(12) UK Patent Application (19) GB (11) 2 200 383 (13) A

(43) Application published 3 Aug 1988

(21) Application No 8701433

(22) Date of filing 22 Jan 1987

(71) Applicant
Peter Charles-Greed
3 St. Michael's Court, Monkton Combe, Bath, Avon, BA2 7HA

(72) Inventor
Peter Charles-Greed

(74) Agent and/or Address for Service
Peter Charles-Greed
3 St. Michael's Court, Monkton Combe, Bath, Avon, BA2 7HA

(51) INT CL⁴
E04B 1/24

(52) Domestic classification (Edition J):
E1D 2019 402 GS K2

(56) Documents cited
GB 1574402 **GB 1546886** **EP A 0070962**
WO A 82/04453 **US 4575974** **US 4443992**
US 3845592

(58) Field of search
E1D
Selected US specifications from IPC sub-class E04B

(54) Engineered housing

(57) A building comprises a series of prefabricated steel frames which are coupled together with self-locating locking devices and which support prefabricated wall panels, floor and ceiling panels and roof units.

When the units are assembled the superstructures are ready for fitting out as required with prefabricated electrical, gas, water and waste systems together with internal wall partitions, joinery units and sanitary fittings all of which when assembled make up the complete building of traditional appearance and ready for occupation.

The construction is modular, and is relatively easy to construct.

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PERSPECTIVE

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Frame and wall panel layout G.F.

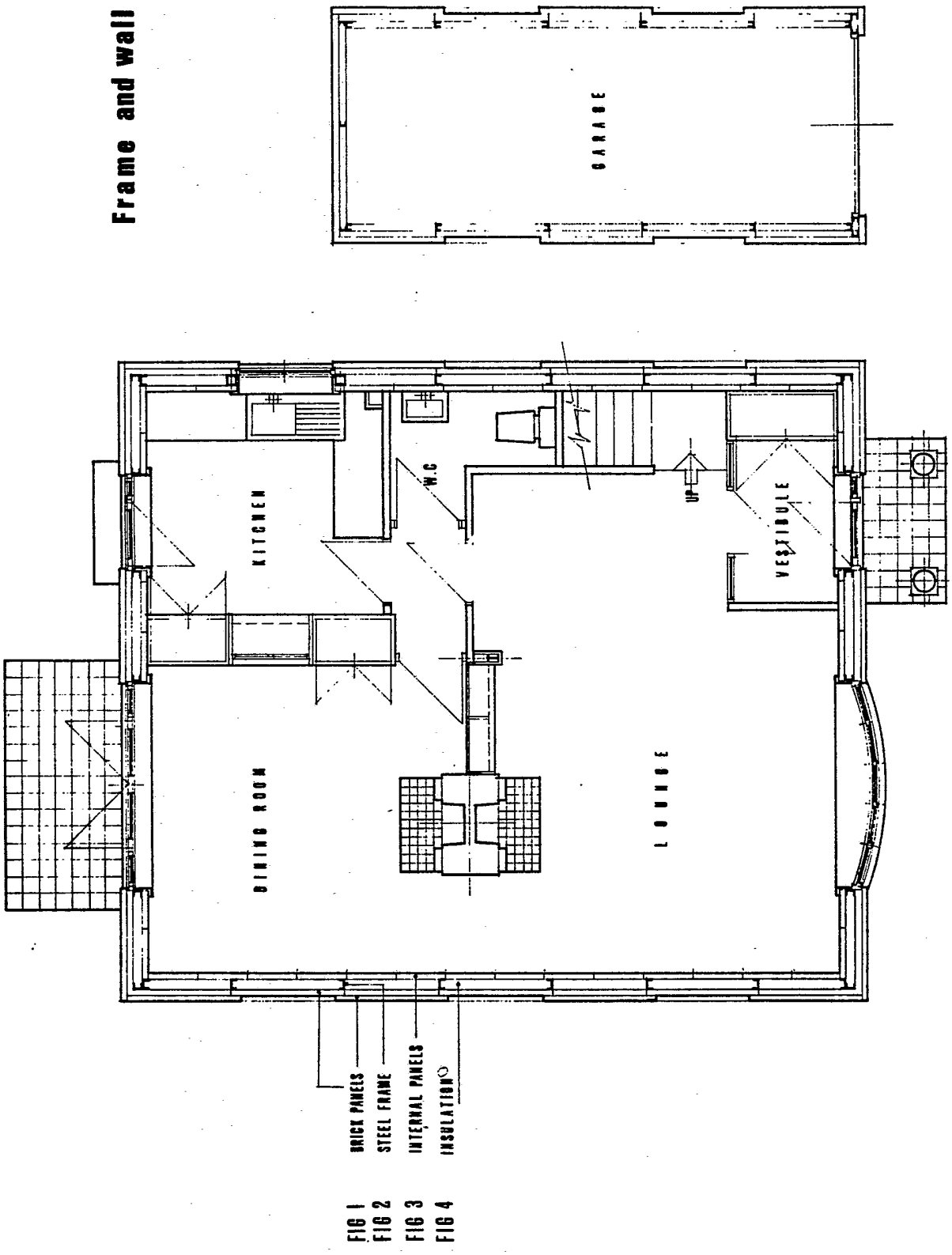

FIG 1
FIG 2
FIG 3
FIG 4

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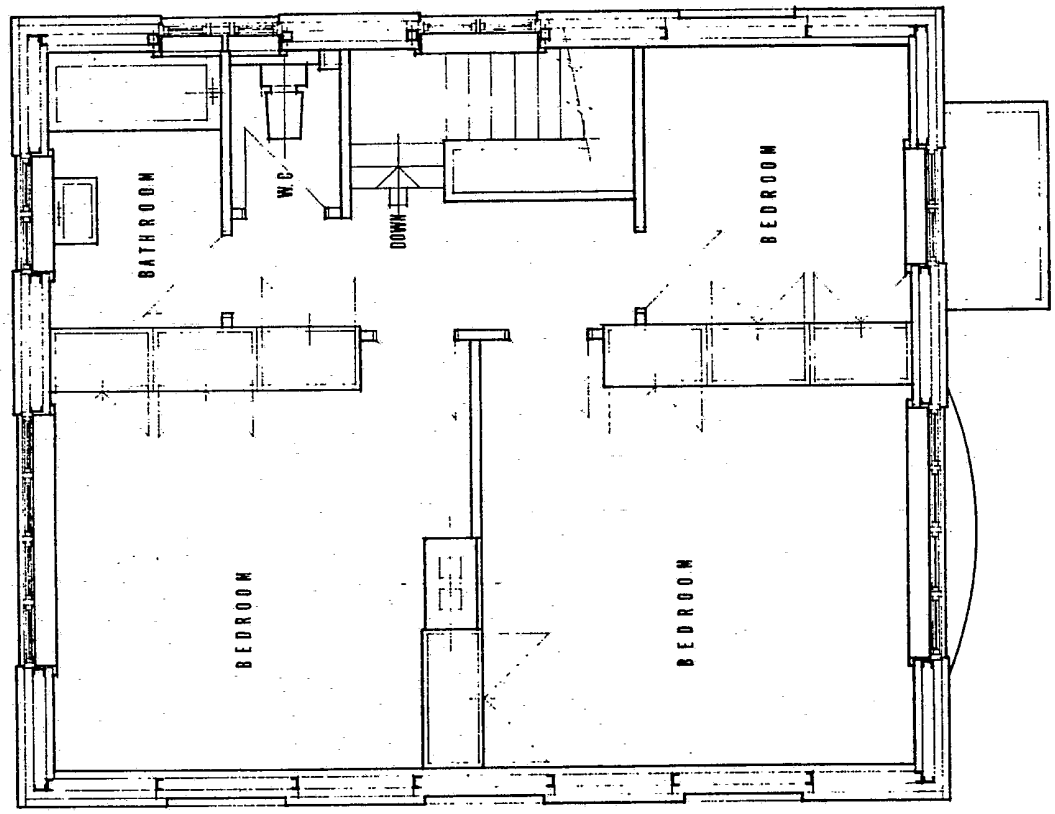
1st. fl.



TYPE **A**

Front Elevation

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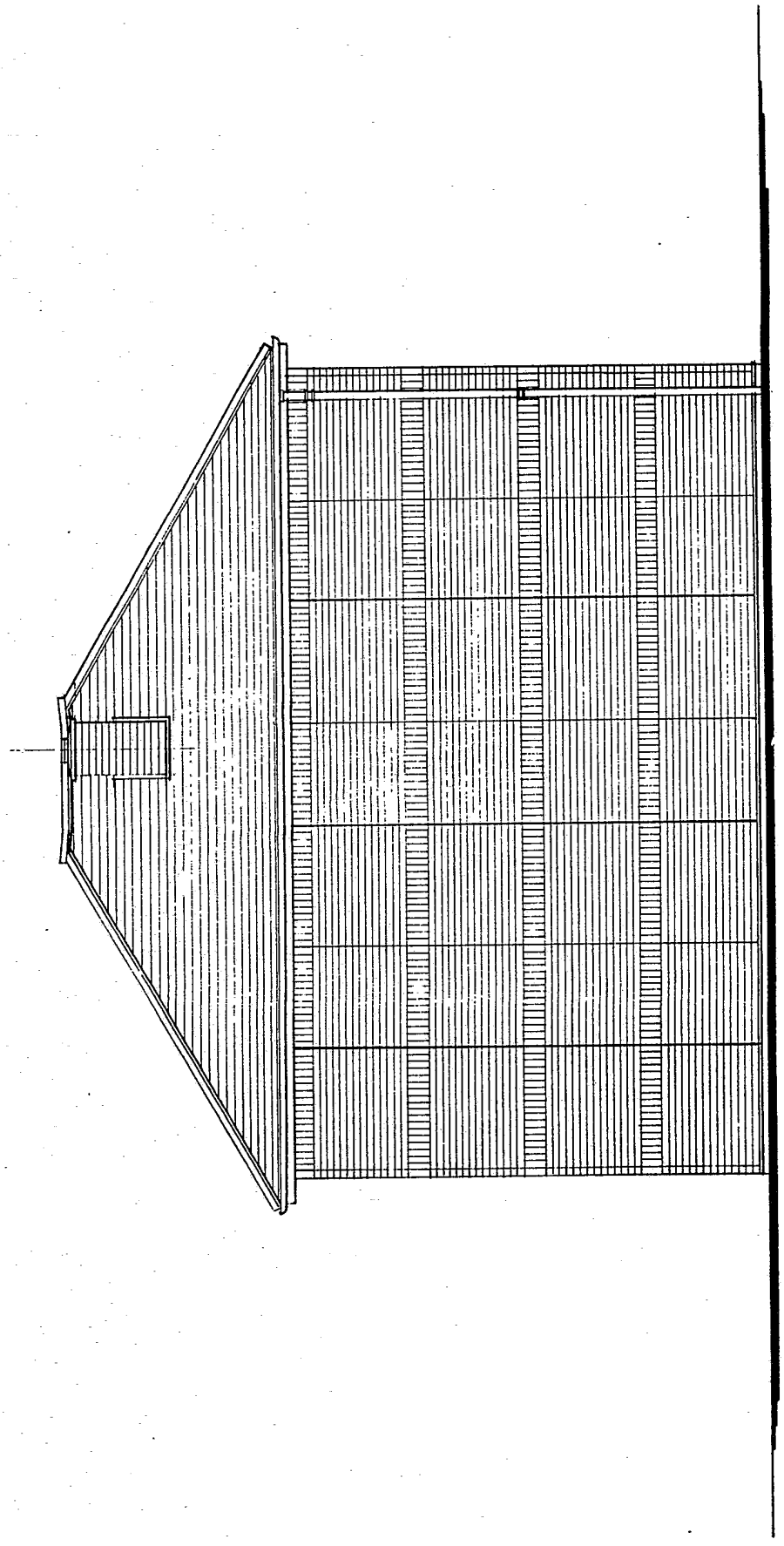
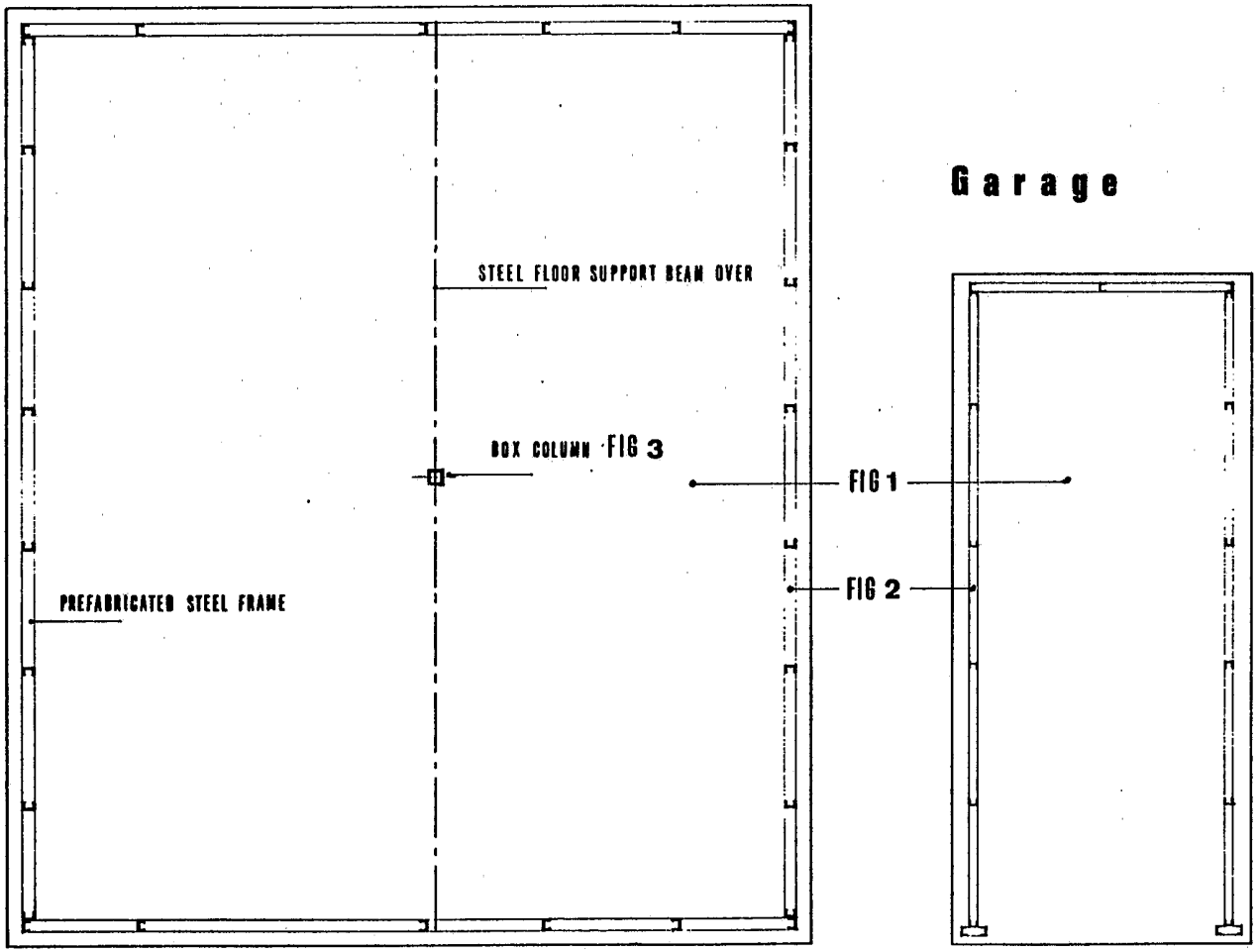


