Oct. 5, 1965 MASAMITSU NAKANISHI 3,209,510

METHOD OF CONSTRUCTING A COLUMN OR FRAME

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FIG. 1

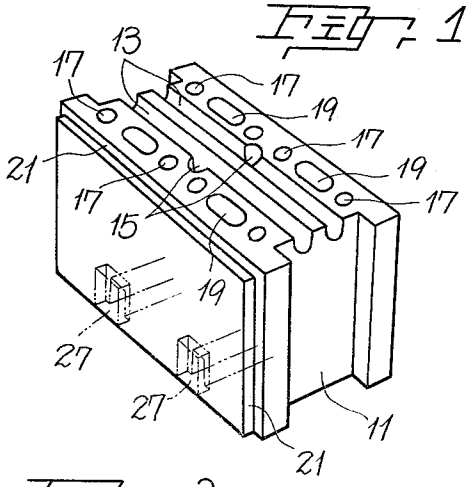


FIG. 2

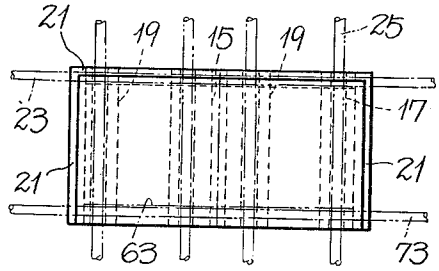


FIG. 3

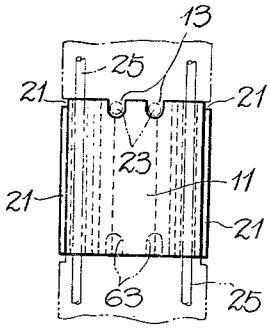


FIG. 4

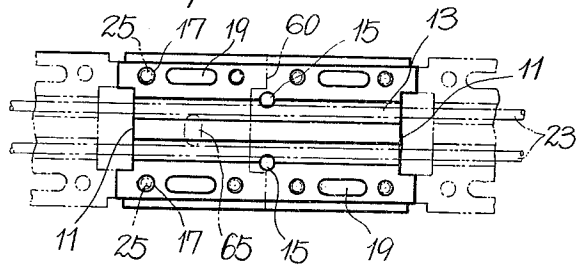


FIG. 5

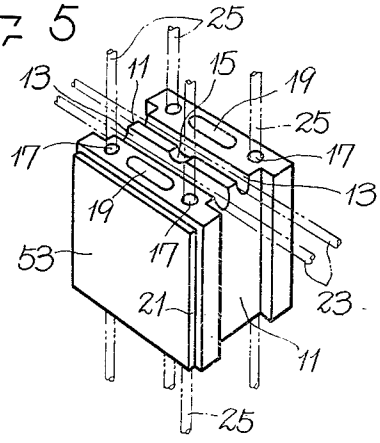
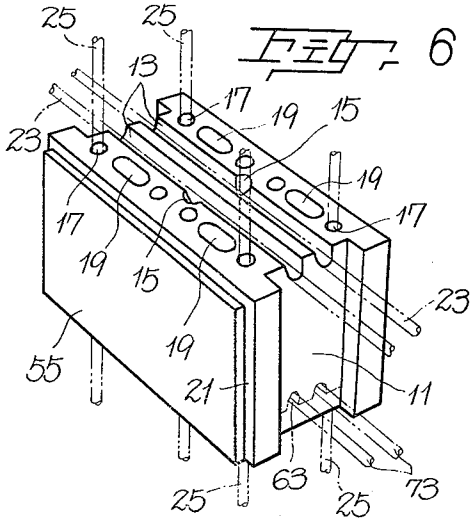


