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(58) Field of Search

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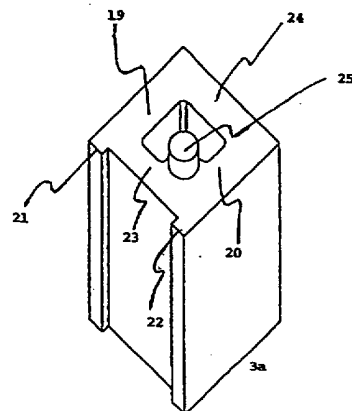
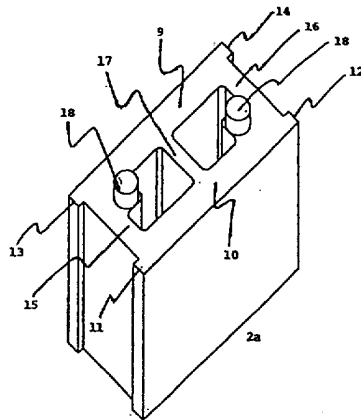
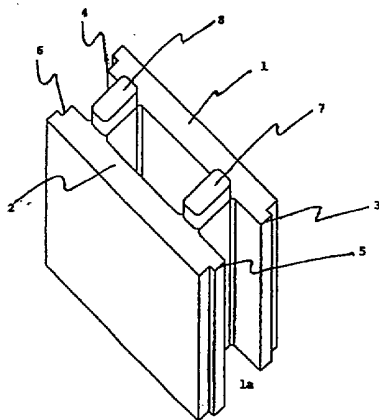
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(54) Abstract Title

Interlocking mortarless building block system

(57) A modular block system for mortarless walls uses three different types of block: stretcher blocks and corner blocks having lengths at least one and a half times the width, and half blocks with a length up to half the stretcher length, each of the blocks comprising a pair of spaced parallel upright sidewalls having flat top and bottom surfaces and block interlocking means, and first and second transverse end walls. A stretcher block has side walls 1 and 2, interlocking formations 3,4,5,6 and end walls 7 and 8 each of which protrudes above the block as shown. A corner block has sidewalls 9 and 10, interlocking formations 11,12,13,14, and upstanding protrusions 18 as shown, and a transverse web 17. A half block (Fig 3a) is effectively half a corner block. In use, walls are constructed using the blocks, and reinforcing rods may pass through the hollows in the blocks, either horizontally or vertically, and cement is used to fill the voids and to hold the reinforcing rods in place.