House



Garage

Wall Frame Layout

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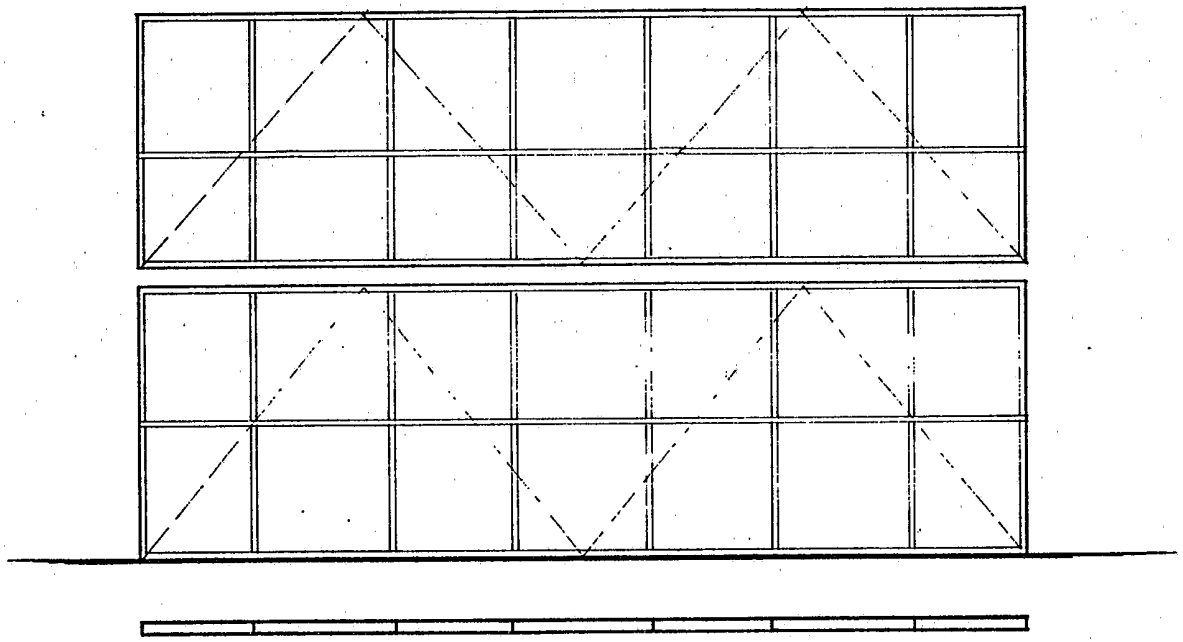

FRAMES FABRICATED FROM LIGHT WEIGHT
RUST-PROOFED STEEL COLD ROLLED SECTIONS

Wall Frame (left)

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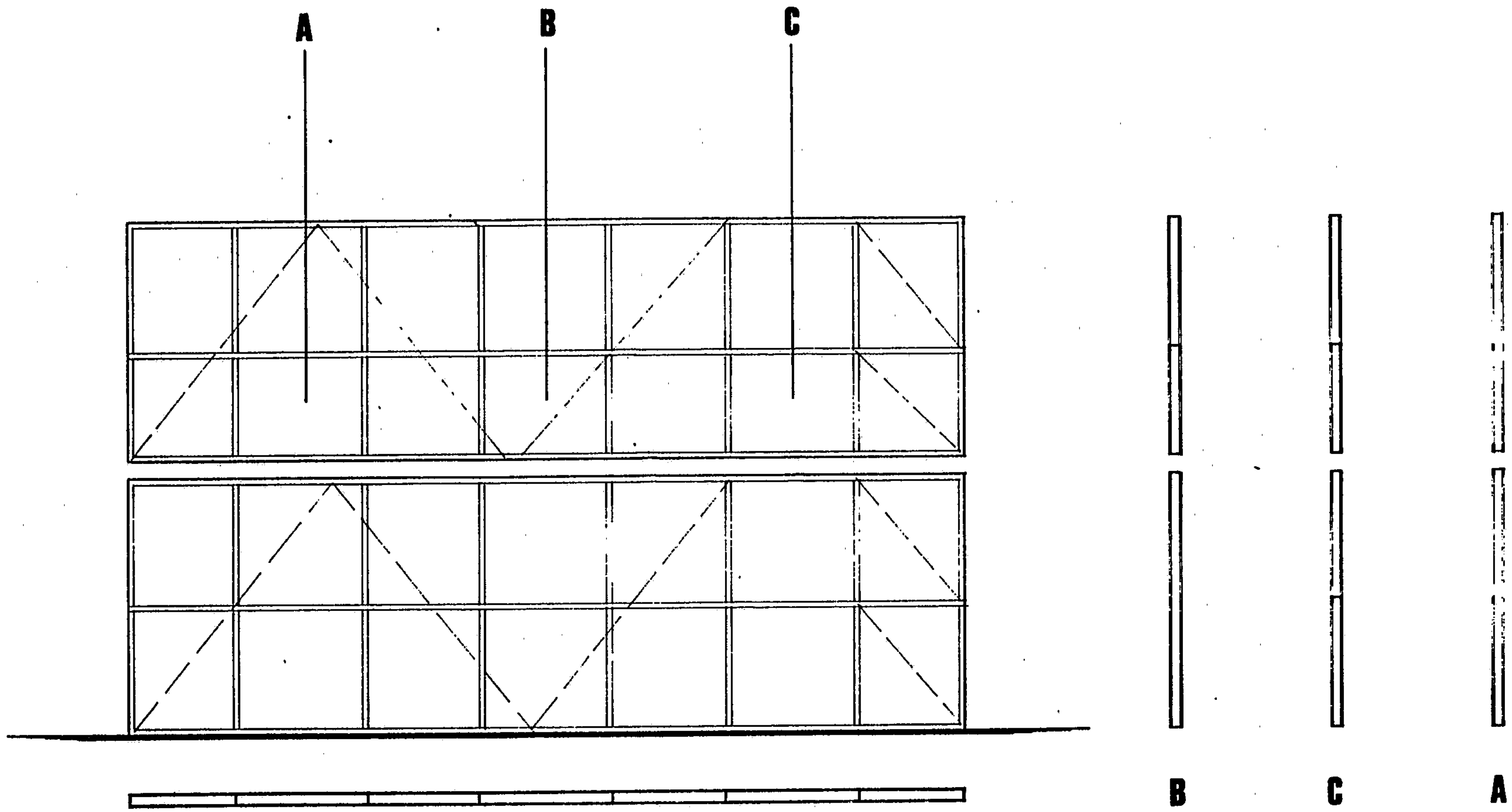

Sections

Wall Frame (right)

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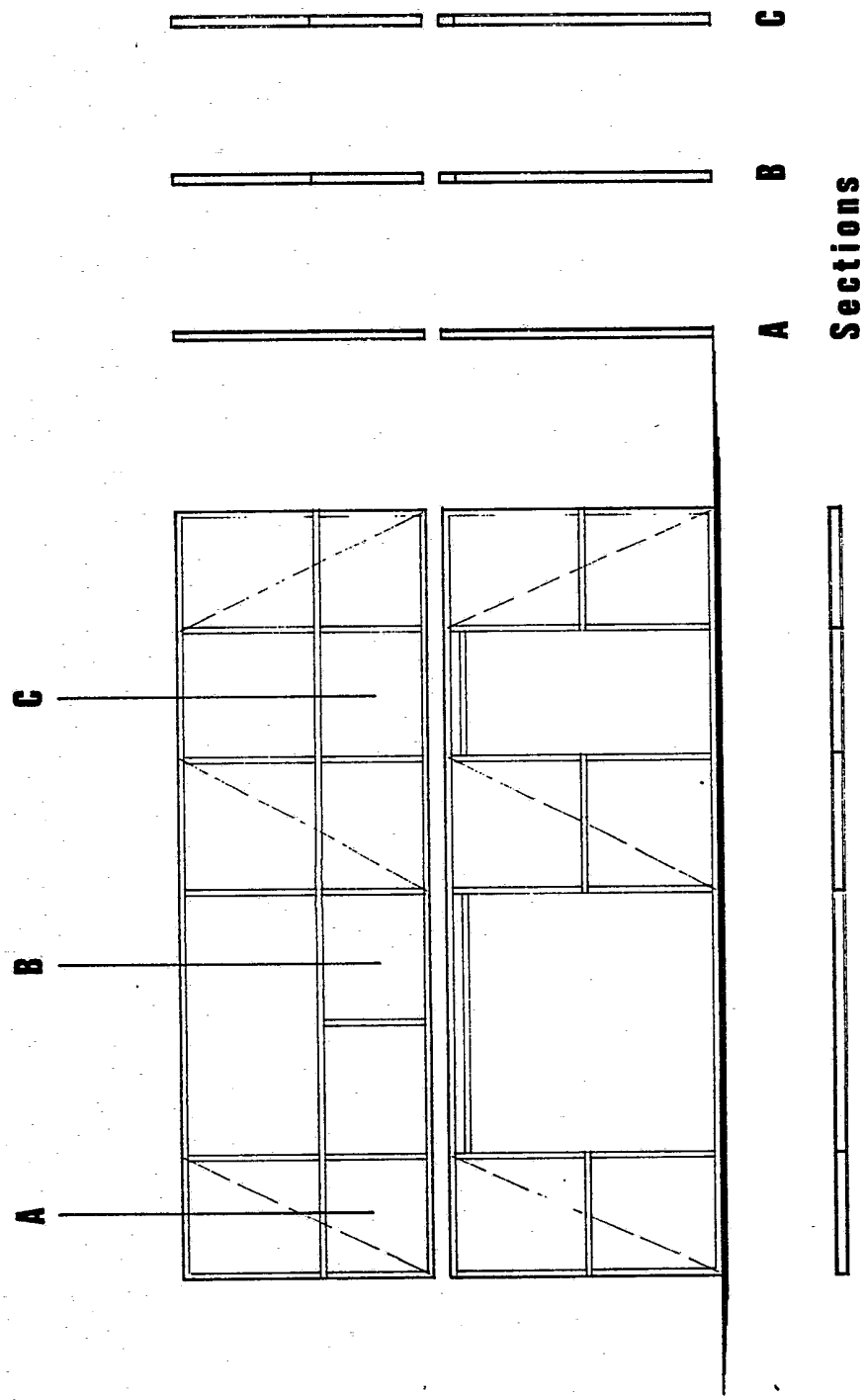
Wall Frames (back and front)



