Jan. 23, 1968 G. HUBMANN 3,364,647

METHOD FOR ERECTING TALL BUILDINGS WITH BALCONIES

Filed April 26, 1965 6 Sheets-Sheet 1

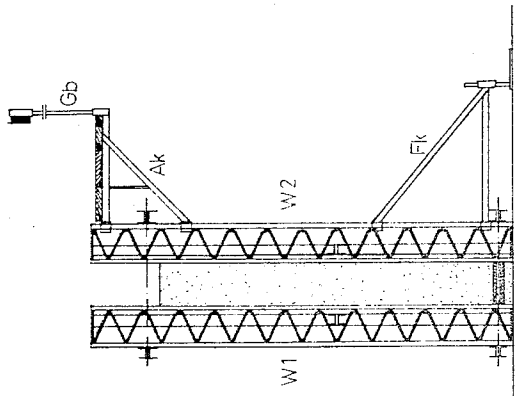

FIG.1a

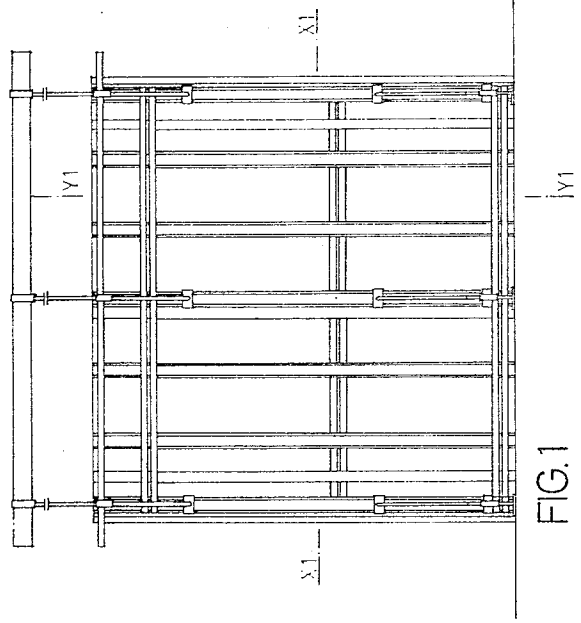

FIG.1

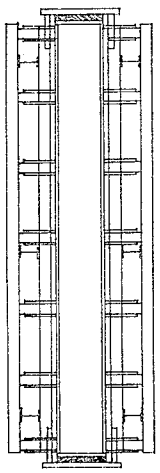

FIG.1b

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METHOD FOR ERECTING TALL BUILDINGS WITH BALCONIES

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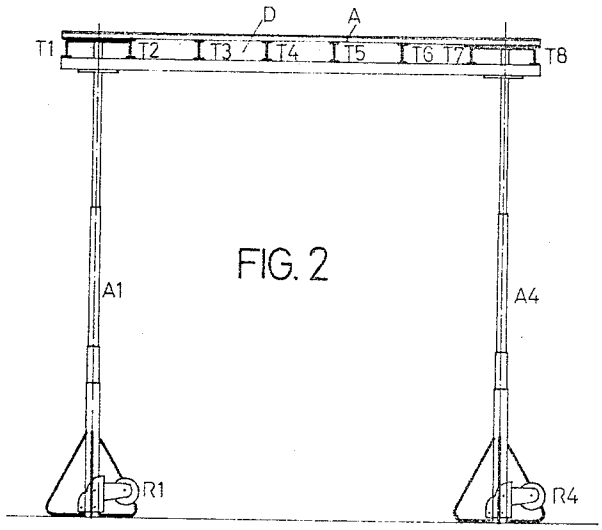

