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(54) **Method for renovating a building and a building**

(57) The invention relates to a method for renovating a building (32) and a building (35) built according to this method. According to the invention at least one storey (41a, 41b, 41c) is demolished from the original building (32), and at least one room module (33) is fitted in the place of the demolished storey (41a, 41b, 41c).

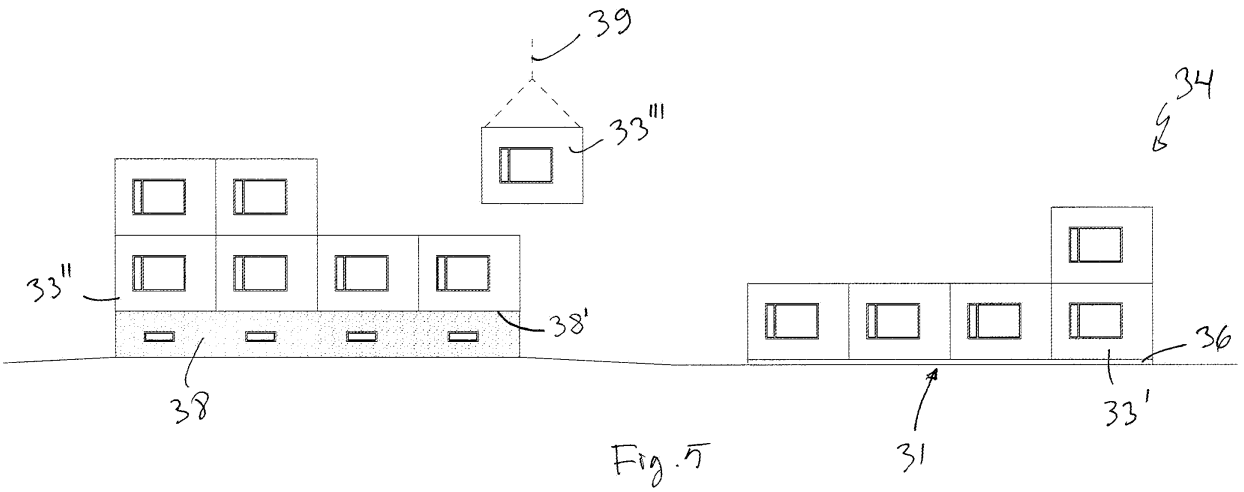

Fig. 5

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The invention relates to a method for renovating a building and a building according to the preambles of the independent claims presented below. The invention especially relates to a new manner of renovating a multi-storey residential building.

PRIOR ART

[0002] Buildings should typically be renovated after 30-40 years from when they are built. In Finland the buildings produced in the quantitative peak years of apartment building, the 1960's and 1970's, will be renovated in the next few years. The main part of these buildings are multi-storey prefabricated houses situated in the suburbs. Such houses were in their time built to suit most people and the young families moving into the cities. They are outdated both in their structure and design, and cannot as such meet present-day living requirements. The aging of the population in the next few years adds even more to the need to modernize living solutions. The renovating of prefabricated houses designed and realized in the 60's and 70's to better meet present-day needs and the wishes of the residents can become unreasonably expensive or even be impossible to start with.

[0003] Prefabricated houses can be renovated with known renovation methods for example with a façade renovation, by renewing the insulation of the building, by building elevators, by renewing the ventilation systems, etc. In this type of renovation the building costs typically rise close to the costs of new construction. Further such a renovation can rarely modernize a building to meet actual needs or wishes of the residents. Alternatively the problem has been solved by demolishing the old building entirely and building a new building on the site along with the foundations. Such solutions are expensive. Additionally a temporary placement for the residents is needed for the duration of the building.

OBJECT AND SUMMARY OF THE INVENTION

[0004] It is an object of the present invention is to reduce or even eliminate the above-mentioned problems appearing in prior art.

[0005] It is an object of the present invention to provide a quick and cost-efficient solution to the renovation of buildings.

[0006] It is another object of the present invention to provide a solution, which makes possible the combining of old foundations and possible basement spaces with completely new residential storeys.

[0007] It is still an object of the present invention to provide a solution, which decreases inconvenience caused to residents, users and owners of the building to be renovated.

[0008] In order to realize the objects mentioned above, among other things, the method and the building according to the invention are characterized by what is presented in the characterizing parts of the enclosed independent claims.

[0009] A typical method according to the invention for renovating a building comprises at least the following steps

- demolishing at least one storey from the original building,
- fitting at least one room module in the place of the demolished storey.

[0010] A typical building according to the invention has been renovated with the method according to the invention and the building has a foundation and/or basement, and at least one room module built on top of it, possibly at least partly supported thereon.

[0011] A typical arrangement according to the invention comprises

- an original multi-storey mainly for example concrete-built residential building, which has foundations and/or a basement, and original residential storeys built thereon, and
- room modules arranged near the original residential building, which can be fitted on top of said foundations and/or basement and possibly at least partly supported thereon as renovated residential storeys after the original residential storeys have been demolished. If at least not all the residential storeys are demolished, the room modules can be fitted on top of the original residential storeys.

[0012] The foundation and/or basement to be preserved from the original building can for example be mainly concrete or masoned from stone. The storeys of the original building, which are on top of the foundations and/or basement, which storeys can be demolished, can to their structure be for example mainly concrete, wood, steel, or masoned such as stone or brick.

[0013] It has now surprisingly been noted that a building can be renovated by demolishing storeys from the building and replacing the demolished storeys with room modules. This way the existing foundations and possibly basement of the building can be utilized. Thus costs caused especially by an extensive renovation can be decreased. Thus the performing of extensive renovations can also be made quicker and thus the costs lower and the inconvenience caused to the residents of the building to be renovated can be decreased. The method according to the invention is especially suited for renovating such objects, the renovation of which would be unreasonably expensive with conventional methods. The part of the renovated building according to the invention, which is made up of room modules, can be arranged to be significantly lighter than the original building. Thus it

stresses the old structures less than the original building. With the aid of the invention, more storeys can be built on the original foundation or basement than before.

[0014] In this application storey to be demolished means for example a part of a building, which to its room height is suited for human use. The storey to be demolished can for example comprise residential spaces, an attic, storage spaces or engineering and utility service rooms. The storey to be demolished can comprise roof structures, such as a gable roof or a flat roof of a building. In some embodiments of the invention storey to be demolished may mean the roof structures of the original building with their substructures and possible space beneath it. In an embodiment of the invention the storey to be demolished has no spaces meant for permanent use or recreation of humans.

[0015] In this application renovating means repair work, for example the renovation of a building or the complete or partial renewal of a building, while preserving the foundations of the original building.

