

Dec. 26, 1939.

O. I. FREEMAN

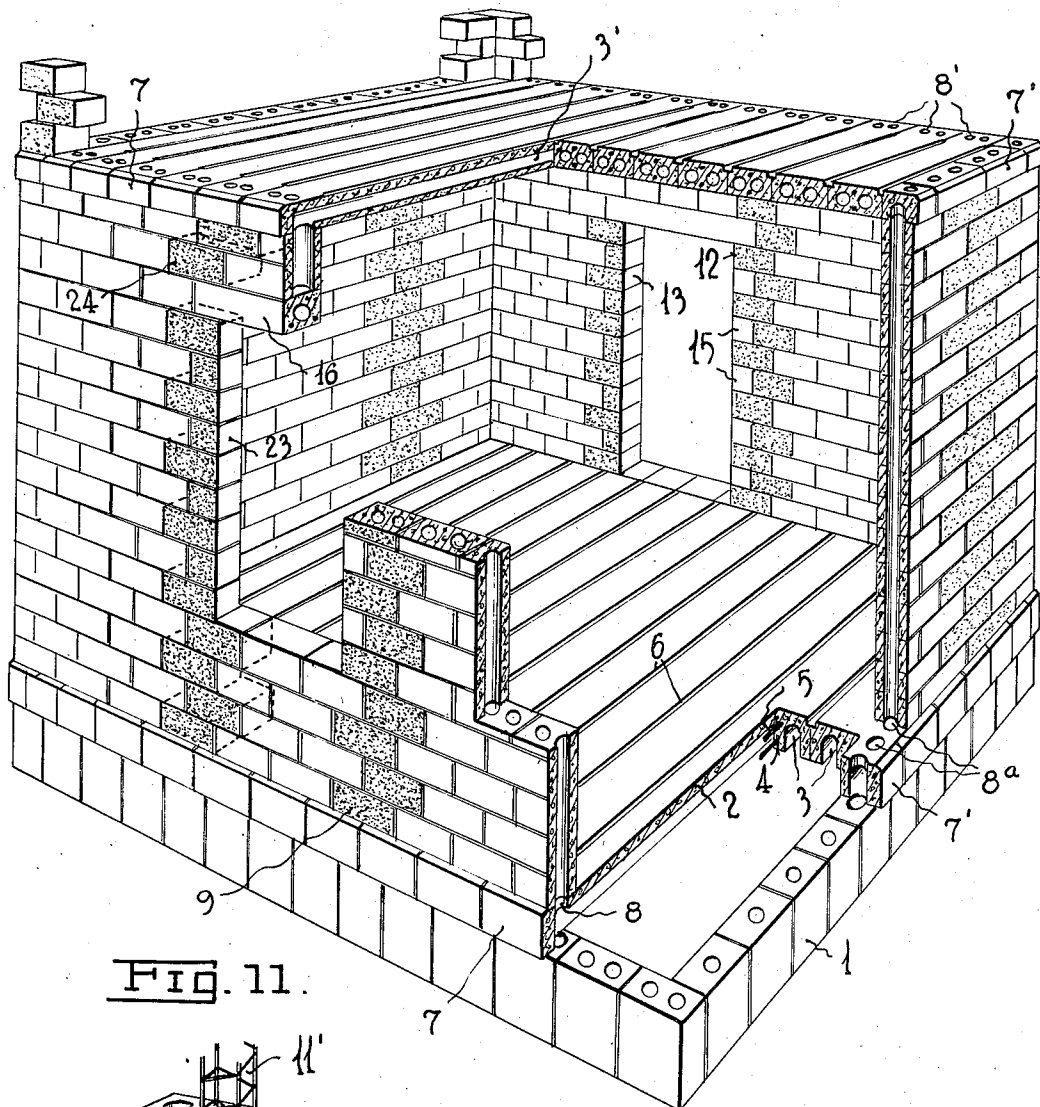
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BUILDING CONSTRUCTION

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Fig. 1.