FIG. 2

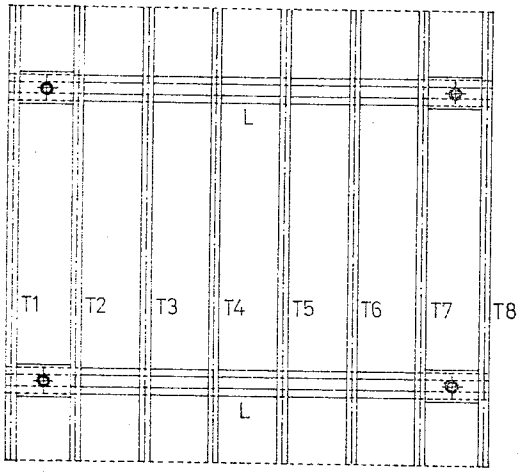

FIG. 2c

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METHOD FOR ERECTING TALL BUILDINGS WITH BALCONIES

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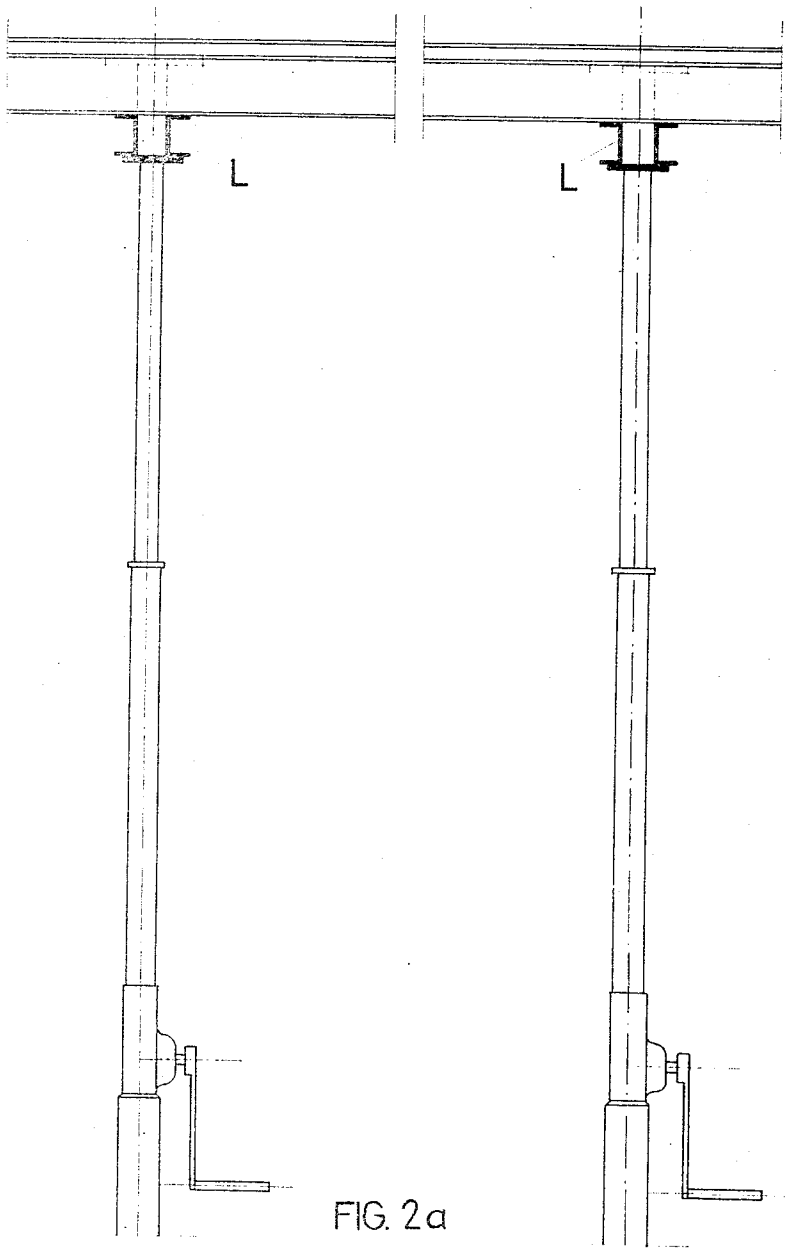

FIG. 2a

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METHOD FOR ERECTING TALL BUILDINGS WITH BALCONIES

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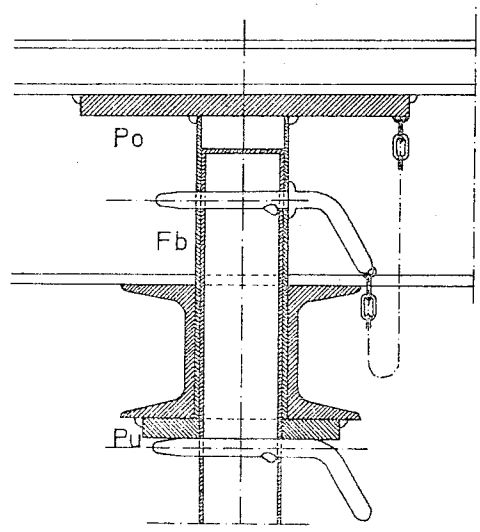