[0016] The walls of a typical room module according to the invention can be manufactured for example from metal or wood. The walls of the room module can for example be mainly manufactured from steel, stainless steel or aluminium. A typical room module according to the invention is provided with necessary doors and possibly windows. Typically, the walls, floor and ceiling also have a necessary number of openings for cords, pipes etc. Typically, the room module according to the invention can be moved in one piece and installed to its location in one piece. The room module may for example be an apartment, a hotel room, a room in an office building or a room in some other building. The room module may for example be a conventional apartment or a row house apartment, for example a one-room, two-room or three-room apartment. There can alternatively be several apartments in a room module, for example 2-3 or 2-4 apartments, which can be moved in one piece and installed in its location in one piece. The room module can alternatively also be a part of for example an apartment, a hotel room, an office room or some other room. The outer walls of adjacent room modules and/or the same room module can be attached to each other for example with bolts and/or by welding. Strips may also be attached on seams for example by welding or gluing. The width of a typical room module according to the invention can be for example 2-15 meters, 3-10 meters or 5-10 meters. The length of a typical room module according to the invention can be for example 2-30 meters, 5-22 meters, 9-15 meters. A typical room module according to the invention can for example have the shape of a rectangle. The outer wall of a room module according to the invention can be for example even or also meandering. A balcony can when necessary be arranged in connection with one or several walls of the room module according to the invention. The room module according to the invention typically has at least two walls, a floor and a ceiling. It is possible that the room module has three, four or even more walls. A typical room module according to the invention comprises, in addition to outer walls, a necessary amount of separating walls, in order to divide the space formed by the room module, for example into rooms. In this application walls of the room module primarily mean the outer walls of a room module. It is possible that all the walls of the room module, including the separating walls, are load-bearing or for example only the outer walls can be load-bearing.

[0017] According to an embodiment of the invention the room module according to the invention is prefabricated elsewhere than at the renovation site. Prefabrication means that the ceiling, floor and walls of a room module have been joined together already prior to its installation to its location in a building. Thus the room module can always be built in good conditions, for example indoors. The prefabrication decreases the amount of necessary work at the renovation site, making the renovation work quicker.

[0018] The interior design of the room module according to the invention, such as wallpapers, floor materials, the interior design of the bathroom and also the kitchen if necessary, can be completed before the room module is brought near the building to be renovated. An advantage with this procedure is that the room modules and their interior design can be made already before the renovating is begun at the building site of the room module and the renovation of the building is made even quicker.

[0019] According to an embodiment of the invention at least one room module is fitted in the place of the demolished storey, the floor, ceiling and at least two walls of which room module are manufactured at least mainly of cellular board. The cellular board can for example be mainly steel, stainless steel, zinc coated steel, aluminium or steel or aluminium coated with a PVC sheet. In an embodiment of the invention the load-bearing structures of the room module are at least mainly of cellular board. In an embodiment of the invention the load-bearing structures of the storeys to be built on top of or supported on the foundation and/or basement of the original building are at least mainly of cellular board.

[0020] In this application cellular board means a structure formed of two substantially parallel surface plates and of a plate-like core arranged between them. The shape of the plate-like core is arranged to deviate from the direction of the surface plates, for example by forming folds in the plate material and grooves in between the folds. Cellular board resists bending in a transversal direction in relation to the direction of the cores especially well. Typically the core of the cellular board has been firmly attached to the surface plates. By means of a cellular board structure, it is possible to achieve a structure that is considerably lighter, more rigid and has better bending resistance than a continuous plate structure. The shape of the core has a great impact on the rigidity and strength of the cellular board. The core can for example have the shape of a wavelike bent plate, where the wave crests are typically welded to the surface plates.

The cores can also be arranged for example in the shape of a letter V, or formed of plates substantially perpendicular to the surface plates, i.e. of plates that are arranged in the shape of a letter I. The core can consist of a plate bent in the form of a honeycomb. It is also possible to use beams that have the shape of a pipe, the cross-section of which is circular or another shape, as a core. In an embodiment of the invention the surface plates and the core of the cellular board are of the same material.

[0021] According to an embodiment of the invention the cellular board is manufactured from individual profiles, by joining several profiles side by side. The profiles are manufactured from a plate-like material, which can be for example steel or aluminium. The plate-like material can on its one or both sides be coated, for example with a PVC sheet. The thickness of the plate-like material can for example be 0.5-5 mm or 0.5-3 mm.

[0022] According to an embodiment of the invention each individual profile is meant to form in the completed cellular board a planar first surface protrusion, a planar second surface protrusion or a core, which is arranged to join the first and the second surface protrusion together. The profiles of the cellular boards are attached together so that the first surface protrusions are side by side and form the first surface plate of the cellular board, the second surface protrusions are side by side and form the second surface plate of the cellular board, and the cores of the profiles are attached to the first and second surface protrusions, whereby they make up the core structure of the cellular board. The length of the profiles can in the so-called core direction be for example 0.5-20.0 m or 1.0-10.0 m. The width of an individual profile can be for example 0.1-1.0 m, 0.1-0.5 m or 0.1-0.2 m. The thickness of a completed cellular board can be for example 0.1-1.0 m, 0.1-0.5 m or 0.1-0.2 m. A completed cellular board can have for example 5-1000, 10-200 or 20-100 profiles joined beside each other. Generally the length i.e. size of the completed cellular board is approximately the same in the direction which bears more load as the length of the profiles in the so-called core direction. The width of the cellular board in the direction, which is perpendicular to the core direction, can be for example 0.5-50 m, 1-25 m or 5-20 m. In an advantageous embodiment the direction of the cores of the cellular boards, which make up the walls of the completed room module and building, is arranged to be vertical.

[0023] In an embodiment of the invention, attaching folds which fit into each other, have been formed in the edges of the profiles which are to be joined with other profiles. Typically an attaching fold of a profile, which forms the core of a cellular board, has also been arranged to fit in connection with the attaching folds of two adjacent surface protrusions. The attaching folds can be formed so that the attaching folds formed in the ends of three separate profiles in one contact point can be attached to each other. The attaching is easy to perform for example by pressure seaming in a way known as such. Before the pressure seaming or after it, a seam insulating substance, such as a mineral wool sheet or glue, for example urethane glue, can be arranged between the profiles of the cellular board.

[0024] In an embodiment of the invention the floor, ceiling and at least two walls of the room module are manufactured at least mainly from the cellular board as described in patent publication WO 2007/054608.

[0025] According to an embodiment of the invention the original building is demolished so that only the foundations and/or basement remain, which form the foundations and/or basement of the renovated building. The original building is demolished in each case as much as the technical solutions require and/or as much as is reasonable when taking into account the financial aspects. An appropriate number of room modules can be fitted on top of the foundations and/or basement. Other necessary spaces, such as stairwells, possible engineering and utility service rooms etc., can be solved with modules outside of or inside the frame or by building at the renovation site.

