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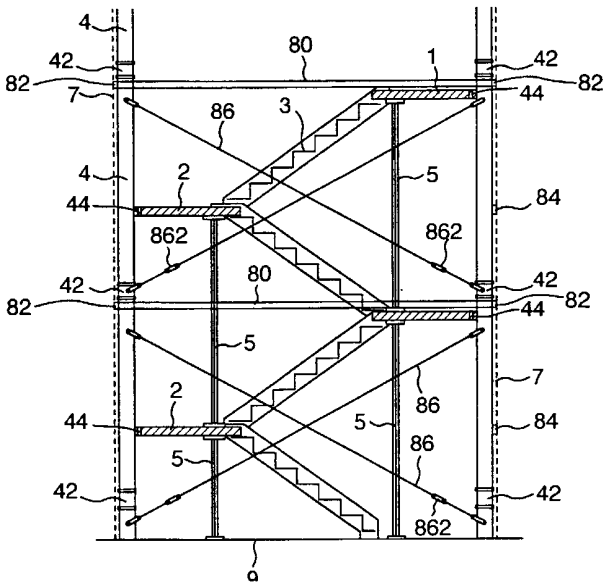

(57) Abstract: There are provided inner stairs for a building which include a main landing (1) formed of a precast concrete plate and supported by two props (4) buried in a wall portion and exclusive jig-supports (5) removable therefrom prior to placing of concrete in a wall portion, an intermediate landing (2) formed and supported as well as the main landing (1) at a intermediate position between floors, and stair units (3) having wall-side and central strings (32, 34), treads (362) fixed in these strings and handrails provided with balusters, a bottom rail and the like. By using the inner stairs, an efficiency of works in a construction of the building can be improved by making removal of constructing material minimum, and a reduced term of construction and remarkable low cost thereof can be achieved by omitting the works of the construction and restraining an amount of material.

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DESCRIPTION

INNER STAIRS FOR BUILDING AND METHOD OF CONSTRUCTING IT

TECHNICAL FIELD

The present invention relates to stairs provided inside a building, more particularly to an inner stairs for a building as temporarily provided prior to construction of a building and capable of being installed at the same time as the construction of a building so as to facilitate constructing thereof and a method of constructing it according to the independent claims.

BACKGROUND ART

Conventionally, there have been provided methods of constructing stairs inside a building as follows.

One of those stairs is a stair made integral with a building, in which in a site of construction work a form carpenter makes solid stairs constructed with forms using form panels, yokes, square rods and the like by cutting them in alignment with those site-dimensions and combining one by one with each other. And, a craft man arranges reinforcing bars in the forms, after that rare concrete is placed in the forms and hardened to provide the inner stairs.

In case of making the inner stairs for a

building by structural steels, the stairs are made in a factory based on working drawings, and in a site of the building construction the stairs are lifted by a lifting machine to be located and constructed inside the building, after that rare concrete is placed in landings and treads to provide the inner stairs.

In other type inner stairs, for example, as disclosed in the Japanese Patent Unexamined Publication No. 6-146520, landings and stair units are beforehand made of precast concrete members in a factory, and the stair units are supported on beam members projecting from both wall surfaces of inner wall members of a building to combine them with each other in a site of its construction. Further, as disclosed in the Japanese Patent Unexamined Publication No. 6-11747, there has been provided a method of constructing inner stairs such that each of landings and stair units are beforehand made of precast concrete members, and the stair unit is mounted to both sides of wall posts by bolts and nuts, and further the landings and the stair unit are combined with each other by plate connectors so as to support the landings on the building.

In light of problems of the stair units inside a building as mentioned above, there is provided inner stairs for building as disclosed in the Japanese Patent Application No. 11-167143 filed by the applicant of this application. That is, main landings, intermediate landings and stair units for a

predetermined number of floors are temporarily provided using constructing- jigs of temporary work previous to placing of concrete in a wall portion thereof, and the main landings and the intermediate landings are constructed to provide inner stairs by mounting forms of the wall portion so as to bury parts of the landings in the wall portion.

In the conventional stairs inside a building, especially the stairs made of concrete as reinforced by reinforcing bars as made integral with a building, the time is remarkably needed in its construction steps. In a restricted site of a building and a period of its construction, the inner stairs consume a long time in its construction and become a portion causing high cost.

And, in case of making the inner stairs by structural steel, if this case is compared with a case of the stairs making of concrete as above described, a construction period of the inner stairs made of structural steel is fairly improved since the stairs are beforehand and partially made in a factory so as to reduce the time consumed in its work site. On the other hand, since there are many cases requiring steel, beam members or the like for supporting the stairs, it is not improved in its cost or conversely causes high cost.

Further, in case of the conventional stairs having landings, stair units or the like each

beforehand made of precast concrete to be built in a building, mounting measures having high strength are required for supporting them on wall posts and a body of the building since a weight thereof becomes great. In installing of the landings and the stair units at those positions, they have to be carefully treated in operation of a lifting machine such as a crane. Further, in case of the landing and the stair units each being made of precast concrete, in order to support the landings and stair units having large weight to the building already constructed, wall posts are particularly provided and fittings having high strength are required so as to accompany with high cost. Thus, the work has to be performed in a narrow work space inside a building already constructed so as to become built-in having troubles.

In case of using constructing-jigs for temporary work, when placing of concrete in the wall portion is finished and concrete is hardened, those jigs have to be taken apart and removed therefrom. In a narrow space of the inner stairs, the work is facilitated more than that of the conventional stairs, while its term is taken for taking apart and transporting them to a following upper floor so that the work was not said to be easy one.

DISCLOSURE OF THE INVENTION

The invention is made in view of the above

problems, and it is an object of the invention to provide inner stairs for a building which can reduce a term of works and achieve remarkable lower cost by omitting construction works.

And, it is an other object of the invention to provide a method of constructing inner stairs for a building so that the inner stairs is beforehand installed and fixed in a site of construction prior to construction of a building so as to improve an efficiency of the works by making removal of constructing material minimum.

To achieve the above object, according to the present invention there is provided inner stairs for a building having wall portions provided by placing of concrete, the inner stairs comprising a main landing disposed at a floor-height position of the building or a floor portion thereof so as for parts of three side portions of the landing to go into the wall portions and having a plurality of anchors projecting from said three side portions, the main landing being supported by two props which are connected to each other by bridging members and buried into the wall portions and also supported at a free side of the landing by exclusive jig-supports removable therefrom, an intermediate landing having a plurality of anchors projecting from three side portions of the intermediate landing and disposed at a substantial intermediate-height position between upper and lower floors of the

building so as for parts of the three side portions thereof to go into the wall portion, said intermediate landing being supported by two props which are connected to each other by bridging members and buried into the wall portions and also supported at a free side of the intermediate landing by exclusive jig-supports detachable therefrom, and stair units having a wall-side string bridged to said upper and lower landings or a base plan of the building and located adjacent to said wall portion, a central-side string located at a central portion of the stairs and fixed with said landings, treads extended between and fixed to these strings, and a handrail including a capping for providing balusters parallel to each other between the capping and the handrail, said stair units being provided with a plurality of stud bolts as projects toward an inside of the wall portions and fixed with a wall-side surface of the wall-side string so as to be buried in the wall portions previous to placing of concrete of the wall portions and disposed with respect to the main landing, the intermediate landing or the base floor, the landings and stair units being positioned and adjusted at each position of those heights previous to construction of the building by using beams for connecting each of said prop to each other and braces for reinforcing and connecting said prop to each other at a plan provided by the prop, and when forms of said wall portions are provided, the

bridging members, the beams and the braces being positioned within said forms with said anchors and said stud bolts and buried in the wall portions so as to be provided at the same time when concrete is placed in the wall portion.

In such inner stairs for a building, after the main and intermediate landings and the stair units are combined with each other, uppermost end portions of the four props provided between a predetermined number of floors are connected to each other at an upper horizontal plan thereof by braces, and further after concrete is placed in the wall portions, the braces are removed therefrom.

Also, in this inner stairs for building, the landings are fixed using bolts, nuts or the like with respect to said props by way of brackets.

In such inner stairs for a building, both of the landings are made of precast concrete members, the precast concrete members being reinforced by piano steel wires tensioned between side portions of climbing and descending portions of the landings and having a required number of insert nuts as buried in the wall portions and for holding forms in the props and the like on three side portions thereof, and mounting metal-fittings provided in the strings of the climbing stairs and the descending stairs to be buried into and fixed to both ends and a central portion of a remained side surface of the landing.

And, in such stairs for a building, a central mounting portion of the landing for mounting the central portion side string of the stair unit to the central portion thereof is provided so as to be enlarged upwardly as fills a space between the landing and the capping. And, the central mounting portion for the landing is mounted to a recessed portion of the central portion of the landing by anchor props serving as a buried insert buried and fixed in a rear surface thereof opposite to the central mounting portion.

In this inner stairs for a building, the treads supported on both the wall-side and central side strings of the stair unit are made of precast concrete members.

Further, to achieve the other object of the present invention, the method of constructing the inner stairs for a building, includes the steps of, arranging props having a height provided by locating a top thereof at a floor surface of the upper floor more than a base floor in positions for performing burying of the props in wall portions of four corners of a stairwell prior to constructing of the stairwell,

interconnecting the top of the props at four side-surfaces thereof by using horizontal beams to each other,

connecting substantially intermediate portions of the props to each other by anti-swinging members,

reinforcing and connecting the props by braces at four side surfaces which each are formed by two props,

installing an intermediate landing at an opposite side to the anti-swinging members and at a substantially intermediate position between a base or lower floor and an upper floor by supporting a central side of the intermediate landing with exclusive removable jig-supports and mounting a wall side thereof to the props by way of brackets,

installing a main landing by supporting a central side thereof in an stairwell with exclusive jig-supports removable therefrom and having a height corresponding to a floor position of an upper floor more than that of the base floor and by tying a wall side thereof to the props by way of brackets,

lifting a stair unit having a string fixedly provided with anchors projecting from a side surface of a wall portion toward an inside thereof and treads mounted between the strings with respect to each of the landings, first installing and fixing one stair unit with respect to the base floor or the main landing of the lower floor and the intermediate landing, and next another stair unit with respect to the intermediate and main landings,

attaching horizontal braces to each top of the props in a horizontal plan provided by those tops, adjusting and temporarily providing the built-in of the

stair unit while tensioning each of all the braces,

arranging form members for walls forming a stair room so as to bury and position the props, the beams, the anti-swinging members and the braces together with anchors which project from the landings and the stair units into an inside of walls of a building, and

placing concrete in said forms so as to bury the props, said beams, the anti-swinging members and the braces together with the anchors of each said landings in the inner portion of the wall.