FIG. 6



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FIG. 7

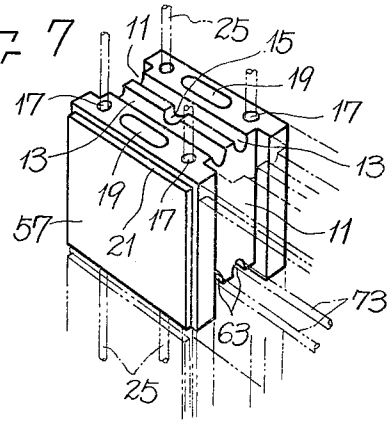


FIG. 8

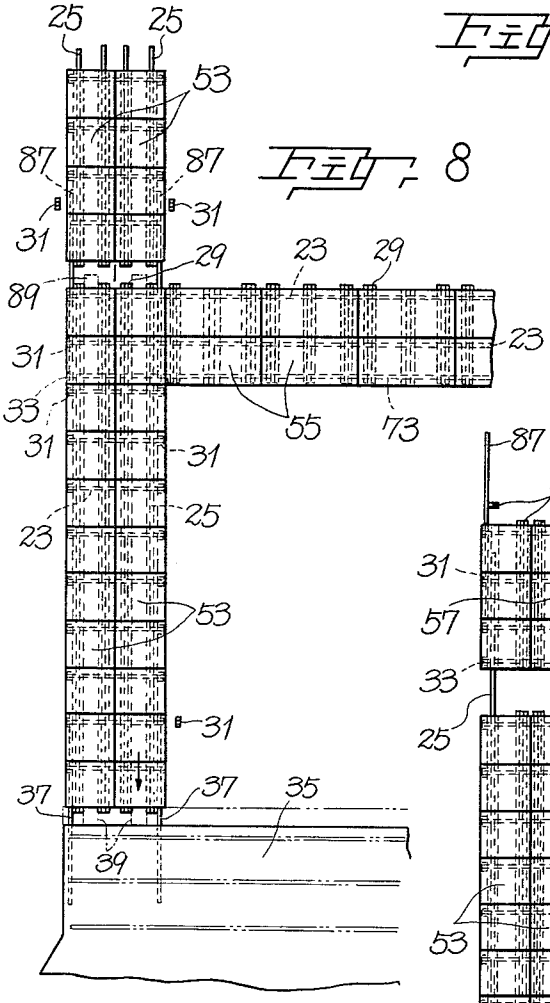
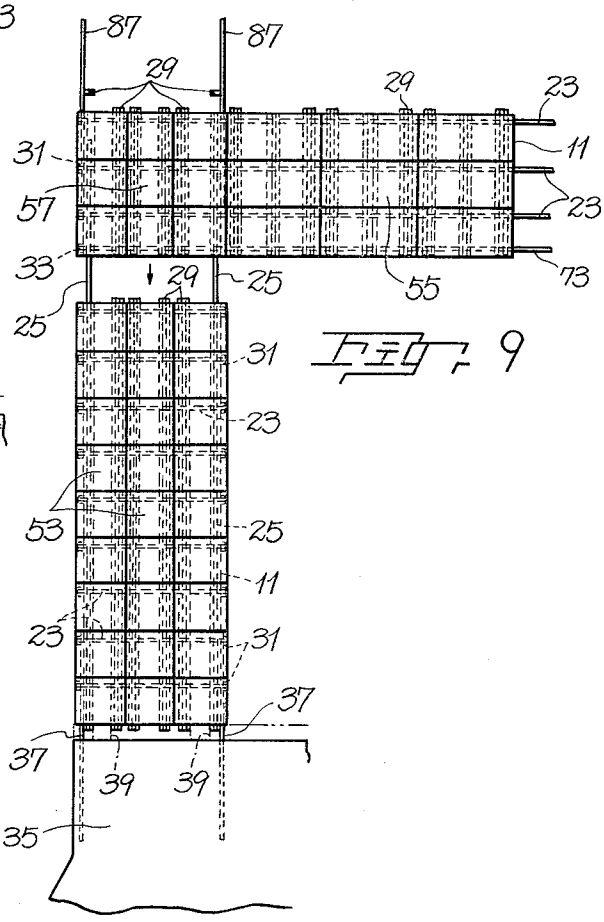


FIG. 9



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United States Patent Office 3,209,510 Patented Oct. 5, 1965

3,209,510

METHOD OF CONSTRUCTING A COLUMN OR FRAME

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Filed Apr. 8, 1960, Ser. No. 21,018
2 Claims. (Cl. 52—744)

This invention relates to concrete blocks and methods of using the same for construction.