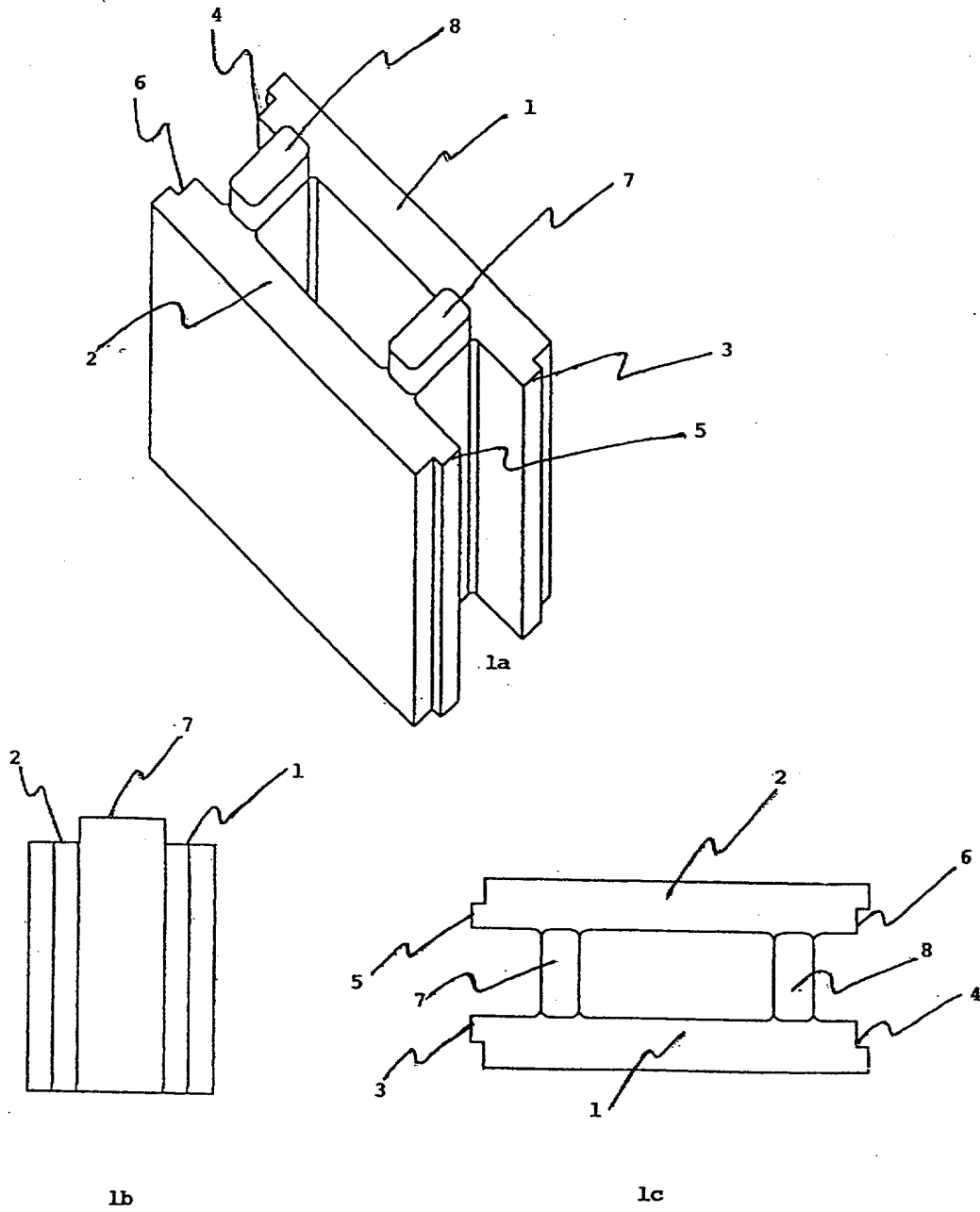


Fig. 1

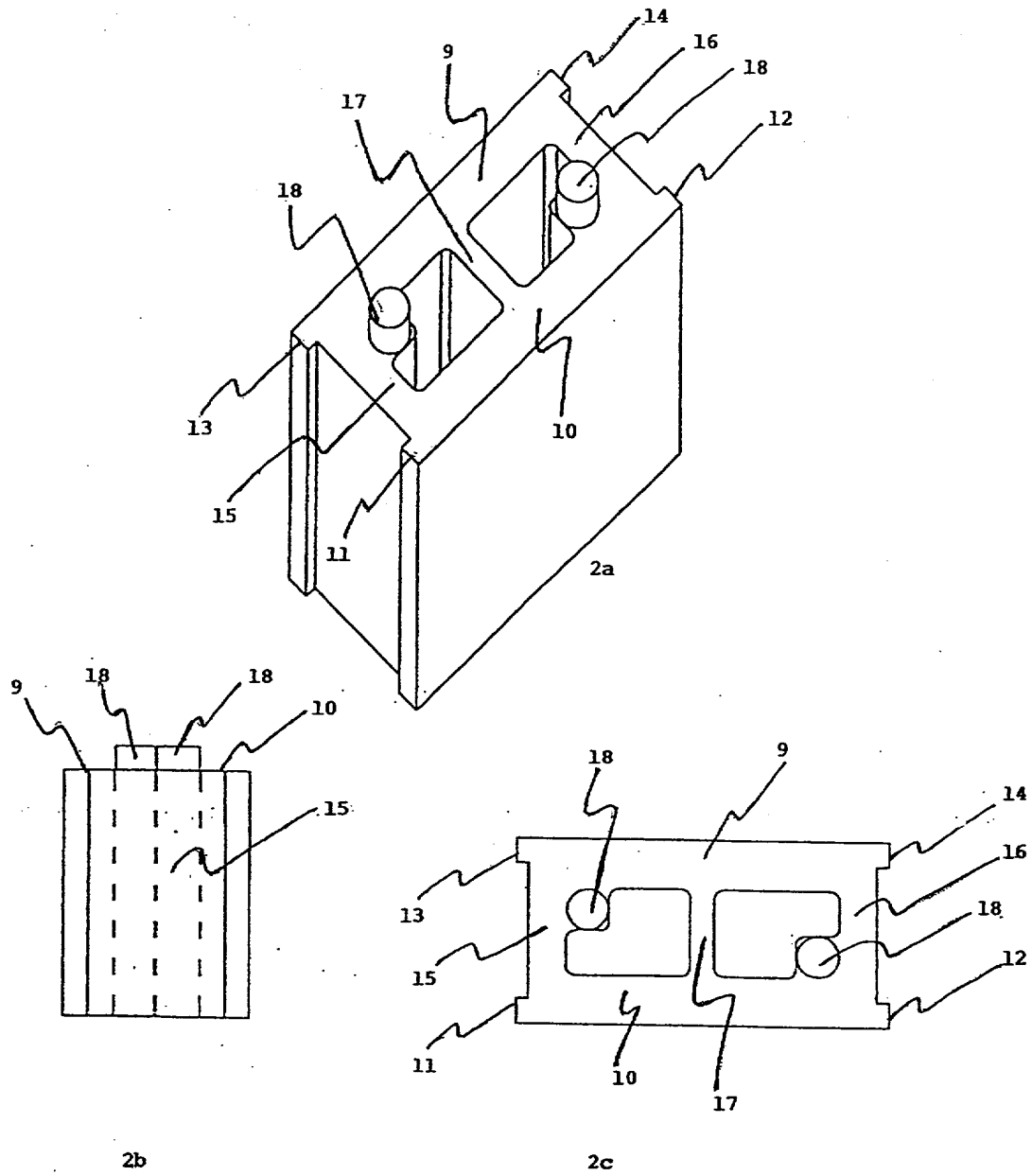