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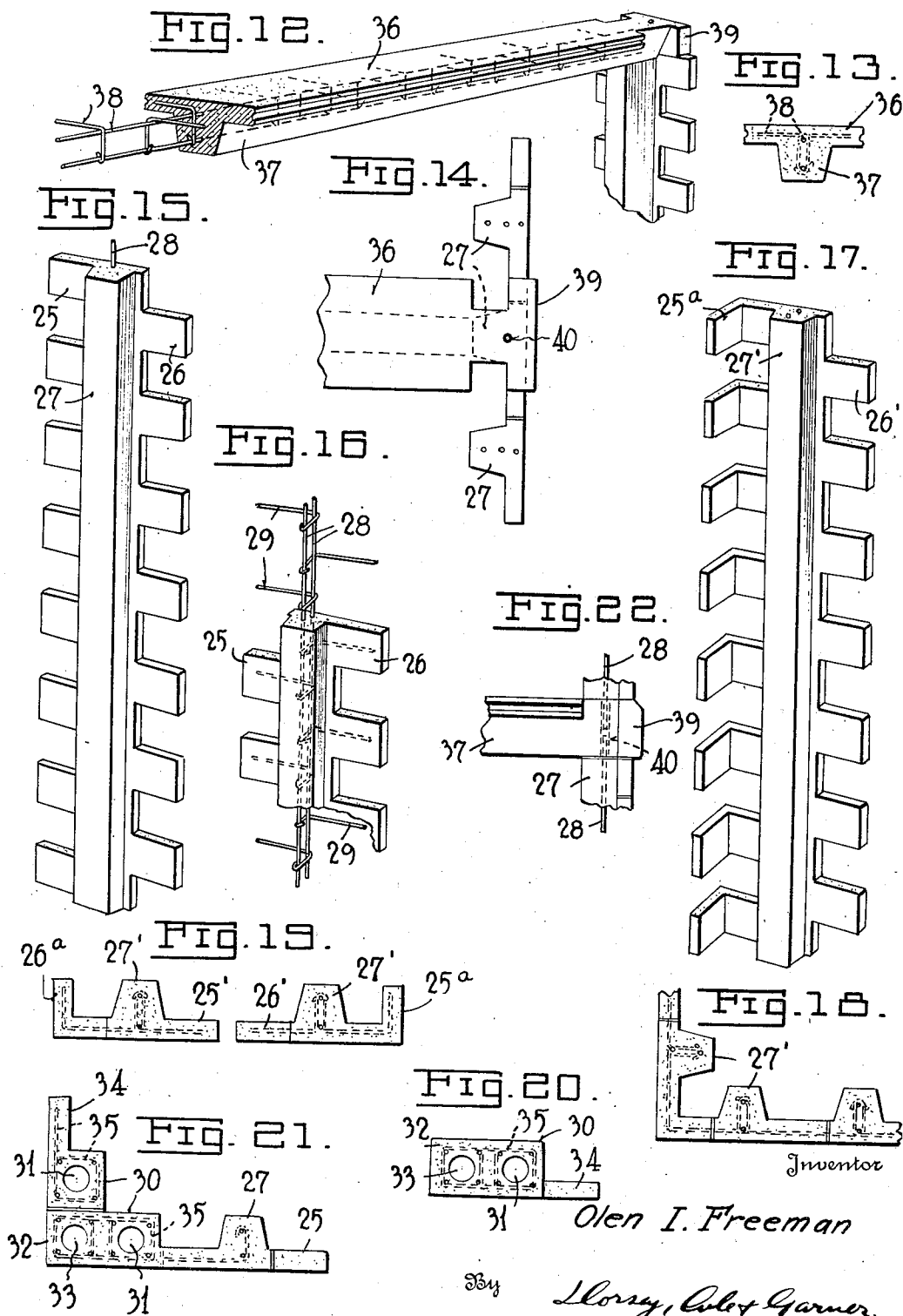
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BUILDING CONSTRUCTION

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6 Claims. (Cl. 72-1)

My invention relates to new and useful improvements in building structures and more particularly to that type of buildings constructed of concrete, masonry and the like, and has for its object to provide precast columnar units with integral projecting keys or blocks adapted to interlock with the complementary keys of an adjacent columnar unit to form the finished wall.