FIG. 2d

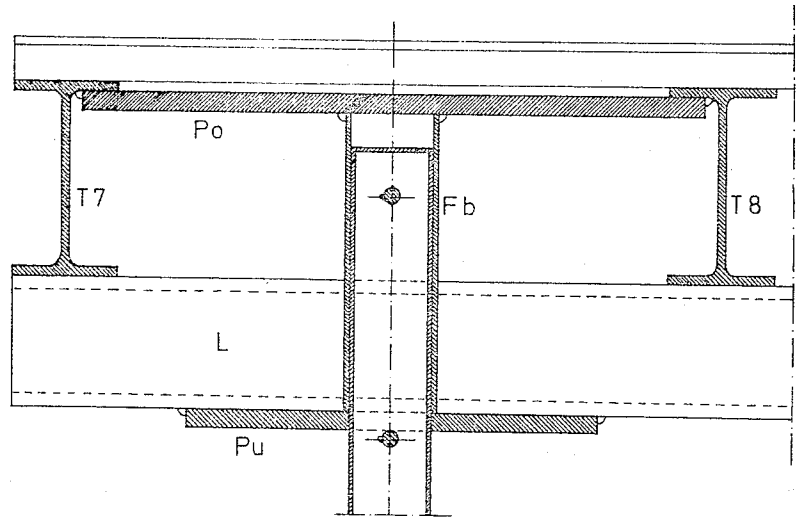

FIG. 2 b

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METHOD FOR ERECTING TALL BUILDINGS WITH BALCONIES

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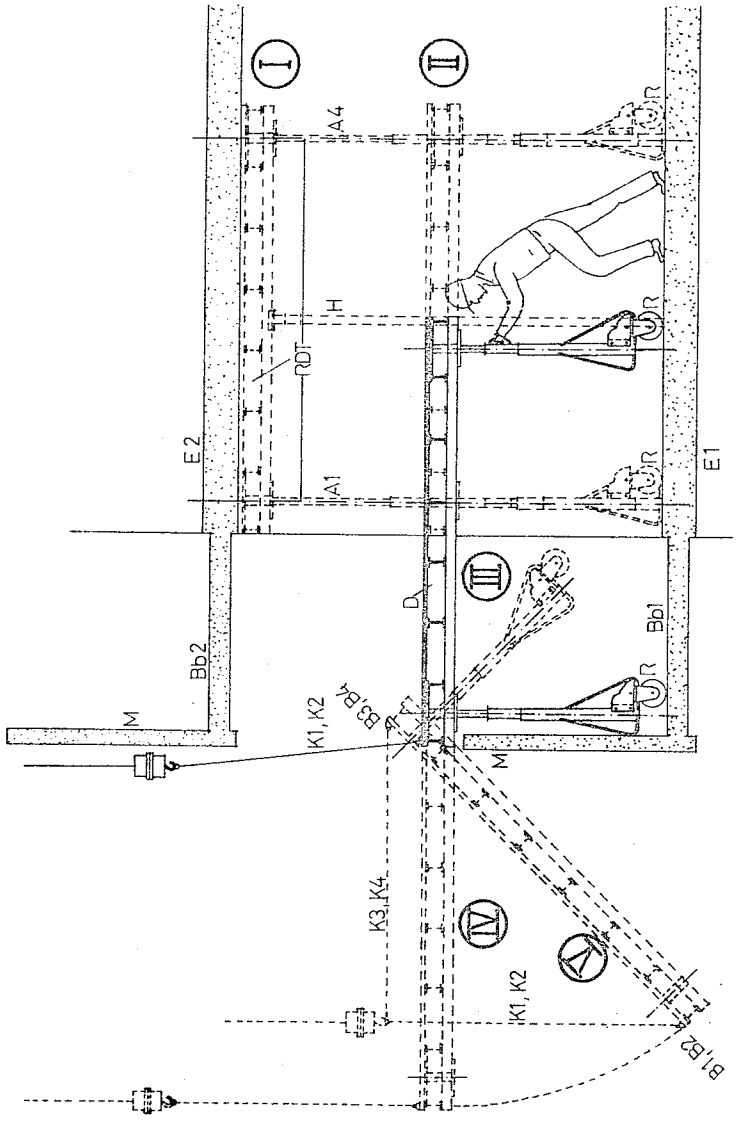

FIG. 3

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METHOD FOR ERECTING TALL BUILDINGS WITH BALCONIES

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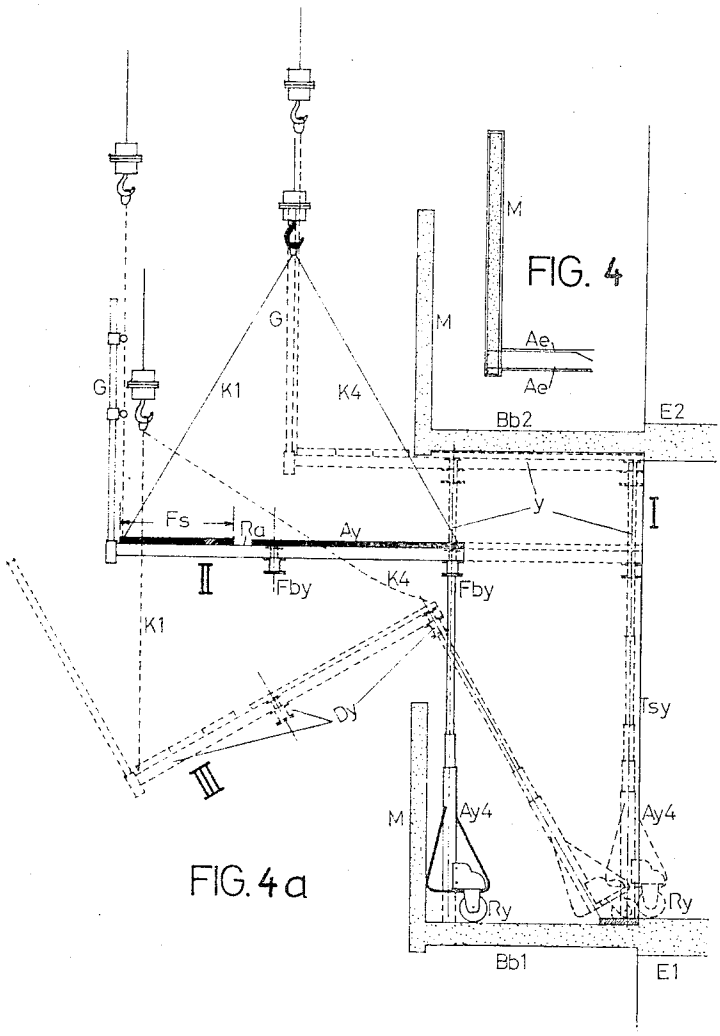