Fig. 2

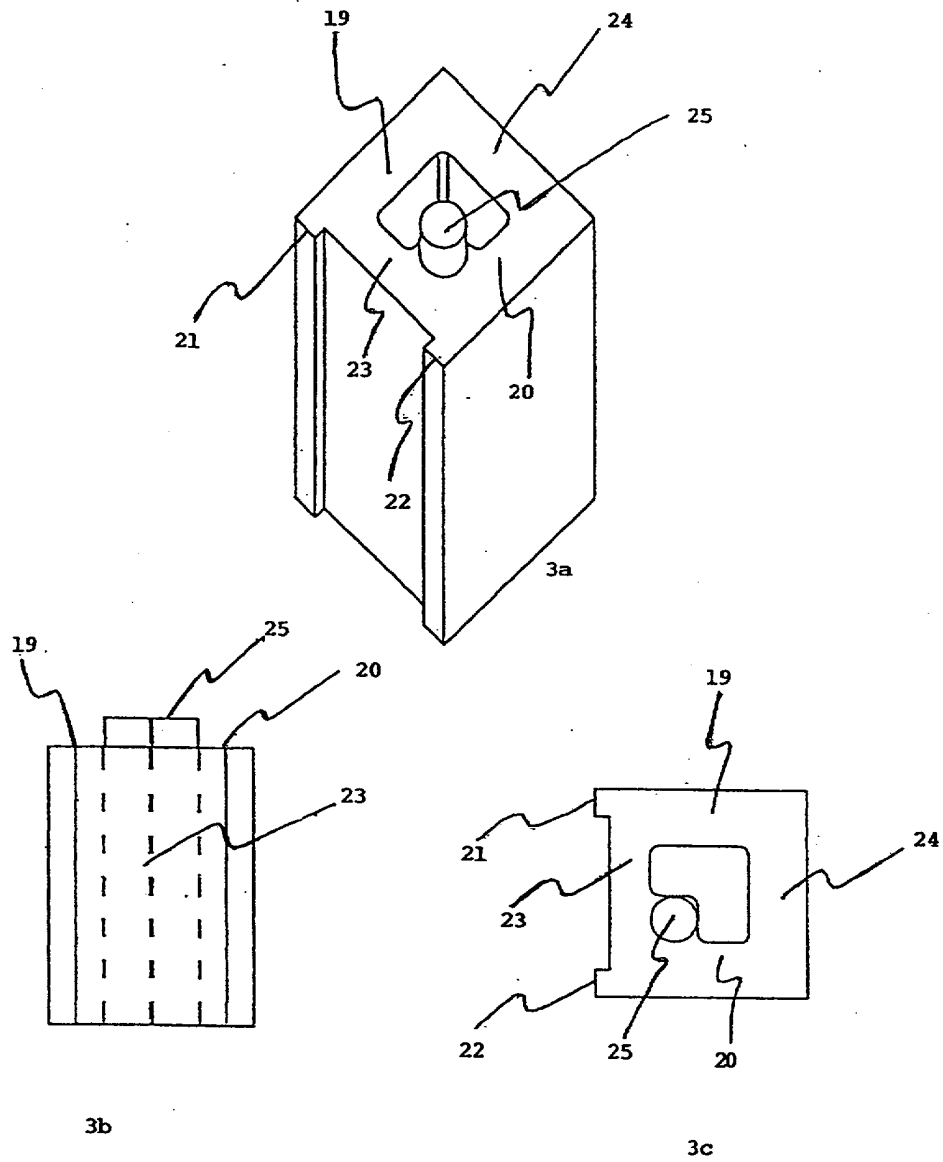


Fig. 3

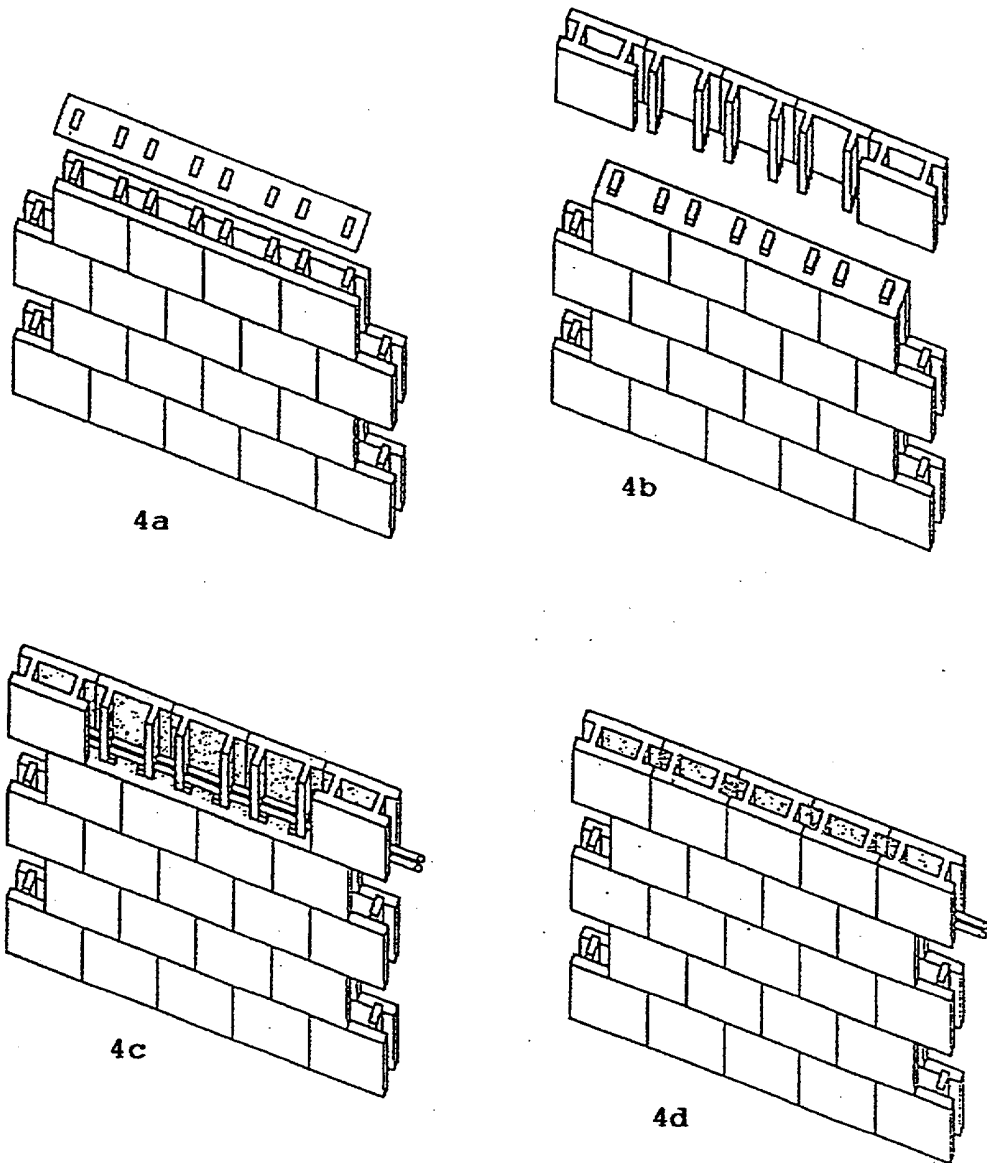
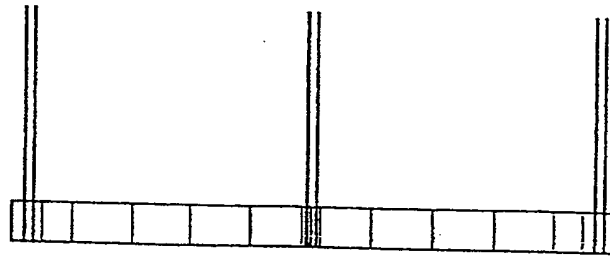
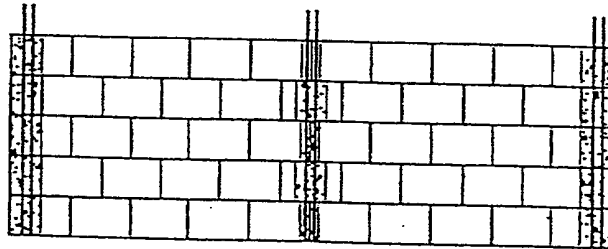


