 and 5, while at the same time they serve in this case to support also the end portions of the floor elements 26A.

Each device 46 comprised a bar 48 sliding vertically within guiding members and the end portion 48A of which

enters the channel opened downwardly of the respective inverted U-shaped iron 47; said bar 48, by means of a lever 49 pivotally mounted about a pin 50 supported by the body side 40 can be moved up or down by a threaded rod 51 and a control threaded nut 52.

For carrying out the corner portions of the peripheral walls 2, 4 and 5 of the building, inner corner members 53 and outer corner members 54 are provided, which are connected, by means of portal frames 14, to modified end forms 7A.

Each form 7A at the end thereof which is adjacent to an opening 3, is shaped like the end portions of the casting forms 7, while at the opposite end it ends only with the end frames 17 similar to those of the plates 20 of the form elements 8 and 9 of the casting forms 7 and therefore can be employed and fixed in the same manner, as the plates 13 of the casting forms 12. Of course, pairs of plates 13a (not shown), which are selected between the plates of the appropriate modular lenghts, can be mounted by means of a portal frames 14 and can be juxtaposed between a casting form 7A and the corner members 53 and 54, whenever the adjacent corner of the peripheral wall 2 is placed at distance from said corner greater than the length of a casting form 7A. For the connection of a main wall 1 to the transversal wall 4 or 5, two angled pieces 53 are used on the inside of said wall 4 or 5, while in order to define the outer surface of said walls 4 and 5 in this zone can be used the plates 13.

It will be now described in what a manner the casting form system is assembled, employed and then disassembled. Upon the plane of the upper surface of an already constructed floor 26, will be mounted the casting forms 7, 7A where portions of the peripheral walls 2 comprised between the subsequent openings 3 have to be constructed, and end casting forms 12, if required, as well as the corner pieces 53,54. For the construction of the walls 1,4 and 5 are mounted the casting forms 12 and the corner pieces 53 and 54, where required. Between each adjacent casting forms 7 and between the casting forms 7 and 7A will be inserted the prefabricated lintel members 11, mounted on the seats 19 with the interposition of known bearing devices of an adjustable height (not shown in the drawings). Then the height of the heads 33 of the columns 29 will be adjusted, causing the columns 29 to rotate with respect to their bases 29A. Then the lenghts of the screw couplings 32 will be adjusted, in order to obtain the correct verticality of the plates 20 of the form elements 8 and 9. Upon the heads 33 an inverted U shaped iron 37 will be inserted, the vertical side 37A of which will be put into contact with the upper portions of the inner surfaces of the plates 20 of the form elements 8; in addition a support plate 64 is mounted behind each listel member 11, if required. For performing the assembly of a casting form 12, first at all the portal frames 14 are mounted as well as the pieces 45 made of plastics and which are inserted on

the portion of each bar 34 which is placed in the space between the facing surfaces of a pair of plates 13, said bars 34 being then locked to the body sides 40 by means of the screws 55. Then the plates 13 will be mounted which are locked in their work position to the portal frames 14 by the wedges 43, inserted with force into the slots 42. Then will be adjusted the height of the upper ends 48A of all the bars 48 so that they reach the same height and upon the two rows of heads 48A are mounted the respective inverted U-shaped irons 47. Then will be inserted the extractable probe-like forms 15 (Figure 7): each exctractable form 15 is provided at its upper part with connections 65: or, as an alternative, casting forms 56 are used, designed to be left on the place. Said forms 15 or 56 serve for the construction of the reinforced concrete pillars 16, after having previously inserted therein the respective reinforcing irons, which, of course, will be fixedly connected to those of the pillars 16, of the storey placed below, the end portions of which extend upwardly from the upper surface of the floor of said formerly constructed storey in correspondance of the walls 1,2,4 and 5 and in the corner zones or in the union zones of the walls. At the last the standard concrete 57 will be casted into the probe-like extractable forms 15 or in the forms 56 designed to remain in place, which can substitute the forms 15.

Each form 56 consists of a prismatic metal tubular body having short lenghts of iron 56A fastened to its outer

surfaces and extending horizontally towards the outside (Figure 9). At the same time will be casted the mix 58 designed to obtain the curtain walls, said mix enclosing the whole pillar body 16. The casting of the mixes is carried out until the level of the shoulders 11B of the lintel members 11 is reached. Afterwards the optional extractable forms 15 are removed, lifting each form 15 by means of a crane, the hook of which is anchored to the upper connections 65 of said form 15. Afterwards the to mixes 57 and 58 can interpenetrate one into the other in the joint areas, so as to create a monolithic connection between the pillars 16 and the curtain walls. In the case, when the forms 56, to be left in place, are used, the short lengths of the irons 56A ensure the interconnection between the curtain walls and the pillars 16 embedded therein. Then will be mounted the reinforcing irons for the construction of the horizontal girders or beams 23 and are mounted the prefabricated elements 26A of the floor, (the end portions of which rest on the irons 37 and 47 respectively) and then optionally the reinforcing irons for said floor 26. At one of the ends of the spaces separated by the main wall 1, the construction of the floor is temporarily suspended, so as to create in each floor, which is being constructed, a large passageway 60 for the purpose which will be hereinafter illustrated.