Heretofore, in the erection of buildings, the walls have generally been constructed in one of two groups, each based on different principles of design, and each having its own advantages and possessing inherent weaknesses.

Under one group, commonly termed bonded masonry walls, the walls are designed to support applied loads and distribute these loads in a uniform manner to supporting foundations. The materials used in this construction are brick, stone, tile, concrete blocks and the like, requiring in common, mortar and some type of bond to form a homogeneous wall. The advantages of this type are its bond, strength at corners, elimination of continuous horizontal or vertical joints and that no special anchorage is required at base or top. The design disadvantage of this type is its lack of vertical rigidity in that walls have a tendency to buckle and bend at the vertical center under loads far less than the crushing strength of materials used and the necessity of increasing thickness in such high ratio to height that design limitations in buildings are quickly reached.

The second group, generally referred to as column and beam construction, employs the principle of concentrating structural loads on columns, usually by use of beams and girders, the loads being transferred by columns to ground footings. The advantages of this type of construction is the savings accruing from the use of thin walls for panel between columns, flexibility in design, rigidity and high load values concentrated on relatively small areas. The disadvantages are the tendency of beams to separate from columns at joints, the tendency of columns to gyrate around their base, thus necessitating the anchoring of columns at base and top and rigid bracing of entire structure both horizontally and vertically; further disadvantage is found in obtaining satisfactory joints between framework and panels.

It is an object of my invention to provide a wall unit possessing the combined advantages of bonded masonry walls and column and beam design, and, in addition, to correct the inherent weaknesses of both types. The precast columns provide the rigidity and high load bearing qualities, while the interlocking keys, integral with the column, when interlocked with the keys of the adjoining columns and bonded thereto, serve the dual purpose of forming a definite brace for the column, allowing no movement either in the plane of the wall

surface or in cross-section, and at the same time serve as panel fillers between columns; also provides the staggered bonded joints and strength at corners which are the chief advantages of bonded masonry walls.

A further object is to provide floor and ceiling beams projecting beyond the side walls and forming a drip and belt course in the finished structure.

Still another object is to provide hollow floor beams and hollow columnar wall units as well as hollow integral interlocking keys, forming continuous longitudinal and vertical passages in the finished structure to accommodate pipes, wires and the like or for insulating purposes.

A still further object of my invention is the utilization of the hollow horizontal beams as part of the floor or ceiling structures, requiring only the addition of mortar between the joints of the beams to form finished surfaces.

Yet another object is to provide suitable reinforcement in the hollow floor and ceiling beams as well as in the hollow vertical columnar wall units.

A further object is to provide a building unit for the vertical walls comprising a precast hollow concrete column, story high in length, and having integral locking blocks or keys.

Another object of my invention is to provide in a building structure the combination with hollow floor beams having closed end portions of vertical walls between the floor beams, comprising interlocking units story high in length and engaging said floor beams adjacent their closed ends, each of the units consisting of a precast, reinforced hollow column having masonry keys interlocking with complementary keys of adjacent units.

With the above and other objects in view which will appear as the description proceeds, my invention resides in the novel features herein set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

Referring to the drawings in which numerals of like character designate similar parts throughout the several views:

Fig. 1 is a perspective view, partially broken away and in section, to illustrate the walls and floors of a building constructed in accordance with my invention.

Fig. 2 is a detail view of one of the columnar wall units.

Fig. 3 is an end view of the same.

Fig. 4 is a detail view similar to Fig. 2, showing a modified form of columnar wall unit.

Fig. 5 is a similar view of one of the columnar units forming the partition wall of the building.

Fig. 6 is an end view of the same.