In such a method of constructing inner stairs of a building, the props are made one for an upper floor by connecting a prop having a length of one floor to the prop of a lower floor after temporary providing of said intermediate landing, the main landing, the stair units and said form members are completed, thereby performing temporarily providing of an intermediate landing, a main landing and a stair unit as well as those of said lower floor, and then form members of wall portions for an upper flower are arranged, and concrete is placed in all temporary provided floor after temporary providing of suitable number of floors and arranging of form members are completed.

In the inner stairs for a building having the above structure, prior to constructing of a stairwell the props having a height of those top positioned at a

floor surface of an upper floor more than that of a base floor are located in positions of four corners of the stairwell where the props are buried in a wall portion, the tops of these props are connected to each other using horizontal beams in four outer surfaces formed by the props, and substantial intermediate portions of two opposite props are connected to each other by anti-swinging members, and further the props are reinforced and connected to each other by braces between them in four surfaces formed by each two props.

With respect to the props disposed as mentioned above, an intermediate landing made of precast concrete members and beforehand manufactured in an exclusive factory thereof is disposed at a substantial intermediate position between an upper floor and a base or lower floor. This intermediate landing is provided so as for three side portions thereof to partially go into the wall portion positioned at a floor of a building or a floor portion of the building, and this landing has also a plurality of anchors projected from the three side portions and buried in the wall portion and the floor portion. Then, a central portion of this intermediate landing at a central side of the stairwell is supported by an exclusive jig-supports removable therefrom, and its ends at wall-side corners thereof each are temporarily mounted to the props by bolts, nuts and the like using brackets.

Next, in the same location as the floor surface of the upper floor, the main landing having substantially the same shape and structure as those of the intermediate landing and made of a precast concrete member is supported by removable exclusive jig-supports having a length corresponding to that between the base floor and the upper floor, and then both those wall-side portions at corners of the stairwell is located so as to fix them to the props by way of brackets.

With respect to these located intermediate and main landings, the stair unit having a string at a central side thereof and another string having stud bolts buried in the wall portion of the building and fixed so as to project from a side surface thereof, treads bridged between and fixed to both the strings, and handrails mounted with balusters and a capping to the strings is lifted by a lifting machine, and the stair unit is first taken down and disposed to the main landing and the intermediate landing of the base floor or lower floor, and then another stair unit having the same structure is disposed to the intermediate landing and the main landing of the upper floor as well. And, these stair units are temporary positioned by mounting the ends of the strings to mounting portions of each landing.

In such props in which the main and intermediate landings and the stair units are positioned, horizontal braces are mounted between those

tops to adjust plumbing of the stair units by tensioning each the braces including these horizontal braces using turnbuckles so as to perform temporary thereof. With respect to the stair units temporary provided prior to construction of a building, forms for walls forming the stairwell are disposed so that each prop, beam, anti-swinging member and all braces excluding ones of those tops are located within the wall portions. And, placing of concrete is performed in the forms so that all props, beams, anti-swinging members and braces together with the anchors of each landing and the stair units and the stud bolts of the wall-side strings of the stair units are buried into the wall portions.

The construction of the inner stairs for a building as described above is performed by temporary providing of the main and intermediate landings and the stair units corresponding to a number of floors accompanying with the construction of the building itself, arranging forms corresponding to the temporary provided ones and placing concrete into those portions, while in a temporary work of a following floor, new props having a length of one floor are connected to the props of lower floor so as to provide props of an upper floor.

After temporary providing of the stairs of a number of floors according to the design and arrangements of forms are performed and placing of

concrete is performed, passing a term of curing, the braces provided in the horizontal plan in the tops of the props in each floor are removed previous to removing the forms, and the exclusive jig-supports are removed therefrom so as for inner stairs of a following floor to be prepared in construction of the following floor. And, the props are connected to each other up to the most upper floor by free joints. The above construction works are repeated to be proceeded by providing the stairs previous to construction of the building, so that the inner stairs for a whole building is completed.

And, in the stair units mounted between the landings of the stairs constructed as described above, the treads bridged between the strings and mounted on there are made of a precast concrete member, thereby enabling sounds generated from the treads by pedestrians to be remarkably suppressed in an envelopment having a large echo as in the inner stairs.

In the following, the invention will be explained with reference to preferred embodiments and to the drawings.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a plan view of a temporary condition of inner stairs for a building in accordance with an embodiment of the present invention;

Fig. 2 is a right-side elevation of a

temporary condition of inner stairs for a building in accordance with the present invention;

Fig. 3 is a top view of the inner stairs for a building in the temporary conditions of Figs. 1 and 2;

Fig. 4 is a sectional view of a mounting condition of props and forms in corner portions of a landing under construction of the inner stairs for a building according to the present invention;

Fig. 5 is a side elevation of the props and the landing viewing in the direction of allow A-A in Fig. 4;

Fig. 6 is an illustration of a wall side string and a mounting condition of treads for this string in the landing of the inner stairs for a building according to the present invention;

Fig. 7(a) is a plan view of a fixed portion of a central string in the inner stairs for a building according to the present invention;

Fig. 7(b) is an illustration of a mounting condition of the string in the fixed portion thereof;

Fig. 8 is a sectional view of treads of a stair unit in the inner stairs for a building according to the present invention;

Fig. 9 is an illustration of a string mounting portion in a central portion of the landing in the inner stairs for a building according to the present invention;

Fig. 10 is a schematic view partially showing a condition of forms for a building provided after temporarily providing of the inner stairs for a building according to the present invention;

Fig. 11 is a sectional view taken along line XI-XI in Fig. 4;

Fig. 12 is a schematic view viewing from the top of the inner stairs for a building after removing the forms thereof;

Fig. 13 is a plan view of the inner stairs according to another embodiment of the present invention;

Fig. 14 is a side elevation of the main landing and the upside stair unit connected to each other as in Fig. 13;

Fig. 15 is a sectional view of a downside stair unit and the landing taken along line XV-XV in Fig. 13;

Fig. 16A is a front view of a tread according to another embodiment of the present invention; and

Fig. 16B is a side elevation of the tread in Fig. 16A.

BEST MODE FOR CARRYING OUT THE INVENTION

The embodiments of the present invention will now be described with reference to these figures.

Fig. 1 is a side elevation showing a whole stairs inside a building for two floors as temporary

provided prior to construction of a building, and Fig. 2 is a right side elevation of the stairs in Fig. 1, in which structural members are partially shown to be omitted so as to be made clear, while the stairs of one floor is mainly described in the following description. The inner stairs compose of a main landing 1 provided at a floor position of the building, an intermediate landing 2 provided at an intermediate position between the floors, and stair units 3 disposed the intermediate landing and the main landing 1 or the set-up or base plan 9 of the stairs, located prior to construction of a building, and mounted to and supported by four props 4 and exclusive jig-supports 5 for supporting a central portions, at a central side of a stairwell, of the main landing 1 and the intermediate landing 2 so as to temporarily provide the inner stairs.

As further described in detail, the main landing 1 as shown in Fig. 12 is made of a precast concrete member having a thickness of 100 - 130mm, in which traverse and longitudinal deformed bars or rods 12 and 14 are buried in grating for reinforcement thereof. Those ends project from side surfaces facing wall portions 6 and 7 of the building, and the reinforcing bars are bent as directed parallel to a side surface thereof at a distance of about 80 mm from the side surface as anchors 13, 15. Further, in the stair-unit side portions of the main landing 1, the landing 1 is reinforced by extending a piano steel wire

17 between fittings of the piano steel wires provided in the wall side portion and the central portion thereof. And, inserts 19 for mounting forms are provided and buried with a suitable distance at side walls facing walls 6, 7 of the main landing 1. Thus, the main landing beforehand made of a precast concrete member is used as one having a strength of withstand load, 300-400Kg/m^2.

The intermediate landing 2 as shown Fig. 12 is made of a precast concrete member having a thickness of 100 - 130mm as well as the main landing 1, in which traverse and longitudinal deformed bars 22, 24 are buried in a grating manner, and those ends project from three side surface thereof so as to go into walls of a building. The projecting deformed bars are bent as made parallel to the side surfaces at a portion of about 80mm length therefrom. The stair-side portion of the intermediate landing 2 is reinforced by extending a piano steel wire 27 between fittings 28 of piano steel wire. And, inserts 29 for mounting forms are mounted and buried with a suitable distance between the inserts in side surfaces, at sides of walls 6, 7, of the intermediate landing 2.

And, the stair unit 3 as shown in Figs. 12 and 6 to 9 has a wall-side string 32 and a central-side string 34 in a stairwell of a building, and these strings 32, 34 are made of steel plates having a thickness of 12 - 16mm and selected in use of one

having width 250 - 300mm. And, the treads 362 made of precast concrete members are disposed between both the strings 32, 34. In this tread 362, the reinforcing bars 370 of a diameter 13mm are passed therethrough and buried therein, and a wall-side end of the bar 370 projects in a length thereof capable of burying in the wall portion 6 from the end portion of the tread 362. The projecting portion of the reinforcing bar is threaded to able to be fixed to the wall-side string 32 by a nut, and the end, at a central side of the stairwell, of the reinforcing bar 370 is threaded as well and in a manner of the bar 370 being screwed into a half portion of an elongated nut 366 buried in the end of the tread, and the tread 362 can be secured to the strings 32, 34 by clamping and screwing a bolt to a remained portion of this elongated nut 366 so as to fix the tread 362 to the string 34 at a central side of the stairwell. Two upper and lower treads 362, as shown in Figs. 5 and 7, are connected to each other by fitting a riser 368 provided in a lower surface of this side end of one tread and in a slot 365 formed at a remote side of another tread, and the treads 362 are continuously connected to each other as shown in Fig. 8. The treads 362 at the most upper step and the bottom step in the strings 32, 34as shown in Fig. 9 have a structure as disposed as shown in Fig. 9. Further, in the central side string 34, as conventionally provided though not shown in figures, supporting rods 38 such as a capping

are provided parallel to the string 34, and a handrail having balusters provided upright between the lower side supporting rod 38 and the upper supporting rod not shown is mounted thereto. This handrail may be mounted to the string later, and further a handrail may be mounted to the wall-side string 32.