Of course, the reinforcing irons of the prefabricated elements 26A of the floor 26, which extend outwardly

from said elements 26A will be connected with the reinforcing irons of the beams 23. Then is casted the concrete 57 which serves for the construction of the beams 23 and the slab 59 which covers the floor 26, except in the zones in which have been created the passageways 60, where no floor is yet constructed. For a best work safety of the workers which carry out all these operations, in prosecution of the outer plates 20 of the casting forms 7 and of the peripheral outer plates 13 of the casting forms 12 used for the construction of the walls 4 and 5 or for the end portions of the walls 2 provision can be made that protection parapets could be installed (Fig.2) which are constituted of frames 61, provided with legs 61A to be inserted, in a disassemblable manner, into seats 62 arranged near the upper parts of the plates 20 of the form elements 9 of the forms 7, 7A or of the outer plates 13 of the casting forms 12. When this casting operation has been completed and after the short time period, which is necessary for the completion of the first phase of the setting of the mixes 57 and 58, it will be possible at first to begin the disassembly of the forms 7 and 7A. For such a purpose first of all the parapet elements 61 will be disassembled; then the connections 34 are removed which connect the columns 29 to the beams 27, and the latches 25, 25A will be released. Afterwards the screw couplings 32 can be actuated so as to increase their length of such an extend that the outer form elements 9 can be inclined

outwardly and can be more easily hooked to the hook of a crane for performing their lifting and transport up to be mounted in their operative positions upon the just constructed floor 26, so that they can be ready to be used for the construction of the subsequent storey. In the case of the outer members of those casting forms 12, which are used for the construction of the walls 4 and 5 and of the possible end portions of the walls 2, will be necessary to install outer work bridges, for performing the disassembly of the outer plates 13 of the casting forms 12, previously removing the locking wedges 43. On the contrary, the inner components of the forms 7 and the inner plates 13 of the casting forms 12 thereof will be disassembled and than transported at first underneath the respective passageway 60, where they can be hooked to the crane hook which can enter until the inner space designed to form each suite of rooms or flat, passing through the passageway 60 which has been left on each floor 26 for such a purpose. Then the window sills will be obtained, where required, by the insertion, with a sliding dowwards movement, of the prefabricated window sill members 10, 10A with their vertical grooved edges 10A sliding into the respective ribs of the casting forms (7, 7A). The beams 23 and the floors 26 will be supported until the hardening of the mixes 57 and 58 has been attained, by means of the inverted-U irons 37 and 47 mounted on the heads 33 of the columns 29 and respectively on the heads 48A of the bars 48 which are part of the devices 46 mounted on the

portal frames 14. On the contrary, the corner elements 53 and 54 will be left yet in their operative positions.

When the hardening of the concrete or the like is terminated and the dismantling on the casting form system have to be completed, the columns 29 are caused to rotate about their axes with regard of their bases 29A, so that their heads 33 can lower. At the same manner are caused to be lowered the ends 48A of the bars 48 of the devices 46, so that the U-shaped irons 37 and 47 can be moved downwardly, this being separated from the beams 23 and the floor 26. Afterwards the columns 29 can be removed as well as the irons 37 carried thereby; will be then also disassembled the irons 47 as well as the side members 40, 41 forming the portal frames 14, after having removed the screws 55 and having extracted the bars 44, which can slide easily, since any direct contact with the concrete of said bars 44 has been prevented, owing to the presence of the polystyrene spacing pieces 45 covering said bars 44; said pieces 45, on the contrary, remain embedded into the so obtained wall. The elements 40, 41 as well as the corner elements 53 and 54, the columns 29, 29A and the shaped irons 37 and 47 are then transported on the storey placed upon for a further utilisation, trasporting said elements across the passageway 60. As all these operations are over, each floor 26 will be completed in correspondance of the passageway areas 60, while on the already constructed floor portions can be

mounted the casting form system for the construction of a new storey.

From what has been hereinbefore said, can be understood that by the use of the casting form system of this invention a building construction method of a non conventional type can be carried out, wherein each building is constructed, storey by storey, and each storey in two times and precisely:

- At first are casted in the open the peripheral and the main walls, previously mounting the lintel members 11 in the openings 3, where windows of window-doors are provided, said walls being constructed using a lightweight, thermo-insulating and sound proofing mix 58; contemporaneously the pillars 16 made of reinforced concrete are casted, using a standard cement mix 57. The pillars 16, embedded into the curtain walls, can be casted by the use of the tubular forms 15 of an extractable probe-type, or of the tubular forms 56 to be left in the place.

- At a second time will be mounted the prefabricated floor elements 26A and the reinforcing irons, afterwards is carried out the casting of the horizontal carrying beams 23 and of the slabs 59 of the floors 26, except the passageways 60. When the first phase of the concrete setting is over, will be performed the partial disassembling of some of the casting form components, while the other components remain in their operative position, i.e. the columns 29 and the portal frames 14 which serve, by means of the irons 37 and 47

respectively, to support the floor elements 26A as well the beams 23 until the complete dismantling of the form elements, while the other already disassembled form components can be trasported and lifted on the upper surfaces of the just constructed floors 26 and positioned so as to be able to be assembled in order to obtain the casting form system for the construction of the superior storey. At last each passageway 60 will be closed, which has been used for permitting the inner components of the form system to be hoisted up on the plane of the just constructed floors 26.

It will be apparent that the casting form system of this invention could be also used in the case of the construction of buildings having walls and pillars obtained by any standard reinforced or not reinforced concrete or other suitable mixes.