[0026] The foundation or basement usually already has for example engineering and utility service rooms, house engineering solutions such as expensive air raid shelters, heating systems, electric centres and connections to the municipal engineering, such as district heat, sewer, water and electric mains. These can be taken into use in the renovated building with a comparatively small amount of work, i.e. they can be connected to the room modules according to the invention arranged on top of the original foundations and/or basement. Thus for example spaces and house engineering solutions in the basement do not need to be built at least completely anew.

[0027] By not demolishing the foundations and possibly the basement and by using them as a part of the renovated building, the costs caused by the renovation can be decreased. Basement spaces are often especially expensive and difficult to build again in a corresponding way. With this solution, slow and expensive moulding of structures in place and difficult earth moving can for example be completely avoided. The savings may become especially large if the basement is partly or completely underground. Thus the building of for example walls, which can withstand the soil pressure, can be avoided. The alterations needed in the old basement can be made partially before the room modules are installed and partially afterwards. When the room modules have been fitted on top of the basement, the basement is protected from the weather and has good work conditions. With such a renovation method it is possible to provide spaces which correspond to new ones quickly and cost efficiently, depending on the use purpose for example residential spaces or office spaces which correspond to new ones. With such a method a large part of the materials of the original building can with a reasonable amount of work be replaced with new, for example environmentally friendly, materials. Additionally it is possible to renovate the building with a simple method to be more energy ef-

ficient, by using solutions in the room modules, which decrease the energy consumption. With such a method the façade of the building can additionally be repaired in a durable way.

[0028] In an embodiment of the invention the original building is demolished so that the ceiling of the basement of the original building is at least partly preserved. In an embodiment of the invention said at least one room module of the renovated building, for example several storeys, are built on top of the ceiling of the basement of the original building. Possibly at least one room module, storey or storeys are built at least partly supported on the ceiling of the basement. By ceiling of the basement is in this context meant an intermediate floor above the basement, which is for example moulded from concrete, masoned or built from hollow slabs. The ceiling of the basement may for example be the intermediate floor between the original basement arranged at least partly underground and the first storey at ground level.

[0029] The preserving of the ceiling of the original basement improves the prerequisites of preserving the original basement spaces and the apparatuses in them to be used in the new building. The original ceiling of the basement protects the foundation and basement structures during the demolition of the original building above it from harms caused by the demolition.

[0030] With the combination of the ceiling of the original basement and the floor of the room module according to the invention which comes on top of it, it is possible to easily achieve a good sound and fire shield. It may also be possible to use at least a part of the technical solutions in the ceiling of the original basement, such as insulations, heating, plumbing, ventilation and electrical installation solutions, pipes or cords, in the new building.

[0031] With the aid of the ceiling of the original basement it is possible to even out the load of the building to be built thereon over the entire foundation. Thus the floor of the bottom room module can at least in some situations be quite thin or structurally quite weak, and thus more cost efficient than what would be possible without the original ceiling of the basement. The load-bearing wall lines of the building to be built on top of the ceiling of the original basement can in some situations also be directed elsewhere than onto the load-bearing wall lines of the old basement. Of course the load-bearing wall lines of the new cellular board structured building can be placed directly on top of the load-bearing wall lines of the old basement, even if the original ceiling of the basement were in between.

[0032] According to an embodiment of the invention room modules are fitted side by side in the place of the demolished storeys, so that the renovated building comprises at least two room modules in one storey. Room modules according to the invention can be fitted side by side for example so that one storey in the renovated building comprises 2-10 or 3-6 or 4-5 room modules or apartments.

[0033] According to an embodiment of the invention room modules are fitted on top of each other in the place of the demolished storeys, so that the renovated building comprises at least two storeys. Room modules according to the invention can be fitted on top of each other so that the renovated building comprises for example exactly or at least 2, 3, 4, 5 or 6 storeys. The original building can for example be demolished so that only the foundations and/or basement remain, and room modules can be fitted on top of each other on top of the foundations or basement so that a desired number of storeys is obtained in the renovated building. Room modules can for example be fitted on top of each other so that a part or all of the load-bearing walls of the room modules are arranged to be aligned. Room modules can be fitted on top of each other also so that the load-bearing walls of the room modules end up on top of each other, but at least a part of the end walls of the room modules do not end up on top of each other. Room modules can be fitted on top of each other also so that the lower storeys have more room modules than the higher ones. Thus the amount of load-bearing walls can be increased in the lower storeys.

[0034] According to an embodiment of the invention at least a part of and possible all of the walls of the room modules are arranged to be aligned, so that the lower edge of the walls of the upper room module settles against the upper edges of the walls of the lower room module. Thus room modules on top of each other have the same outer measurements. This way the load-bearing walls with cellular board structure are in alignment, and a structure with a good load-bearing capacity in the vertical direction is achieved.

[0035] According to an embodiment of the invention the room modules on top of each other and/or side by side are attached to each other with attaching means. The attaching means can comprise for example bolts and/or some connecting element such as a connecting profile or even several connecting elements. The walls of the room modules and the connecting elements can also be attached to each other for example by welding.

[0036] According to an embodiment of the invention room modules, which are on top of each other, are attached together by their aligned walls with attaching means, which comprise a connecting profile, which has a first shape, which fits the upper edge of the wall of the lower room module, and a second shape, which fits the lower edge of the wall of the upper room module, which walls are to be fitted in an aligned manner, and a part which joins the first and the second shape. Such shapes that fit walls, such as a U-shaped profile, are easy to manufacture so that the connection will be firm but at the same time such that the walls are easily attached thereto.

[0037] In one embodiment of the invention at least two room modules are attached together with attaching means, which comprise a connecting profile having shapes that fit the upper edges and/or lower edges of the walls of the room modules to be set adjacent to each other, as well as a part connecting these shapes. By joining room modules together in the horizontal direction with

attaching means, which comprise a connecting profile, even high adjacent towers formed of room modules can be made more solid.

[0038] The above-mentioned connecting profiles can be made of some suitable material, such as steel, so that they are slightly flexible. Thus even high room arrangements can achieve better resistance to vibrations and bending. The connecting profiles can when necessary be joined together, for example by welding. The connecting profile according to the invention can be manufactured for example from 2-4 mm thick steel. The walls of the room modules can be attached to the connecting profile for example by welding, gluing or with bolts.

[0039] According to an embodiment of the invention at least one room module is arranged at a temporary location near the building to be renovated. Room modules can be arranged at the temporary location according to need, for example 1, 2-4, 5-10 or 11-20 or 2-50 room modules. The room modules or a part of them can for example be brought near the original building before the demolition is begun. The room modules can be placed for example in a parking lot or on a compacted gravel bed arranged at a suitable location.

[0040] According to an embodiment of the invention room modules are stacked on top of each other at the temporary location, so that a structure is formed, which has at least two residential storeys. By stacking the room modules at the temporary location it is possible to arrange more room modules in the available space. Room modules can be stacked at the temporary location on top of each other for example into exactly or at least 2, 3, 4, 5 or 6 storeys. The room modules can be temporarily attached to each other for example with bolts and/or by welding.