Further, in the wall-side string 32 of the stair unit 3, as shown in Fig. 5, a stud bolt 31 corresponding to anchors of the above landings 1, 2 are disposed at the wall-side side surface to be welded and fixed thereto as shown in Fig. 5 and projects so as to be buried into walls of the building as in Fig. 6. Furthermore, the stud bolts 31, when a strength is required according to a length of the stair unit 3, as shown in Fig. 9 may be provided to be disposed in turn parallel to each other at two positions in the same horizontal level on the side surface of the string 32.

Further, the wall-side string 32 of the stair unit 3 is fixed to the mounting plate having buried nuts in the main landing 1 and the intermediate landing 2 by bolts, and the central-side string 34, as shown in Fig. 7, has a central-side string fixing portion 16 made of a channel-shaped steel member provided with stud bolts projecting from a central portion to which the stair unit is mounted, and this central-side string fixing portion 16 has two nut holes and is mounted integral to a recessed portion of a precast concrete member with the central-side string being secured to

this fixing portion 16 with bolts. The central-side string fixing portion 16 as shown in Fig. 9 may have an enlarged portion 162 enlarged upwardly substantially in alignment with an extension of an upper edge of the string 34 so as to make narrow a space between a bottom rail of the handrail 34 and the upper surfaces of the landings 1, 2.

The stairs having the above structure is temporary provided in a stairwell constructed in the building by each prop 4, the exclusive jig-supports 5, beams as hereinafter described, anti-swinging members and the like prior to construction of the building. Therefore, as shown in Figs. 1 to 5, in order to support the main landing 1 as meets with a floor level of the upper floor and the intermediate landing 2 at an intermediate position between a setup plan 9 or a floor surface of the installed floor and the upper floor, the props 4 are provided at positions inside the wall portions 6, 7 constituting the stairwell. Other props of an upper floor following this prop 4 are connected thereto by using free joints 42 so as to correspond to a height of one floor, while the free joint 42 may be beforehand attached to the tops of the props 4 for one floor.

In case of the base surface being defined by a setup plan 9 of the lowest floor, the props 4 for one floor as disposed at four corners of the stairwell, as shown in Figs. 3 and 4, are made of channel-shaped

steel members and secured vertically to the fixing portion fixed on the setup plan 9, as located at positions inside the wall portions 6, 7 and buried therein by placing of concrete, by way of free joints 42 with bolts and nuts according to its requirements. And, the tops of these props 4 are connected to each of other short-side beams 80 and longitudinal-side beams 82 made of channel-shaped steel members having a predetermined size. Further, those substantial intermediate portions in a height direction thereof are connected to each other by anti-swinging members 84 made of the channel-shaped steel members. And, in both side plans formed of two longitudinal-side props 4 and both another side plans formed of two short-side props 4, the bottoms and the tops of those props 4 are connected diagonally to each other so as to be reinforced adjustable by way of turnbuckles 862, 882 provided in braces 86, 88.

With respect to the props 4 built in as above-described, the intermediate landing 2, as shown in Figs. 4 and 5, are supported in portions thoseof located at an intermediate position of the props for one floor by securing an end of the exclusive jig-supports 5 located on the setup plan 9 with bolts, nuts and the like. And, in corner portions met with both wall portions 6, 7, the intermediate landing 2 is secured to the props 4 by clamping and locking one of right-angled brackets 44 in corner portions of the

intermediate landing 2 with bolts 14 to two of the buried inserts 12 including long nuts and by clamping and locking another bracket 44 to the props 4 with bolts and nuts. In the same manner, the main landing 1 is supported at a central side of the stairwell to the setup plan 9 by the exclusive jig-support 5 having a vertical length of one floor, and the end portions thereof facing the wall portions 6, 7 are secured by way of the right-angled bracket 44 to the props 14 by clamping and locking with bolts 14 passing through holes formed in the props 4 to the buried insert 12 of the main landing 1.

With respect to the main and intermediate landings1, 2 located as described above, the tread 362 made of precast concrete members is bridged between and mounted to both the strings 43, 34 by locking the bolt to the buried insert provided at the ends of the tread 362, and further the stair unit 3 formed by mounting the hand rail thereto is lifted by a lifting machine and taken down from the lifted position to thereby position the stair unit 3 between the setup plan 9 and the intermediate landing 2 and secure it to the setup plan 9 by screwing and locking nuts to the stud bolt buried and fixed thereto. And, in the intermediate landing 2, as shown in Fig. 7, the ends of the central-side strings 34 is mounted to the recessed fixing portion 16 thereof adjacent to the support portion of the exclusive jig-supports 5, and the wall-side string

32 is mounted to the side portions thereof with bolts and nuts. And, the beforehand combined stair unit 3 is positioned between the intermediate landing 2 and the main landing 1 by lifting and taking down it using the lifting machine as well so as to be secured with bolts and nuts to both the landings 1, 2.

In the stairs temporary provided as described above, further, the props 4 between which free joints 42 are put are extended upwardly by connecting them to each other, and the tops of the connected props 14 are connected and reinforced to each other by the beams 80 connecting the tops of the props to each other as well as the lower floor, next the anti-swinging members 84 being mounted to a substantial intermediate portion of the prop 4 at the short-side surface formed of two props, and the braces 86, 88 being mounted to the props 4 in the short-side surface and the longitudinal-side surface thereof as well as the lower floor. In this manner, as in the lower floor, the lower ends of the exclusive jig-supports 5 each are mounted to the intermediate landing 2 and the main landing 1 with bolts, then the intermediate lading 2 of the upper floor and the main landing 1 are in turn lifted to a predetermined position by a lifting machine and the side portions are secured with bolts by way of brackets 44 to the props 4 at corner portions of the stairwell as well as the lower floor. And, the upper portions of the exclusive jig-supports 5 are secured to those

central-side end portions in upper surfaces of the main landing 1 and the intermediate landing 2 so as to provide both the landings 1, 2. Further, each of the stair units 3 is installed between the main landing 1 of the lower floor and the intermediate landing 2, and a beforehand combined stair unit 3 is installed between this intermediate landing 2 and the main landing 1 of the upper floor by lifting and taking down these landings 1, 2 by a lifting machine. And, as shown in Fig. 3, braces 90 are extended and mounted between the tops of the props 4 through turnbuckles 902 by fixing those ends with bolts.

In such a temporary provided stairs, braces 90 are extended through turnbuckles 902 between the tops of the most upper props 4 and mounted to the props 4 by securing bolts and nuts. Then, these braces 90 may be mounted to the tops of the props 4 for each floor according to its requirement, while the braces may be mounted thereto at a minimum according to a necessity of its work since these braces are finally removed therefrom.

After the above work is completed, since the stairs have to be adjusted in its built-in, the built-in adjustment is performed by using a plumb line suspended from the most upper portion of each props 4 while adjusting tension of the braces 86, 88, 90 provided in a horizontal plane defined in those most upper portions, after that the work of this built-in is

finished.

With respect to the stairs temporary provided as described above, forms 8 is arranged for constructing the stairwell of the building. The forms 8, as shown in Figs, 4, 10 and 11, are formed of construction panels 96 having a predetermined length and width and disposed parallel to each other as forms both wall surfaces by framing and reinforcing with soldiers 98 and by nut-clamping of short pipes 84 arranged parallel to each other through form stoppers 92 having resin coating 83 at its tip end with bolts 93 so as to determine width of those walls. In Fig. 10, the short pipes 84, the form stoppers 92 or the like are partially shown, while those right-side portions are really provided according to its necessity, and the portions not shown in the figures are omitted therefrom.

The above construction panels 96 has a relationship of those locations as shown in Figs. 4 and 11 with respect to the main landing 1 and the intermediate landing 2. Fig. 11 is a sectional view taken along line XI-XI in Fig. 4 and showing a portion only along the line XI-XI. In this case, when the landings 1, 2 have a thickness of 100mm, edge portions of the landings 1, 2 are gone with a distance of about 20mm into the wall, so that the construction panel 96 has a panel surface and an end surface 106 of the landing shown with dash lines in Fig. 4. and in Fig. 11

the form 8 is disposed so as to put upper and lower surfaces of the landings 1, 2 therebetween, in which that position is regulated by both projecting end portions coated with resin coating 93 of the form stopper 92 secured to the form mounting insert 29 with bolts 95 and positioned to make 20 mm a distance between a surface of the construction panel 92 and the end surface 106 of the landing. In this case, anchors 13, 15, 23, 25 of each landing 1, 2 and stud bolts 31 of the stair unit 3 are located at positions shown in Fig. 12.

As described above, the forms 8 are constructed in the built-in stairs, after that concrete is placed into the forms 8 of walls of the stairwell for a body of the building, and after a term of curing is progressed, the forms 8 are removed therefrom so as to complete the inner stairs. In this case, the handrail is not shown in the figures, while it may be combined with the stairs after the steps shown in those figures. Further, as shown in Figs. 1 and 2, the inner stairs from the first floor to the second floor are shown in a sectional view, in which there is not a wall of an entrance portion of the stairwell, and the setup plan 9 of the lowest stair unit 3 is made the same plan as the ground. Also, the arrangement of the wall 7 of the stairwell or the second floor portion, the anchors provided by extensions of deformed reinforcing bars of the main landing 1 and the intermediate landing 2, the

anchors, and the stud bolts secured to the strings 32 of the stair unit 3 is in a condition shown in Fig. 12.

These built-in of the inner stairs and constructions of the forms 8 are in turn repeated in each floor so as to complete the inner stairs by constructing continuously to the most upper floor. From the manner shown Figs. 1 and 2, particularly, the temporary is performed using the landings 1, 2 completed for the second floor, the props 4, the exclusive jig-supports 5, beams 80, 82, the anti-swinging members 84, the braces 86, 88, 90 in the most upper, horizontal plan, and the stairs are constructed and provided by adjusting tension of each brace. The exclusive jig-supports 5 for the intermediate landing 2 particularly has substantially the same height as that for the main landing 1 shown in Fig. 1, and the intermediate landing already completed is used as a setup surface, on which the supports 5 are provided, and that supports 5 is made a support portion for the intermediate landing 2 of the following floor, so that new intermediate landing 2 is temporary provided previous to construction of the building itself. The main landing 1 is installed by using the completed main landing located in the floor level as a setup plan, so that the main landing at a floor level of a following floor is temporary provided previous to construction of the building.