CLAIMS

1- A casting form system composed by modular members for the construction of buildings, storey by storey, in combination with prefabricated elements (10, 11 and 26A) characterized by the fact that said casting form system cmprises:

- disassemblable casting forms (7, 7A) for the construction of the portions of peripheral curtain walls (2) ending at least in one of their vertical sides with an opening (3) for receiving a window or a window-door, said opening (3) having to be closed at its upper part by a prefabricated lintel member (11);
- disassemblable casting forms (12) for the construction of the main curtain walls (1) and of the peripheral curtain walls (4) without any window or door, or of the walls (5) provided with doors (6), as well as the end portions of the walls (2), if required, the said walls (1, 2, 4 and 5) emboding reinforced concrete pillars (16), said walls being casted by using a lightweight, thermo-insulating and sound-proofing mix, casted in said forms (7, 7A and 12), which are associated with or are provided with support devices (19 or 46) carrying shaped irons (37 and 47) respectively, designed to-cooperate for the shaping of at least one of the sides of the horizontal curb beams (23) and for carrying the ends of the prefabricated floor elements (26A) for composing the floors (26) of each storey, said support devices (19 or 46) being connected to the casting forms (7 and 7A) and (12)

respectively, in a separable manner, so as to be able to remain in their operative position, when other components of the casting form system (7, 7A and 12) have been disasembled.

2- A casting form system according to claim 1, wherein each casting form (7) comprises an inner part (8) and an outer part (9) which in combination constitute a prismatic disassemblable hollow form comprising two longitudinal plate walls (20), the outer of which has substantially the same height as that of a storey, while the inner wall (20) has a height sligtly less than that of the rooms of the building, the outer plate element (20) of the form part (9) extending on each side towards the respective adjacent opening (3) with a vertical shaped flange (21) designed to define the outer vertical portion of vertical side of said opening (3), until the height of the lowermost part of the lintel member (11), where it forms a horizontal edge (19) for bearing one end of said lintel member (11), said flange (21) extending with another flange (21A) which supports locking latch devices (25), while from the vertical corners of the plate (20) of the form part (8) a flange (24) extends towards the opening (3) and has a height slightly less than that of the plate (20) so as to form a shoulder (24B), parallel to the plate (20) and adapted to engage the latch devices (25), for the mutual seal connection of the flanges (21, 21A and 24, 24B) to one another, the flange (24) extending outwardly with another flange (24A) shaped as to define

the splay of a window-door, while in the case of a window, the lower portions of the flanges (21, 21A) and of the lower portion (24A) of the inner flange (24, 24A) are substituted with two short flanges (22A and 24B respectively) which form along the whole height of a window sill (10) a vertical rib facing the opening (3), into which will be inserted the grooved vertical edge (10A) arranged on each vertical side of the prefabricated window sill (10).

3- A casting form system according to claim 1, wherein the casting forms (7A) are shaped so as to define the shaping of the vertical sides of an opening (3) only at one of their two vertical sides.

4- A casting form system according to claim 1, wherein the outer form elements (9) of each casting form (7, 7A) at the lower part of their side adjacent to an opening (3) are hinged to a horizontal beam (27) which extends innerwardly, passing across the opening (3) and ending into the space which will form the suite of rooms of the storey, which is being constructed, while at an intermediated point of said side an inclined bar (31) is pivotally connected to the form element (9), in said bar (31) being inserted a screw coupling (32) of an adjustable length, said bar (31) being pivotally connected at its lower end to the inner end portion of said beam (27).

5- A casting form system according to claim 1, wherein near the inner form elements (8) are mounted columns (29, 29A, 33) of adjustable height, each column being

connected by releasable means (34, 35A, 35B) to the form elements (8 and 9) and having the maximum height, which is not less than the height of the rooms of the respective storey of the building, said columns (29, 29A, 33) supporting at their upper ends an inverted-U iron (37), having a vertical side flange (37A) of such a height that it can be brought in contact with the upper portion of the inner surface of the plate (20) of the form element (8).

6- A casting form system according to claim 1, wherein in the zone placed upon an opening (3), the lintel member (11) together with a detachable plate element (64) is mounted, said lintel member (11) also defining a rear space for receiving the caisson of the roller blind, and having at its upper part an outer longitudinal vertical flange (11A) forming a rear horizontal longitudinal shoulder (11B) on its rear part, which serve for shaping of the bottom and of the outer surface of the respective beam (23) while the inner vertical surface of said beam (23) will be defined by the said auxiliary plate (64).

7- A casting form system according to claim 1, wherein the casting forms (12) are formed by pairs of parallel plates (13), spaced away from one another and which are supported at their ends by portal frames (14), each frame (14) comprising two shaped coplanar side plates (40) each extending at its inner vertical ends in a pair of coplanar vertical flanges (41) set at right angles with respect to the plane of the respective

plate (40), said side plates (40) being connected to one another in a spaced relationship by transversal bars (44) passing through pairs of horizontal facing slots arranged in one of the facing flanges (41) of the plates (40) of each portal frame (14), said bars (44) being covered in their part placed inside the form (12) by protection spacing means (45) and being fastened to the side plates (40) of the respective portal frame (14) by means of screws (55) in such a manner as to maintain the facing flanges (41) of each portal frame (14) at a predetermined distance from each another, so that the plates (13) are supported in a vertical and parallel relationship at the desired distance by said flanges (41) of the portal frames (14), said plates (13) being fixed to the respective portal frames (14) being releasable locking means (42, 43), on each side members (40, 41) of each portal frame (14) being provided a device (46), comprising a bar (48, 48A) which can be moved up and down by means of control means (49, 50, 51, 52), said bar (48) having such a length as to be able to extend upwardly beyond the upper edge of the plate (40) so as to support an inverted-U iron (47) which comprises a side wall (47A) which can be inserted in the inside the form (12) in contact with the inner surface of the respective plate (13), while the horizontal wall of said iron (47) forms a shoulder on which can bear the end portions of the prefabricated elements (26A) for the construction of the floor (26).