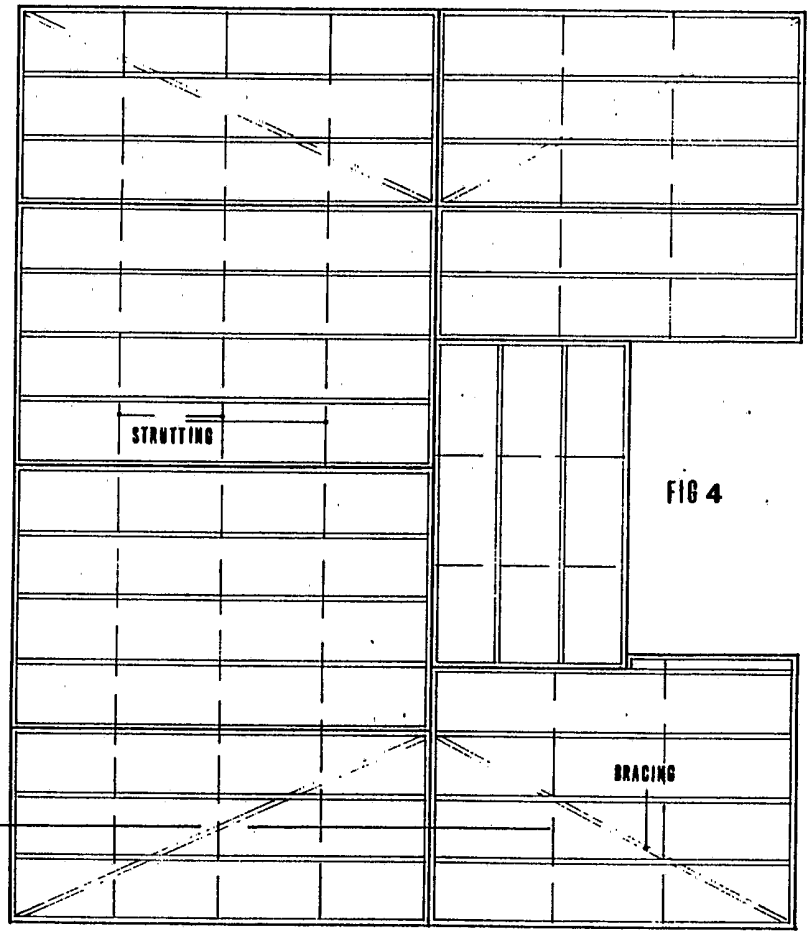
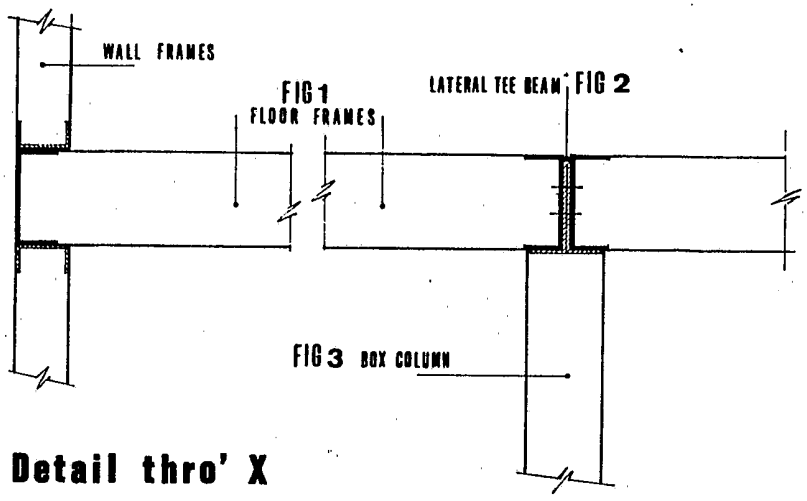
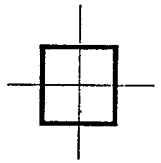


FIG 4

8 NO. STEEL FLOOR FRAMES FIG 1



Detail thro' X



Column

First Floor Joist Layout

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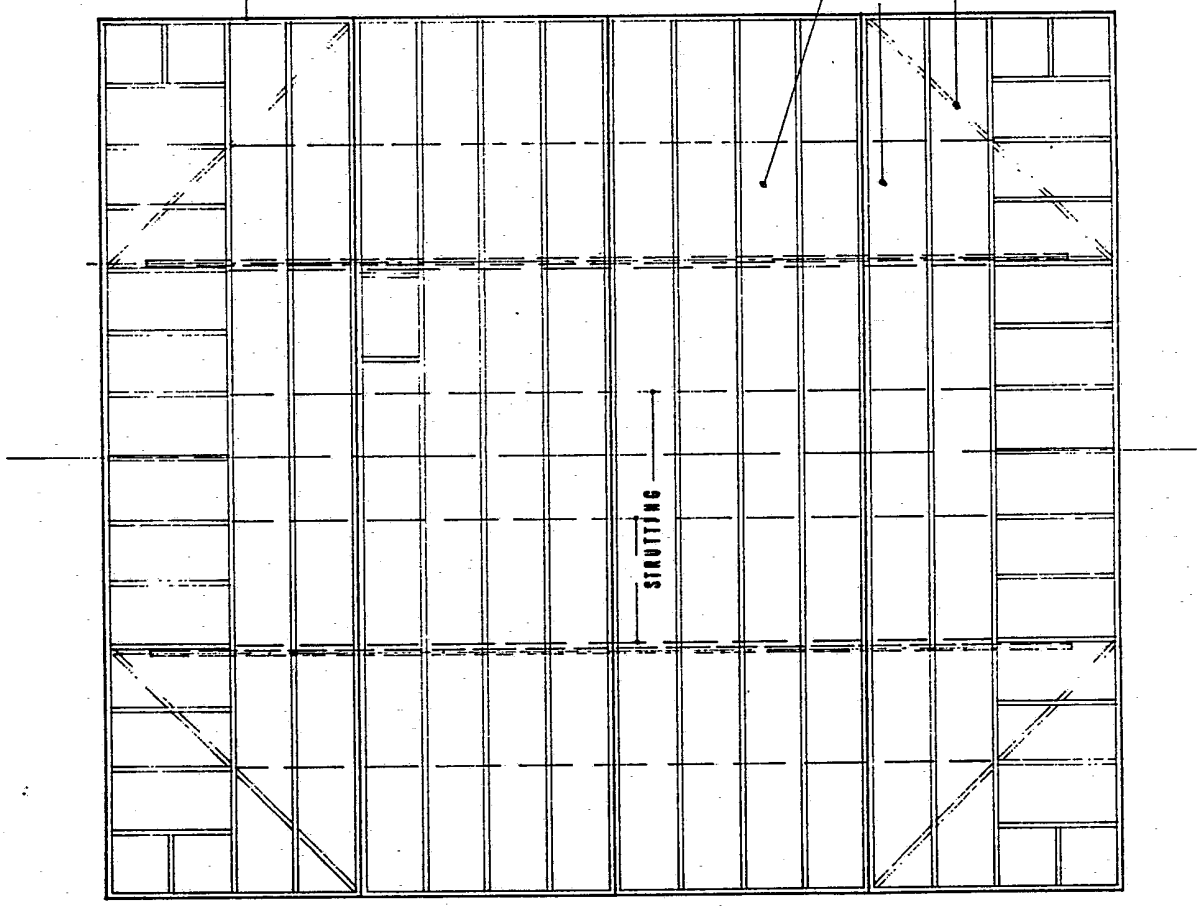
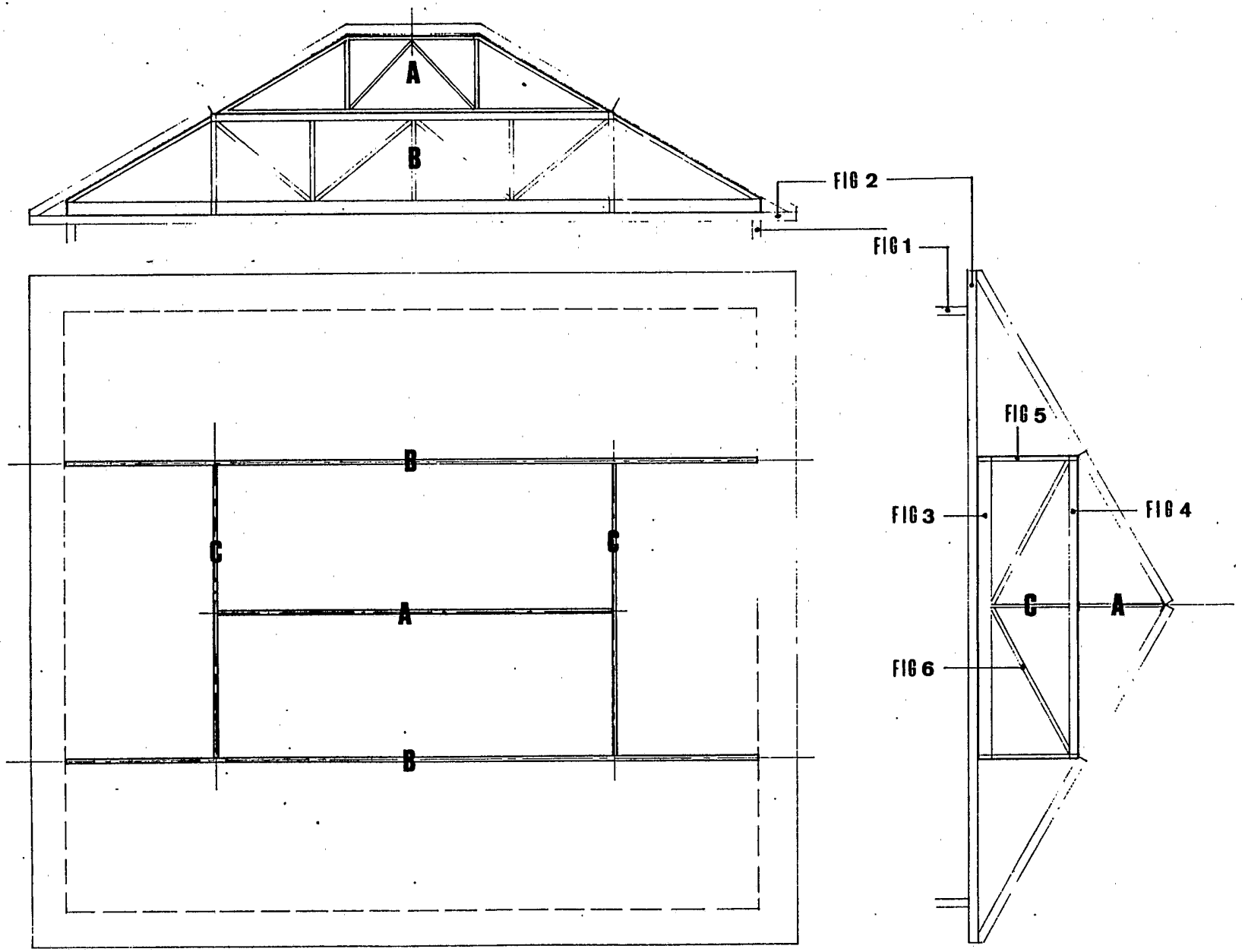
Ceiling Joist Layout