Furthermore, the stairs shown with the forms

8 in Fig. 10 has no exclusive jig-supports 5, while the main landings 1 and the intermediate landings 2 for the first to third floors each are used as a setup place of the jig-supports 5 to perform constructing of a stand, so that as shown in figures the inner stairs for three floors may be temporary provided and built in. And, according to its necessity, four wires for preventing falling of the stairs may be tensioned from the top portions to left and right directions.

As described above, in the stairs built in and to which the forms 8 are constructed, placing of concrete is performed to the wall portions 6, 7 including the floor of the most upper floor, and then all props 4, all beams 80, 82, all anti-swinging members 84 and the braces 86, 88 at each side plan provided by the props are buried in the wall portions 6, 7 including a floor. And, after passing a term of curing for hardening concrete, the forms 8 are removed therefrom, after that the exclusive jig-supports 5 for supporting each main landing 1 and each intermediate landing 2 and the braces 90 at a horizontal plan provided in the most upper portion are merely removed therefrom to make it possible to finish construction of the stairwell and the stairs for two floors.

By repeating such a work as described above, the inner stairs for a building is constructed with the building body. Then, the temporary of the main and intermediate landings can be certainly performed with

correct positioning thereof by securing to the props by way of the brackets, and by performing reinforcement of the props with the braces provided at each side surface and a horizontal plan of the most upper portion. Additionally, since a number of work steps can be remarkably reduced by making minimum a number of support jigs to be removed after hardening of concrete, shortening of a term of works and reduction of cost can be established.

Furthermore, in the inner stairs having the above structure, only the treads are made of precast concrete members, while, as shown in Figs. 13 to 16, especially in sectional views of Figs. 14 and 15, the suspended plate serving as a riser is not separated from the tread but may be made of one precast concrete member made integral with each other as a tread 362'. Then, the tread 362' as shown in Fig. 16 may be mounted to the strings 34 up to the upper side landing as shown in Fig. 15 except that there is provided the riser 368' made of a precast concrete member so as to close a space provided between the lowest tread 362' and the top surface of the landing 1, 2 in an up-direction side of the stairs.

And, the channel-shaped steel member 61 mounted to the central recessed portion of the landing 1, 2 having the above structure as shown in Fig. 9 is not provided therein, but as shown in Fig. 13, the end of the central side string 34 may be mounted directly

to the fixing portion 16 of the central recessed portion as well as the wall-side string 34.

The mounting of these treads 362' or the riser 368' to the strings 34 is performed by screwing and fixing nuts or bolts to buried bolts or nuts provided in the end portions of the treads 362' or the riser 368'.

Thus, the inner stairs for a building of the present invention as mentioned above is effective as follows.

According to the present invention, there is provided the inner stairs for a building having wall portions in which concrete is placed, in which a main landing provided at a floor position of the building to locate three side portions thereof in the wall portion thereof or a floor portion thereof and have a plurality of anchors projecting from the three side portions, and an intermediate landing provided at an intermediate level between the floors of the building so as to partially bury three side portions thereof in its wall portions and have a plurality of anchors projecting from the three side portions thereof are secured by way of brackets to props disposed in the wall portions at four corners of the stairwell, having those tops connected to each other by beams, opposite intermediate portions thereof connected to each other by anti-swinging members and four side surfaces formed of the props as reinforced by the braces and buried in placing

of concrete, and the central portion thereof at a central side of the stairwell is supported by exclusive jig-supports so as to position them at each height of the props prior to construction of the building, and the inner stairs having a wall-side string adjacent to the wall, a center-side string fixedly located at a central portion of the stairwell to be bridged to the main landing and intermediate landing as vertically disposed, treads bridged between these strings and a handrail including balusters mounted upright to a bottom rail parallel to the handrail are temporary provided prior to construction of a building, further tops of the props being connected to each other by horizontal braces at a horizontal plan provided by those tops so as to be reinforced, anchors of each landing being provided so as to be buried inside the wall portion together with a plurality of anchors projecting from a wall side surface of the string to an inside of the wall portion at the same time in placing of concrete for the building, thereby enabling the work of constructing forms to be performed simply in construction of the inner stairs itself by placing of rare concrete, a term of construction in a site thereof to be successively reduced. And, the main and intermediate landings and the stair unit as made beforehand are positioned and temporary provided in the forms so as to be buried therein at the same time when concrete is placed, so that the exclusive jig-supports

for supporting a central portion of each landing at a central side of the stairwell and the braces for holding the props at a top plan provided by the props are merely used to make it possible to minimize temporary construction material to be removed and reduce material and cost of the work more than conventional works.

Further, the whole stairs for the required number of floors which requires troubles of works at a maximum in the construction of a building is temporary provided prior to construction of a building, so that the work of construction of the inner stairs can be performed in the step of the construction which be facilitated, the props of main material for temporary are buried in walls so as to need no material to be removed and also obtain the strength for supporting the landings, and the term of construction can be reduced and low cost can be substantially established so as to enable efficiently construction of the inner stairs.

INDUSTRIAL APPLICABILITY

The inner stairs of the invention can be applied to a construction of a building provided with inner stairs composing of landings, treads and the like formed of a precast concrete plate, the inner stairs for a predetermined number of floors being primarily built in by supporting them with removable jig-supports and props, the props with side-ends of the landings or

the like being buried in wall portions of the building in placing of concrete for a building body.

CLAIMS

1. Inner stairs for a building having wall portions to be concreted, comprising:

a main landing disposed at a floor-height position of the building or a floor portion thereof so as for parts of three side portions of the landing to go into said wall portions and having a plurality of anchors projecting from said three side portions, said main landing being supported by two props which are connected to each other by bridging members and buried into the wall portions and also supported at a free side of the landing by exclusive jig-supports removable therefrom,

an intermediate landing having a plurality of anchors projecting from three side portions of the intermediate landing and disposed at a substantial intermediate-height position between upper and lower floors of the building so as for parts of the three side portions thereof to go into the wall portion, said intermediate landing being supported by two props which are connected to each other by bridging members and buried into the wall portions and also supported at a free side of the intermediate landing by exclusive jig-supports removable therefrom, and

stair units having a wall-side string bridged to said upper and lower landings or a base plan of the building and located adjacent to said wall portion, a central side string located at a central portion of the

stairs and fixed with said landings, treads extended between and fixed to these strings, and a handrail including a capping for providing balusters parallel to each other between the capping and the handrail, said stair units provided with a plurality of stud bolts as projecting toward an inside of said wall portions fixed with a wall-side surface of said wall-side string so as to be buried in the wall portions previous to placing of concrete for the wall portions and disposed to said main landing, said intermediate landing or the base plan,

said landings and stair units being positioned and adjusted at each position of those heights previous to construction of the building by using beams for connecting each of said props to each other and braces for reinforcing and connecting said props to each other at a plan provided with said props, and when forms of said wall portions are provided, said bridging members, the beams and the braces being positioned within said forms with said anchors and said stud bolts and buried in said wall portions so as to be provided at the same time when concrete is placed in the wall portion.

2. Inner stairs of a building as claimed in claim 1, wherein after said main, intermediate landings and said stair units are combined with each other, uppermost end portions of said four props provided between a predetermined number of floors are connected

to each other at a upper horizontal plan thereof by braces, and further after concrete is placed in the wall portions, said braces are removed therefrom.

3. Inner stairs of a building as claimed in claim 1, wherein said landings are fixed using bolts, nuts or the like with respect to said props by way of brackets.

4. Inner stairs of a building as claimed in claim 1, wherein both of said landings are made of precast concrete members, said precast members being reinforced by piano steel wires tensioned between side portions of rising and descending portions of the landings and having a required number of insert nuts as buried in the wall portions and for holding forms on the props and the like in three side surfaces thereof, and mounting metal-fittings provided in the strings of the climbing stairs and the descending stairs to be buried into and fixed with both ends and a central portion of a remained side surface of the landing.

5. Inner stairs of a building as claimed in claim 1, wherein a central mounting portion of said landing for mounting the central portion side string of said stair unit to the central portion thereof is provided so as to be enlarged upwardly as fills a space between the landing and the capping.

6. Inner stairs of a building as claimed in claim 5, wherein said central mounting portion of the landing is mounted to an recessed portion of said

central portion of the landing by anchor studs serving as a buried insert buried and fixed in a rear surface thereof opposite to said central mounting portion.

7. Inner stairs of a building as claimed in claim 1, wherein the tread supported on both the wall-side and central side strings of said stair unit is made of a precast concrete member.

8. A method of constructing inner stairs of a building, comprising the steps of:

arranging props having a height provided by locating a top thereof at a floor surface of upper floor more than a base floor in positions for performing burying of the props in wall portions of four corners of a stairwell prior to constructing of the stairwell;

interconnecting said top of the props at four side-surfaces provided by two props by using horizontal beams to each other;

connecting substantially intermediate portions of said props to each other by anti-swinging members;

reinforcing and connecting the props by braces at four surfaces which each are formed by two props;

installing an intermediate landing at an opposite side to said anti-swinging members and a substantially intermediate position between a base or lower floor and an upper floor by supporting a central

side of said intermediate landing by exclusive detachable jig-supports and mounting a wall side thereof to said props by way of brackets;

installing a main landing by supporting a central side thereof in an stairwell with exclusive jig-supports detachable therefrom and having a height corresponding to a floor position of an upper floor more than that of said base floor and by tying a wall side thereof to said props by way of brackets;

lifting a stair unit having a string fixedly provided with anchors projecting from a side surface of a wall portion toward an inside thereof and treads mounted between the strings with respect to each of said landings, first installing and fixing one stair unit with respect to the base floor or said main landing of the lower floor and said intermediate landing, and next another stair unit with respect to said intermediate and main landings;

securing horizontal braces to each top of said props in a horizontal plan provided by those tops, adjusting and temporarily providing built-in of the stair unit while tensioning each of all said braces:

arranging form members for walls forming a stairwell so as to bury and position said props, said beams, said anti-swinging members and said braces together with anchors which project from said landings and the stair units in an inside of walls of a building; and

placing concrete in said forms so as to bury said props, said beams, said anti-swinging members and said braces together with the anchors of each said landings in the inner portion of the wall.