8- A casting form system according to claim 1, wherein the casting forms (56) designed to be left in place, consist of tubular members shaped as the pillars (16) to be obtained from the outer surfaces of said forms (56) extending outwardly short lengths of irons (56A) or the like.

9- A casting form system according to claim 1, wherein each extractable probe-like form (15) consists of a tubular body of a cross section equal to that of the pillar (16) to be constructed, said form (15) having opened ends, the upper end of which are provided with connections (65) adapted to be hooked to the hook of a lifting apparatus, in particular, a crane.

10- A construction method to be carried out by the use of the casting form system as claimed in claims 1 to 9, according to which method the building is constructed, storey by storey, using the forms (7, 7A and 12) and prefabricated elements, comprising: lintel members (11) to be mounted upon the openings (3) of the peripheral walls (2), which are designed to form windows of window-doors; window sill members (10, 10A) where and when windows are required; floor elements (26A) for the construction of the floors (26), and wherein each storey of the building comprises: peripheral walls (2) including openings (3) for obtaining window or door-windows: peripheral walls (4) without any opening; peripheral walls (5) including opening for obtaining doors (6); and inner main walls (1), said construction method being characterized by the following steps:

-the installation and assembling on each already obtained floor (26), of the casting forms (7, 7A and 12) for the construction of the walls (1, 2, 4 and 5) with the insertion of the lintel members (11) on the housing seats (19) provided in the casting forms (7, 7A) upon each opening (3);

- the insertion in the casting forms (7, 7A, 12) of the casting forms (56) to be left in place or of the removable forms (15) for the construction of the pillars (16) and the insertion into the forms (56 or 15) of the reinforcing irons for said pillars (16) and the connections of the ends of said irons with the respective reinforcing irons of the pillars of the storey placed below;

- the casting in the open into the forms (15 or 56) of standard cement concrete (57) and into the forms (7, 7A and 12) of a lightweight, thermo-insulating and sound-proofing mix (58) until to reach the height of the shoulders (11B) of the lintels (11);

- the removal of the probe-like forms (15), if used;

- the insertion of the reinforcing irons for the carrying beams (23) and the mounting of the prefabricated floor elements (26A), and of the floor reinforcing irons except on an end zone of each floor, where a passageway (60) has to be obtained for the lifting until the upper surface of the floor (26), when has been obtained, of the form elements, which have been mounted inside the rooms of the just constructed storey of the building;

- the casting of the mixes (57) for obtaining the horizontal curb beams (23) and the floor slabs (59);
- the disassembly and removal of the outer and inner forms elements, except the columns (29), carrying the inverted U-shaped irons (37) and the portal frames (14) carrying the inverted U-shaped irons (47), which will be removed only after the hardening of the concretes (57 and 58); and
- the completion of the floor portions corresponding to the passageways (60).