One object of this invention is to provide concrete blocks which are very useful in construction.

Another object of this invention is to provide a method of constructing buildings, which is easier than the prior art.

Still another object of this invention is to provide a method of constructing buildings, whereby the buildings may be constructed more quickly than the prior art.

Still another object of this invention is to provide a method of constructing buildings, whereby the buildings may be constructed comparable in strength to those utilizing the prior art, and yet easier and faster to construct.

A further object of this invention is to provide a method of constructing buildings, whereby openings in the buildings may be designed similarly freely to the case in accordance with the reinforced concrete construction.

A further object of this invention is to provide a rigid built-up framelike structure for the buildings of which the method for the construction has the above advantages.

A further object of this invention is to provide buildings of more than three stories comparable to those using reinforced concrete construction, and yet having the above-mentioned advantages.

Briefly stated in accordance with one aspect of this invention, there is provided a concrete block of a rectangular parallelopiped in shape having a vertically through recess in and across each of the lateral surfaces. This recess provides a space in which concrete is to be placed. The block has also horizontally through grooves in and across the top surface. This groove communicates with the recesses and provides a space in which a reinforcing bar is to be placed. There is in the block at least a vertically through bottomless sprue communicating with at least one of the grooves for grouting the same. There is in the block at least a vertically through bottomless tube not communicating with the groove, in which a reinforcing bar is to be inserted. There is in the bloock also at least a vertically through bottomless hole not communicating with said groove, which is to be used to facilitate piping.

In accordance with this invention, the concrete block of the above class is used in constructing a pillar, a wall, and a frame-like structure, whereby a building is constructed. A similar block may be used in constructing floors.

The invention will be better understood and other objects and additional advantages of the invention will become apparent upon perusal of the following description taken in connection with the drawings, and the scope of the invention will be defined in the appended claims.

In the drawings, FIG. 1 is a perspective view of a concrete block embodying the principles of this invention, in which bottom grooves and bars are shown in chain lines;

FIG. 2 is a front elevational view thereof;

FIG. 3 is a side elevational view thereof in which another block just thereabove and still another block just therebelow are shown partly in chain lines;

FIG. 4 is a plan view thereof in which laterally neighbouring blocks are shown partly in chain lines;

FIG. 5 is a perspective view of another concrete block also embodying the principles of this invention;

FIG. 6 is a perspective view of still another concrete block in accordance with this invention;

FIG. 7 is a perspective view of further another concrete block in accordance with this invention;

FIG. 8 is an explanatory diagram of a frame-like structure in accordance with this invention; and

FIG. 9 is an explanatory diagram of another frame-like structure of another execution also in accordance with this invention.

Similar numerals refer to similar parts throughout the several views.

Referring now to drawings, there is provided a rectangular parallelopiped concrete block. There are respective recesses **11** in and across the lateral surfaces of the block. The recess **11** is rectangular parallelopiped in shape and has vertical side edges. This recess is provided in order to constitute a vertically through space co-operating with a corresponding recess of a neighbouring block. Into the space concrete paste is placed to incorporate these blocks in site. Also an anchor plate is arranged within this recess, which will be explained hereinafter.

There are two laterally through grooves **13** in and across the top surface of the concrete block. These grooves **13** are parallel with the front edge of the top surface and end within the recess **11**. These grooves **13** are provided and adapted to receive straight reinforcing bars **23**, respectively. In order to arrange a straight reinforcing bar **23** within a series of the grooves **13** of laterally neighbouring blocks arranged in a row, these grooves **13** are arranged in alignment with each other over the row.

One or two sprues **15** is formed through the body of the block. It is necessary to communicate the sprue **15** with the groove **13**, because the sprue **15** is used to grout the groove **13** after blocks are piled up one above another and reinforcing bars **23** are inserted within the grooves **13**. To this end the sprues **15** are arranged in a similar position to each other in each block so as to be in vertical alignment to each other in a column of blocks.