Roof Support Trusses

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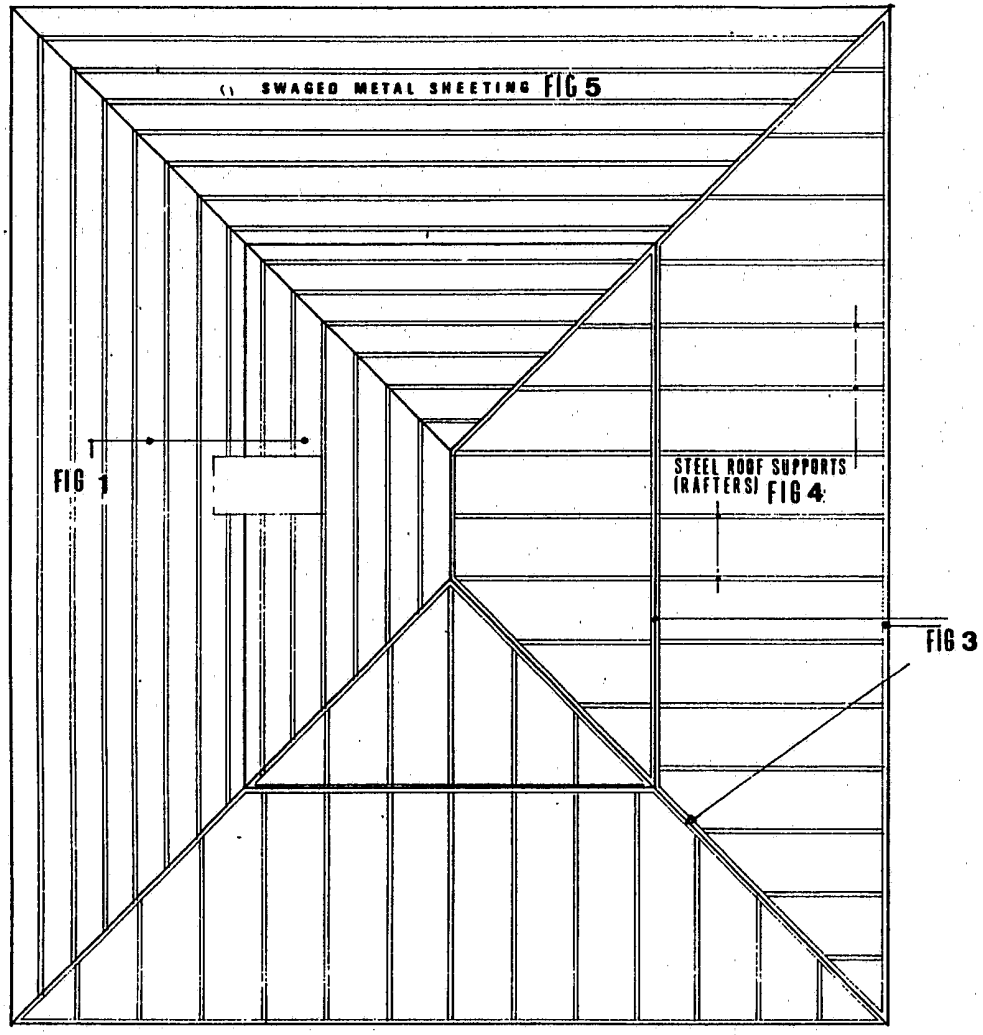

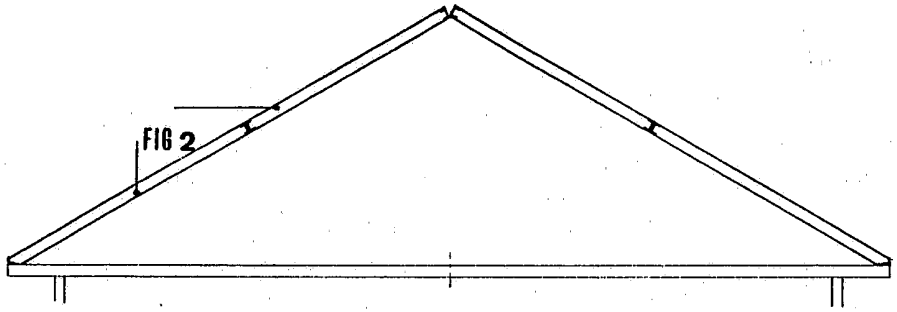

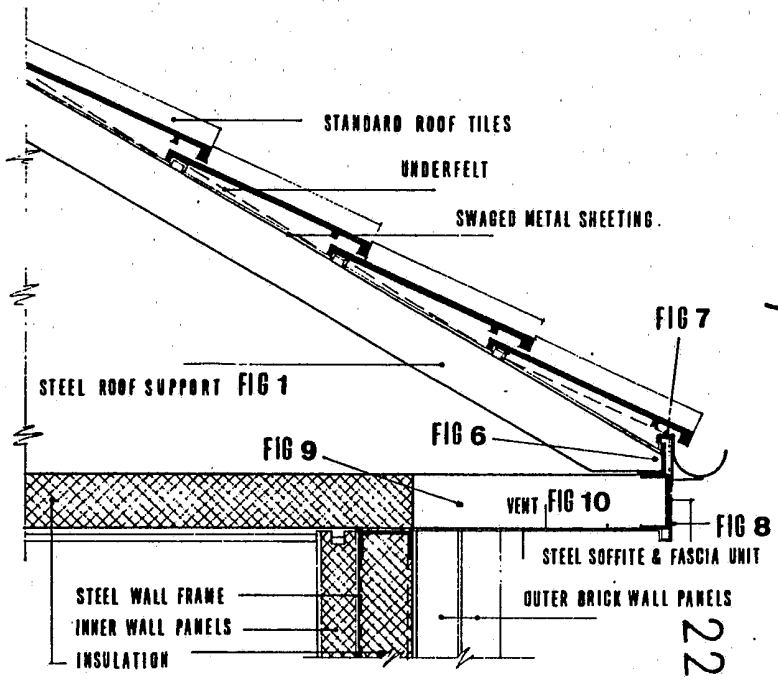

Roof Construction Detail

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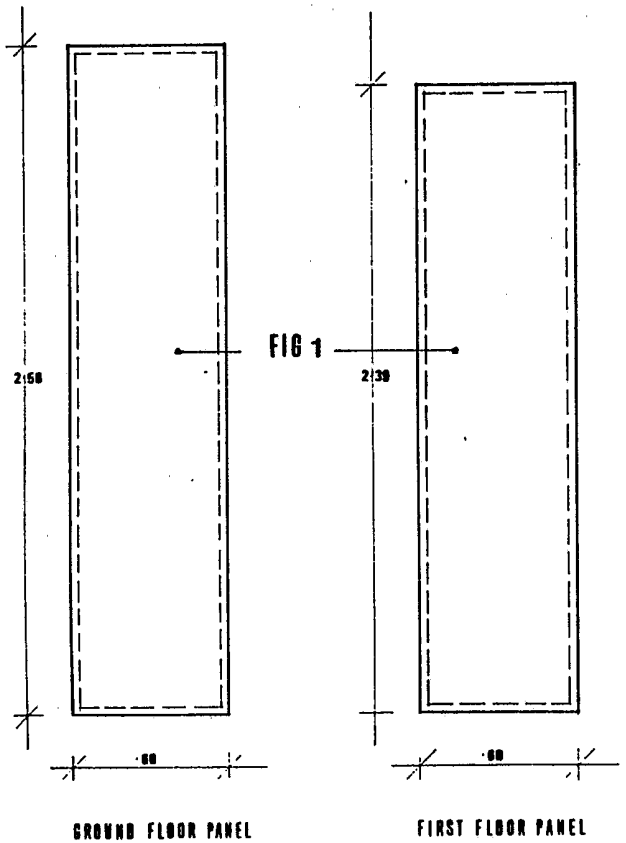
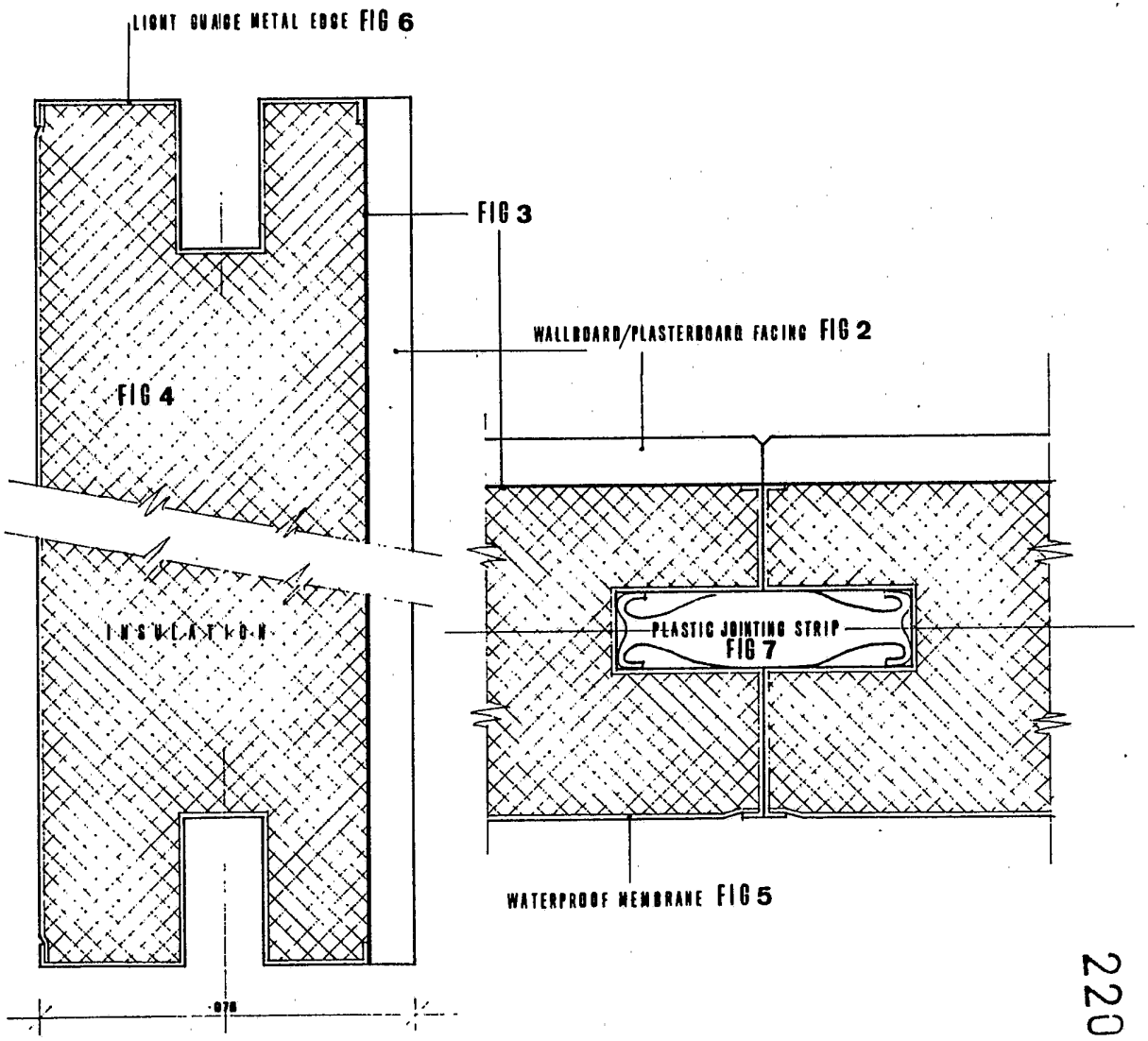