Fig. 7 is a sectional view longitudinally of a floor beam at the junction of the foundation and side

wall illustrating a modification of floor beam shown in Fig. 9.

Fig. 8 is a detail perspective view, broken away, of one form of floor beam.

Fig. 9 is a similar view of another form of floor beam, and

Fig. 10 is a similar view of another form of floor beam.

Fig. 11 is a broken detail of a column unit illustrating the embedded reinforcing means.

Fig. 12 is a detail perspective view of another form of floor beam, broken away to illustrate the reinforcing means.

Fig. 13 is a transverse section through the same.

Fig. 14 is a plan view of the beam in place on the wall units.

Fig. 15 is a detail view of a modified columnar wall unit.

Fig. 16 is a similar view broken away to illustrate the embedded reinforcement.

Fig. 17 is a detail view of one of the units forming the corners.

Fig. 18 is an end view of a corner assembly.

Fig. 19 is an end view of the two units which go to form the corner.

Fig. 20 is an end view of a modified form of corner unit.

Fig. 21 is an end view of a corner assembly constructed in accordance with the modified form of units of Fig. 20; and

Fig. 22 is a fragmentary side elevation showing the assembly of a floor and wall unit.

In the drawings, 1 indicates a foundation or base which may be of any material including the wall unit of my design, that shown in the drawings being composed of hollow blocks of concrete or the like, bonded together in the conventional manner by means of mortar. This foundation supports my novel flooring construction which comprises a series of precast units 2 in the form of beams extending longitudinally across the base 1, being bonded together and anchored to the base in any desirable manner such as by dowels and mortar. In order to eliminate the non-effective beam material and correspondingly reduce the dead load of the flooring structure, but at the same time afford a sufficiently sturdy support, the underside of each of the beams 2 is hollowed or recessed longitudinally thereof to form a pair of spaced arches 3 in the shape of inverted U's, thus providing convenient channels for easy anchorage and passage of plumbing pipes, electrical conduits and the like. The intervening web 4 between the arches is preferably reinforced as shown at 5 in any desirable manner such as wire or bars placed in the beam during molding or casting thereof.

The top surface of the beams 2 may form the actual floor of the building, if desired, in which event the same may be finished smooth or treated with mixtures of tile, marble, stone or like materials, requiring grinding for the finished surface. On the other hand, if a wooden or similar flooring is desired, the transverse edges of the beams may be longitudinally grooved as shown at 6 in Figs. 1, 8 and 9, for the admission of splines to serve as anchoring means for the flooring.

The ends of the beams are preferably closed and project slightly beyond the vertical plane of the walls to form a drip and belt course 7 (Figs. 1 and 7), and adjacent said closed ends, I may provide suitable vertical openings 8 in communication with the arches 3 but not interfering with the intervening web 4, for the purpose herein-
after set forth. In the beam forming the belt

course on the side walls running parallel to the horizontal beams 2 the vertical openings 8^a are provided longitudinally of the end beams in communication with one of the arches 3, in position to register with the openings 10 and 14 respectively of the vertical wall units hereinafter more particularly described.

It will thus be seen that I have designed a self-contained floor unit requiring no additional beams or reinforcing braces for supporting the same, and yet is sufficiently strong to support any predetermined load placed thereon. Floor beams may have open arches as shown in Fig. 8 or bottom of arch may be closed as in Fig. 9. To add additional supporting strength to T-beam sections Figs. 8 and 9, depth of beam may be increased, reinforcing increased or form of structure may be changed to permit the use of H-beam reinforcing 5' as shown in Fig. 10.

In the construction of the walls W, I employ a novel combination of precast hollow column and integral hollow masonry design, consisting of a series of interlocking vertical units extending from the floor beams 2 to the desired elevation of the second floor or ceiling, and which, when assembled together, form a rigid self-contained structure.