FIG. 4

FIG. 4a

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METHOD FOR ERECTING TALL BUILDINGS WITH BALCONIES

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Filed Apr. 26, 1965, Ser. No. 450,697
Claims priority, application Germany, Apr. 25, 1964, H 52,505
7 Claims. (Cl. 52—741)

This invention relates to the erection of tall buildings of 30 floors and more.

Tall buildings may have masonry facades or they may be covered with a concrete or metal facing. Masonry facades usually require plastering and involve maintenance costs due thereto.

Tall buildings covered with a metal facing are subject to the influence of the sun rays, especially during the summer.

In erecting tall buildings, it is necessary to comply with all building regulations pertaining thereto. It may be required, for instance for reasons of fire safety, to provide reinforced concrete balconies connected with the ceiling structures to prevent spreading of a fire from floor to floor.

Conventionally, reinforced concrete balconies have been structurally connected to the ceiling slabs by bracing the supports of the largely wooden ceiling forms with diagonal braces between the supports so as to achieve the required rigidity and to prevent twisting and shifting of the form supports. This makes it impossible for the form supports to be removed as one unit from rooms having reinforced balcony parapets and ceilings. When dismantling the supports, they had to be disassembled into their components. This is not only time consuming but it also requires employment of experts, so as to avoid unnecessarily large losses of lumber used in the forms. Even when experts are employed, losses due to parts becoming unusable will occur. In this conventional method, experts must be employed for the erection as well as for the dismantling of the ceiling supporting forms.

In all known building methods providing loggia type balconies on all sides of the building, expensive temporary and intermediate scaffolds are required. It is absolutely necessary to provide protective scaffolding, regardless of whether the slab for a loggia type balcony is cast on the building site or a prefabricated slab is installed to protect the workers installing or pouring the next slab. To provide safety during the installation of each balcony slab, it is necessary to anchor the scaffolding to the next lower balcony floor slab.

The repeated removal and installation of the temporary protective scaffolding for the balcony parapet is always time consuming and correspondingly expensive, and these costs are eliminated by the present invention.

The temporary scaffolds, used in the construction of tall buildings, create an accident hazard, specifically because, as experience has shown, no windboards are used in addition to the railing. During the dismantling of the temporary scaffold for the balcony parapet, it becomes necessary, to close the respective section of the street for the whole period of the dismantling or alternatively a guard must be provided during the period of lowering to the street the components of the parapet scaffold.

It is a general object of this invention to eliminate the disadvantages of known types of tall buildings and building methods therefor, and to reduce building costs.

It is a specific object of the present invention to do away with such cumbersome safety scaffolds and to

mount a complete working and safety scaffold on a balcony form support.

It is a more specific object of the invention to provide a building system permitting the use of form supports which are reusable and can easily be mounted and disassembled without losses, which furthermore can be used in the construction of tall buildings of reinforced concrete, without the presently extensive need for skilled building labor.

It is another object of the invention to eliminate the use of the presently conventional ground supported permanent scaffolds, or other scaffolds like for instance the costly working scaffolds and protective scaffolds required for mounting of prefabricated parts of balconies, and thus to avoid the constant repetition of mounting of working scaffolds and protective scaffolds, which considerably reduces the building time.

It is still another object of the invention to eliminate the need for masonry facades and concomitant plastering and/or other facings whereby maintenance costs are reduced and the outer room walls may be made entirely of glass while the glass facades remain protected from the sun during the summer months.

The above and other objects are accomplished in accordance with the invention by providing balconies extending along the entire width of all or selected building floors. On each floor, where a balcony is to be built, the room walls are first erected on the ceiling of the floor below, except for the outer wall of the building. A concrete ceiling form support is then lowered into the room, which is open towards the outside, and a balcony floor form support is then positioned outside of the ceiling form support, the balcony floor form support carrying a working and protective scaffolding. The balcony floor form support may be connected to the ceiling form support and/or it may be anchored to the balcony floor below or to the room floor or walls. Thereupon, prefabricated balcony parapets provided with connecting rods are mounted in suitable grooves provided in the balcony floor form support between the scaffolding and the balcony floor, and the ceiling and balcony floor are now cast in their forms to produce a concrete unit consisting of ceiling, balcony floor and balcony parapet. After the concrete has set, the balcony form support is first removed, lifted by a crane and removed to another building site, whereupon the ceiling form support is dismantled and moved by the crane for reuse, these steps being repeated in the same manner at the next floor until the building has reached its intended height.