[0041] According to an embodiment of the invention room modules are stacked on top of each other at the temporary location so that those room modules, which will be fitted as the highest storeys of the renovated building, are stacked at the bottom of the formed structure, and those room modules, which will be fitted as the lowest storeys of the renovated building, are arranged at the top of the structure.

[0042] According to an embodiment of the invention room modules are arranged at the temporary location before the demolition of the original building is begun, so that there are at least as many apartments at the temporary location as in the original building. By arranging an apartment at the temporary location for every apartment in the original building, for example the moving of all the residents in the building to be renovated or the transferring of their belongings into the room modules directly from the original building can be made possible.

[0043] According to an embodiment of the invention the room modules arranged at the temporary location are connected to the municipal engineering. By connecting to the municipal engineering is in this context meant the connecting of the room modules to the municipal water and sewer mains and the electric mains. The room modules can also be provided with heating. By connecting the room modules arranged at the temporary location to the municipal engineering and heating, the room modules can be made habitable and the moving of residents from the original building directly into the room module meant to be their apartment is for example made possible.

[0044] According to an embodiment of the invention readily furnished room modules are arranged at the temporary location near the building to be renovated before the demolition is begun. In this context readily furnished means that for example the surface materials of the walls and separating walls, the surface materials of the floors, the toilet spaces, the bathrooms, sauna spaces of the room modules and other decoration elements belonging to the apartment or other room are arranged to be ready for the user. The room modules can be placed for example at the same site as the building to be renovated. The room modules can be placed for example in a parking lot or on a compacted gravel bed arranged at a suitable location. The room modules can further be connected to the municipal engineering. In this way the residents of the building to be renovated can move from the original building directly into the room module at the temporary location, which is meant to be their apartment. When the residents have moved out of the original building, the required demolition work can begin. When the required demolition and preparation work has been done, the room modules can be moved out of their temporary location and be installed into place. It is possible that other room modules are also installed in the building to be renovated, for example ones that come from storage or directly from a factory. Several modules can even be installed in one day. An advantage with the method is for example that a resident can get to a new better home immediately, and the resident does not need to arrange accommodation for himself in other temporary spaces, and the resident also does not need to arrange a temporary storage space for his belongings. For the residents in the building to be renovated the inconvenience from the renovation is significantly decreased and additionally the income losses for the owners of the building to be renovated during the renovation can be decreased.

[0045] According to an embodiment of the invention room modules are fitted on top of each other in the place of the demolished residential storeys of the original building, so that the renovated building has more storeys than the original building. The use of materials, such as cellular board, as frame materials for the renovated building, which materials are light in relation to the building materials of the original building, such as for example concrete elements, makes possible the building of more storeys on the same foundations. By increasing the number of storeys, for example the number of apartments, hotel rooms or office spaces in the building can be increased or larger apartments, hotel rooms or office spaces can be arranged in the building than in the original building. The incomes from the quantitative increase or the surface

area increase in the apartments, hotel rooms or office spaces can for example cover the renovation costs.

[0046] In an embodiment at least one room module is arranged at a temporary location near the building to be renovated in a situation, where at least one staircase and/or elevator has to be removed from use due to the renovation.

[0047] Arranging at least one room module at a temporary location near the building to the renovated in any of the above-mentioned ways may be useful also in renovations, where no storeys are demolished from the original building, but the object is to install more rooms or at least one additional storey in the building. In addition to the building of additional space or an additional storey alone, other procedures can simultaneously be performed on the building. Examples of such embodiments are for example the following renovations: the elevator of the original building is repaired or exchanged or a new elevator is built for example as post-installation, the staircase of the original building is renovated, another extensive repair work is performed in the original building, such as pipe renovation. Naturally one or more storeys may sometimes also be demolished in the above-mentioned renovations. Typically at least a part or all of the room modules arranged at the temporary location are used as said additional spaces or additional storeys.

[0048] In an embodiment the apartment modules or other room modules, which make up the additional storey or additional storeys and are designed for that purpose, are brought to the temporary location near the house, for example in the yard. The residents in the house, for example in one stairwell to be renovated, move into said modules for the duration of the renovation. When the renovation is complete, the residents move back into their apartments and the apartment or room modules are installed into the house to make up the desired additional space or additional storey. If the staircase and/or elevator can be used during the renovation, the modules can be installed directly on top of the original building and the people in the stairwell to be renovated could be moved into the new spaces already for the duration of the renovation. In most renovations, however, for example often when post-installing elevators, the staircase of the house cannot be used during the repair work.

[0049] The embodiments and advantages mentioned in the text relate, in applicable parts, both to the method, the building renovated with the method and the arrangement according to the invention, and to other manifestations of the invention.

BRIEF DESCRIPTION OF THE FIGURES

[0050] The invention is described in more detail below with reference to the enclosed schematic drawing, in which

Figure 1 shows as a principal view a part of a cellular board according to an embodiment of the invention;

Figure 2 shows as a principal view a part of a cellular board according to an embodiment of the invention;

Figure 3 shows an arrangement according to an embodiment of the invention, i.e. an original building meant to be renovated and room modules stacked at a temporary location;

Figure 4 shows the arrangement of Figure 3 when residential storeys have been demolished from the original building;

Figure 5 shows the arrangement of Figure 3 when room modules are placed on top of the foundations of the original building;

Figure 6 shows the arrangement of Figure 3 when a renovated building has been formed from room modules to be supported on the foundations of the original building.

DETAILED DESCRIPTION OF THE EXAMPLES OF THE FIGURES

[0051] For the sake of clarity, corresponding parts of different applications have the same reference numerals.

[0052] Figure 1 shows a surface protrusion 6 and a core 4 according to the invention. The profiles or lamellae 4 and 6 are formed of an even metal plate by roll forming attaching folds in their longitudinal edges and strengthening shapes 20 in the longitudinal direction of the profile between the edges of the surface protrusion 6. In the first edge 11 of the surface protrusion 6 there is an attaching fold 13 and in the second edge 12 an attaching fold 14. In the first edge 21 of the core 4 there is an attaching fold 23 and in the second edge 22 an attaching fold 24.

[0053] Figure 2 shows an example of how a cellular board 1 is formed of separate profiles, i.e. surface protrusions 6, 6', 6", 6"' and cores 4, 4'. The attaching fold 14 of the second edge of the surface protrusion 6, the attaching fold 13' of the first edge of the surface protrusion 6' and the attaching fold 23 of the first edge of the core 4 are fitted together at the contact point 10. In the same way, the attaching fold 14" of the second edge of the surface protrusion 6', the attaching fold 13"' of the first edge of the surface protrusion 6"' and the attaching fold 24 of the second edge of the core 4 are fitted together at the contact point 10'. The profiles are attached together by machine seaming at the contact points 10 and 10'. Thus the first surface plate 2 of the cellular board 1 is formed from the surface protrusions 6 and 6' and the second surface plate 3 of the cellular board 1 is formed from the surface protrusions 6" and 6"'. At the attaching points the material to be pressed together is sixfold.