In the blocks to be used for constructing a beam member, beam grooves **63** are provided in and across the bottom surface of the beam block **55** and the beam end block **57**. The beam groove **63** is shaped and used similarly to the above-mentioned groove **13** so that it is necessary to communicate the same with the sprue **15**.

Besides the sprues **15**, vertical bottomless tubes **17** and vertical bottomless holes **19** are provided through the body of the block which are parallel with the sprues and therefore the vertical edges of the block but do not communicate with the groves **13** and **63**. The vertically through bottomless tubes **17** are provided in order to insert reinforcing bars **25** thereinto, respectively. The vertically through bottomless holes **19** are provided in order to insert various pipes, conduits, etc. and also aid in reducing the weight of the block. Accordingly, it is not necessary to have a generally elliptical cross section as shown in the drawings.

Sometimes the bottom grooves are arranged longitudinally from the front to the rear in order to join a block to another arranged just behind. In order to facilitate placing a washer and a nut for engaging with a threaded end of a reinforcing bar to be inserted within the longitudinal groove to join the block with the block or blocks behind it, an end of the groove is enlarged so as to form a recession **27**.

There is provided a pointed joint channel **21** bordering the front surface of each block along the upper and vertical edges of the surface.

The blocks in accordance with this invention are classified into four types. They are the standard block **51**, the

pillar block **53**, the beam block **55**, and the beam end block **57**, as shown in drawings.

Now a procedure of construction of a wall using a lot of these blocks, particularly the standard blocks **51**, will be explained. It is to be noted that FIGS. 8 and 9 may be referred to here, but these drawings show mainly embodiments of the construction of frame-like structures which will be explained hereinafter. At first a foundation **35** of reinforced concrete construction is provided. Anchor plates **37** and reinforcing bars, if desired, are embedded firmly in the foundation **35** and the other ends thereof rise upright. In general, the upright ends of the anchor plates **37** are designed so as to engage the recesses **11** of the blocks at least in the lowermost row.

The required number of the blocks are laid on their front sides on a surface plate, facing similarly to each other in required rows and required columns so as to be arranged side by side and top to bottom. Thus there are provided straight through grooves **13** over the blocks in a row and straight through sprues **15**, straight through tubes **17**, and straight through holes **19** over the blocks in a column. Cement paste is inserted between these blocks. Reinforcing bars **23** having threaded ends are inserted into the grooves **13**, respectively. By means of washers and nuts engaging the threaded ends of the reinforcing bars **23**, the blocks in the row are secured to each other. Reinforcing bars **25** having threaded ends are inserted into the tubes **17**, respectively. By means of washers and nuts engaging the threaded ends of the reinforcing bars **25**, the blocks in the column are secured to each other. It is to be noted that too much tension is not applied to the reinforcing bars **23** and **25**, and also **73** shown in other embodiments, but enough tension to maintain the blocks in the incorporated arrangement is applied to the reinforcing bars by the nuts. The clearance within the tubes **17** into which the reinforcing bar **25** has been inserted is filled with cement paste forced in the clearance through perforations provided in the washer.

After the cement paste has set, a wall composed of the lot of blocks and built in the laid position is raised into the upright position and placed on the foundation **35**. The raised wall is anchored by the anchor plate **37** and the bars half-embedded in the foundation. The upright spaces between neighboring blocks, formed by the recesses **11**, are then filled with concrete. Clearances within the grooves **13** into which the reinforcing bars **23** have been received are filled with cement paste grouting through sprues **15** communicating with the grooves **13**.

A rigid wall may be constructed as above in accordance with this invention. Such execution requires a rather short period of time by virtue of the block construction. Since there are provided the upright through holes **19** through the blocks in a column, it becomes rather easy to execute piping work. By virtue of the provision of the pointed joint channel **21**, rain-water drains well and the interior of the block is effectively prevented from being permeated with water.