The equipment required for this method includes large wall forms in which, in a known manner, first two side walls and the back wall of the individual rooms of the respective floors are cast in concrete to which, wherever necessary, one or more utility walls or wall parts may be added. Furthermore, it requires supports for permanent ceiling and balcony floor forms, each consisting of cross beams and struts intersecting at least at four points. Bearing sleeves are mounted at these points for receiving the upper ends of adjustable support pillars, which may be telescoping jacks, so that the supports may be raised or lowered, and which are movable on wheels mounted on the legs of the support pillars. The balcony form support carries a protective scaffolding with a railing and also has grooves to receive the connecting rods of prefabricated balcony parapets. It may also include coupling means for connecting the balcony form support with the ceiling form support or anchoring devices to attach the balcony form support to the floor below or to the erected room walls.

The combination of the ceiling and balcony floor form supports used in the invention, requires that for economical reasons the design of the two components be based on identical plans.

The supports must be removable by crane through the opening formed by the upper edge of the balcony parapet of the floor on which they are supported and the lower edge of the balcony floor which was formed on the supports before dismantling of the same. Furthermore, the loss of any reusable parts during dismantling of the supports must be avoided. The supports must be constructed from only a few basic components so that only commercially available girder sections and a few basic components have to be kept in stock for the construction of form supports of different sizes.

The few basic elements include a form, four easily removable support pillars, and bearing sleeves on form supports to receive the upper ends of the pillars.

The individual components of all the basic elements are identical for all sizes of forms so that only a few individual parts have to be kept in stock.

The bearing sleeves form rigid joints of the form supports and will absorb all stresses which may develop due to shifting or twisting of the support pillars relative to the forms. Consequently the mounting of diagonal braces between the pillars is not required. Another advantage of this arrangement is that the supporting pillars can easily be removed and that the upper ends of the supporting pillars can be made immovable by locking bolts.

The invention will now be described in further detail and explained with reference to the attached drawing wherein

FIG. 1 is a plan view showing a form for casting a concrete room wall;

FIG. 1*a* is a cross sectional view along line Y_1—Y_1 of FIG. 1;

FIG. 1*b* is a cross sectional view along line X_1—X_1 of FIG. 1;

FIG. 2 is a side elevational view of a support for a concrete ceiling form;

FIG. 2*a* is a front elevational view of the support, showing the cranks for operation of the telescoping pillars;

FIG. 2*b* is a sectional view showing details of the ceiling form mounting;

FIG. 2*c* is a top view of the support shown in FIG. 2;

FIG. 2*d* shows further details of the ceiling form mounting;

FIG. 3 is a cross sectional view of two superposed concrete ceilings E1 and E2 integral with balcony floors and balcony parapets;

FIG. 4 is a cross sectional view of a prefabricated concrete balcony parapet equipped with connecting rods; and

FIG. 4*a* is a cross sectional view of two superposed concrete ceilings integral with two balcony floor members and concrete balcony parapets.

FIGS. 1, 1*a* and 1*b* show a form for casting a concrete wall for a building room, including vertical supports W_1 and W_2 for the form, as well as bracing F_k for support W_2, a working bracket A_k and a railing strut G_h.

As seen in FIGS. 2, 2*a*, 2*b*, 2*c* and 2*d*, the concrete ceiling form A is supported by a plurality of cross beams T1, T2, T3, T4, T5, T6, T7 and T8 carried by perpendicularly extending struts L_1, L_2, L_3 and L_4. Telescoping support pillars or jacks A1 to A4 carry the struts at one of their ends while their other ends rest on the floor below and have pivotally attached thereto wheels R1 to R4.

As can be seen from the drawing, two connecting plates Po are welded to the respective outer pairs T1, T2 and T7, T8 of the cross beams while two connecting plates Pu are welded therebelow to the struts L_1, L_2 and L_3, L_4, respectively, and sleeves Fb extend between each superposed pair of connecting plates to receive therein the upper ends of the support pillars or jacks. The sleeves Fb are thus supported, through the connecting plates Po and Pu, by the cross beams T1, T2 and T7, T8 as well as by the struts L_1, L_2 and L_3, L_4.

FIG. 2*d* shows the upper ends of the telescoping jacks extending into the sleeves Fb and held in position by two locking bolts passing through aligned apertures in the sleeves and jack ends.