GROUND FLOOR PANEL

FIRST FLOOR PANEL



Internal Wall Panel

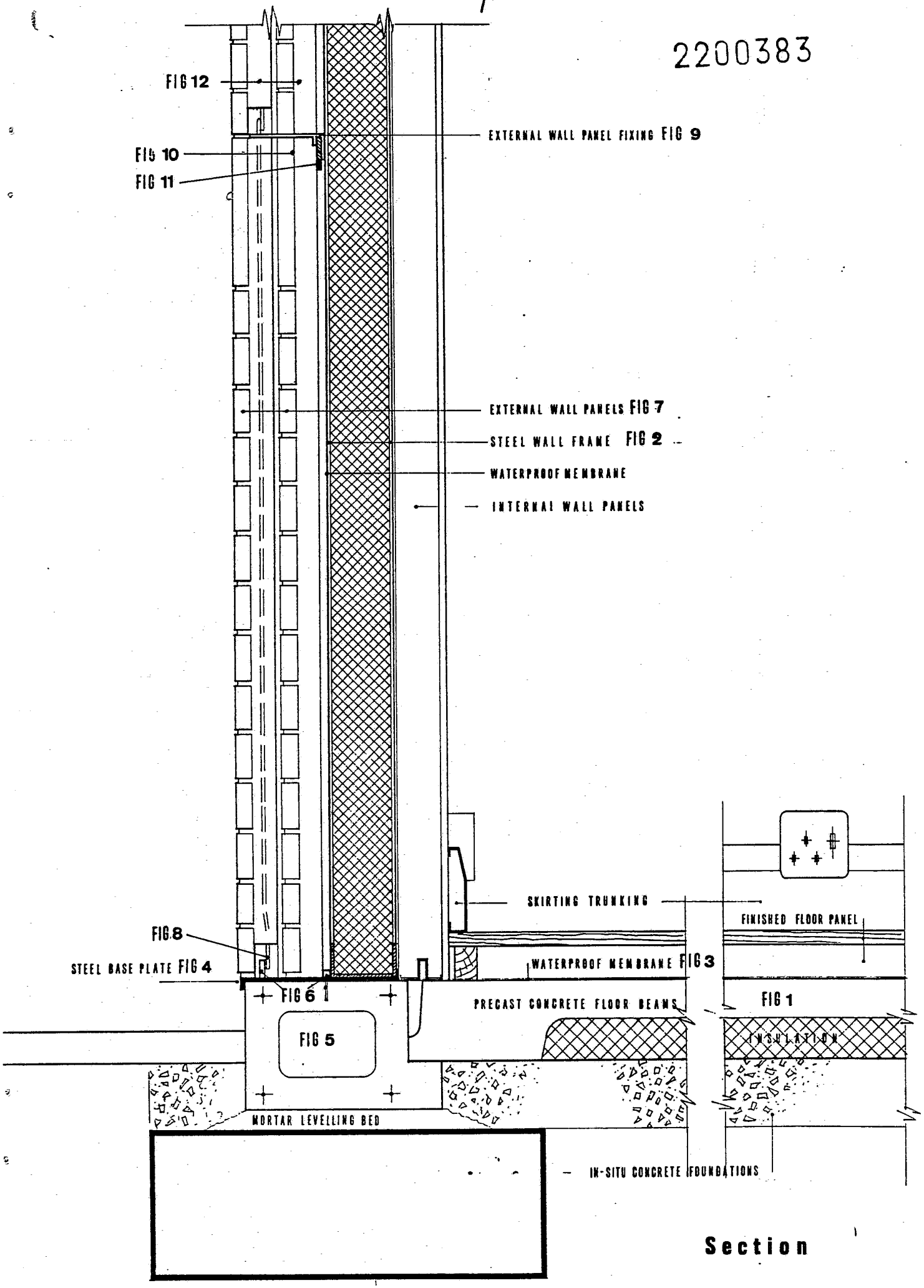


FIG 12
EXTERNAL WALL PANEL FIXING FIG 9
FIG 10
FIG 11
EXTERNAL WALL PANELS FIG 7
STEEL WALL FRAME FIG 2
WATERPROOF MEMBRANE
INTERNAL WALL PANELS
SKIRTING TRUNKING
FINISHED FLOOR PANEL
FIG 8
STEEL BASE PLATE FIG 4
WATERPROOF MEMBRANE FIG 3
FIG 6
PRECAST CONCRETE FLOOR BEAMS
FIG 1
FIG 5
INSULATION
MORTAR LEVELLING BED
IN-SITU CONCRETE FOUNDATIONS

Section

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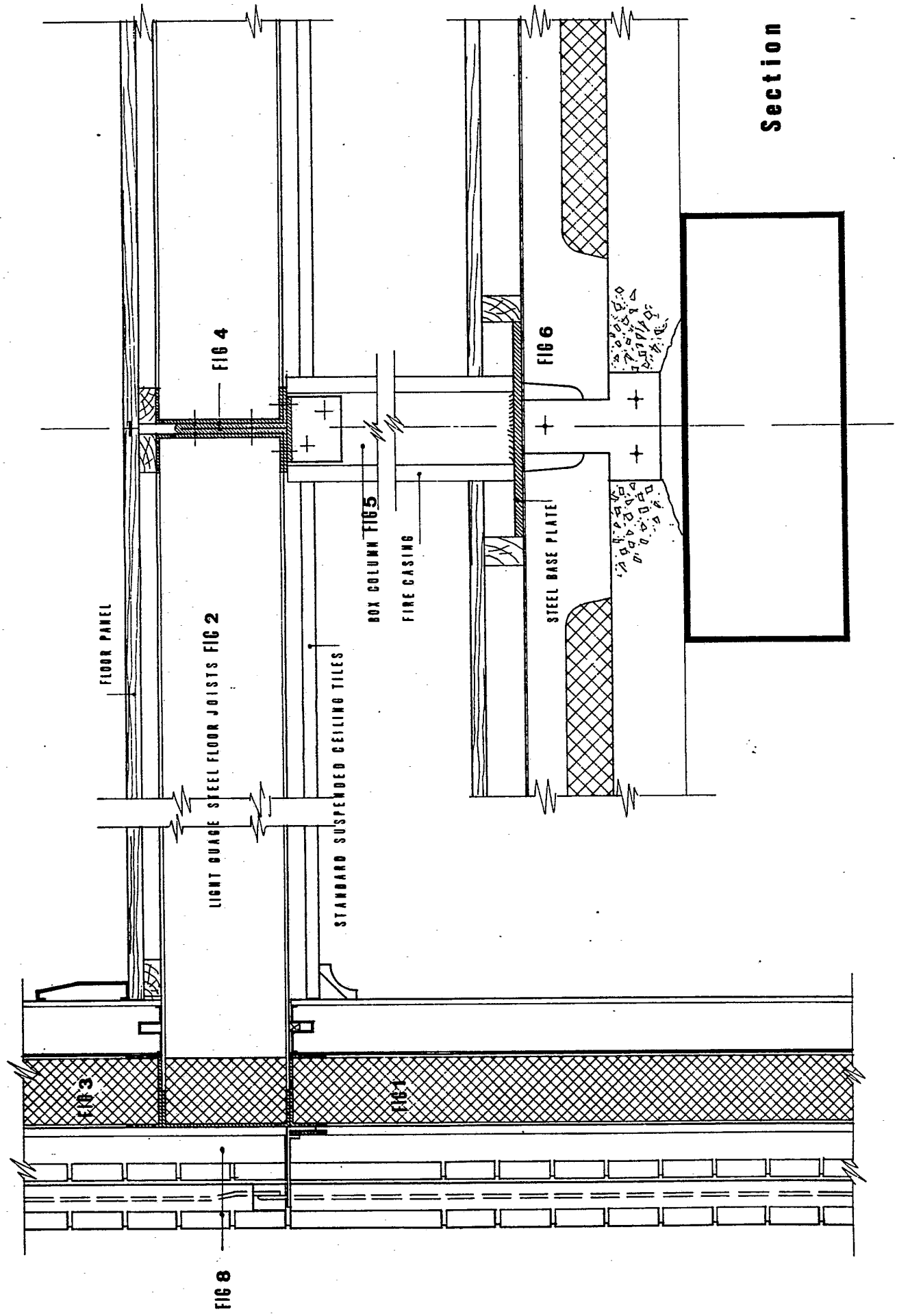
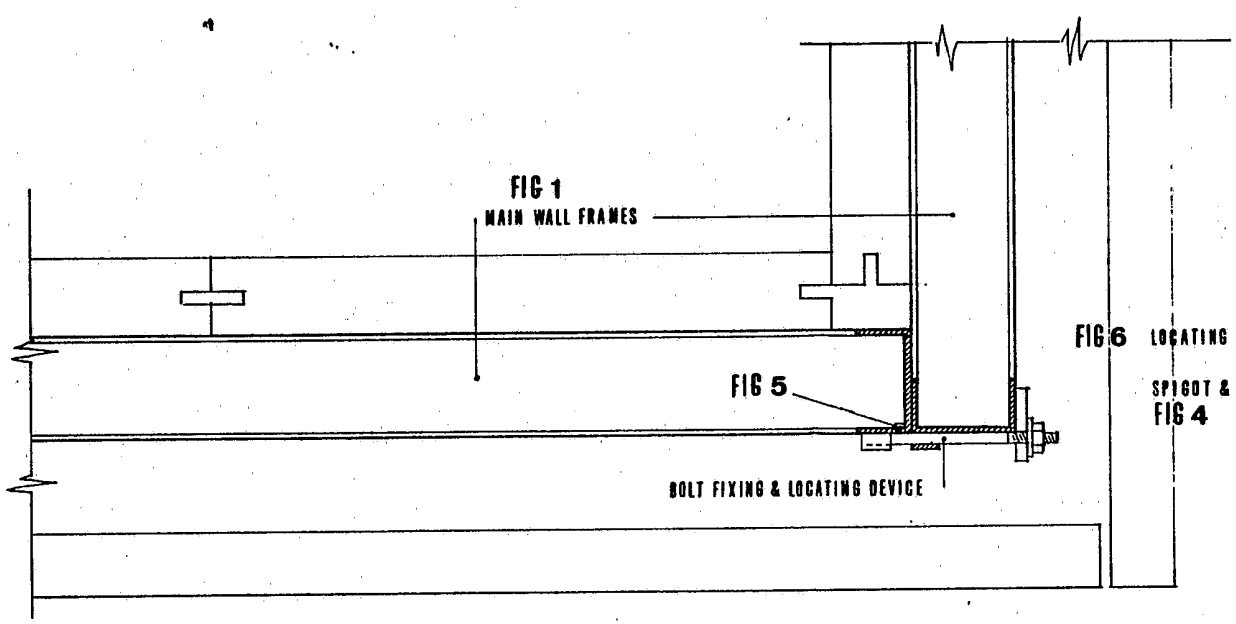
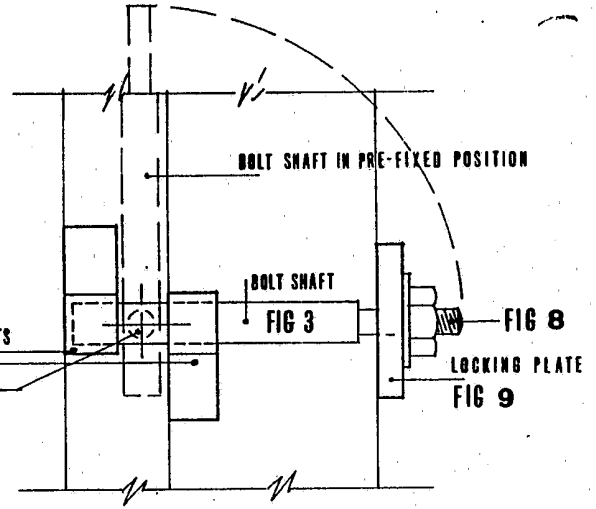
Section