Similarly a pillar may be constructed. In such a case, the pillar block **53** shown in FIG. 5 may be used. A beam member may be constructed also similarly. For the same, the beam block **55** shown in FIG. 6 may be used together with the beam end block **57** shown in FIG. 7. The beam block **55** and the beam end block **57** have the straight through bottom grooves named beam grooves **63** which constitute laterally through straight grooves when these blocks are arranged laterally in a row, in which reinforcing beam bars are to be inserted, respectively.

Now a frame-like construction in accordance with this invention will be explained. On a suitable surface plate, required number of required kinds of concrete blocks are laid on their front sides. They are assembled in required positions for building a frame-like construction. Detailedly speaking, the beam blocks are arranged in required rows and in required columns. The rows are extended by the beam end blocks laterally so as to form a beam

member. The upper side rows of the beam member may be made using the standard blocks and the pillar blocks may be substituted for the beam end blocks only in the upper side rows. Alternatively, the upper side rows made of the beam blocks and the beam end blocks may lack the beam bars **73** to be inserted in the beam grooves **63**.

The columns in the extended parts of the beam member or the columns of the beam end blocks **57** is extended longitudinally in the direction of the bottom of the laid block by using the pillar blocks **53**. The pillar blocks **53** are arranged top to bottom and side by side so as to form extended columns in any of which the blocks are arranged in alignment.

Cement paste is inserted between any neighbouring two of the blocks. Then straight reinforcing bars are inserted in the straight through grooves in rows and the straight through tubes in columns. By virtue of regularity in dimension and arrangement of the grooves **13** and **63** and tubes **17**, it is easily possible to insert reinforcing bars **23**, **73**, and **25** into such grooves and tubes. Then the threaded ends of these bars **23**, **73**, and **25** are engaged with washers and nuts which secure the blocks in position, respectively. It is to be seen that dissimilarly to the above-mentioned embodiment the beam blocks **55** and the beam end blocks **57** have the beam grooves **63** in which also reinforcing bars or beam bars **73** are inserted. It is also to be understood that too much tension is not to be applied to the reinforcing bars similarly to in case of the aforementioned example. The clearances within the tube **17** and within the grooves **13** and **63** into which reinforcing bars have been inserted are filled with cement paste which is forced into the clearances through perforations provided in the washers under pressure.

After the grout has set, the laid frame-like construction is raised on a previously built foundation **35** of reinforced concrete construction. Anchor plates **37** and spacers **39** and, if desired, reinforcing bars are half-embedded firmly in the foundation **35** and the upper ends thereof rise upright. The upright ends of the anchor plates **37** are engaged with the recesses **11** of at least the lowermost rows of the pillar sections of the frame-like construction and fixedly secured against the blocks by means of the reinforcing bars and nuts and washers carried thereon. In arranging the pillar sections of the frame-like construction on the foundation **35**, the upstanding spacers **39** serve to position the pillar sections. Then the upright through spaces between a column of the pillar blocks **53** and the neighbouring column composed of the recesses **11** are filled with concrete. Then the upright through straight sprues are used for grouting the clearances around the horizontal bars **23** and the beam bars **73** within the blocks.

For setting upright the laid frame-like construction on the foundation **35**, a crane (not shown) may be used. It is necessary to take down the construction vertically as shown by arrows in the drawings.

For building a frame-like construction of an upper story, the above-stated procedure is repeated on the upper surface of the frame-like construction of the lower story. On the upper surfaces as above, more spacers **89** are set and an assembled floor is placed which has been constructed similarly using similar blocks. A similar frame-like structure constructed on the surface plate is craned on the frame-like structure of the lower story as shown in the drawings. It this case, main vertical reinforcing bars arranged outer positions within the frame-like structure are connected with the corresponding bars of the upper structure by means of welding or turnbuckles. Frame-like structures for still upper stories may be bulit similarly repeating such a procedure.

If a span of a beam is large to an extent, pillars only which will reach the lower surface of the beam are built at first separately. Such an example will now be explained in connection with FIG. 9. But it would not be necessary to explain the procedure for building the pillar

in detail in view of the description made hereinbefore. In short, required number of blocks are arranged on their front side on a surface plate, fixedly secured to each other by means of reinforcing bars carrying nuts and washers, grouted, and raised on a foundation **35**, similarly to the afore-mentioned embodiments.