FIG. 3 shows a ceiling form support in position I, that is in operational position with the telescoping jacks extended, and in position II with retracted telescoping jacks, the wheels being folded upwardly in both instances. In position III the ceiling form support R*dt* is shown moved right to the parapet of the balcony, with cables K1, K2 attached to the hoisting gears B1, B2 and to the hook of the crane, the telescoping jacks having been completely retracted and made movable by lowering the wheels R. Position IV shows the ceiling form D suspended in horizontal position from cables K1, K2, with the front pillars A1 and A2 removed and the back pillars A3, A4 moved right to the balcony parapet. Position V shows form D in a position inclined by an angle of 45° relative to the previous position in which it was horizontal. Also shown are the cables K3 and K4 attached to hoisting gears B3 and B4 before the pillars A3 and A4 are removed.

In position I of FIG. 4*a* is shown in broken lines, the support Y for the balcony floor form in operating position, with the four sleeves F*by* for attachment of pillars Ay1–Ay4, of which only Ay4 is seen. The height of the telescoping pillars is adjustable by spindles and the pillars are movable on wheels R*y*.

Position II shows in solid line the form support Y suspended in horizontal position from the cables K1 and K4 attached to the hook of the crane, with the front pillars Ay1 and Ay2 removed and with pillars Ay3 and Ay4 moved right to the parapet of the balcony. Position III shows the support, which in position II was suspended horizontally, now in an inclined position for removal.

The ceiling form support R*dt* (FIG. 2) and the balcony floor form support Y (FIG. 4*a*) are combined by lowering the support R*dt*, with the pillars A1 to A4 lowered and with the wheels R put in operative position, from above into a room which is open in the direction of the outer wall of the building and which is defined by walls from which the forms have been removed. Auxiliary jacks H are first used to support the support R*dt*, whereupon the telescoping jacks A1 and A2 are cranked up so that the wheels R may be folded upward. The cranks are then operated again until the pillars A1 to A4 are supported by the floor. The lower element A of the ceiling form D is then put in a horizontal position at the required level by manipulating the telescoping jacks A1 to A4.

The support Y for the balcony form is now placed on the balcony floor in front of form support R*dt*. At this point the pillars Ay1 to Ay4 are in retracted position and the wheels are in operating position. The support Y is lifted to the required level by manipulation of the telescoping jacks Ay1 to Ay4. Auxiliary jacks are first used to hold the support at this level so that the telescoping jacks Ay1 to Ay4 can be manipulated to lift the wheels R*y* from the ground, so that they can be folded upward. The legs of the supporting pillars are now braced against the floor by manipulating of the telescoping jacks Ay1 to Ay4 and the support Y is put into a horizontal position at the required elevation. The prefabricated concrete parapets M may now be set by the crane into the groove R*a* provided for this purpose in support Y. The steel reinforcement is now put in position and the casting operation for the balcony floor and the room ceiling is completed, whereby the joining of the prefabricated part M with the balcony floor and the room ceiling is achieved.

After this composite unit has set, the forms for the balcony floor are dismantled in the same manner as was described above in reference to FIG. 4*a*. The form support for the concrete balcony floor is now removed and subsequently the support for the room ceiling form is dismantled.

For this purpose, the adjustable support pillars A1 to A4 are retracted sufficiently to permit the wheels attached to the legs of the pillars to be lowered. The auxiliary jacks H remain in position during this operation. The wheels are now put on the floor by extending the telescoping jacks. The adjustable support pillars are now lowered as much as is required and the ceiling form support R*dt* is now moved on the wheels to the balcony parapet. Four equally long cables K1 to K4, suitable for the removal of the ceiling form D are attached to the hook of the crane. Two cables K1 and K2 are attached to lifting gears B1, B2 located on the side nearest to the balcony. The other two cables are held in position by ropes. The ceiling form D is now slightly lifted and support pillars A1, A2, located at the front, are removed. The form support is now moved forward as much as the rear support pillars will permit. The ceiling form is now lowered (45°) until the cables K3, K4, which are held by the rope, can be hooked to lifting gears B3, B4 of the ceiling form, whereupon the ceiling form is lifted and removed to be used in another location. According to the present invention, a working and protective scaffold is mounted on the balcony form support to provide protection during the setting of the prefabricated concrete balcony parapets M with their connecting rods into the groove R*a* and during the concrete casting operation, by which the balcony floor, the room ceiling and the parapet are formed into a concrete unit. The concrete balcony thus produced is connected with the ceiling of the respective floor as one static unit. The reinforcing rods of the balcony floor extend accordingly into the concrete ceiling.

The concrete balcony is consequently an integral part of the respective ceiling which at that time is the highest ceiling of the building. This can not be achieved with similar balcony plates which have been installed subsequently as a separate unit. The effect of uniting the parapet plate with the concrete balcony floor into one unit is that the reinforcement and the weight of the balcony is supported by the ceiling.