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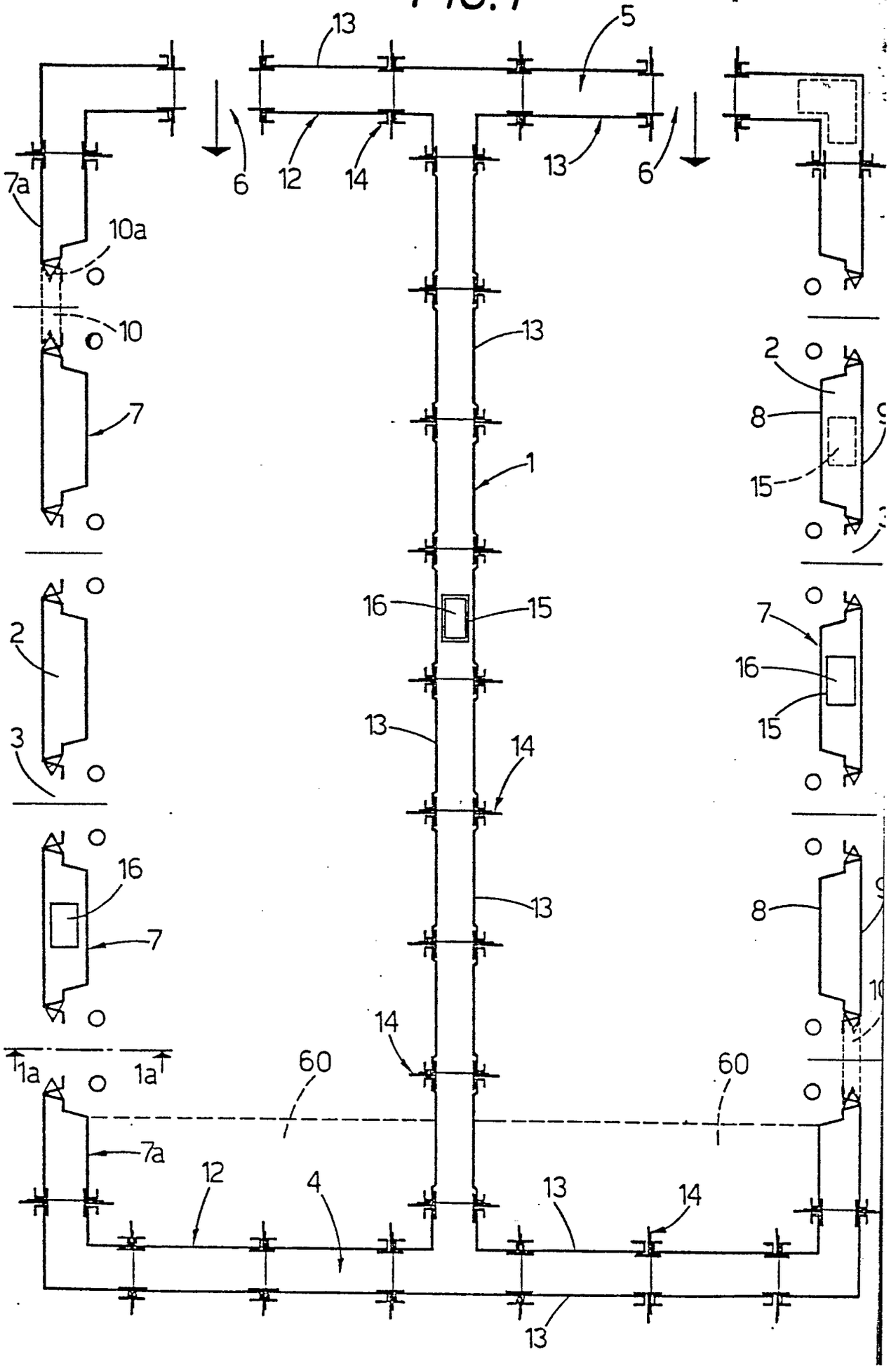
FIG. 1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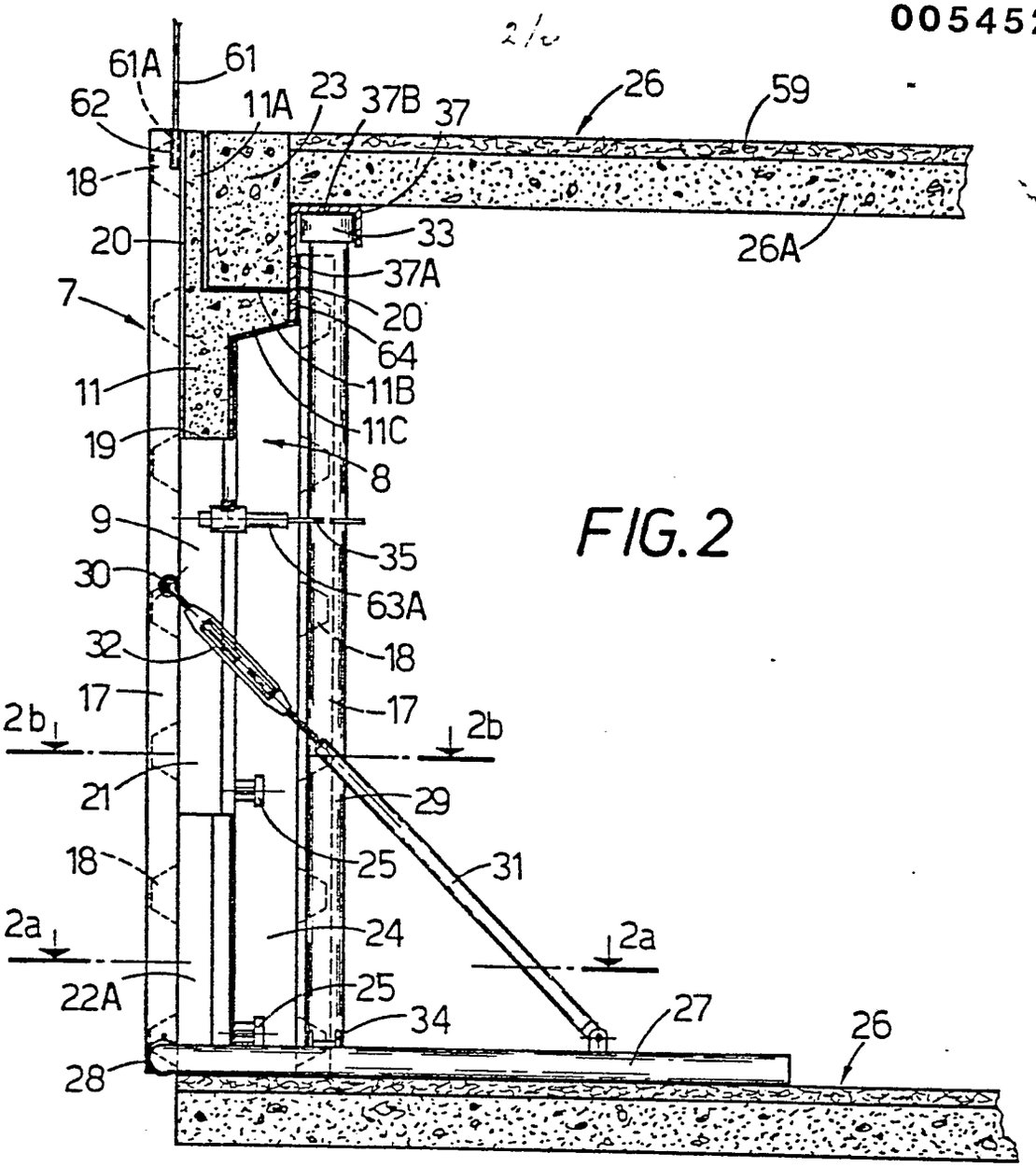
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11C