9. A method of constructing inner stairs of a building as claimed in claim 8, wherein said props are made one for an upper floor by connecting a prop having a length of one floor to the prop of a lower floor after temporary providing of said intermediate landing, said main landing, said stair units and said form members are completed, thereby performing temporarily providing of an intermediate landing, a main landing and a stair unit as well as those of said lower floor, and then form members of wall portions for an upper flower are arranged, and concrete is placed in all temporary provided floors after temporary providing of suitable number of floors and arranging of form members are completed.

FIG. 1

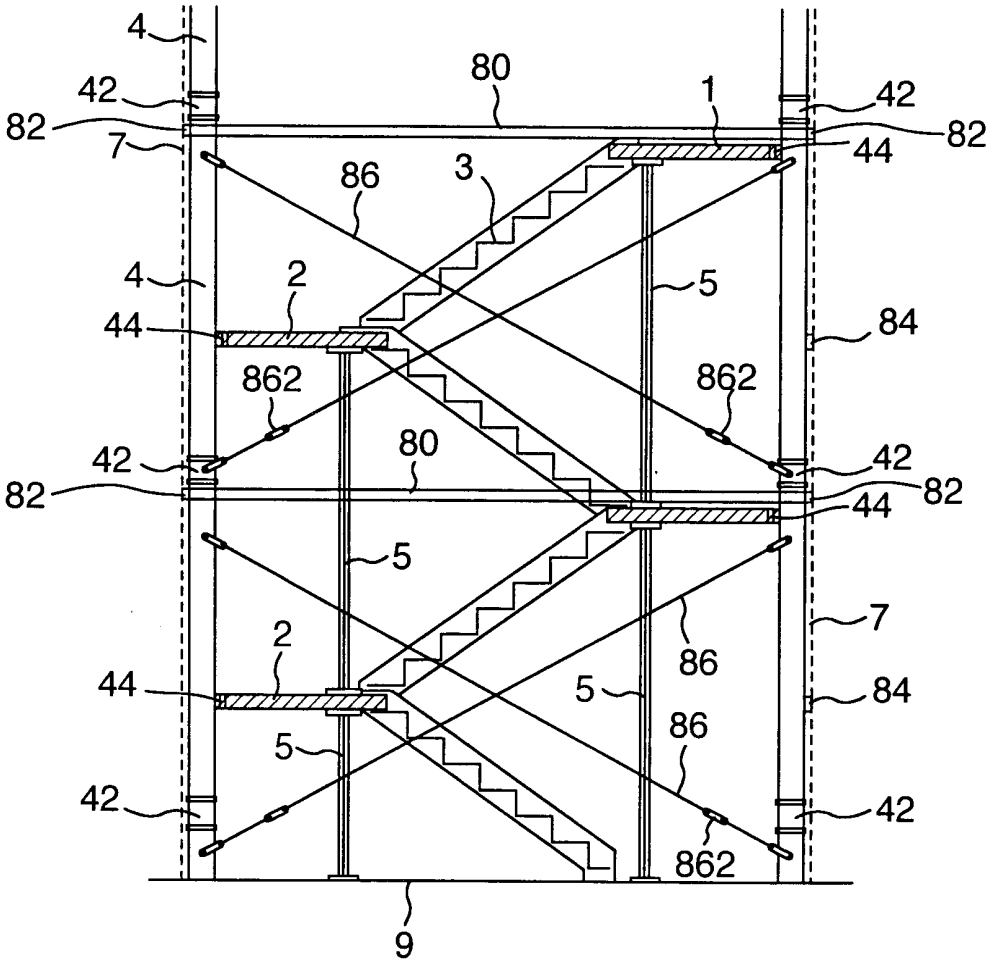
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FIG. 2

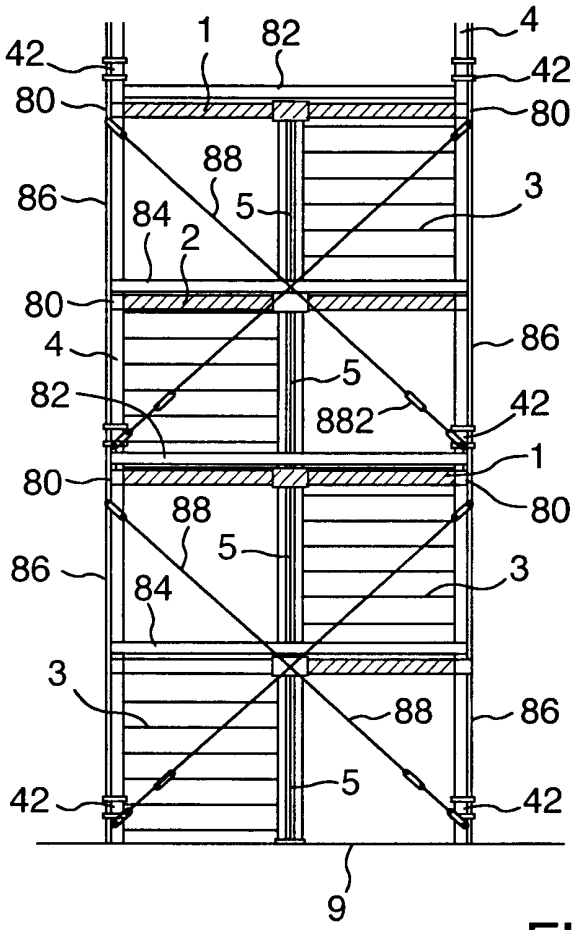
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FIG. 3

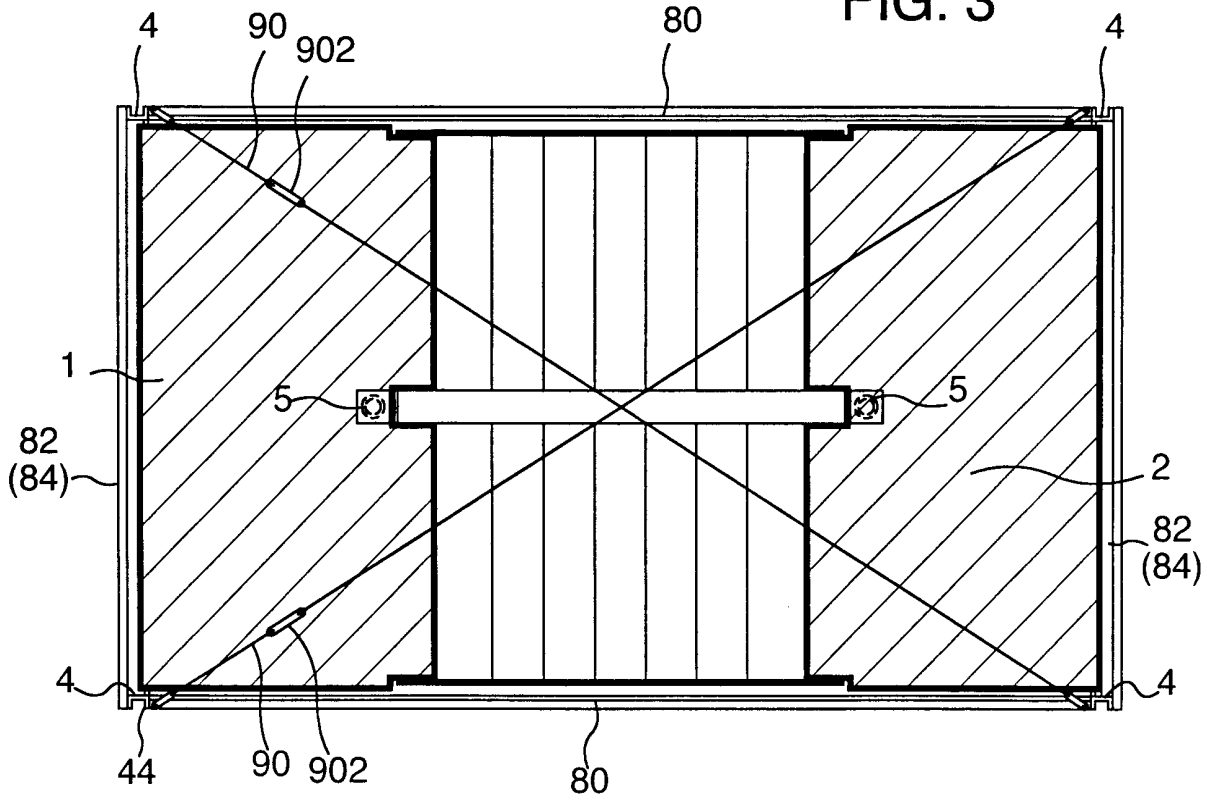
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FIG. 4