The balcony form support, which is set in front of the adjustable and removable ceiling form support, is equipped on its outside with a solid scaffold and consequently a complete working and protective scaffold is available at the level of the respective highest concrete ceiling. This scaffold, which is mounted on the support of the balcony form, is required for the protection of the workers and also for mounting of the concrete balcony parapet plate until the parapet plate is properly set in position. As soon as the concrete work in the highest ceiling of the building has been finished, the scaffold mounted on the support of the balcony form is no longer required. Starting from the day of its completion, the concrete parapet plate located on each floor is an independent scaffold. The protective scaffold on the support of the balcony form is then no longer required. The concrete balcony parapet plate operates as a complete protective scaffold during the erection of partitions on each concrete floor.

The present system accordingly offers an allaround improved building system, which permits the use of conventional methods for the actual building procedure. With special reference to the building expenses, the time and the requirements for employment of skilled labor (specifically masons and carpenters), the requirements for such labor are reduced to 20%. Where until now 100 masons' hours were required, no masons are needed at all and no more than 20 hours of skilled labor are required for completion of the same job.

In respect of the time savings, the walls are not being plastered. The walls may be immediately painted or papered although it is advantageous to smooth the walls and to finish them with a grinding disc.

An important advantage of the present system resides in the possibility to complete the apartments shortly after the concrete work has been finished and the forms removed. The utility walls, which have been mentioned above, contain all pipes for the individual rooms. Any subsequent building operations will therefore not interfere with the finishing of the individual rooms. All final installations may be performed from the stairway as all waterpipes, heating pipes and power conduits are located in utility shafts which have doors through which they are accessible from the stairway.

The present system not only removes completely the necessity of erecting scaffolds but it provides a safety scaffold consisting of the high concrete parapet on all sides of the building, being approximately 1.20 m. high by 1.70 m. width of the balcony. This is not only of importance during the building operation and the erection of partitions but later on it gives to the tenants an assuring feeling of safety.

Although the space available for the removal of the form supports is reduced by nearly 50% by the height of the parapet of 1.20 m. the special construction of the form support combination makes it easily possible to remove the form supports from the completed individual rooms of the structure and to move them to the next floor under construction, which is already equipped with balcony parapets serving as scaffold. It should be noted that the forms may be made from commercially available lumber of at least 22 mm. thickness. This is also a constructive improvement and pricewise a remarkable factor because heretofore it was necessary to use wooden beams and boards in the substructure. The forms according to the invention are attached to the support by countersunk bolts and nuts. The countersunk holes are filled in, and the large form plates are prepared with grooves, spliced and glued together, so that the resultant wall is smooth like a mirror when the form is removed.

As a further development of the invention, all partitions and room walls have, at the front facing the outside, bolt anchors cast into the wall facing the balcony plate. Six bolt anchors are screwed into the front end of the form with two locknuts. These six bolt anchors (3 on the left and 3 on the right) serve for attaching the window frames. An insulations plate, precut as to size, is located on the front end of the partitions before the frames are attached. The whole external face of the building consists of windows or fixed glass plates.

According to the invention, a slot of about 25 mm. width and about 150 mm. length is cut into the window frames in alignment with the bolt anchors to facilitate the mounting of the windows. Each window frame is lifted by the crane to the balcony of the respective floor. While the window frame is still suspended from the cables of the crane, it is moved inside the proper position by two laborers, one side of the window frame being in contact with one partition and the other side with the other partition. Due to the length of the slot of 150 mm. and on the other hand the width of the slot of 25 mm. and the location of the bolt anchor in the front end of the partitions, it is possible for two laborers utilizing the crane to mount the window frames within a very short time. The lower surface supporting the window frames is completely level. Therefore, the use of a spirit level or a plumb is unnecessary. The mounting of window frames, which until now was a job for skilled labor, can now be performed without any difficulties by two unskilled laborers with a fraction of the effort previously required.

Another important object of the invention is to prevent exposure to unpleasant solar radiation in spite of large area windows or front walls made exclusively of glass. So far there was no solution for this problem. It was agonizing for the occupants to live in apartment buildings or work in office buildings having large windows and a front wall made completely of glass. Present tall buildings, especially office buildings, have large windows but do not have satisfactory protection against solar radiation. For comparison purposes, it should be noted that temperature readings have been made in the months of March and April in certain tall office buildings, and have shown tem-

peratures in the rooms of far above 30° C., not to speak of temperatures during the months of May, June, July and August. Such high temperatures reduce the working capacity often to 50% or less. In many instances, they are the cause of heart ailments.

Balconies and loggias of 1.7 m. width located, according to the present invention, on all sides of the building, and above all the concrete parapets of the balconies of 1.2 m. height offer an automatic and complete protection against sun rays.

The following facts point out the economic advantages of the invention:

One conventional building method provides large prefabricated balcony slabs. Such prefabricated concrete slabs must be transported to the building site on flat-bed vehicles. The production of such slabs in a plant requires practically the same production steps as would be required for production of the slabs at the building site. Disregarding the cost and difficulties of the transport of the prefabricated slabs to the building site, the actual production in the plant is very costly. An elaborate form must be used, the slabs must be reinforced and each must be separately cast. A large space is required for the production of such slabs. To utilize the available space in the plant, the setting time is in most instances reduced by using steam for setting of the slabs.