[0054] From Figures 1 and 2 can be seen that the surface protrusions which are set against each other, such as 6 and 6", are identical to their shape. The surface plates 6 and 6" are just installed in an opposite position in relation to each other. The cellular board 1 is thus formed by using only two differently shaped profiles - one

for the surface protrusions and another for the cores.

[0055] The width i.e. advance A of the surface protrusion drawn in Figure 1 can for example be about 0.15 m. The width B of the core drawn in Figure 1 can for example be 0.09 m. The thickness C of the entire cellular board 1 drawn in Figure 2 would thus be approximately the thickness of two used metal plates more than B, i.e. for example 0.095 m.

[0056] Insulation can be installed in the space 30 remaining inside the cellular board during the assembling. The insulation can for example be a mineral wool sheet, which essentially fills the space 30 completely. A mineral wool piece, which to its cross-section is approximately a rectangle, can for example be placed into one space 30. The measurements of this insulation can for example be A times B when using the above-mentioned measurements. In the direction which is perpendicular to the cross-section shown in the figures, the insulation can be for example of the same size as the entire cellular board or the profiles 4 and 6.

[0057] Figures 3-6 show a method and an arrangement according to an embodiment of the invention. Room modules 33 according to the invention have been stacked in Figure 3 at a temporary location 31, near the original building 32 meant to be renovated. The original building 32 has three residential storeys 41 a, 41 b and 41 c above the basement 38. The room modules 33 have been stacked on top of each other and side by side so that a structure 34 is formed, which has three residential storeys 42a, 42b and 42c, as in the original building 32. The room modules 33 of the structure have been attached together in a detachable manner, for example mainly with bolts. The room modules 33 are stacked on top of each other at the temporary location 31 so that the room modules 33', which will be fitted as the highest storey 42c of the renovated building, are at the bottom in the formed structure 34, and the room modules 33", which will be fitted as the lowest storey 42a of the renovated building, are at the top of the structure 34. The room modules 33 have been brought near the original building 32 before the demolition is begun. The room modules 33 are placed for example on a compacted gravel bed 36 arranged at a suitable location. The room modules 33 have the necessary doors and windows 37. The room modules 33 are readily furnished, so that for example wallpapers, floor materials and bathroom decoration are ready. The room modules 33 have at their temporary location been connected to the municipal water and sewer mains and to the electric mains and they have been provided with heating. In the examples in the figures, the same amount of room modules 33 have been arranged at the temporary location 31 as there are apartments in the original building. In this way the residents can move from the original building 32 directly into the room module 33 which is meant to be their apartment, before the demolition of the original building 32 is begun.

[0058] Figure 4 shows how the residential storeys of the original building 32, which are drawn with dotted lines, are demolished. The foundations and basement 38 of the original building 32 are left. The intermediate floor between the basement of the original building 38 and the residential storeys, i.e. the ceiling 38' of the basement, is at least mainly preserved. The ceiling 38' protects the structures of the basement 38 and spaces therein, for example engineering and utility service rooms, during the demolition.

[0059] Figure 5 shows a step according to an embodiment of the invention, where room modules 33 are moved from the temporary location 31 and fitted on top of each other and side by side on the building to be renovated 35, so that the room modules 33 form several residential storeys in the renovated building 35. The room modules 33 are detached from each other at the temporary location 31 one by one and moved and installed as one piece in their place in the new building 35 for example with a crane. Figure 5 shows how a room module 33"' is being moved supported by the crane cable wire 39. The room modules 33 can be conventional complete apartments, which to their shape mainly are rectangular and to their outer measurements are for example 3-10 meters wide and 5-22 meters long. The walls of the room modules are manufactured for example from zinc coated steel cellular board. The cellular board of the walls can be manufactured from profiles, which have been joined together by pressure seaming according to Figures 1 and 2. The foundations and basement 38 of the original building 32 make up the foundations and basement 38 of the new renovated building 35. The residential storeys of the new renovated building are built on top of the ceiling 38' of the basement of the original building.

[0060] Figure 6 shows a situation, where all the room modules 33, which were at the temporary location 31, have been placed on top of the foundations and basement 38 of the original building. Thus a renovated building 35 has been formed. A roof covering 40 has been built on top of the room modules 33 of the renovated building 35. The temporary location 31 is now empty and landscaped for example by planting a lawn.

[0061] The figures show only one a few embodiments according to the invention. Facts of secondary importance regarding the main idea of the invention, facts known as such or apparent for a person skilled in the art, such as support structures possibly required by the invention, are not separately shown in the figures. It is apparent to a person skilled in the art that the invention is not limited exclusively to the examples presented above, but that the invention can vary within the scope of the claims presented below. The dependent claims present some possible embodiments of the invention, and they are not to be considered to restrict the scope of protection of the invention as such.

Claims

1. A method for renovating a building (32), which meth-

od comprises at least following steps

- demolishing at least one storey (41 a, 41 b, 41 c) of an original building (32),
- fitting at least one room module (33) in place of the demolished storey (41 a, 41b, 41c).

2. The method according to claim 1, **characterized in** fitting at least one room module in the place of the demolished storey, floor, ceiling and at least two walls of which room module are manufactured at least mainly of cellular board.

3. The method according to claim 1 or 2, **characterized in** demolishing the original building (32) so that only the foundations and/or the basement (38) is left, which make up the foundations and/or basement of the renovated building.

4. The method according to claim 3, **characterized in** demolishing the original building (32) so that a ceiling (38') of the basement of the original building is at least mainly preserved.

5. The method according to claim 4, **characterized in that** said at least one room module of the renovated building is built on top of the ceiling (38') of the basement of the original building.

6. The method according to any of the preceding claims, **characterized in** fitting room modules on top of each other in the place of the demolished storeys (41 a, 41 b, 41 c), so that the renovated building comprises at least two storeys (42a, 42b, 42c).

7. The method according to claim 6, **characterized in** attaching the room modules, which are on top of each other, together by their aligned walls with attaching means, which comprise a connecting profile, which has a first shape, which fits an upper edge of the wall of the lower room module , and a second shape, which fits a lower edge of the wall of the upper room module, which walls are to be fitted in an aligned manner, and a part which joins the first and the second shape.

8. The method according to any of the preceding claims, **characterized in** arranging at least one room module at a temporary location near the building to be renovated.

9. The method according to claim 8, **characterized in** stacking the room modules on top of each other at the temporary location so that a structure is formed, which has at least two storeys.