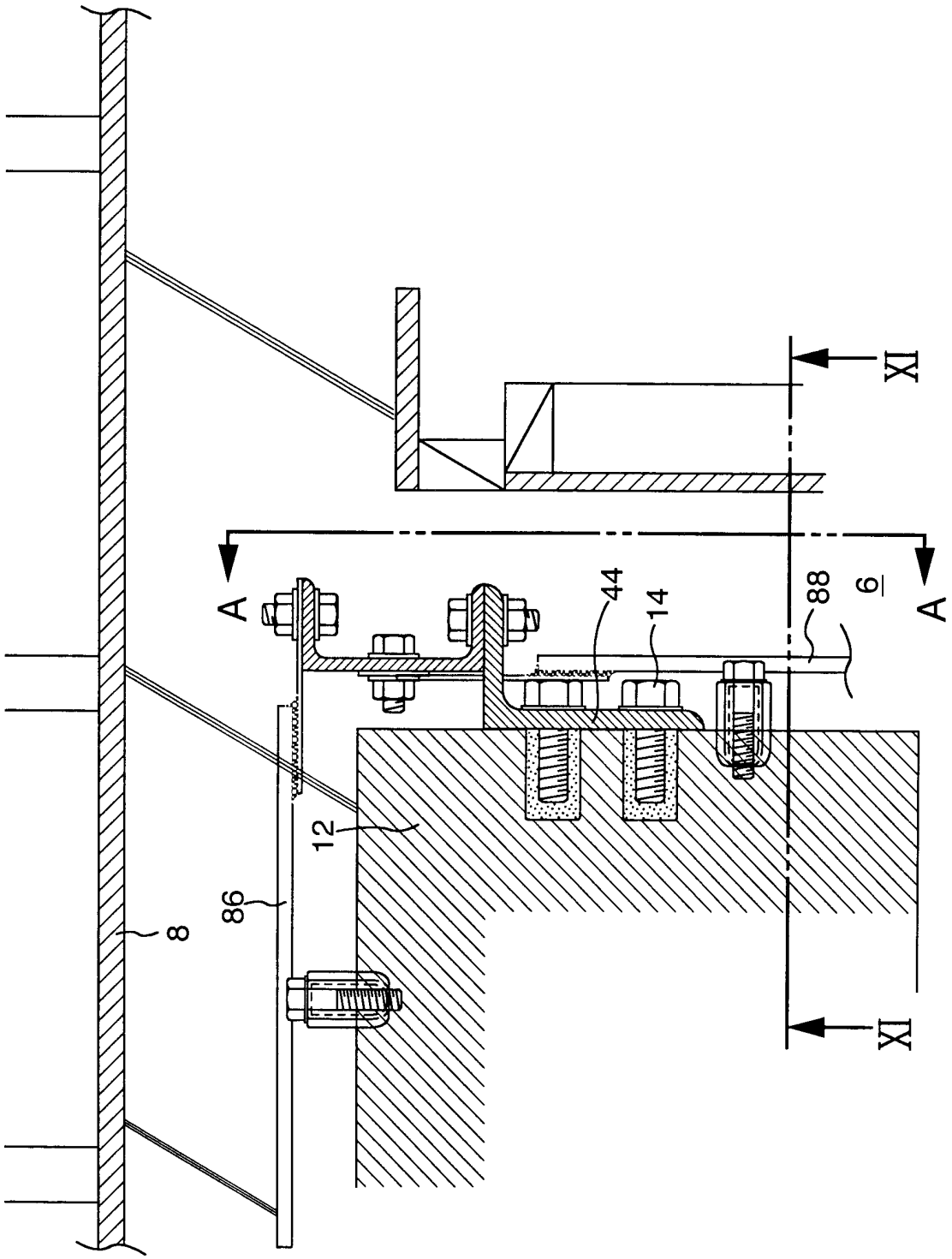


FIG. 5

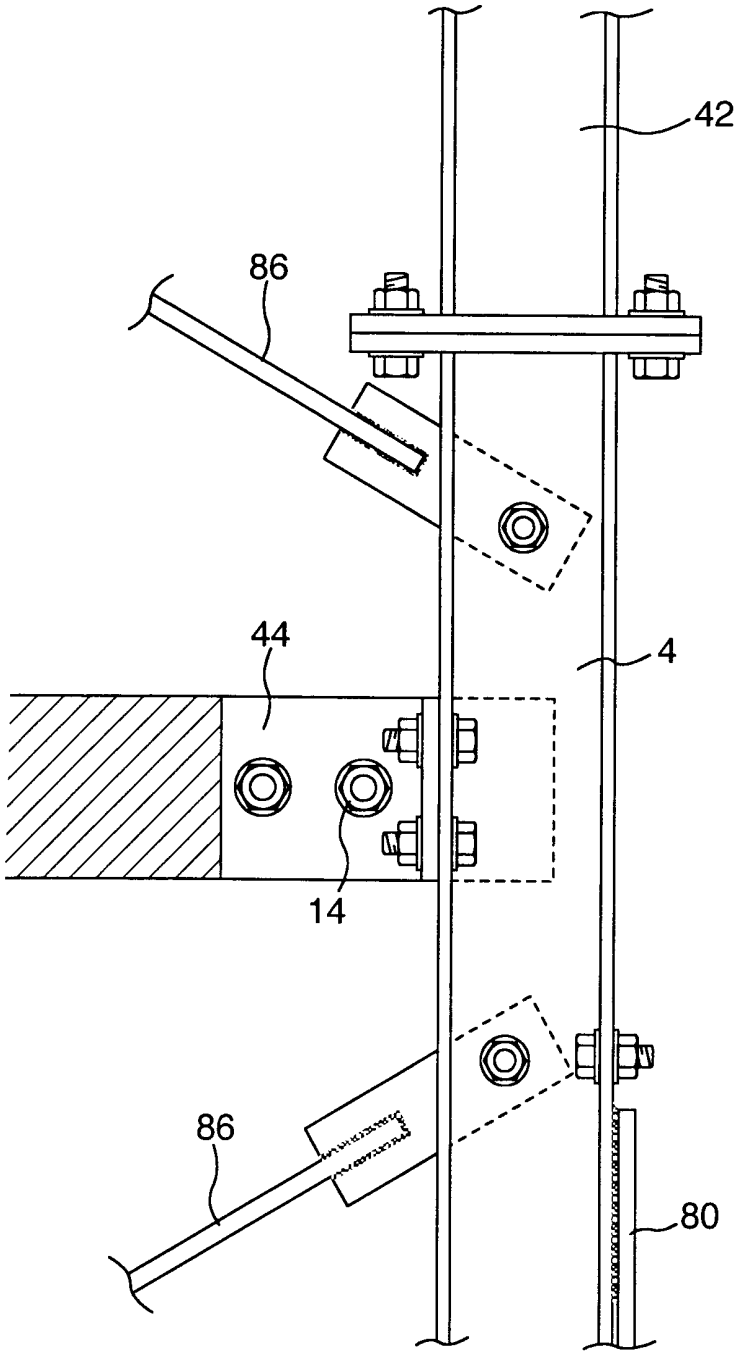


FIG. 6

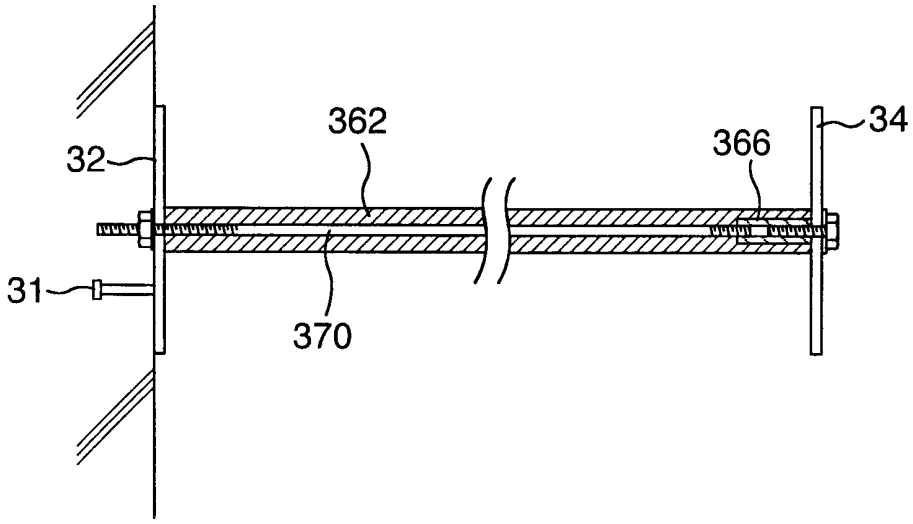
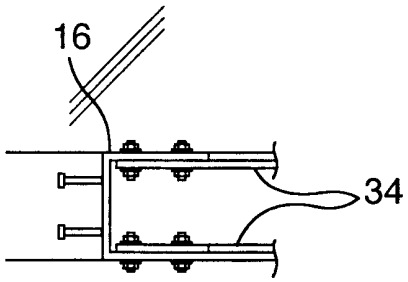


FIG. 7

(a)



(b)