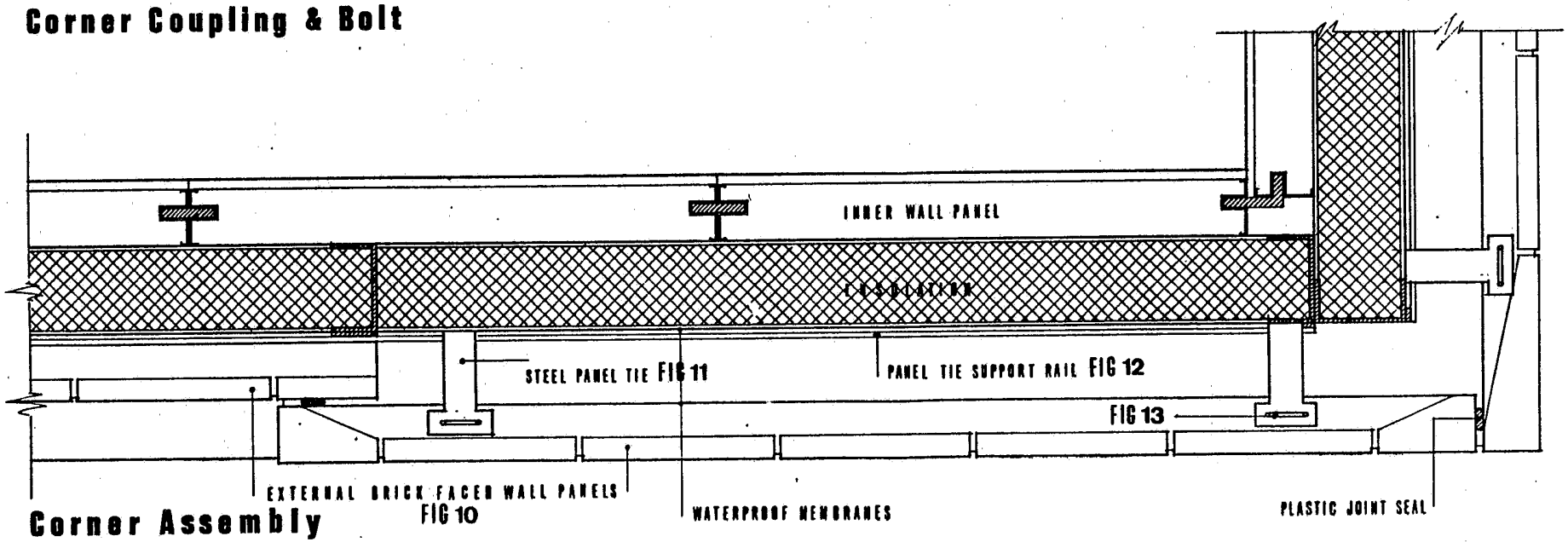




Corner Coupling & Bolt



Bolt Fixing Assembly FIG 2



Corner Assembly

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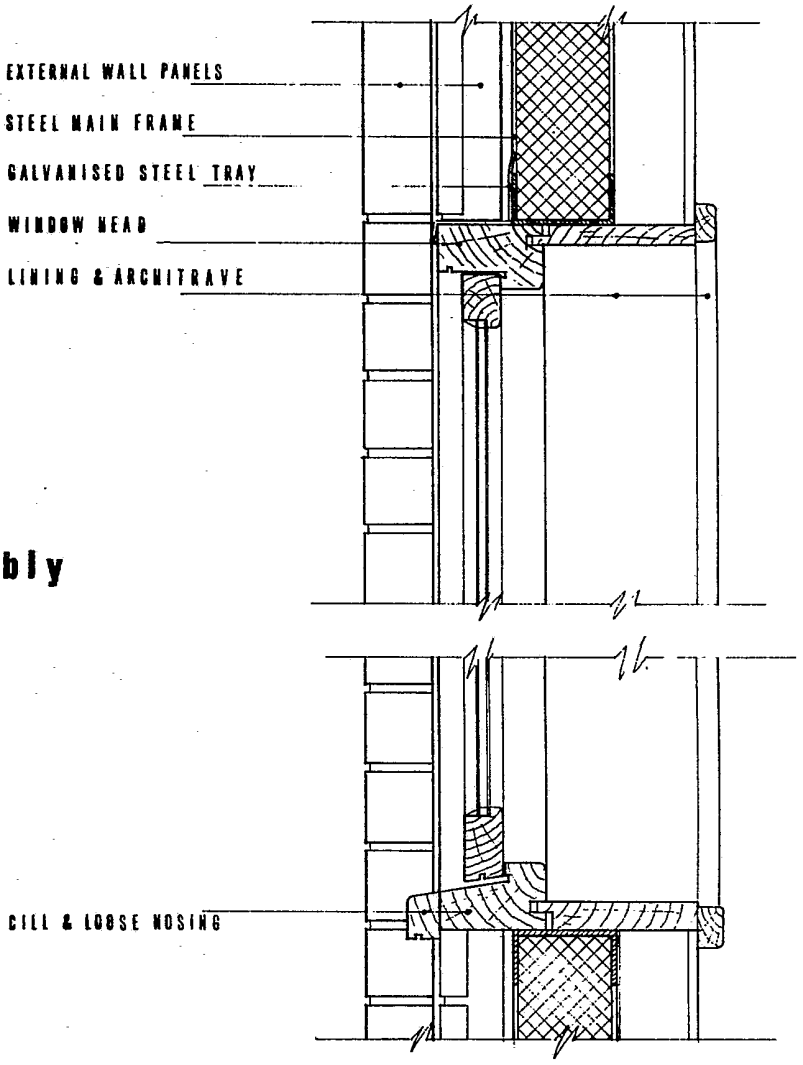
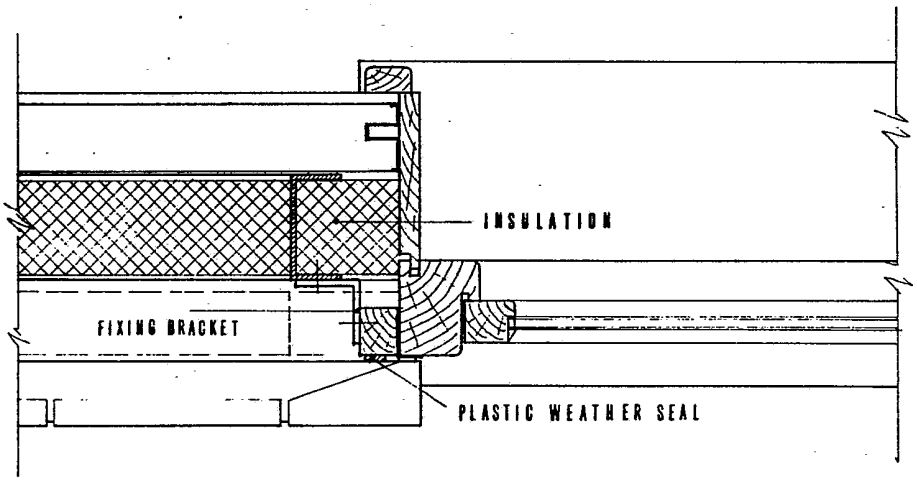
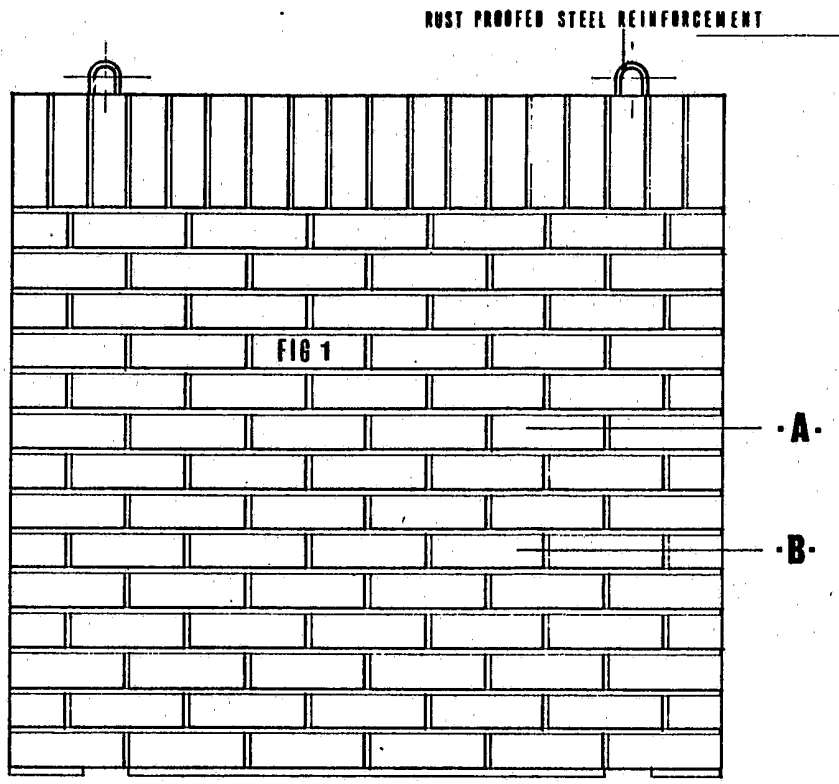
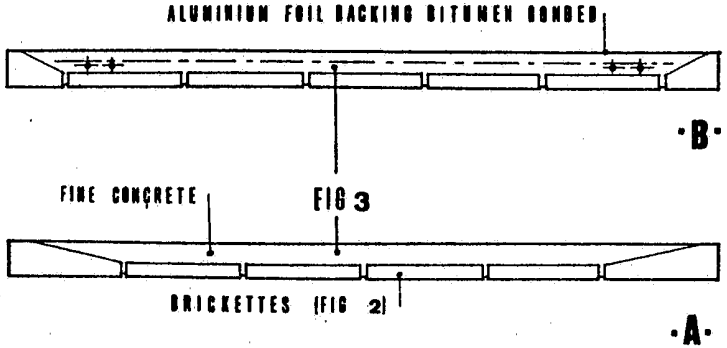
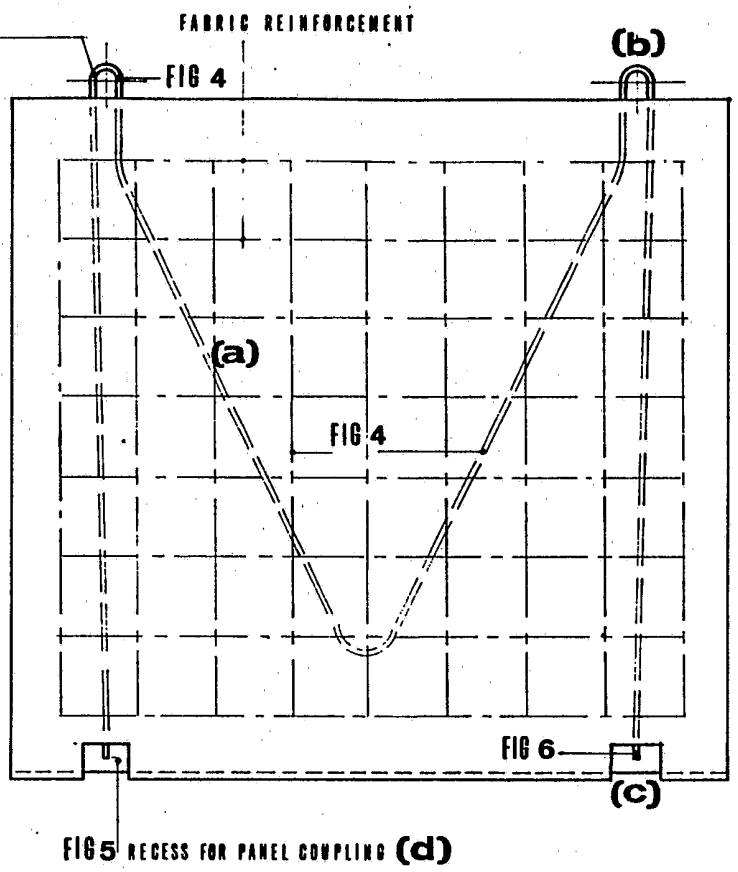
Window Assembly











External Cladding Panel

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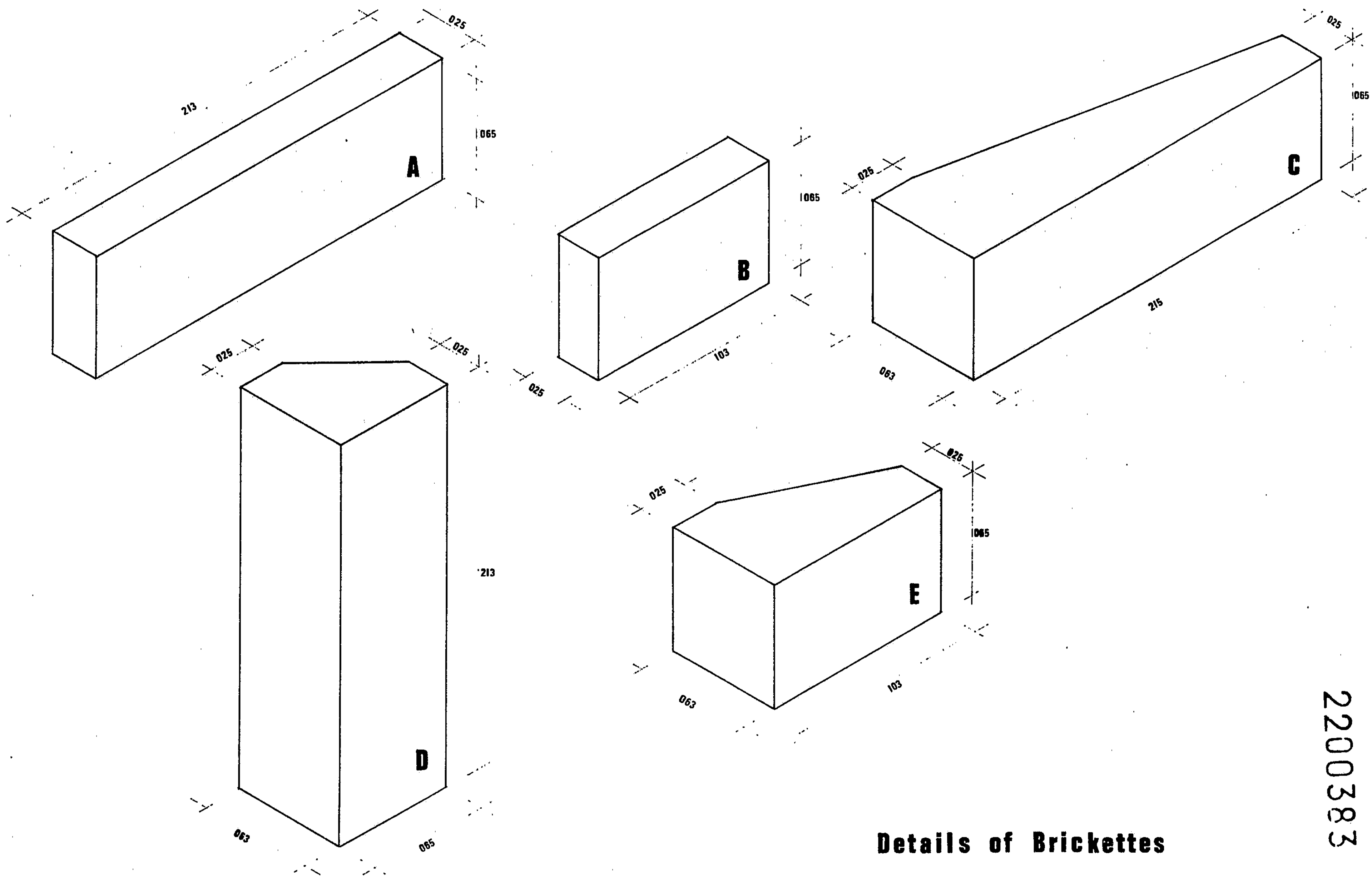

Details of Brickettes

ENGINEERED HOUSING

1. This invention relates to one and two storey building structures which can be erected by non-professional people as well as professsional building operatives from a complete set of component parts which are manufactured and pre-assembled in factories to engineering standards and which when put together on a building site provides either accommodation for residential purposes, office use, or a combination of both.