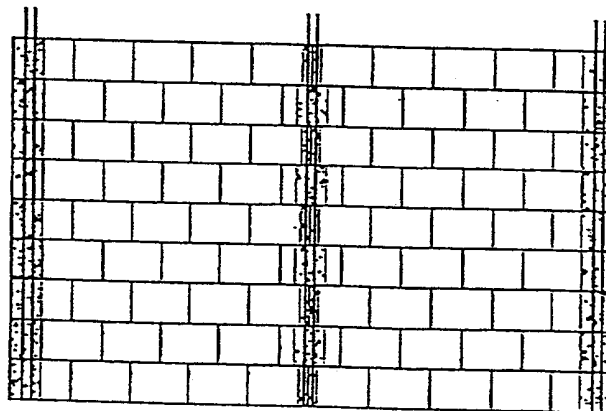
Fig. 4



5a



5b



5c

Fig. 5

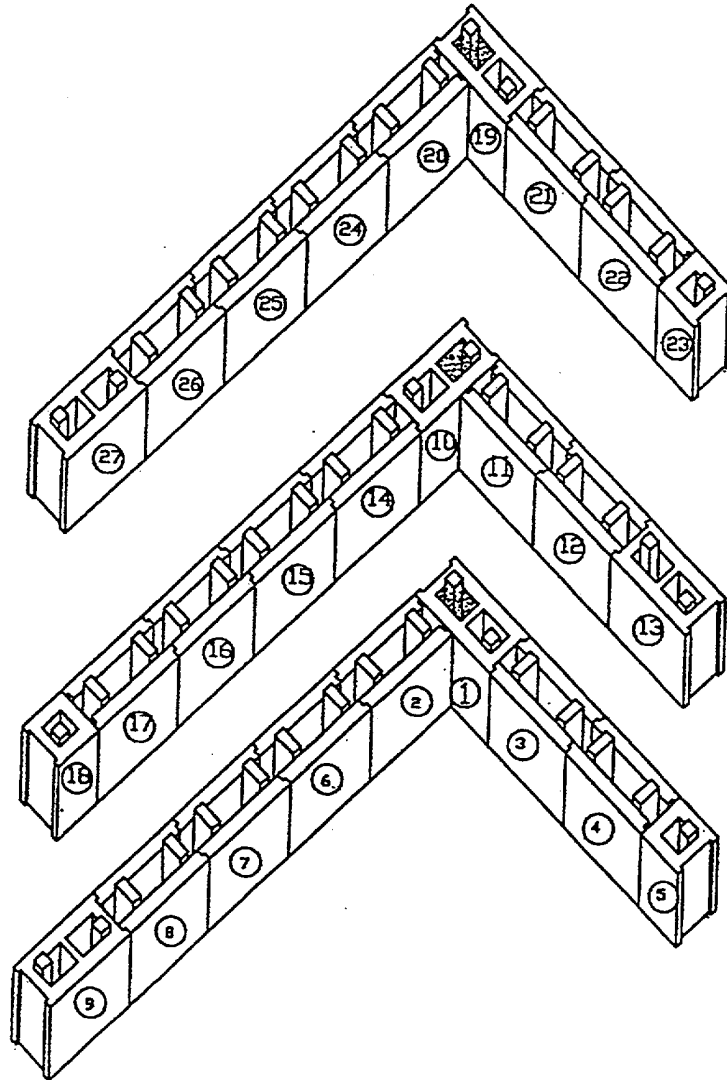


Fig. 6

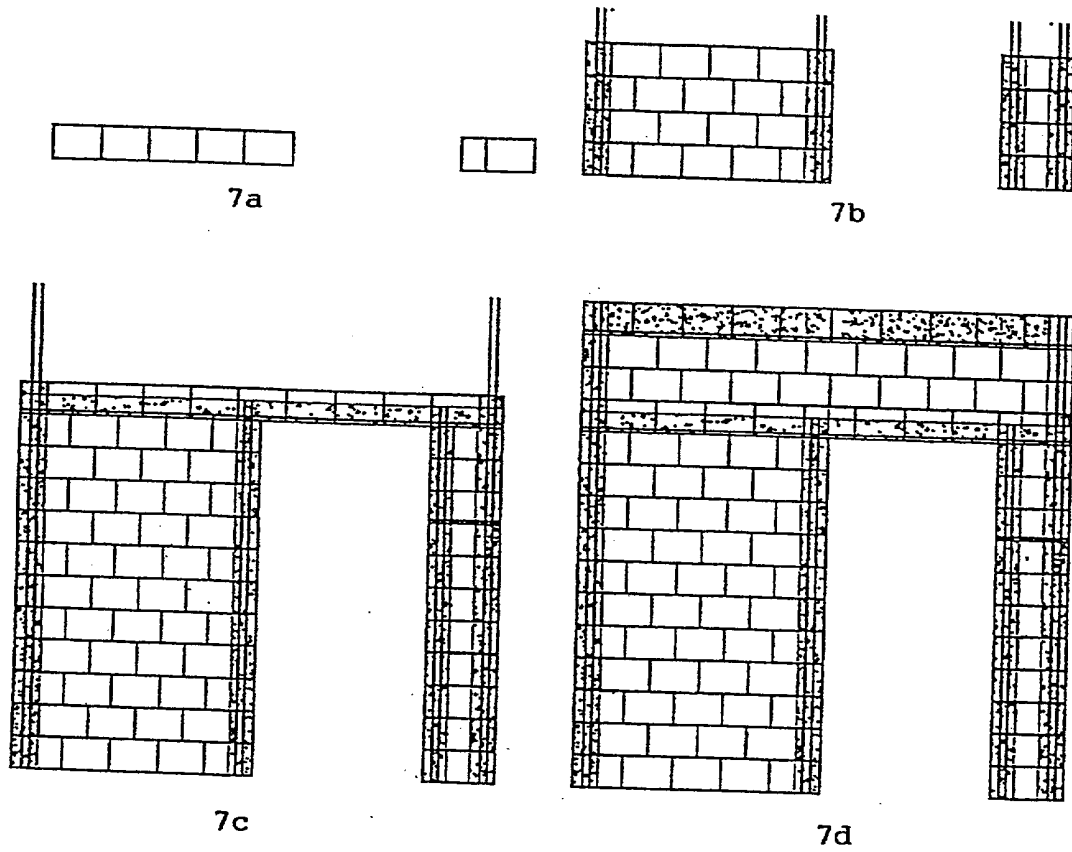
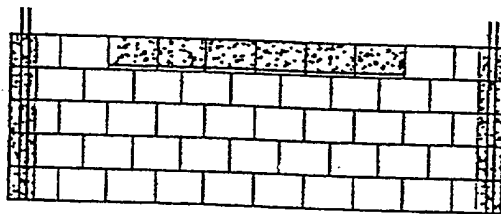
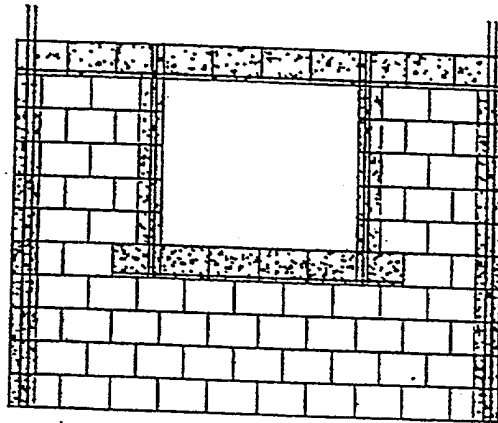


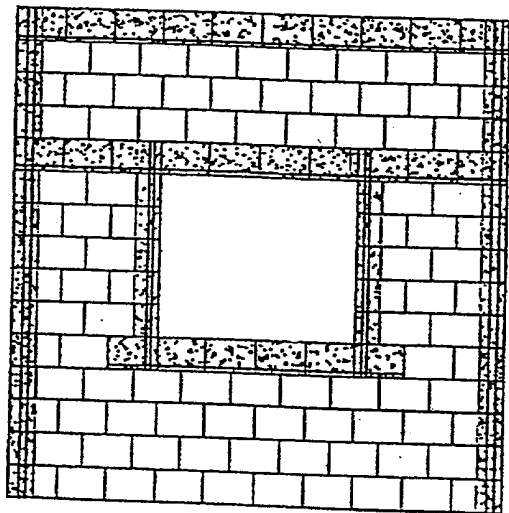
Fig. 7



8a



8b



8c

Fig. 8

INTERLOCKING MORTARLESS LOAD BEARING BUILDING BLOCK SYSTEM

5 The present invention generally relates to construction materials and, more particularly to a mortarless load bearing building block system of an improved type.

Conventional concrete block walls are laid up by a time-consuming difficult procedure which involves troweling a layer of concrete mortar onto a level concrete or stone base or the like, or the top of a course of previously laid blocks and then setting blocks one at a time in the mortar layer, in each instance also applying mortar to the end walls of each block to join the blocks together. This procedure is continued until the required number of courses are laid. Great care must be taken to keep each course perfectly horizontal and straight. Few people have the skill to carry out such a procedure in a competent manner, therefore the cost of such construction is always high.

15 Various types of interlocking blocks have been devised in the past to facilitate the construction of block walls and other structures. Most such blocks have been very expensive to produce since the interlocking portions, usually grooves or protrusions, are normally cut into the blocks after they have been formed by molding. Moreover, it is difficult to maintain the required tight tolerances for accurate construction of large walls or other structures through the molding and cutting steps. The prior blocks often required additional finishing or grinding steps to meet the required tolerances.