Referring to Fig. 2 which illustrates a detail of one of these combination units, 9 designates a vertical member in the form of a concrete column provided centrally thereof with an opening 10 defining a continuous passage which extends from top to bottom, being suitably reinforced for example, by vertical and spiral wire 11 embedded in the concrete cell around said vertical passage, to add rigidity to the column structure and prevent buckling thereof. If desired, the reinforcement may be in the form of rods running longitudinally of the column, entwined with wire welded or otherwise secured thereto, as indicated at 11', Fig. 11.

12 represents a series of vertically spaced blocks or keys integral with the column 9 and projecting horizontally therefrom in a vertically aligned row, and 13 designates a similar series of complementary blocks also integral with the column 9 but projecting horizontally in the opposite direction. The blocks 12 are arranged in staggered relation to the blocks 13 and are spaced apart vertically a predetermined distance to permit the easy entrance of and interlocking with the complementary blocks 13 of an adjoining column 9, and, after proper alignment of the vertical units, only requires the filling of the joining ends with mortar to form a solid and continuous masonry structure throughout.

As clearly shown in Fig. 2, each row of blocks 12 and 13 is provided with a central vertical opening 14 so disposed in said blocks that when the keys 12 of one section are in proper interlocking position with the keys 13 of an adjacent column section, the openings will form continuous vertical passages similar to passage 10 in the column structure 9.

The vertical openings 14 are kept free from mortar during the setting and fitting of the units 9 by temporarily filling the same with flexible collapsible tubing or the like, adapted to close the horizontal joints where they intersect such vertical openings. This tubing is then withdrawn after the joints are sealed.

The thickness of each column 9 and the length of its integral blocks or keys 12 and 13 are so coordinated in dimensions as to permit these units to be used in forming the corners of the

building, and by virtue of the interlocking masonry design of the blocks, require no additional reinforcement or special bracing and supporting members.

As stated before, the beams 2 may be provided with vertical openings 3 in communication with the horizontal openings or arches 3, and in assembling the vertical wall units, their vertical openings 10 and 14 are aligned with those in the beams to form continuous communicating horizontal and vertical passages.

While I have shown these passages open and unobstructed, I may, if desired, fill the same with insulating material to improve the thermal qualities of the units.

The interior and/or exterior faces of the columnar units may be indented or raised to form any desired architectural designs, or the blocks, openings and thickness of the units may be varied in size to meet any required design conditions, one such unit being illustrated in Fig. 4 wherein 9' represents the central column section, 10' the vertical passage extending therethrough, 11' the embedded reinforcement, 12' and 13' the oppositely disposed blocks, into which lateral reinforcements 26 from the central reinforcement 25 may extend and 14' the vertical openings in the blocks.

For filling in the spaces between the projecting blocks of a column unit to form a vertically straight face along the edge thereof adjacent the opening for doors, windows and the like, I employ suitable filler blocks 15 (Fig. 1) corresponding to the dimensions of the projecting blocks of an adjacent column unit. If desired for reversing the blocks of typical column units, or for filling out spaces below or above special horizontal members, or for particular projections or for producing architectural effects, double filler blocks, that is blocks twice the length of fillers 15, may be used. Some of the individual columnar units have been illustrated as stippled in Fig. 1 for clearness of illustration.

The upper horizontal edge of the door or window openings is formed by means of a hollow reinforced beam member 16 extending horizontally across the opening and supported by the projecting blocks 12 and 13 of the column units adjacent the same, as illustrated on the far side of Fig. 1, or teeth may be omitted on one side of column for height of predetermined opening, column shortened to admit of a lintel, beam, sill, etc., resting directly on column 23 and shorter units of same wall design 24 fill space above beam to next floor level as shown on the near side of Fig. 1.

In the construction of interior partitions which do not carry any heavy structural loads, and where conservation of space is more desirable than load bearing qualities, I preferably employ slightly modified precast units of less thickness in cross section but generally made along the same lines as the column and interlocking units of the outside walls.