2. There are, and have been in the past, a number of pre-fabricated housing systems patented and marketted, but such systems rely on the skills of trained constructors to put together. This invention has been devised to enable people with simple 'do-it-yourself' skills to construct for themselves a permanent housing structure, and since the expensive on-site costs which traditional building methods demand are eliminated, the structures described in this document can be constructed at substantially lower costs.

3. The essential technical features which makes this invention unique are as follows:-

3.1. The structural elements of the building are made up of light-weight steel frames which are held together with self-locating devices (Fig. 24) and which when locked in position provide a secure and rigid framework upon which the various wall, floor and roof parts are fitted.

3.2. The structure can be assembled quickly and easily by non-technical people who need not have had any previous experience in building construction.

3.3. When the structure is erected it has a completely traditional appearance with a life factor at least equivalent to that of the normal comparable brick and tile building. Fig. 1 is an illustration of a typical 2 storey house having 3 bedrooms and 2 reception rooms constructed to the specification of the invention.

3.4. The external walls comprise pre-fabricated outer and inner skins which are fastened securely to the steel framework by self-locating devices (Fig.24) the outer skin being made up of brick or stone-faced reinforced concrete panels (Fig.31). The inner skin being a panel of insulating material (Fig.21) surfaced for decoration as required.

3.5. The roof structure is a composite of a number of pre-assembled light-weight steel frames:-

3.5.1. The ceiling joist layout (Fig 16) which is made up of 4 sections.

3.5.2. The roof support trusses (Fig 17) which provides the main support for the roof and which is securely bolted to the wall frames.

3.5.3. The rafter layout (Fig 18) is made up of 8 sections which are coupled together to provide a support for a swaged metal sheet roof covering. When assembled this part of the structure is then ready to receive the selected final roof comprising underfelt covering, slates, tiles or pre-formed panels.

3.5.4. The eaves and fascia assembly (Fig 18) is made up from pre-formed lengths and corner sections of metal coloured finish and which are attached to the bottom rail of the rafter assembly. Incorporated in this assembly are brackets (Fig 18) to support standard lengths of pre-formed plastic or metal gutters.

4. The specific features of the invention are now described with reference to the following drawings:-

FIG.1. is a perspective which shows the external appearance of a typical 2 storey house and which illustrates the traditional brick wall and tile roof construction that the invention provides.

FIG.2A. & 3A. are the ground and first floor layout plans of a 2 reception, 3 bedrooms 2 storey house and illustrates the general arrangement of the internal walls and joinery fittings etc. of a typical house constructed by the invention method.

FIG.4. is an elevational drawing of the front of a typical house (as Fig.1) showing the brick panel arrangments and the various window and door insertions.

FIG.7. is an elevational drawing of a side wall of a typical house (as Fig 1) showing the brick panel arrangement where there are no door and window openings.

FIG.11. Shows the layout of the steel wall frames and the central steel column support for the first floor.

FIGS:12:13:14: These drawings show the construction of the light-weight steel frames which are designed to support the external and internal cladding of the outside walls and which forms the main framework of the structure and ensures its stability.

NOTE: For clarity the doors and windows are not shown in position, but when the frames are prepared in the factory for delivery to the building site they will be complete with the doors and window frames together with the insulation material and vapour barriers already in position.

FIG.15 Shows the layout of the light-weight steel joist frames required for the support of the first floor covering and the ground floor ceiling units. Fig.15 also shows a detail of the light-weight steel box column required to support the first floor structure.
The assembly of the joist frames is made up of a composite of 8 units which when bolted together forms a complete horizontal framework and which, when secured to the wall frame provides the appropriate lateral rigidity for the structure.

FIG.16. Shows the layout of light-weight steel joist frames required to support the ceiling units of the first floor. The assembly is a composite of 4 units which are coupled together and bolted to the wall frames to form a rigid and secure structure.

FIG.17. Illustrates the layout of trusses required to support the roof structure (Fig.18). This assembly is a composite of 5 units which are bolted together and secured to the wall frames.

FIG.18. Illustrates the roof panel layout designed to support the roof covering (tiles or slates etc). The assembly is a composite of 8 panels which are bolted together and coupled to the trusses (Fig.17). The panels comprise light-weight steel frames covered with swaged metal sheeting with the swaging pre-formed to a distance apart which allows for the requisite gauge and lap for the selected roof tiles or slates to be accommodated. The fascia and soffite is made up of folded metal sheet pre-formed to suitable lengths and with purpose-made corner units, the soffite being provided with a perforated area for roof ventilation.

FIG.21. is a detail of the panels which make up the inner skin of the outside walls and which comprise insulating material formed to appropriate sizes edged in light gauge metal rebated for jointing. These panels are faced one side with a waterproof membrane to form a vapour barrier and on the other side with a plasterboard or wall-board to provide a surface for selected decoration.

FIG.22. This diagram is a construction detail which is a vertical section through the outside wall showing the method of assembly at ground floor level and the system for securing the external wall panels to the light-weight steel frame.

FIG.23. This diagram is a construction detail which is a vertical section through the outside wall at first floor level; it also shows the central box column support and the first floor joist frames together with the finished floors and ceilings in position.

FIG.24. This diagram is a construction detail which shows the assembly of the corner of the building and the special locking device and coupling which secures and locates in position the light-weight steel wall frames. The detail also shows the clips which hold the external wall panels in position and the method by which they can be adjusted to give a fixing tolerance.

FIG.25. is a construction detail which shows how the window frames, linings and architraves are secured to the wall frames.

FIG.31. Shows the construction of a typical external wall panel which when assembled as indicated on Figs: 1:4:7:. for, the external wall cladding of the building. The panel is made up from Brickettes (See Fig.32), which are made from clay, stone, or concrete of an average thickness of ·025 (1") and being backed with fine concrete of an average thickness of ·038 (1½") reinforced with fabric and steel bars.

The main reinforcement marked (a) is designed to protrude from the top in the form of a loop marked (b) for the dual purpose of providing a facility for easy hoisting the panel into position but which also forms part of a locking device which secures the panel to the main steel wall frame. The lower end (c) of the reinforcement (a) protrudes into a pocket formed in the concrete backing marked (d) where it forms a further part of the locking device which secures the panel to the main steel wall frame.

The concrete forming the backing is further reinforced either by metal or plastic mesh marked (e) or is to be of fibre to suit the appropriate available material as circumstances permit.

SPECIFICATION - ENGINEERED HOUSING.

BACKGROUND OF THE INVENTION

1. In 1946 and for several years thereafter a number of two-storey, three bedroom family houses were erected the structural strength and stability of which relied upon a steel frame and for it's weather resistance pre-cast brick and concrete wall panels.

2. When the buildings were constructed the technology now required to be applied to building construction did not exist and if similar buildings were submitted today for approval under the current Building and Statutory Regulations permission for their erection would not be granted.

3. Nevertheless the buildings which were constructed in 1946 have stood the test of time and from the evident success of the structural system employed, the Applicant, who was the Designer, is satisfied that with appropriate modification to ensure that the system will comply with the current Building and Statutory Regulations therefore seeks patent protection for the up-graded invention as described and illustrated in these documents.

4. The invention is for the construction of buildings and comprises a metal or plastic braced structural frame sufficiently strong to provide a safe and secure base to which is attached a weatherproof wall and roof system. When erected the structure provides a shell which is then ready to be fitted out in a variety of ways and for different uses.

5. The construction set of which the invention comprises is made of the following parts:-

5.1. Ground Floor Slab.
5.2. Wall Frames.
5.3. Damp-proof Floor Trays.
5.4. Floor Frames.
5.5. Ceiling Frames.
5.6. Roof Support Trusses.
5.7. Roof Support Panels.
5.8. Fascia and Soffite Forms.
5.9. External Cladding Panels.
5.10. Internal Cladding Panels.
5.11. Frame Fixings.
5.12. Panel Fixings.

SUMMARY OF THE INVENTION

General Description

6. The invention relates to the manufacture of component parts which make up the set as listed in Paragraph 5 (5.1 through 5.12) and which are suitable for the development of 1:2:3 storey buildings for commercial or residential use.

7. The invention eliminates the need for the on-site traditional skills of the building craftsmen and relies upon engineering technology and tolerances to construct in the factory pre-assembled components which when delivered to the building site can be erected by individuals not necessarily trained in building construction.

8. When the parts of the invention are assembled the structure has the appearance of a building which has been built with traditional materials, brick, stone, rendered on timber framed walls etc., and tile and slate roof covering.

STRUCTURAL ELEMENTS

General Description

9. Ground Floor Slab - (5.(5.1))

9.1. The accuracy of the erection of the main frame is reliant upon the ground slab being level and square and since the invention is made to engineering tolerances it is necessary that the slab also conforms to these standards.

9.2. In these circumstances the ground slab is designed in sections so that it can be pre-cast in the factory under controlled conditions, thus ensuring that when the components are delivered to the building site they are accurately assembled and secured into pre-determined positions by factory located locking devices.

9.3. The ground slab is made up of an assembly of concrete units comprising ring beams, "T" beams and slabs, these are cast onto formers of insulating material and which are left in position to assist with the thermal insulation of the ground floor.

10. Wall Frames - (5.(5.2)

10.1. There are 4.No. wall frames to each one-storey building. 8.No. to each two-storey building and 12.No. to each three-storey building.

10.2. The frames are constructed of metal or plastic and are framed and braced in such a manner so as to ensure a firm, rigid and structurally satisfactory base upon which to properly support the elements and weights to which they will be subjected.

10.4. When the frames are manufactured and prepared ready for delivery to the building site they are complete as required with door-frames, window-frames, insulation and vapour barriers all in position together with special rails and fixings designed to accommodate the devices for securing the external and internal wall panels.

10.5. The frames which come into contact with the ground floor slab are fitted with base plates that enable the frames to be adequately secured in position. These frames are also designed to accommodate a damp-proof element which is inserted to resist any damp penetration.

11. Damp Proof Trays - (5.(5.3)

11.1. These trays are preformed from metal or plastic sheet into shapes which fit the appropriate profile and which when placed in position provide a complete waterproof membrane which is designed to resist both damp rising through capillary attraction and conduct to the outside air any moisture forming in the cavity.

12. Floor Frames - (5.(5.4)

12.1. These elements are inserted when buildings of more than one-storey high are required. The frames provide a double purpose; they form the horizontal stability of the structure when secured to the wall frames and also the support for the upper floors of the building.

12.2. The frames are manufactured to a size which can be easily handled without the use of mechanical equipment and they are designed to interlock when placed in position. A central "T" beam is incorporated to give horizontal stability which in turn is supported on a central column thus effectively leaving a clear internal area for fitting-out as required.

12.3. When the frames are secured in position they also form the support for the finished flooring fabrication.

13. Ceiling Frames - (5. (5.5))

13.1. These frames are designed to interlock and when assembled have a multiple function:-

13.1.1. To provide the horizontal stability for the upper part of the building.

13.1.2. To provide a base upon which the roof structure can be mounted.

13.1.3. To provide support for the fabricated ceiling structure.

13.1.4. To provide support (in conjunction with the roof structure) for the eaves, fascia and soffite assembly.

13.2. The frames are manufactured to span the full short distance of the building and when in position are secured to the roof trusses (5.6) to provide a composite, rigid and braced structure.

14. Roof Support Trusses - (5.(5.6)

14.1. These elements are designed to interlock and when assembled form a rigid and braced structure upon which the roof can be constructed.