Interlocking mortarless building blocks overcoming many of these deficiencies are described in U.S. Patents No. 3,888,060, and 4,640,071. Those blocks have been used successfully for many years. These blocks are assembled in courses, with the block joints staggered and continuous vertical open cells into which reinforcing bars and wet concrete can be inserted. While highly effective, these blocks require that the reinforcing bar be inserted in lower courses, with blocks in later courses lifted over the ends of the reinforcing bar as the structure advances and wet concrete is periodically poured into the cells containing the reinforcing bar.

Thus installing blocks over the reinforcing bar can be a significant problem with tall structures.

Therefore, there is a continuing need for improvements in mortarless building block systems to permit lower cost block manufacture, and lower cost and more rapid structure assembly from the blocks. It would also be desirable to be able to provide an improved mortarless building block system featuring improved adaptability, strength and economy. The design of the block should be such that it can be readily moulded and released from the forming mold with full detail preserved, obviating any subsequent reshaping, finishing, etc. Further, the block should be easily strengthened with reinforcing materials, if needed, and be capable of being fabricated in a full array of sizes and shapes.

Summary of The Invention

Accordingly, it is the object of the present invention to provide an interlocking modular block system for mortarless wall assembly.

This and other objectives of the present invention is accomplished by providing,

15 An interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a staggered relationship wherein three different block configurations are provided, the first and second blocks(stretcher and corner blocks) having lengths at least one and a half times the width, and the third block(half block) having the same width and a length up to half the length of the stretcher and corner blocks, said blocks comprising:

20 a pair of spaced, parallel, upright sidewalls having flat top and bottom surfaces, said sidewalls having block-interlocking means;

a first transverse end wall extending between said sidewalls at a first end of said blocks; and

25 a second transverse end wall extending between said sidewalls spaced from a second end of said blocks; and

An interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a staggered relationship wherein the stretcher block comprises:

a pair of spaced, parallel, upright sidewalls (1,2) having flat top and bottom surfaces, said sidewalls having block-interlocking means (3,4,5,6) on opposed ends thereof;

a first transverse, protruding end wall (7) extending between said sidewalls at a first end of said block; and

5 a second transverse, protruding end wall (8) extending between said sidewalls spaced from a second end of said block; and

An interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a staggered relationship wherein the corner block comprises:

a pair of spaced, parallel, upright sidewalls (9,10) having flat top and bottom surfaces, said
10 sidewalls having block-interlocking means (11,12,13,14) on opposed ends thereof;

a first transverse end wall (15) extending between said sidewalls at a first end of said block;

a second transverse end wall (16) extending between said sidewalls spaced from a second end of said block;

a transverse upright support web (17) spans said sidewalls, integral and defining a cavity for
15 receiving cementitious material therein; and

protrusions (18) on the inside of sidewalls, extending from a base substantially coplanar with said sidewall bottom surfaces and having tips extending above said sidewall top surfaces configured to interlock with a block in a next succeeding course; and

An interlocking modular block system for mortarless wall assembly in which a plurality of
20 blocks are laid up in courses in a staggered relationship wherein the half block comprises:

a pair of spaced, parallel, upright sidewalls (19,20) having flat top and bottom surfaces, said sidewalls having block-interlocking means (21,22);

a first transverse end wall (23) extending between said sidewalls at a first end of said block;

a second transverse end wall (24) extending between said sidewalls spaced from a second
25 end of said block; and

a protrusion (25) on the inside of said sidewalls, extending from a base substantially coplanar with said sidewall bottom surfaces and having a tip extending above said sidewall top surfaces configured to interlock with a block in a next succeeding course.

The interlocking modular block system according to the present invention enables
30 construction of load-bearing and non-load bearing walls without using cement mortar layers

between the building blocks. The system is also designed to withstand different types of stresses which may develop from the applied loads. In addition, the configurations of the unit blocks are simple, they are easily constructed, satisfy structural performance for residential buildings, up to five storeys, and the self-alignment features of the blocks enable fast construction even when using unskilled labour.

Brief Description of The Drawings

Other aspect of the present invention and their advantages will be discerned after studying the detailed description in conjunction with the accompanying drawings in which:

- Fig. 1 : Stretcher block unit.
- 10 Fig. 2 : Corner block unit.
- Fig. 3 : Half block unit.
- Fig. 4 : Procedure for constructing a wall with horizontal stiffener.
- Fig. 5 : Procedure for casting vertical ties.
- Fig. 6 : Construction of corner connection.
- 15 Fig. 7 : Procedure for constructing a wall with door opening.
- Fig. 8 : Procedure for constructing a wall with window opening.

Detailed Description of The Drawings

Figs. 1, 2 and 3 show the perspective, side and top views of the stretcher, corner and half blocks units respectively, in accordance to the present invention.

- 20 Fig. 1a shows the perspective view of the stretcher block unit. As can be seen from Fig. 1a, there are a pair of sidewalls (1,2), interlocking means (3,4,5,6) on opposed ends of sidewalls, male interlocking means located at one end of the sidewalls and female interlocking means located on the opposite ends of the sidewalls, and a pair of transverse, protruding end walls (7,8). Fig. 1b shows the side view of the stretcher block unit as seen from the side of
- 25 transverse wall (7), while Fig. 1c shows the top view of the stretcher block unit.