Fig. 5 illustrates in detail one of these modified units wherein 17 designates the central column section, 18 the vertically extending passages therein, 19 the embedded reinforcing means, 20 the vertically aligned row of blocks on one side of the column, and 21 the row of complementary blocks on the other side of the column, with the vertical openings 22 provided in the individual blocks of each row. When assembled together, these units form a solid and continuous masonry structure entirely self-supported, thereby eliminating any beams or reinforcing braces.

The ceiling is constructed of precast hollow beams Figs. 9 and 10, forming the flooring hereinbefore described. These beams are suitably bonded together after assembly, with their outer ends closed and projecting beyond the vertical exterior walls to form a drip and belt course 7. As in the case of the floor beams 2, the drip and belt course on the side walls parallel to the beams is formed by casting the respective edges of the beams thicker as clearly shown at 7'.

If a second story is desired on the building, the upper surface of the ceiling beams may be finished in any desirable manner to form the flooring, in which event vertical openings 3' may be provided in communication with the horizontal passages 3' as hereinbefore described in connection with the first floor construction.

The top surface of the ceiling beams may also be used as self-supporting roofing slabs to which can be applied tar and gravel or any other material used as roofing on flat surfaces. On the other hand, these beams may be used as supports for structural members necessary in the construction of sloping roofs.

It will thus be observed that I have designed a novel and unique building structure composed of hollow self-supporting units, which possesses the combined advantages of both the conventional column and masonry designs but which, in addition, corrects the weaknesses of each type. In other words, by forming the vertical walls of precast hollowed and reinforced column units extending from floor to ceiling, the buckling tendencies of the masonry design are overcome, and by forming masonry blocks or keys integral with said column units, adapted to interlock with the masonry blocks of an adjacent column unit, the gyrating tendencies of the conventional column design are eliminated.

Furthermore, the walls, while obtaining the advantages of a masonry structure, at the same time can be made of less thickness and weight for supporting a given load than the walls of a masonry design for supporting a corresponding load.

While it is recognized that a floor system with horizontal openings is not new, it is believed that one constructed of hollow precast beams projecting beyond the supporting walls, having their ends closed and beveled to form a belt and drip course in the finished structure, is novel.

In the event it is desired, to provide a finish in the interior of the building different from that obtained in the structure hereinbefore described, I employ basically the same columnar units having integral interlocking masonry blocks which present an outside appearance of masonry design. However, as illustrated in Fig. 15, the oppositely disposed rows of spaced blocks 25 and 26 are relatively thinner than the central column section 27 and are provided on the front surface of the latter, whereby when the units are in place with the blocks 25 interlocked with the complementary blocks 26, the interior will have vertical columns formed by the central section 27. These wall units may be reinforced as shown in Fig. 16, by vertical reinforcing means 28 embedded in the central section 27 from which extends lateral reinforcement 29 embedded in the blocks 25 and 26.

Due to the thinness of the masonry blocks 25 and 26, it becomes desirable to alter their structure in forming the corners of the building, and I employ units constructed in accordance with Fig. 17 wherein the masonry blocks disposed on one side of the central section 27' terminate in

right angular projections 25^a adapted to interlock with a row of similarly constructed complementary blocks 26^a extending from the other side of an adjacent column section (Fig. 19).

5 The embedded reinforcement heretofore described in connection with the wall units may also be used with these corner units as shown in dotted lines in Fig. 18.

I also contemplate a further modification 10 wherein the corners are constructed of combined units shown in Fig. 2 with those shown in Fig. 15. As illustrated in Figs. 20 and 21, numeral 30 designates the central section provided with a vertical passage 31. Projecting from one side 15 of the central section is a vertically aligned row of spaced blocks 32 also provided with a vertical opening 33 and constructed in accordance with the unit of Fig. 2. 34 represents a row of spaced, relatively thin masonry blocks on the other side 20 of the central section 30, made in accordance with the thin blocks of Fig. 15.

By reason of the dimensions of the blocks 32, adjacent units may be placed at right angles to each other and the blocks 32 interlocked as heretofore described in connection with Fig. 1, thus 25 forming the corner and leaving the relatively thin blocks 34 free to interlock with complementary blocks of an adjacent wall unit (Fig. 21). The embedded reinforcement, generally indicated 35, may also be a combination reinforcement shown in Fig. 4 for the central section 30 and blocks 32, and shown in Fig. 16 for the blocks 34.