19
8
9
35
30
63A
32
18
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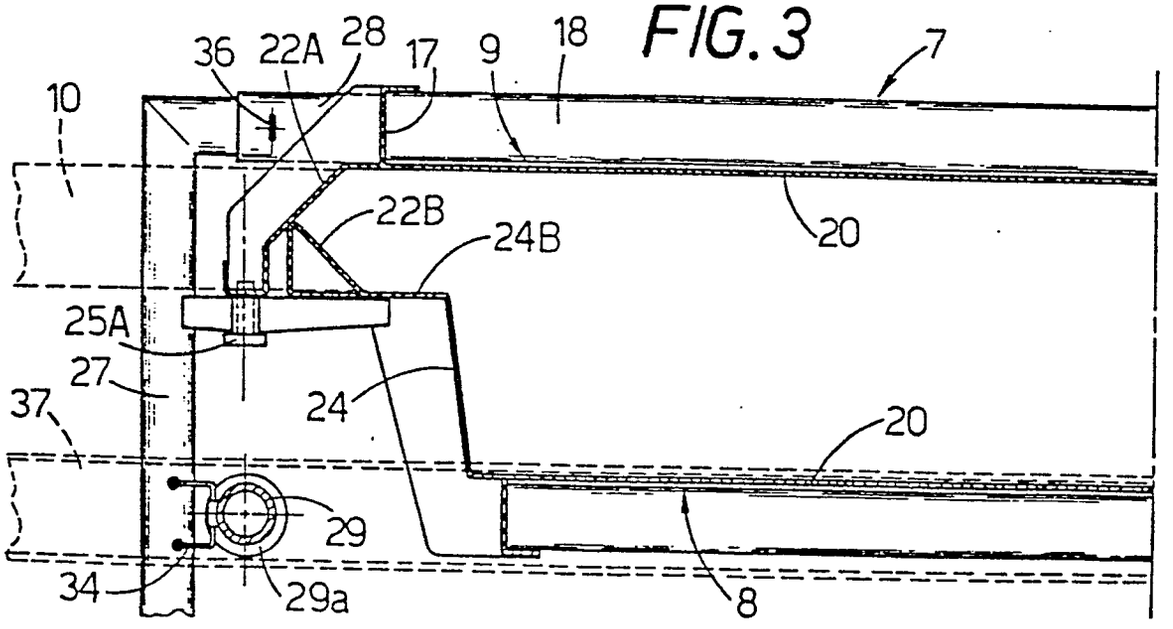
FIG. 2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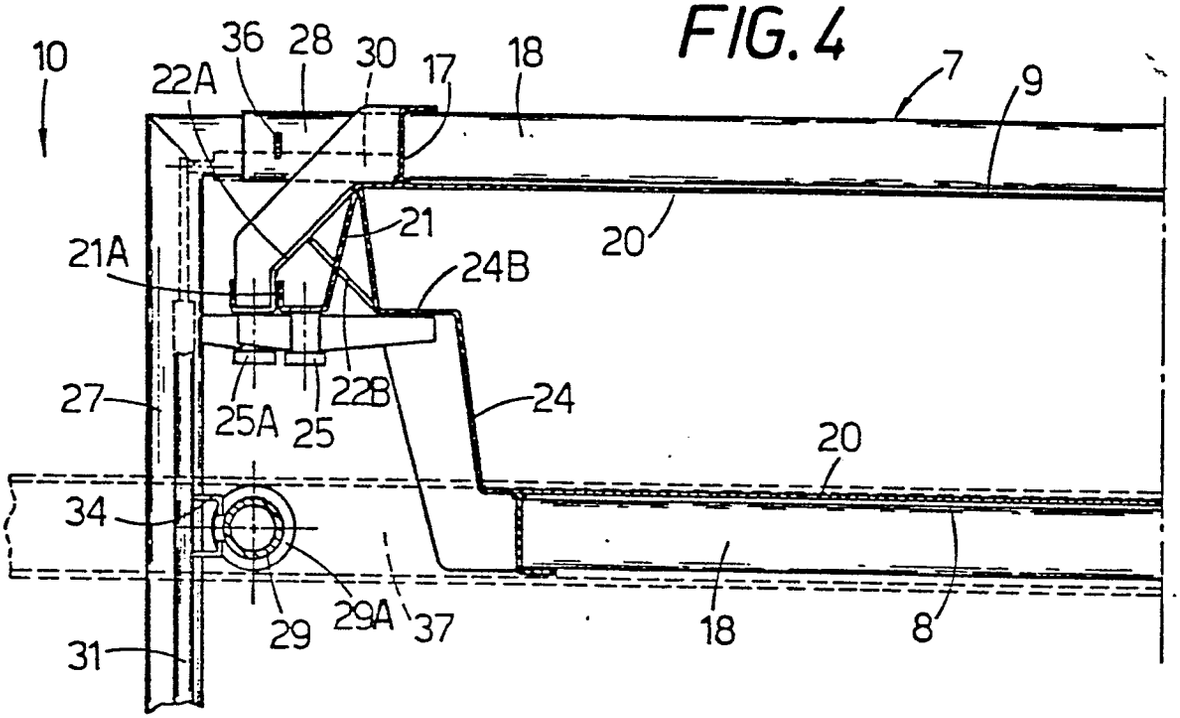
8