Fig. 2a shows the perspective view of the corner block unit. It shows a pair of sidewalls (9,10), comprising interlocking means (11,12,13,14), male interlocking means at one end of sidewalls and female interlocking means on the opposite ends of the sidewalls, a pair of

transverse end walls (15,16), a transverse web (17) and protrusions (18). Fig. 2b shows the side view of the corner block viewed from transverse wall (15) and Fig. 2c is the top view of the corner block unit.

Fig. 3a shows the perspective view of the half block unit. This figure shows a pair of sidewalls (19,20) comprising interlocking means (21,22) located at one end of the sidewalls, a pair of transverse end walls (23,24), and a protrusion (25). Fig. 3b shows the side view of the half block unit from the side of transverse wall (23), while Fig. 3c shows the top view of the half block unit.

The above mentioned interlocking block units form building blocks for an interlocking modular system for construction of load-bearing and non-load bearing walls without using cement mortar layers between the blocks. In addition, the interlocking mechanism in the horizontal plane is ensured by protrusions in the blocks, ensuring connection between adjacent blocks above, below and at each end. The interlocking mechanism provided by the blocks has sufficient strength to resist different types of moments and sheer stresses which develop in load-bearing walls up to five-storey residential buildings, without cement mortar layers. Also, the blocks when assembled have self-alignment features through the provision of groove and tongue means on sidewalls and this results in rapid construction even when using unskilled labour.

Footing and First Course Construction

Two methods of construction are disclosed herein and the main objective of both is to provide very accurate level and alignment. The level of the floor and walkway is preferred to be at mid-height of the course to provide satisfactory restraint of the wall at the bottom.

(a) Casting of continuous footing for the whole structure following the levels that are given by the engineer. Starter bars of the vertical stiffeners must be fixed in position. Very smooth and even surface must be achieved to ease laying of the first course and the subsequent work can be performed as required. It is preferred to cast low grade concrete on both sides of the first course to prevent any movement of the block later on.

(b) Casting of continuous footing with relatively rough surface for the whole structure, requires that starter bars of the vertical ties must be fixed in position. After the initial setting of the concrete, the first course can be laid following the levels that are given by

the engineer and to achieve that cement mortar is required underneath the blocks (conventional construction). As in the first method, the sides of the blocks must be supported by concrete of low grade.

Wall Construction

- 5 Laying of the subsequent courses after the first course is carried out as required taking into consideration the following:
 - (a) Casting of the vertical ties is performed in stages, being one metre height for each stage, as shown in Fig. 5.
 - (b) Casting of vertical ties at each junction of the walls and at the ends of the walls as well, as
10 shown in Fig. 6.
 - (c) Casting of horizontal ties and lintels of the openings when the level is reached.
 - (d) It is not preferred to erect the structures in different height: courses must be laid evenly for the whole structure.
 - (e) The verticality and the alignment of the walls, in addition to the dimensions must be
15 checked for uniformity and preferably before casting of the ties.

Fig. 4 shows the procedure for constructing a wall with horizontal ties / stiffeners. These ties are provided at mid-height of walls, last course of walls, above the openings and below the openings. Short horizontal ties are recommended at T-junctions and cross-junctions to provide satisfactory integrity of the junctions. Construction of these ties require hacking the
20 blocks from bottom to provide access for two bars reinforcement to be placed and these ties also require thin plastic sheet below the blocks to serve as permanent form work for the concrete. The height of these ties is preferred not to be less than 100mm. For the ties at the openings and the top ties, it is preferable to be at the same height of the block (200mm.). Fig. 4 shows the detail of the construction procedure.

- 25 Fig. 5 shows the procedure for casting vertical ties. These stiffeners are provided at the corners, ends of walls, T-junction, cross-junction, and around the openings as well. Two bars will be placed in each stiffener. Construction of this type of stiffener is carried out in stages at one metre high for each stage. Concrete of the same grade as the block is recommended but wet concrete is preferable so that there is no vibration. Stiffeners are necessary to provide
30 connectivity between walls and foundation, walls and floors, and to handle the concentration

of the load of the roof truss. Fig. 5 shows the detail of the construction procedure.

Fig. 6 shows the procedure for the construction of a corner connection. The steps for assembling blocks at a corner connection are as follows:

- (a) Placement of blocks starts with block no.1 and the sequence of laying the blocks are numbered as shown in Fig. 6. Block no.10 is the start for the second course and block no.19 is the start for the third course.
- (b) Vertical stiffeners are constructed at junctions formed by corner blocks e.g. blocks nos. 1, 10 and 19, using in-situ concrete.

Generally, all walls of the structure will contain not less than three vertical stiffeners and not less than two horizontal ties.

Fig. 7 shows the procedure for constructing a wall with door opening. Generally, all openings will be surrounded with two vertical and two horizontal stiffeners. Standard dimensions of doors recommend the height to be 2.1m and for this purpose the level of the floor is preferred to be at mid-height of the first course, hence there will be proper matching at the top. Openings for doors are provided as in the conventional method and the doors are fixed accordingly. Lintels are erected in the same way as horizontal stiffeners but it needs timber support during construction. Fig. 7 shows the detail for construction of door opening.

Fig. 8 shows the procedure for constructing a wall with window opening. The procedure for construction of window opening is the same as for door opening and in addition it requires a horizontal tie at the bottom of the window. Fig. 8 shows the detail for the construction of the wall with window opening.

While the preferred embodiments of the present invention have been described, it should be understood that various changes, adaptations and modifications may be made thereto. It should be understood, therefore, that the invention is not limited to details of the illustrated invention shown in the figures and that variations in such minor details will be apparent to one skilled in the art.