Meantime, a beam member composed of beam blocks **55** and beam end blocks **57** and adapted to the extent of the span is built being laid on their front sides on the surface plate. In this case, the vertical reinforcing bars which have been inserted through the straight through tubes **17** of the pillars have been extended upwards. The upper extra part of such an extended bar **25** is inserted into a corresponding tube **17** of the beam end section of the beam member. The nuts **29** once screwed on the tops of the reinforcing bars **25** of the pillar other than the extended bars as above are removed in order to place the beam end section of the beam member on the tops of the pillars snugly. Of course, cement paste is placed between the top of the pillar and the bottom of the beam end section of the beam member just before the latter is set on the former. After the beam member is laid on the tops of the pillars, the tubes **17** of the beam end blocks into which the above-stated extended bars **25** have been inserted are grouted and on the top threaded ends of the extended reinforcing bars washers are adapted and nuts are screwed so as to fixedly secure the beam member onto the tops of the pillars. Thus the constructions of the beam member and the pillars are executed horizontally and separately and the frame-like structures are built up from these separately raised beam member and pillars, in accordance with this invention. Repeating these procedures, it is possible to build more than three-storied buildings.

Numeral **60** in the drawings represents a line of an end of the pillar block when the same is overlapped on the standard block.

While particular embodiments of this invention have been illustrated and described, modifications thereof will readily occur to those skilled in the art. It should be understood therefore that the invention is not limited to the particular arrangements described and illustrated but the appended claims are intended to cover all modifications which do not depart from the true spirit and scope of the invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A method of constructing a column for support by a structural member comprising the steps of laying a required number of blocks on their front sides on a substantially horizontal surface plate, arranging said blocks in columns and rows, said blocks including row aligned top grooves and aligned columnar end recesses, tubes, and sprues communicating with said row aligned top grooves, inserting cement paste between adjacent rows of said blocks, inserting reinforcing rods through said row aligned top grooves, inserting reinforcing rods through said aligned columnar tubes, tightening nuts and washers on the ends of all of said reinforcing rods against outer surfaces of said blocks to establish compressive forces on all of said blocks to thereby secure said blocks as a unitary structure, raising said unitary columnar structure to a vertical position in place on said structural member and securing it thereon, forcing cement paste into said aligned columnar end recesses to grout said recesses, and forcing cement paste through said aligned columnar sprues into said row aligned top grooves around the reinforcing rods received therein to grout said top grooves, whereby said reinforced, self-supporting column is formed in a horizontal position and is further strengthened after having been set in place.

2. A method of constructing a fully integrated frame-like structure for support by a structural member comprising the steps of laying a required number of column, beam and beam end blocks on their front sides on a substantially horizontal surface plate, arranging said blocks in columns and rows in preselected orientation defining columns and beams, said blocks including aligned top grooves and row aligned beam bottom grooves in said beam blocks and aligned columnar end recesses, tubes and sprues communicating with said row aligned top grooves in all of said blocks and communicating with said row aligned beam bottom grooves in said beam blocks, said beam blocks being arranged in required rows extending from said beam end blocks to form beam members, said column blocks being arranged in required columns and selectively including beam or beam end blocks to form column members, inserting cement paste between adjacent rows of said blocks, inserting reinforcing rods through said row aligned top grooves and said row aligned beam bottom grooves, inserting reinforcing rods through said aligned columnar tubes, tightening nuts and washers on the ends of all of said reinforcing rods against outer surfaces of said blocks to establish compressive forces on all of said blocks to thereby secure all of said blocks as a unitary structure, raising said unitary columnar and beam structure to a vertical position in place on said structural member and securing it thereon, forcing cement paste into said aligned columnar end recesses to grout said recesses, and forcing cement paste through said aligned columnar sprues into said row aligned top grooves and into said row aligned beam bottom grooves around the reinforcing rods received therein to grout said top grooves and said beam bottom grooves, whereby said reinforced, self-supporting column and beam structure is formed in a horizontal position and is further strengthened after having been set in place.

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