In the construction of the floors, I may employ a series of flooring units 36 provided on the upper face of beams 37 and integral therewith, being suitably reinforced by embedded wire or bars 38 placed therein during molding or casting. These beam units extend horizontally beyond 40 the vertical walls to provide a drip and belt course 39 similar to course 7 of Fig. 1.

As clearly shown in Fig. 14, the units 36 are transversely recessed adjacent their ends so that when in place, there will be provided openings 45 in the floor, corresponding to the open area between two adjacent vertical sections 27 of the wall units. Adjacent the ends of the floor units, openings 40 are provided to receive upwardly projecting reinforcing bars extending from the column sections 27 (for instance, bars of the reinforcements 28), as indicated in Fig. 22. Similar bars projecting down from the lower ends of the sections 27 of the next story may project into the upper ends of the openings 40. Thus 50 the floor sections are properly aligned and anchored with respect to the wall sections during the construction of the building. If preferred, openings 40 may be occupied by dowels (not shown) which may project into recesses in the ends of the column sections 27 with which the floor beams contact.

It will be understood that the recesses formed on the inner walls of the building by the spaces occurring between adjacent column sections 27 65 may be filled in if desired with suitable paneling, or occupied by insulation, or otherwise finished. The spaces also afford accommodation for pipes, cables, etc. If desired, an inner finishing wall of fireproof lath and plaster, or other construction, may be built in place and attached by suitable means to the sections 27, in which event the 70 spaces between the sections will form dead air

spaces. Or such spaces may be filled with insulation if desired.

From the foregoing, it is believed that the construction and advantages of my improved building structure may be readily understood by those 5 skilled in the art without further description, it being borne in mind that numerous changes may be made in the details disclosed without departing from the spirit of my invention as set out in the following claims. 10

What I claim and desire to secure by Letters Patent is:

1. A combined column and masonry building unit for the vertical walls of a building, comprising a precast concrete hollow column, a plurality 15 of oppositely disposed masonry blocks integral with said column and extending horizontally from each side thereof in vertically aligned rows, the blocks of one row being arranged in staggered relation to the complementary blocks of the other 20 row, said unit extending from floor to ceiling beams and reinforcing means embedded in said column.

2. In a building structure, the combination with hollow floor beams having closed end portions 25 projecting beyond the side walls and forming a drip and belt course in the finished structure, of vertical walls between the floor beams comprising interlocking units story high in length and interposed between and engaging said floor beams adjacent said belt course, said units having openings 30 communicating with the hollow portions of the floor beams.

3. In a building structure, the combination with floor beams, of vertical walls between the floor 35 beams comprising interlocking combined column and masonry units story high in length and interposed between and engaging said floor beams, each unit consisting of a precast, reinforced hollow column having masonry keys interlocking 40 with keys of adjacent units, the weight of the various columns being distributed among the various floor beams.

4. In a building structure, the combination with floor beams, of vertical outside walls between the 45 floor beams comprising interlocking combined column and masonry units story high in length and interposed between and engaging said floor beams whereby the weight of the interlocking units is carried by said floor beams. 50

5. In a building structure, the combination with hollow floor beams having closed end portions, of vertical walls between the floor beams comprising interlocking units story high in length and interposed between and engaging said floor 55 beams adjacent the closed ends thereof, said units comprising a precast hollow column having integral keys interlocking with keys of adjacent units, and having openings communicating with hollow portions of said floor beams. 60

6. In a building structure, vertical self-supporting walls consisting of a plurality of precast combined column and masonry units, story high in length, and joined together by means of the complementary interlocking masonry blocks of 65 said units and arranged in staggered relation with respect to each other, the interlocking masonry blocks being less in thickness than the thickness of the columns whereby spaces are provided between the columns. 70

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