Claims:

- 1) An interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a staggered relationship wherein three different block configurations are provided, stretcher and corner blocks having lengths at least one and a half times the width, and half block having the same width and a length up to half the length of stretcher and corner blocks, said blocks comprising:
 - a pair of spaced, parallel, upright sidewalls having flat top and bottom surfaces, said sidewalls having block-interlocking means;
 - a first transverse end wall extending between said sidewalls at a first end of said blocks;
 - and
 - a second transverse end wall extending between said sidewalls spaced from a second end of said blocks.

- 2) An interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a staggered relationship according to claim 1 wherein the stretcher block comprises:
 - a pair of spaced, parallel, upright sidewalls (1,2) having flat top and bottom surfaces, said sidewalls having block-interlocking means (3,4,5,6) on opposed ends thereof;
 - a first transverse, protruding end wall (7) extending between said sidewalls at a first end of said block; and
 - a second transverse, protruding end wall (8) extending between said sidewalls spaced from a second end of said block.

- 3) An interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a staggered relationship according to claim 1 wherein the corner block comprises:
 - a pair of spaced, parallel, upright sidewalls (9,10) having flat top and bottom surfaces, said sidewalls having block-interlocking means (11,12,13,14) on opposed ends thereof;
 - a first transverse end wall (15) extending between said sidewalls at a first end of said block;
 - a second transverse end wall (16) extending between said sidewalls spaced from a second end of said block;
 - a transverse upright support web (17) spans said sidewalls, integral and defining a cavity

for receiving cementitious material therein; and
 protrusions (18) on the inside of sidewalls, extending from a base substantially coplanar with said sidewall bottom surfaces and having tips extending above said sidewall top surfaces configured to interlock with a block in a next succeeding course.

- 5 4) An interlocking modular block system for mortarless wall assembly in which a plurality of blocks are laid up in courses in a staggered relationship according to claim 1 wherein the half block comprises:
 a pair of spaced, parallel, upright sidewalls (19,20) having flat top and bottom surfaces, said sidewalls having block-interlocking means (21,22);
 10 a first transverse end wall (23) extending between said sidewalls at a first end of said block;
 a second transverse end wall (24) extending between said sidewalls spaced from a second end of said block; and
 a protrusion (25) on the inside of said sidewalls, extending from a base substantially
 15 coplanar with said sidewall bottom surfaces and having a tip extending above said sidewall top surfaces configured to interlock with a block in a next succeeding course.
- 5) The block-interlocking means according to any one of claims 1, 2, 3 or 4 wherein the interlocking means comprises male and female interlocking means.
- 6) The male and female interlocking means according to claim 5 wherein the said male and
 20 female interlocking means provide self-alignment features to the block system for mortarless wall assembly.
- 7) The interlocking modular block system for mortarless wall assembly according to any one of claims 1, 2, 3 or 4 wherein the said blocks provide void space to house stability and stiffening means in both horizontal and vertical directions.
- 25 8) The interlocking modular block system for mortarless wall assembly according to any one of claims 1, 2, 3 or 4 wherein the said blocks provide for the construction of door and window openings.

- 9) The interlocking modular block system for mortarless wall assembly according to any one of claims 1, 2, 3 or 4 wherein the said blocks may be used to house lintels without requiring the use of form work.
- 10) The interlocking modular block system for mortarless wall assembly according to any one
5 of claims 1, 2, 3 or 4 wherein the said blocks provide for the construction of load and non-load bearing walls.
- 11) The interlocking modular block system for mortarless wall assembly substantially as herein described with reference to the accompanying drawings.

KEY TO FIGURES

Fig. 1 Stretcher Block Unit.

- a: perspective view of the stretcher block unit.
- b: side view of the stretcher block unit.
- c: top view of the stretcher block unit.

Fig. 2 Corner Block Unit.

- a: perspective view of the corner block unit.
- b: side view of the corner block unit.
- c: top view of the corner block unit.

Fig. 3 Half Block Unit.

- a: perspective view of the half block unit.
- b: side view of the half block unit.
- c: top view of the half block unit.

Fig. 4 Procedure for constructing a wall with horizontal stiffener.

- a: First stage – placing the plastic sheet.
- b: Second stage – laying the next course.
- c: Third stage – placing the steel and casting the stiffener.
- d: The completed wall comprising a steel bar and stiffener.

Fig. 5 Procedure for casting vertical ties.

- a: First stage – laying and casting the first course.
- b: Second stage – constructing 1m masonry and casting the vertical stiffener.
- c: Third stage – casting the 2 nd metre of the stiffener.

Fig. 6 Construction of corner connection showing the arrangement of blocks in the first, second and third courses.

Fig. 7 Procedure for constructing a wall with door opening.

- a: First stage – laying the first course and identifying the door opening.
- b: Second stage – constructing 1m masonry and casting the vertical stiffeners.
- c: Third stage – casting the lintel.
- d: Fourth stage – the completed wall with door opening.

Fig. 8 Procedure for constructing a wall with window opening.

- a: First stage – constructing 1m masonry and casting the vertical stiffeners, with horizontal stiffener below window.
- b: Second stage – constructing the 2 nd metre of the wall and casting the lintel.
- c: Third stage – the completed wall with window opening.



Application No: GB 0102835.6
Claims searched: 1 - 11

Examiner: J D Cantrell
Date of search: 18 April 2001

Patents Act 1977

Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): E1D: DLEG, DLEP, DLEJ, DLEQWNT, DLEQWNW, DLEQWST, DLEQWSW, DLEHW

Int Cl (Ed.7): E04B

Other: ON-LINE: EPODOC, PAJ, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X,Y	GB 2088433 A NEWLAY	X: 1,5-7 Y:2,3
Y	GB 2197358 A HAENER	2,3
A	GB 1561935 PARRY	-
A	GB 1413596 WOOD	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.