FIG. 3

FIG. 4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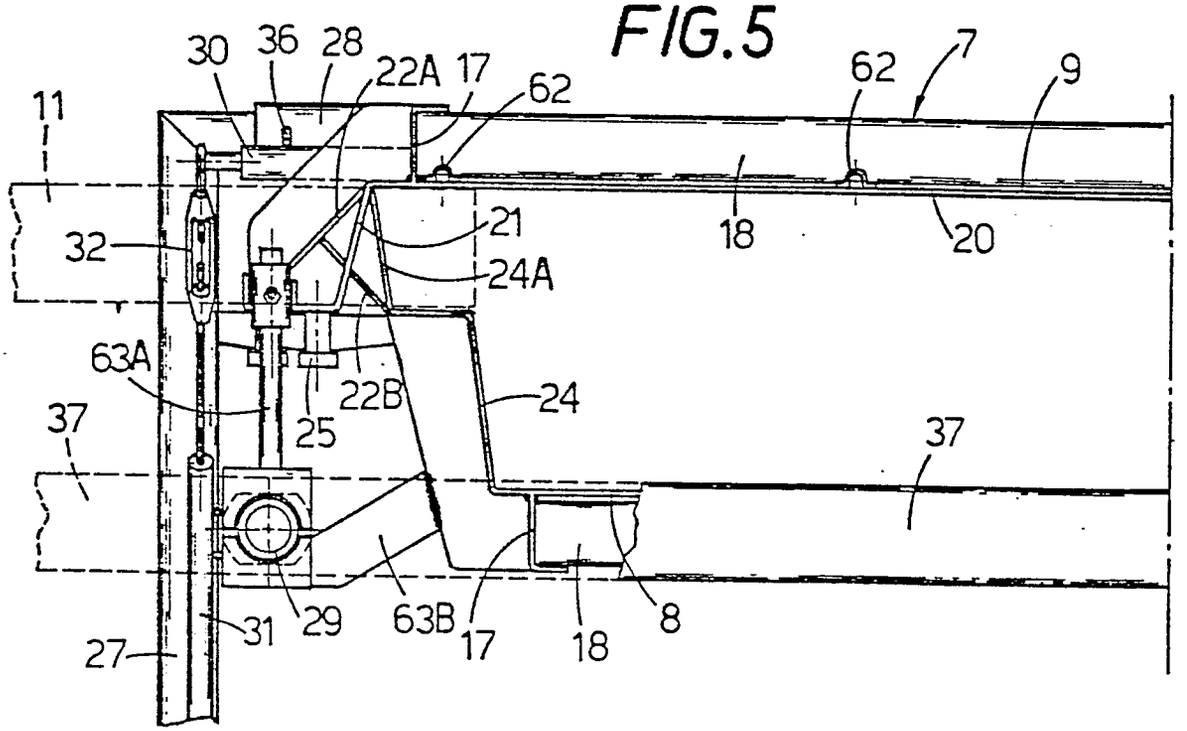
31

FIG. 5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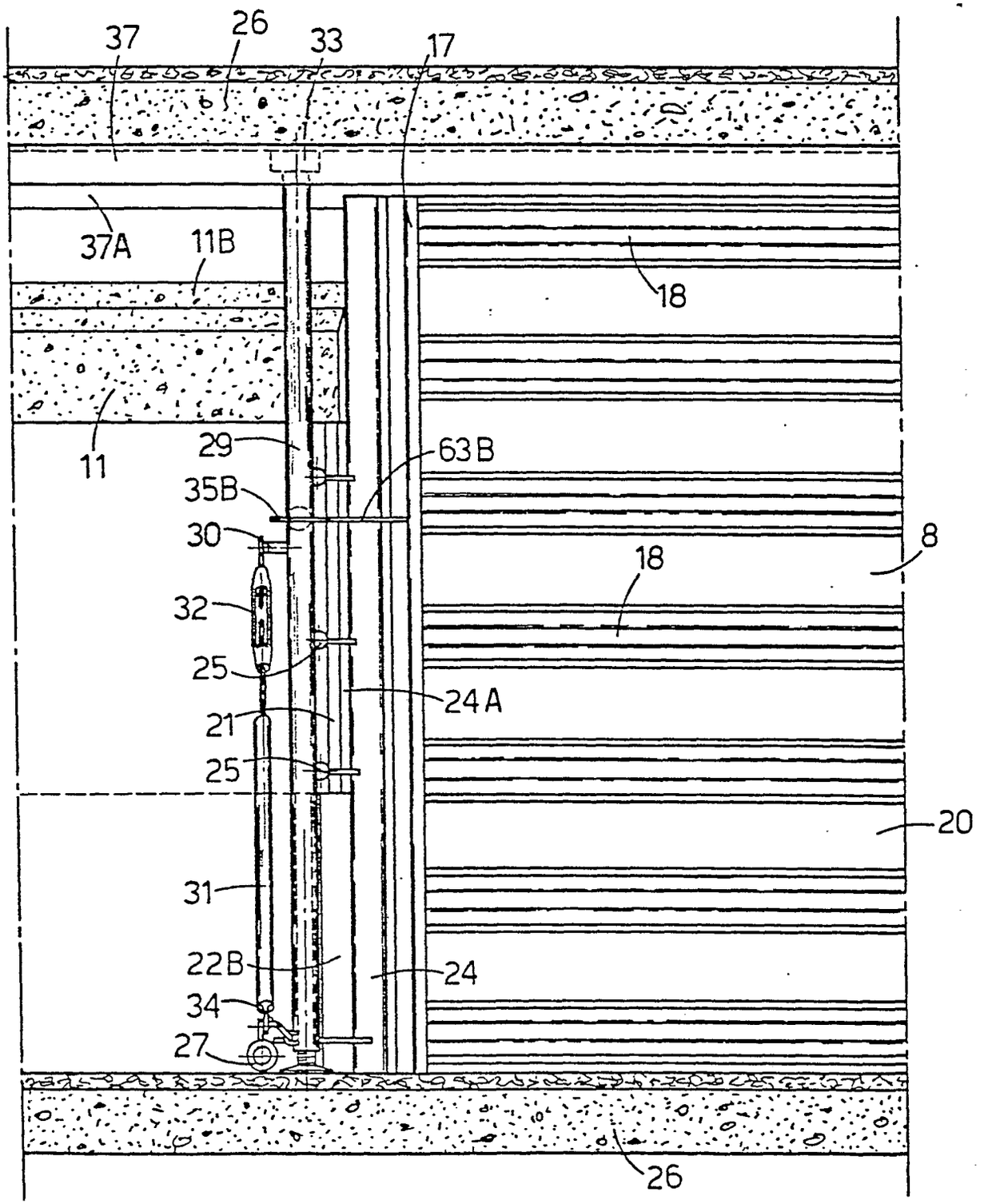
27