10. The method according to claim 8 or 9, **characterized in** arranging room modules at a temporary location before the demolition of the original building is started, so that there are at least as many apartments at the temporary location as in the original building.

11. The method according to any of the preceding claims 8-10, **characterized in** connecting the room modules arranged at the temporary location to municipal engineering.

12. The method according to any of the preceding claims, **characterized in** fitting room modules on top of each other in the place of the demolished storeys of the original building, so that the renovated building has more storeys than the original building.

13. A building, which is renovated with a method according to any of the preceding claims, which building has a foundation and/or basement, and at least one room module built at least partly supported thereon.

14. The building according to claim 13, **characterized in that** the building has an original basement, which comprises the ceiling of the original basement.

15. The building according to claim 14, **characterized in that** the building comprises several room modules, which are arranged in several storeys supported on the foundation and/or basement.

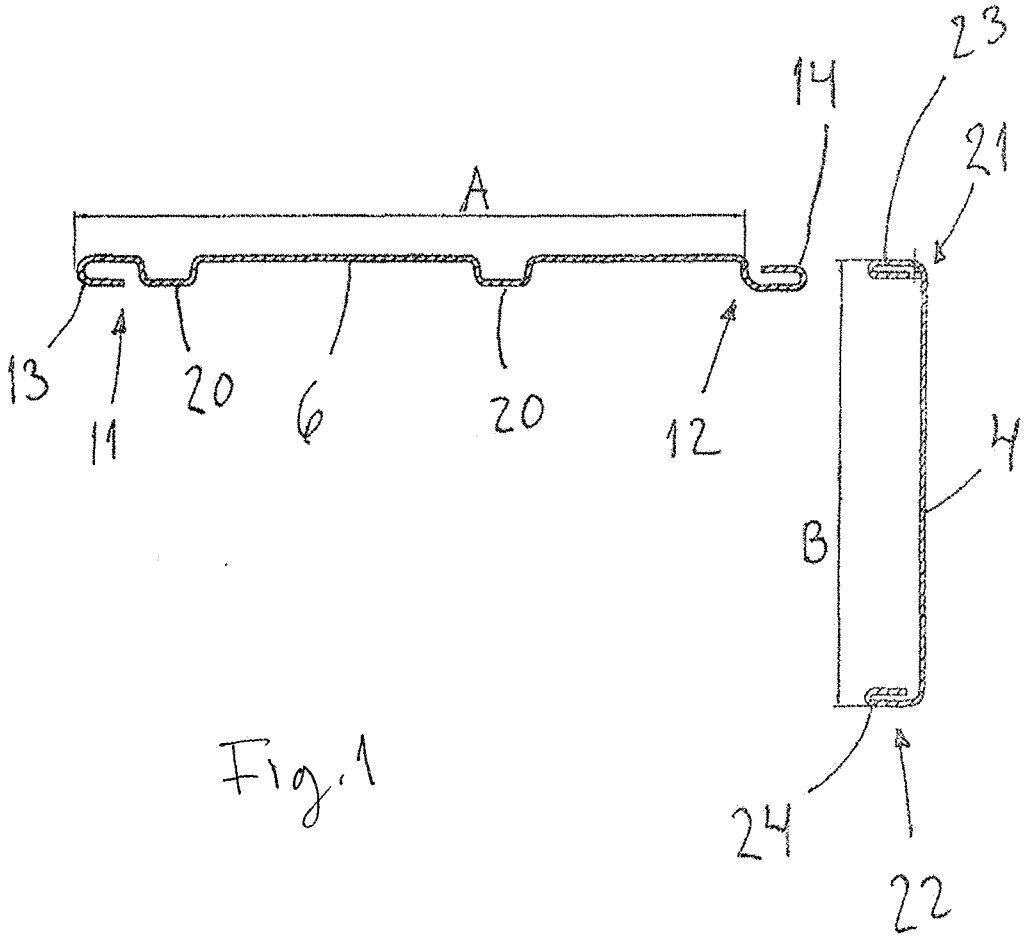

Fig. 1

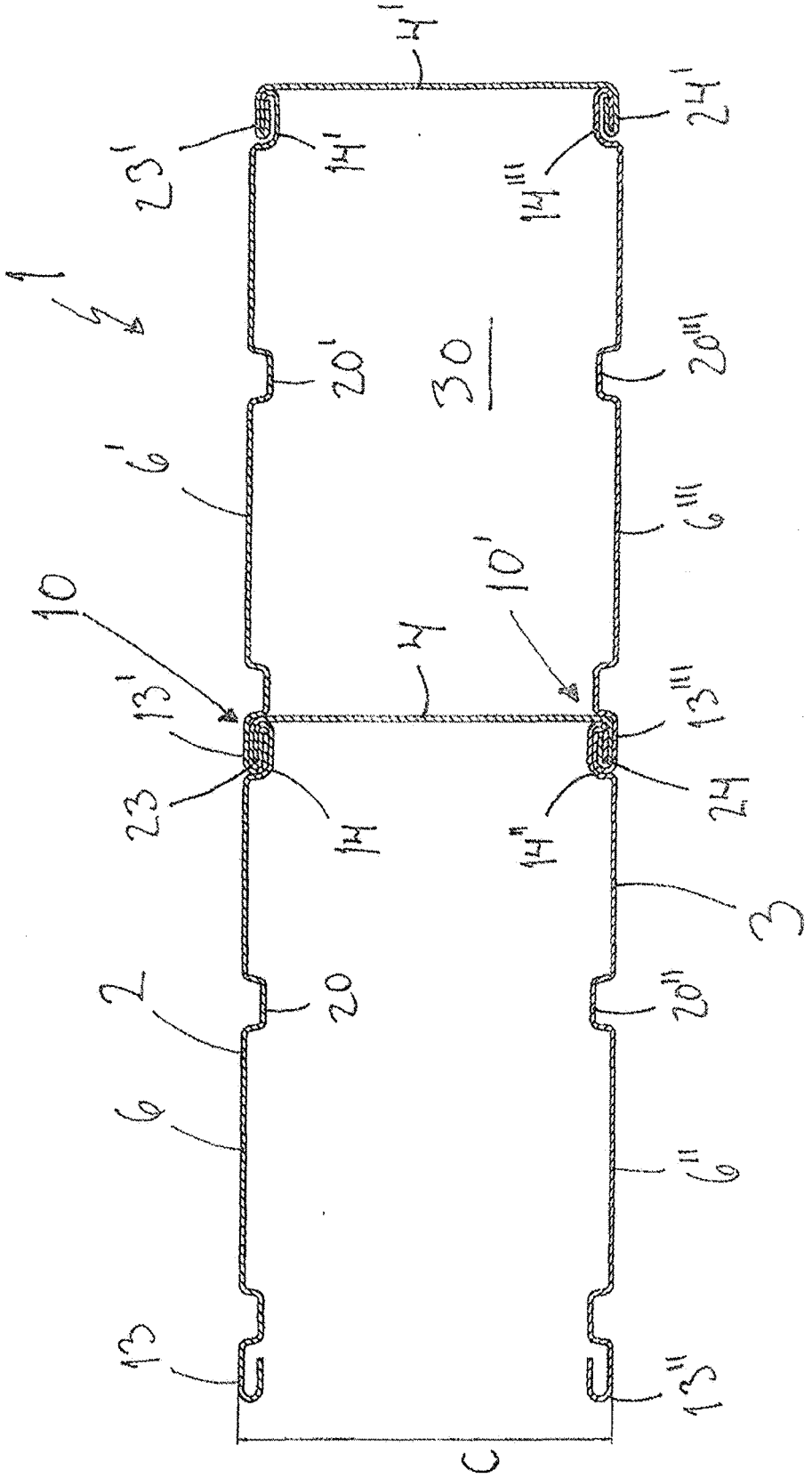

Fig. 2

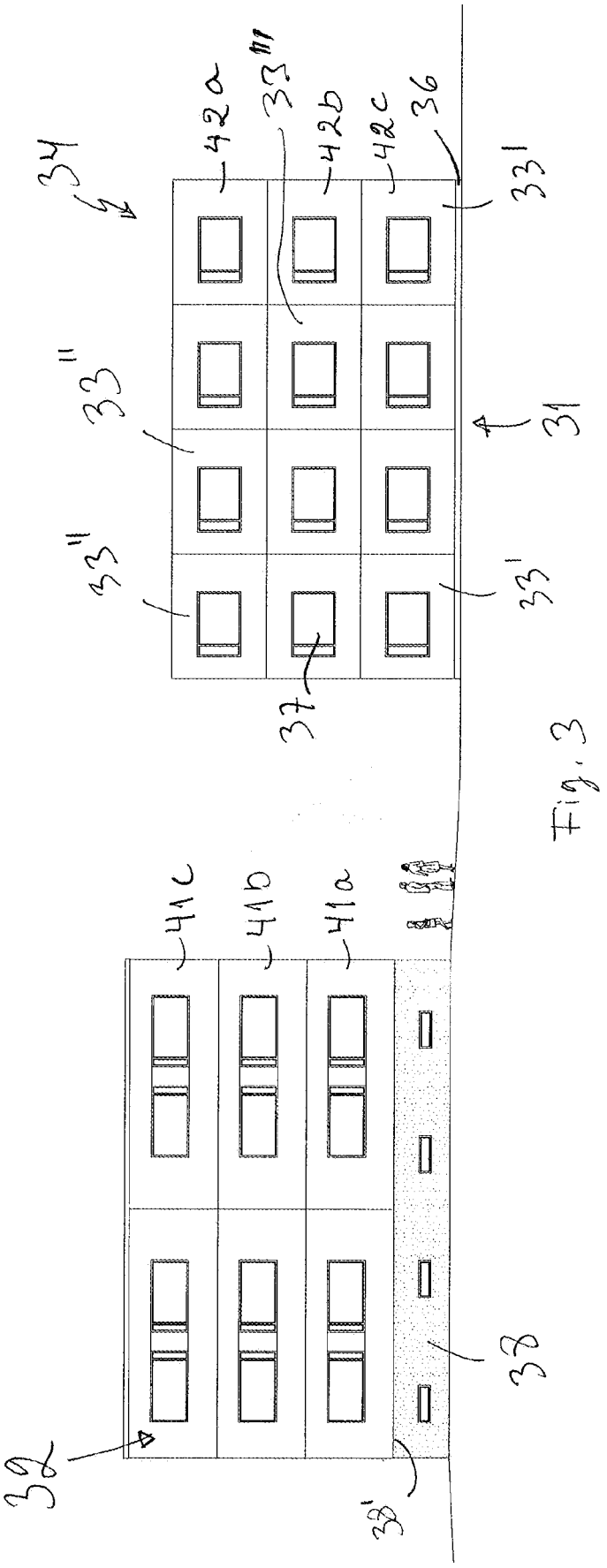

Fig. 3

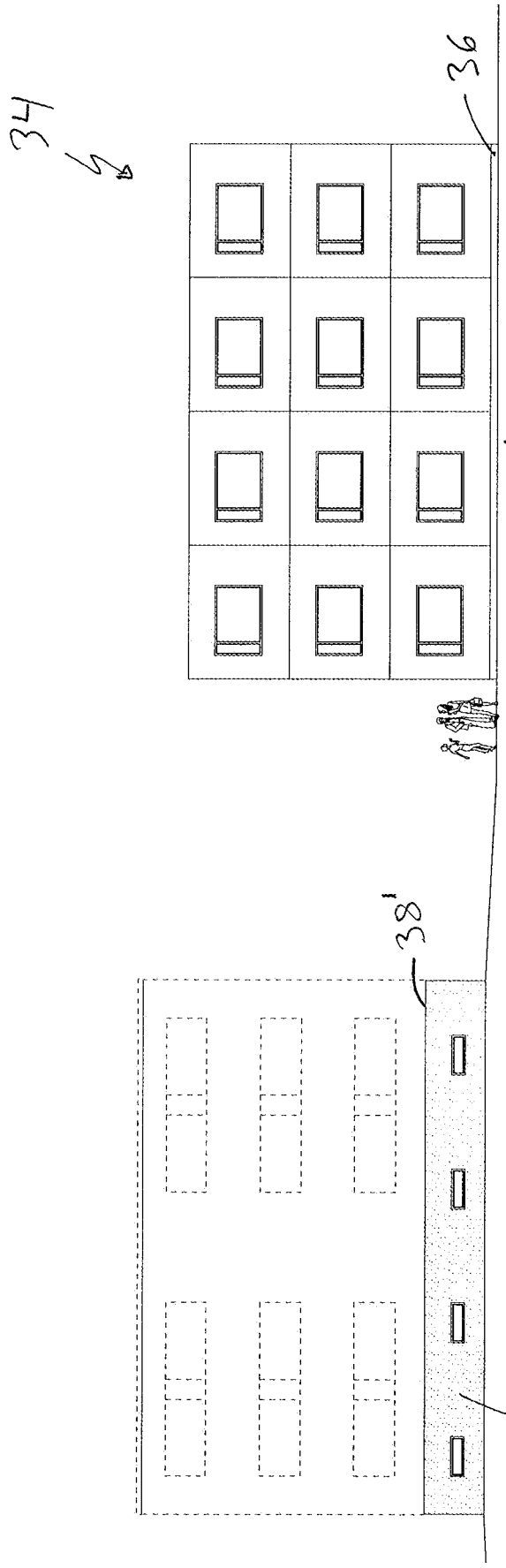

Fig. 4

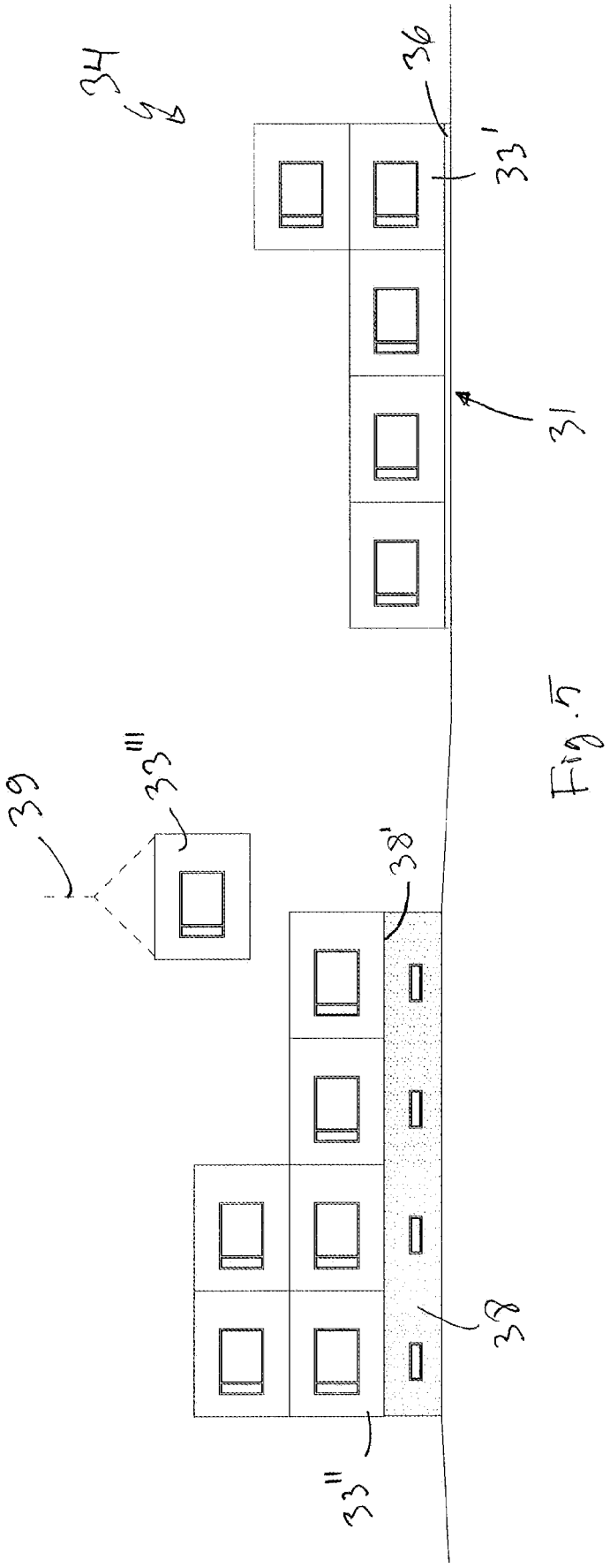

Fig. 5

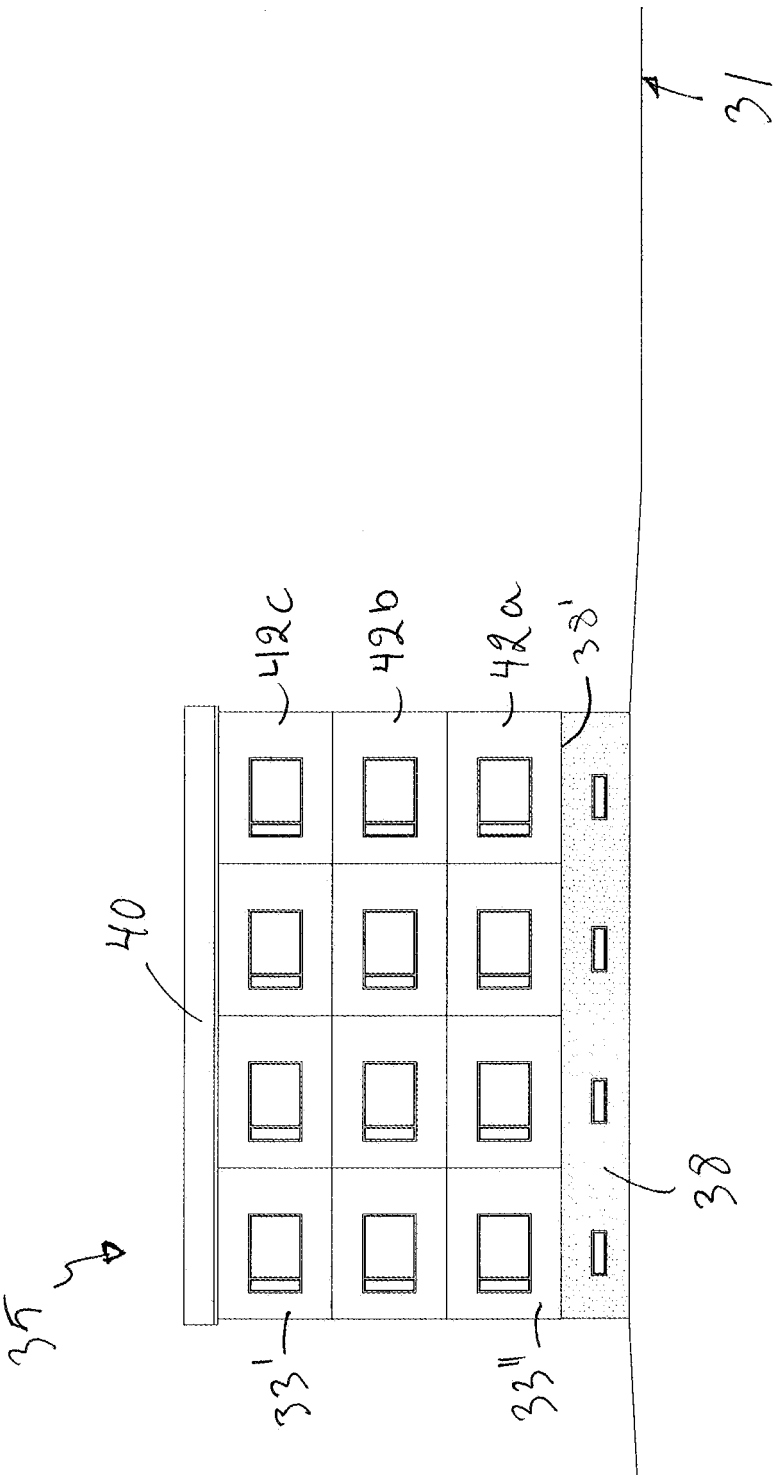

Fig.6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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