According to the invention, it is possible to produce the balcony floor slabs jointly with the room ceilings in one production step; no special expenses for scaffolding are required, nor is it necessary to occupy any space in a plant.

As mentioned above, it is also an object of the invention to eliminate front wall masonry work. For this purpose, a paint is added during the mixing of the concrete for the prefabricated parapets. Such paint may be a dirt repellent, preferably dark gray-blue color, so that it becomes unnecessary to paint the parapets either on the inside or the outside.

It has already been mentioned that the present building system permits planned timing of the individual steps. Accordingly all partitions on one side of the structure are erected in one day, including pouring of the concrete. By using high quality rapid binding concrete, for instance concrete Z 375, it is possible to remove the forms in the morning of the next day after pouring of the concrete, even if the concrete for the partitions was poured in the evening of the previous day. The large forms are then removed and transported to the other side of the building, where the ceiling of the respective floor has already been produced and where the concrete parapets constitute an operating and protective scaffold.

After removal of the partition forms, the ceiling forms on the opposite side of the building are removed, the form supports for the balcony and for the room ceilings being lowered in the manner described above.

The form support for the balcony is first removed from the lower floor on the other side of the building and deposited by the crane on the next floor along the building wall or the building front, where the partitions have already been constructed. Bolt anchors, which later on will be used for attaching of the window frames, are located in the concrete ceiling and in the face of the partitions. The legs of the form support for the balcony are attached to these anchors so that it can never tip outwardly.

The use of prefabricated balcony parapets equipped with connecting rods makes it possible to build high buildings without the use of scaffolds and thus to reduce the building expenses by 5 to 10%.

The permanent supports for the large forms are not permanently locked but may be easily disassembled. No losses are incurred in the process of disassembling. The supports are comparatively light and the special construction of the carriers tremendously reduces the building time.

The new forms can easily be installed and dismantled. They can easily be removed from the walls and are movable practically without any effort. Until now, forms were constructed either totally or partly from lumber and became nearly unusable after dismantling. Reinstallation of such forms was very costly.

The new building system provides in general a reduction of the building cost of up to 30%. Firstly a reduction of wages from 100% to 20% is realized and secondly the building time is reduced by half. On top of this, the costs of front wall masonry, ornamentation or casing are eliminated.

Because the utility walls are also being used and because the pressure and the drain pipes are located outside of the living area, it is possible to occupy the lower 8 floors of a building, which eventually may have 30 floors, even if the construction has reached only the 10th or 11th floor.

Because the balcony parapets are connected with the concrete ceiling into one concrete unit, it is possible to mount the drain pipes of the balconies in such a way that the rain water of the respective last floor of the building can be disposed directly through the drainpipes. The concrete ceiling of a floor made from concrete of quality 300 is completely watertight. The ceiling is provided with a slight incline in each direction and forms a roof or a completely rainproof runoff for the floor below.

The building is constructed with the utility conduits located in separate shafts and, therefore, only the utility shafts have to be protected from rain.

If prefabricated balcony slabs are used, it is impossible to remove the rain water while the construction of the building is in progress and to protect the lower apartments completely from water. Consequently, the lower 8 floors can not be used even when the structure has reached the 10th floor, in this prior building method.

I claim:

1. A system of erecting a tall building of reinforced concrete with balconies along the outer walls of the building, comprising the steps of

(a) building two side walls and a rear wall for each room along the outside of the building, said side walls and rear wall defining a room open to the outside,

(1) said walls being of concrete cast in large forms;

(b) removing the wall forms;

(c) lowering a concrete ceiling form support into said open room from the outside;

(d) positioning a permanently usable concrete balcony floor form support outwardly adjacent the ceiling form support,

(2) a scaffolding including a railing being carried by the balcony form support and

(3) said balcony form support having a groove;

(e) mounting prefabricated balcony parapets with connecting rods in the groove of the balcony form support;

(f) casting concrete in the ceiling and balcony forms to unite the ceiling, the balcony and the parapets into an integral unit;

(g) permitting the concrete to set in the forms;

(h) removing the balcony form support;

(i) transporting the same to the next higher floor;

(j) then removing the ceiling form support;

(k) transporting the latter to the next higher floor; and

(l) repeating the afore-said steps on succeedingly higher floors until the building is completed.

2. The system of claim 1, including the further step of erecting utility walls before the ceiling form support is lowered into the room.

3. The system of claim 1, including the further step of anchoring the balcony form support to the ceiling form support.

4. The system of claim 1, further including the step of anchoring the balcony form support to a lower floor.

5. The system of claim 1, further including the step of anchoring the balcony form support to the side walls of the room.

6. The system of claim 1, wherein the forms are made of large plates.

7. The system of claim 1, wherein said form supports include beams and struts for supporting the forms, and vertically adjustable and horizontally movable pillars carrying said beams and struts.

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