FIG. 6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22B
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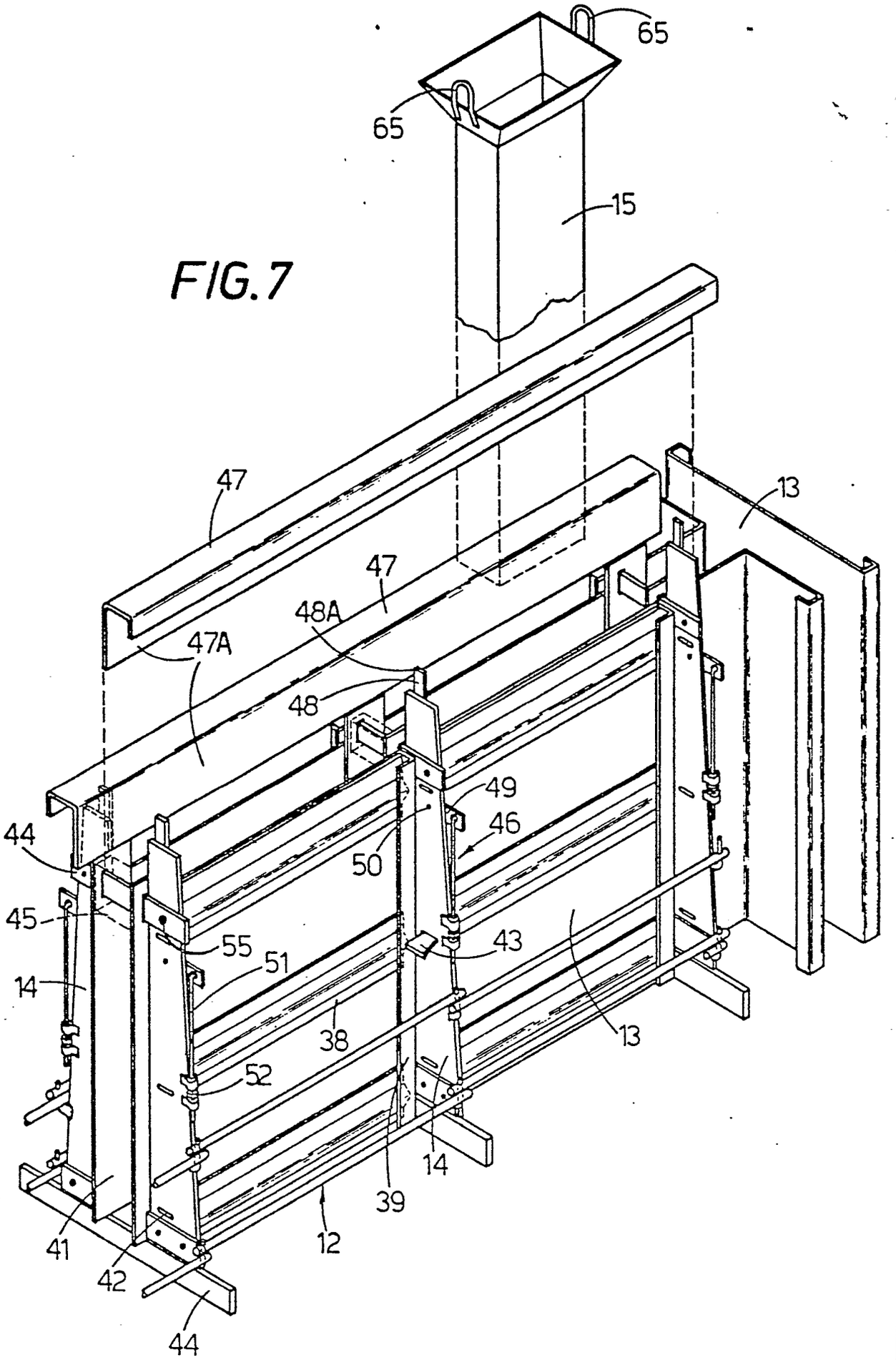
34
27
26

FIG.7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