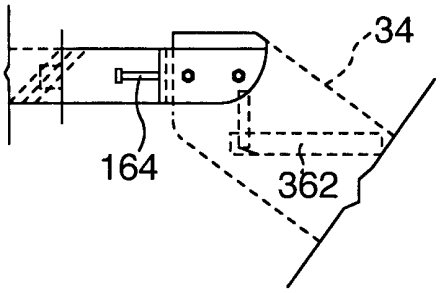


FIG. 8

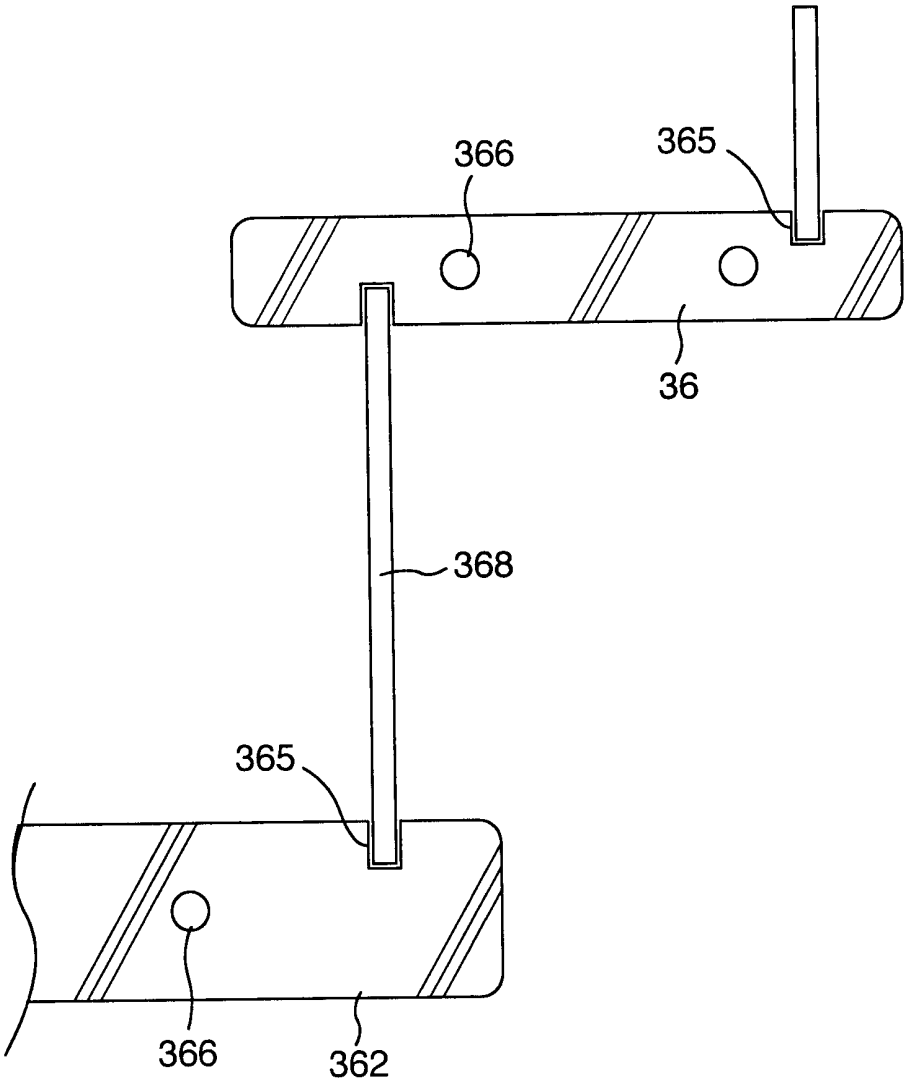


FIG. 9

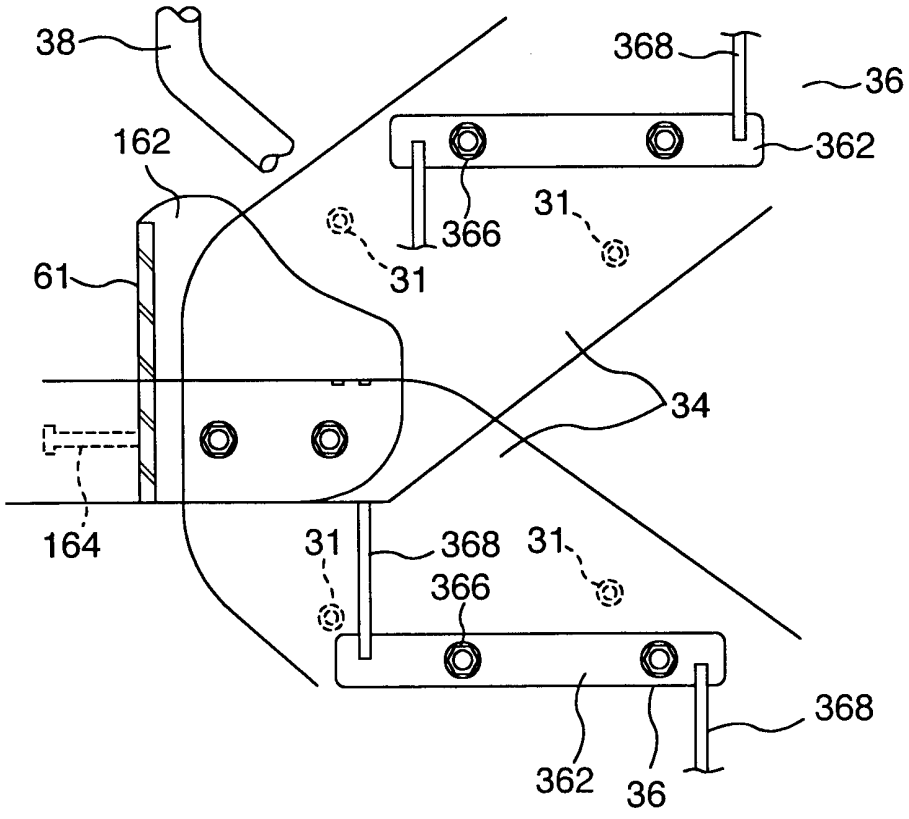


FIG. 10

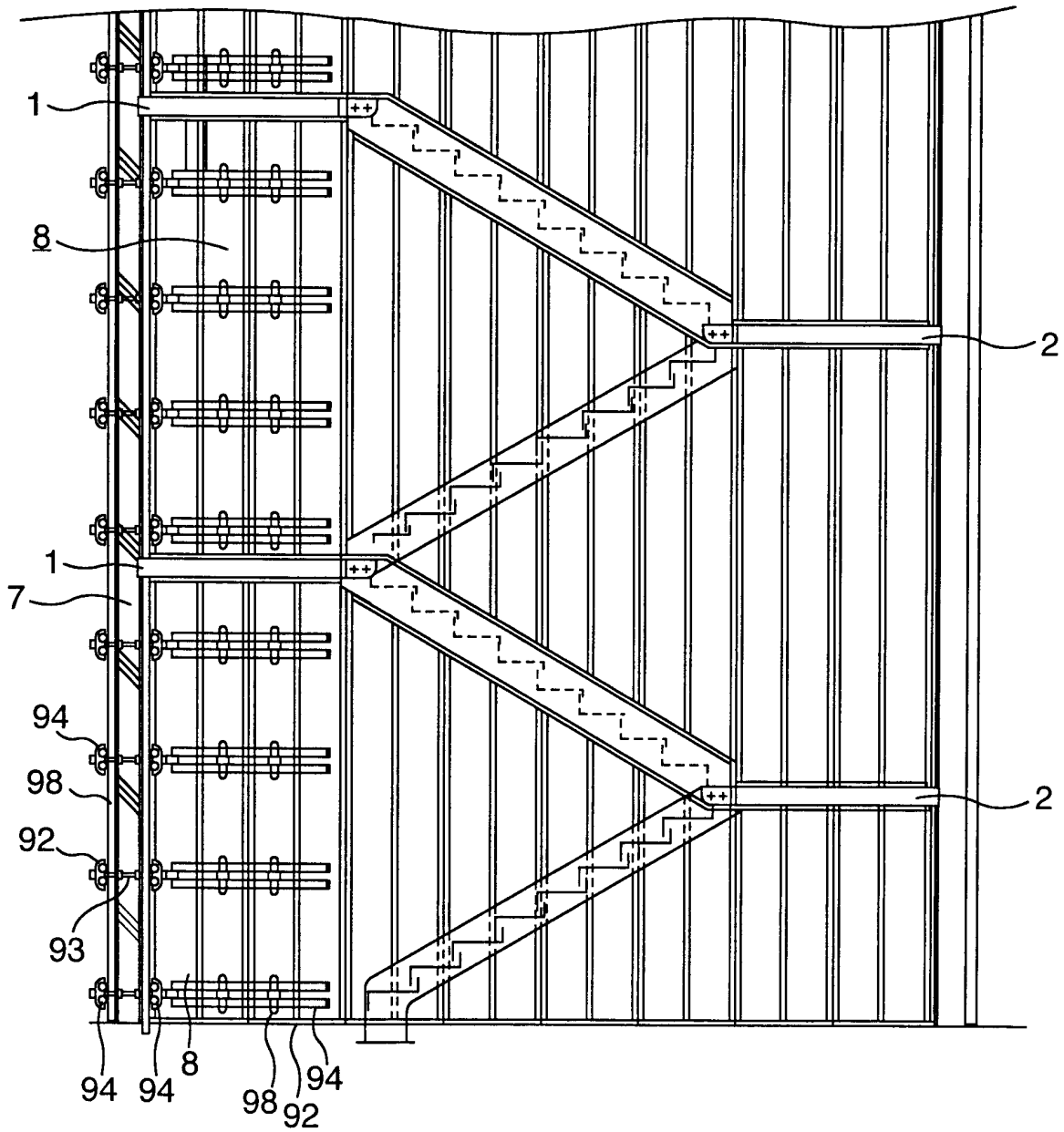


FIG. 11

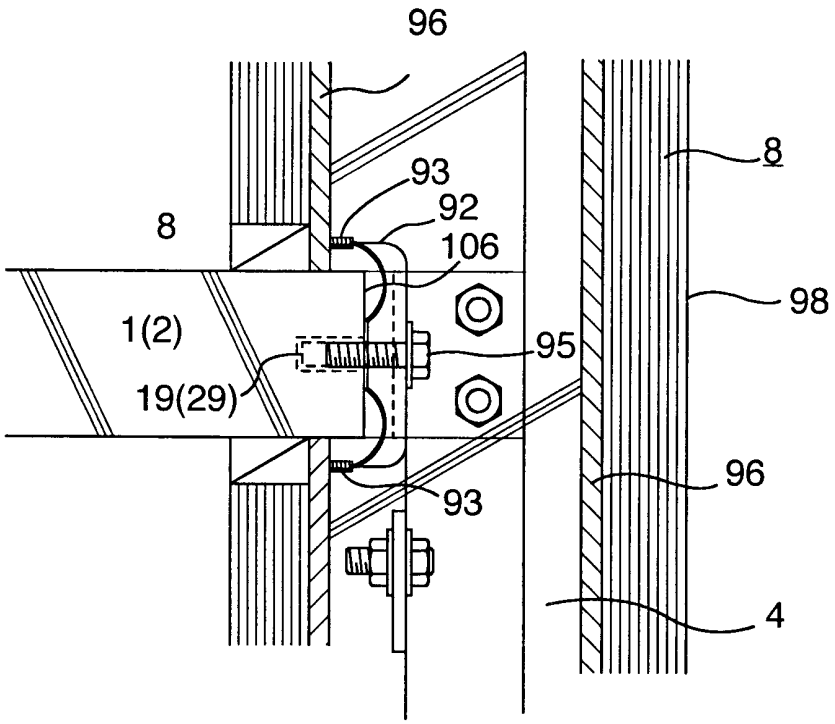


FIG. 12

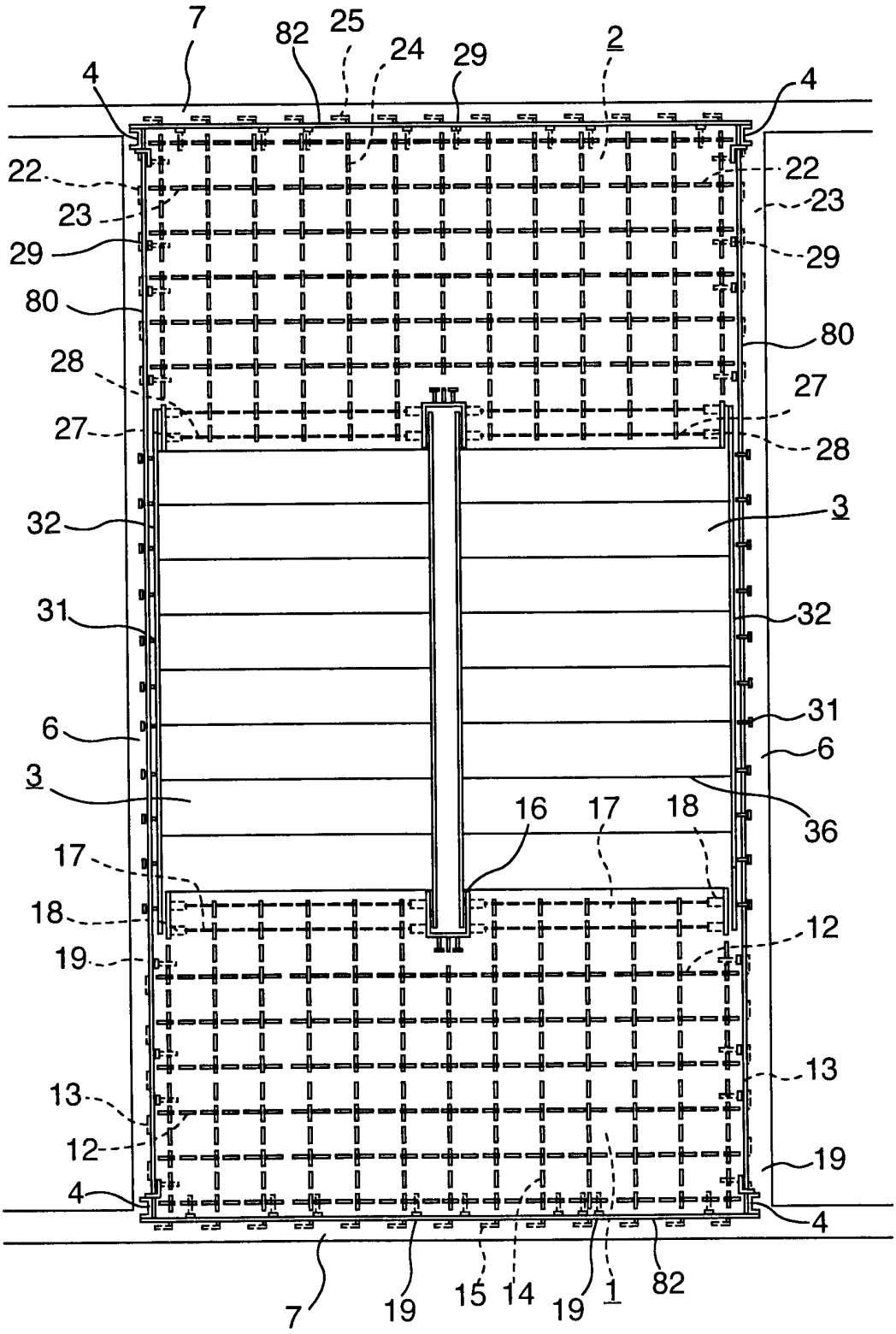

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FIG. 13

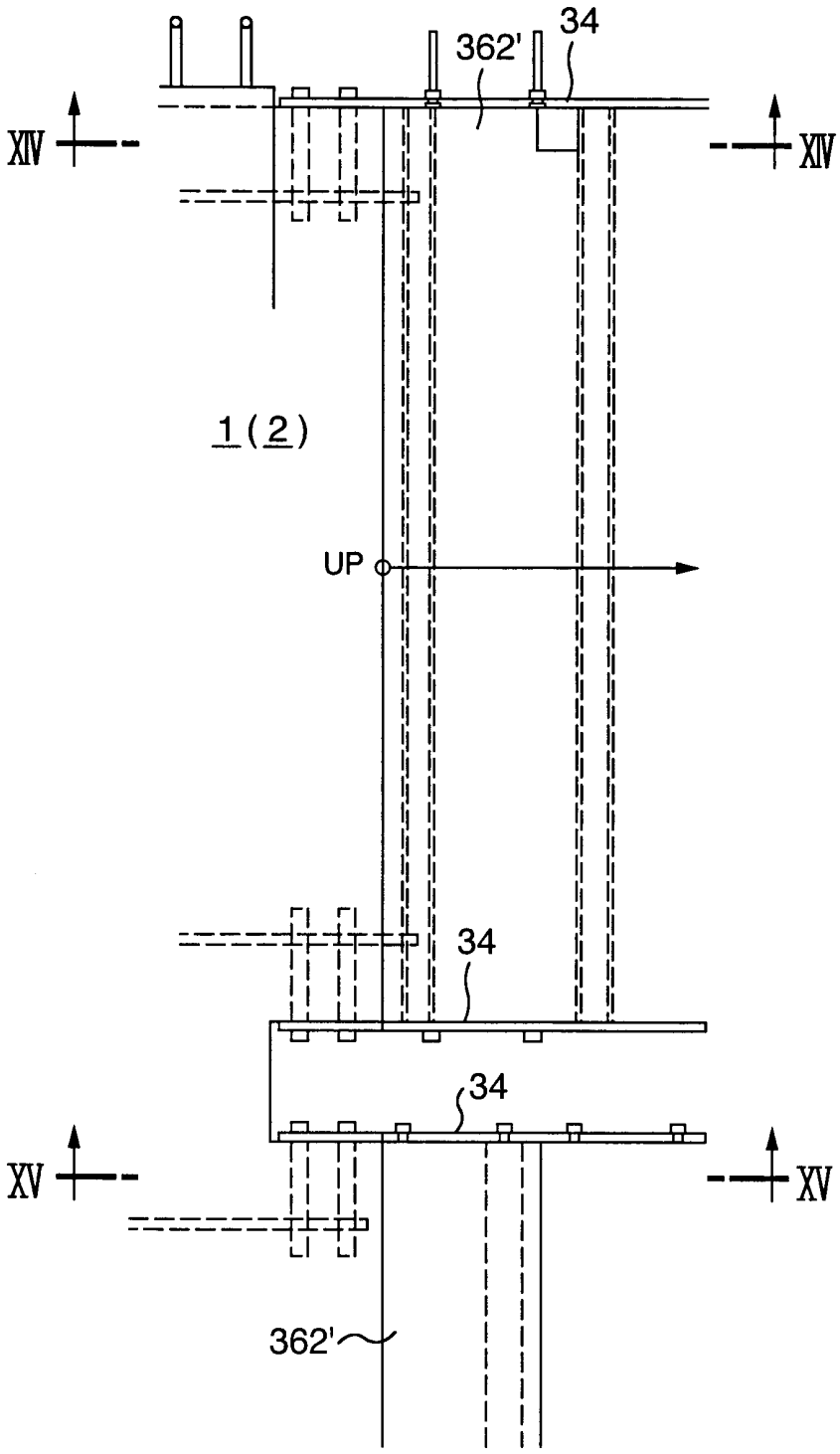


FIG. 14

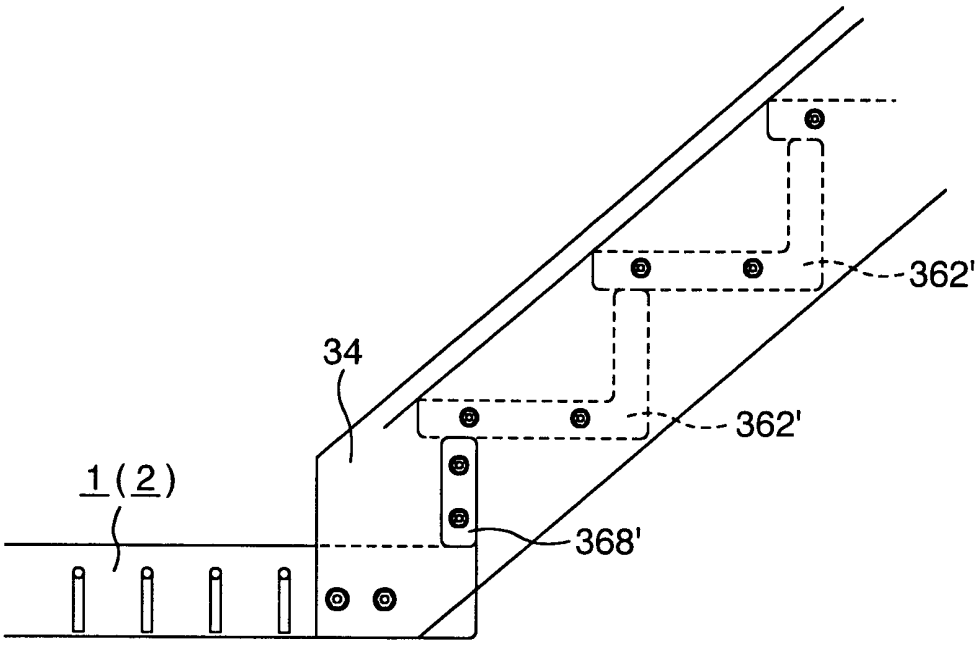


FIG. 15

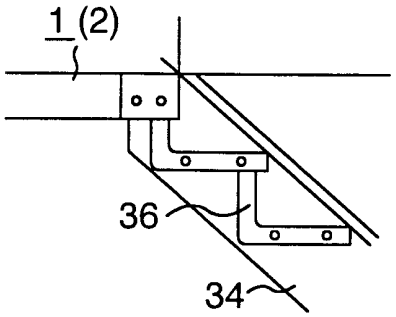
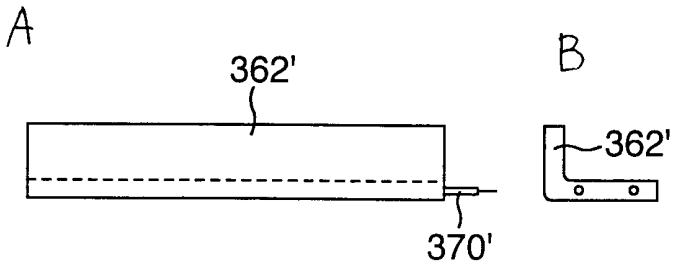


FIG. 16



INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP 01/02012

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E04F11/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E04F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000 038841 A (YOKOMORI KIYOFUMI) 8 February 2000 (2000-02-08)	
A	US 3 052 332 A (MULITZ) 4 September 1962 (1962-09-04)	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 July 2001	13/07/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Vijverman, W

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/JP 01/02012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2000038841 A	08-02-2000	NONE	
US 3052332 A	04-09-1962	NONE	