14.2. The bottom member of the elements which transverse the ceiling frame laterals are designed to join with the ceiling frame laterals so that a composite unit is formed which not only provides support for the roof but also takes up any sag which otherwise may occur when the ceiling finishes are added.

15. Roof Support Panels - (5. (5.7).

15.1. These elements comprise metal or plastic frames manufactured to interlock with the roof support trusses (5.6) and the ceiling frames (5.5) and when placed and secured in position form the plane upon which the finished roof covering (tiles, slates, composities, felt etc.,) is fitted.

15.2. The top surface of these frames is covered with metal or plastic swaged sheeting which when in position have a multiple function:-

15.2.1. To provide a bracing facility for the frames upon which they are secured.

15.2.2. To provide a fixing facility for the tile or slate roof covering at a pre-determined lap and gauge.

15.2.3. To provide a vapour barrier to assist with waterproofing of the roof structure.

15.3. The swaged sheeting is manufactured with ridges spaced at the appropriate distance to coincide with the lap and gauge of the tile or slate selected to cover the roof. These ridges are a box section with the top surface perforated to accept a metal or plastic harpoon designed to lock the tile or slate in position.

15.4. Before the swaged sheeting is fixed to the supporting frames a waterproof felt or plastic membrane is secured between the swaged sheeting and the supporting frame in order to ensure that a waterproof roof space is secured.

16. Fascia and Soffite Forms - (5. (5.8).

16.1. This element completes the roof assembly and comprises metal or plastic forms shaped to provide an all-in-one fascia and soffite unit. The forms are made in convenient lengths which join together and have preformed corner sections.

16.2. The top of the fascia form is made to form a tilt for the eaves tiles and also designed to receive gutter brackets for accommodating standard gutter sections.

16.3. The material selected for the manufacture of this element is designed to be self-coloured and effectively maintenance free.

17. External Cladding Panels-(5. (5.9).

17.1. The invention incorporates a system for providing a weatherproof facing to the structure. This is accomplished by attaching to the outer face of the wall frames, factory manufactured panels made from brick, stone, concrete, G.R.C., G.R.P., a combination thereof or any other material suitable for the purpose and satisfactory to the conditions prevailing.

17.2. The panels are manufactured so that they can be easily handled and placed in position and incorporated within their manufacture a specially designed device which allow them to be fixed to the frame and interlocked to each other at pre-determined locations.

18. Internal Cladding Panels - (5. (5.10).

18.1. When the wall frames and roof are erected and clad externally the only requirement left to complete the structure ready for fitting out is the construction of an internal skin to the external wall. The invention incorporates a system of factory manufactured wall panels which fix to the wall frames and are interlocking so that when they are erected they provide a continuous face ready for decoration as selected.

18.2. The panels are of laminated construction having a smooth and hard surface where exposed within the building, a containing back board and an infill of insulated material. The edges are provided with locating devices which ensure that then the panels are placed in position they form a true and accurate plane throughout their entire length and height.

18.3. The panels are manufactured to a size and weight to ensure ease of handling and erecting.

19. Frame and Panel Fixings - (5. (5.11.).

19.1. Since the invention has been designed to eliminate as much as possible the need for skilled craftsmen, although the need for accuracy in construction is still essential, sundry location and fixing devices are incorporated to ensure that the various elements which are intended to lock together do so in their proper place.

19.2. These devices are described in detail later in the text and comprise, corner fixing for the main frames, securing devices for the frames to be fixed to the ground slab, panel fixing clips etc.

DRAWING SCHEDULE

DRAWING NO.	DESCRIPTION
1.	Perspective
2.	Ground Floor Plan, typical 2.storey house
3.	Elevation of typical 2 storey house
4.	Section through typical 2 storey house
5.	Ground floor slab construction
6.	In situ concrete foundation plan
7.	Main wall frame layout plan
8.	Elevation main wall frame (side)
9.	Elevation main wall frame (side)
10.	Elevation main wall frame (front and rear)
11.	Elevation main wall frame (alternative form of construction)
12.	Plan, upper floor joist frames
13.	Plan, ceiling joist frames
14.	Roof support trusses
15.	Roof panel construction and eaves detail
16.	Swaged roofing sheet detail
17.	Internal wall cladding panel
18.	External wall cladding panel (brick)
19.	External wall cladding panel (alternative finish)
20.	Section detail of ground floor slab and wall intersection
21.	Section detail of upper floor joist frames and wall intersection
22.	Plan, external wall corner coupling.

DETAIL DESCRIPTION OF THE DRAWINGS AND THE ASSEMBLY OF THE CONSTRUCTION SET.

NOTE: To illustrate the invention a design of a 2.storey, 3 bedroom house has been chosen. However the invention is a system for constructing buildings which can be applied to any structure of 1: 2: 3 storeys high and to a multiplicity of plan shapes.

DRAWING No.1.

This drawing is a perspective of a 2 storey, 3 bedroom house and garage with a brick faced external wall panel and tile roof which illustrates the invention being used to construct a house of traditional appearance.

DRAWING No.2.

This drawing shows the wall and partition layout of a house and one possible arrangement of rooms on the ground floor. The drawing is included particularly to show the external wall structure and how it forms the shell ready for fitting-out as required. The external wall comprises:-

Brick Panels (Fig.1.).
Main Frame (Fig.2.).
Internal Panels (Fig.3.).
Insulation (Fig.4.).

and windows and doors in appropriate positions. The drawing also illustrates a garage which can be constructed by the invention.

DRAWING No.3.

This drawing is an illustration of the front elevation of a 2 storey house (as shown in the Perspective (Drawing No.1.) showing the arrangement of the brick faced cladding panels and the door and windows. The drawing also shows matching cladding panels to the chimney which are manufactured units that form part of the invention.

DRAWING No.4.

This drawing is a diagrammatic cross-section through a 2 storey house the main structure of which shows the components of the invention which comprise :-

1.	The Ground Floor Slab.	(Fig.1.).
2.	Brick Cladding Panels	(Fig.2.).
3.	Main Frame.	(Fig.3.).
4.	Internal Panels.	(Fig.4.).
5.	Insulation (Wall).	(Fig.5.).
6.	Upper Floor Joist Frames.	(Fig.6.).
7.	Central Column Support	(Fig.7.).
8.	"T" Beam	(Fig.8.).
9.	Ceiling Joist Frames	(Fig.9.).
10.	Roof Support Trusses	(Fig.10.).
11.	Roof Support Panels	(Fig.11.).
12.	Insulation (Ceiling)	(Fig.12.).
13.	Fascia and Soffite Detail	(Fig.13.).

DRAWING No.5.

This drawing illustrates the construction of the ground floor slab and the layout of the component parts which comprise:-

1.	Ring or Edge Beam	(Fig.1.).
2.	Infill Panels	(Fig.2.).
3.	"T" Beam	(Fig.3.).

This drawing includes a layout plan and a cross-section. The ground floor slab is manufactured either from concrete, G.R.C, G.R.P., or such other suitable material as may be considered suitable for the purpose. It is made up in sections and delivered to the building site as a set of component parts being ready for assembly with the aid of metal plates and bolts.

DRAWING No.5. (Cont'd):

The ring or edge beam (Fig.1), is cast around a former (Fig.4), of mineral fibre, polystyrene or similar suitable material about which the structural material (Fig.5), is moulded. The component parts of the ring or edge beam (Fig.1), are bolted together with metal connectors and secured with bolts. The ring or edge beam (Fig.1), is rebated (Fig.7), on the side which adjoins the infill panels which provide the facilities to accommodate a suitable grouting material. The ring or edge beam (Fig.1), is moulded to accommodate bolts for securing the main wall frame in position. The "T" Beam (Fig.3) which is designed to run through the centre of the ground floor slab is made up in sections and delivered to the building site as a set of component parts and being ready for assembly with the aid of metal plates and bolts. The "T" Beam (Fig.3) is cast solid of material similar to that used in the Ring or Edge Beam and suitably reinforced to a design to suit the ground conditions. The "T" Beam form is inverted and the rebates (Fig.7) on each side and which adjoin the infill panels provide the facility to accommodate suitable grouting material.

When the Ring or Edge Beam (Fig.1) and the "T" Beam (Fig.3) are placed and secured into position they are coupled together squared and levelled (as described under Drawing No.6) after which the infill panels (Fig.2) are placed in position.

The infill panels (Fig.2) are cast on a former (Fig.8) of mineral fibre, polystyrene or similar suitable material which is left in position and about which the structural material (Fig.5) is moulded. Suitable reinforcement is incorporated which is designed to suit requisite ground conditions and structural requirements.

The infill panels (Fig.2) are manufactured in the factory of similar material to that of the Ring or Edge Beam and the "T" Beam and are delivered to the building site with appropriate rebates (Fig.7), on each edge which provides the facility to accommodate a suitable grouting material which when placed in position completes a composite structure that forms the ground floor slab.

DRAWING No.5. (Cont'd):

Depending upon the selected internal layout of the finished building structure, appropriate holes (Fig.11) are cast into the infill panels (Fig 2) to accommodate service pipes etc.

DRAWING No.6.

This drawing is included to illustrate one form of foundation which may be used to support the ground floor slab. The design will vary according to the ground conditions, load factors and other particular requirements; it is included for information only and does not form part of the invention.

NOTE:

Before the ground floor slab can be laid, statutory requirements make it necessary to remove vegetable growth from the building site and provide adequate support for the building. Drawing No.6 illustrates this requirement and shows a strip foundation constructed by normal building methods i.e. perimeter concrete foundation, central spine concrete foundation and concrete pads under point loads, (chimney, columns etc.). Apart from preparing the building site to satisfy the statutory requirements these foundations provide the opportunity to level and square the Ring or Edge Beam (Fig 1) by the use of mortar beds placed on foundation concrete. When the Ring or Edge Beam (Fig.1) element is completed the "T" Beam and infill panels (Fig 2) are then laid and grouted thus ensuring a square and level ground floor slab upon which the main wall frames can be erected.

DRAWING No.7.

This drawing is included to show the ground floor slab (Fig.1) of both the house, garage and the layout of the wall frames (Fig.2) located in their relative positions. The central column (Fig.3) which supports the "T" Beam over is shown and relates to the ground floor only. Excepting the single column on the ground floor the structures developed by the invention provide a totally unrestricted interior allowing for any form of internal room arrangement and to suit any specific requirement.

DRAWINGS No's 8: 9: 10 & 11

These drawings are included to illustrate the arrangement of the wall frames, in this instance the drawings show how the frames would be placed in a two-storey building (a single frame being one-storey in height).

Drawing No.8 shows the arrangement of frames made up of vertical studs where the finished wall will have no window or door openings.

DRAWING No.9 shows the arrangement of the frame made up of vertical studs where the finished wall will have two windows (the side wall of the building with an internal layout as illustrated on Drawing No.2).

DRAWING No.10 shows the arrangement of the frame made up of vertical studs where the finished wall forms the front and rear elevation of the building shown on Drawing No.2.

DRAWING No.11. shows a wall frame system where diagonal framing is employed but which incorporates the horizontal rails (Fig.1) which are required for securing the external and internal cladding.

DRAWING No.12

This drawing illustrates the arrangement of a number of floor frames (Fig 1) which are used when more than a one storey building is required. The frames (Fig.1) are manufactured in the factory of material and strength suitable for the purpose required and the frames are of sizes which can be easily handled and placed in position.

When delivered to the building site the frames (Fig.1) are placed on the top of the previously erected wall frames and locked into position. The central support for the frames is achieved by an inverted "T" Beam (Fig.2) which in turn is supported by a column (Fig.3). The complete assembly forms a rigid, braced and secure platform upon which further main wall frames can be erected and floors can be laid. The aperature (Fig.4) is provided within the design of the floor frames to accommodate a staircase or lift as required.

DRAWING No.13.

This drawing illustrates the arrangement of the frames which form the support for the ceiling and also provide the structure about which the eaves assembly is fixed. The frames (Fig.1) are manufactured in sizes which can be easily handled and placed into position. When delivered to the building site the frames (Fig 1) are placed on top of the previously erected wall frames and locked into position. The frames are made complete with appropriate bracing (Fig 2) and insulation (Fig 3). When assembled the frames are tied together by the roof truss members (as described in Drawing No.14) which when complete forms a composite rigid and braced structure.

DRAWING No.14.

This drawing shows the design and layout of roof support trusses. In the structure as illustrated on Drawing No.1 5.No. trusses are required but with the variation in building design that the invention allows, the number and design of the trusses will vary. The concept of the invention provides elements which tie the structure together to ensure a secure and safe building and give support to the chosen roof covering. The trusses marked 'B' on the Drawing span the full width or length of the building taking support from the main wall frames, (Fig.1. When these trusses are placed in position on top of the ceiling frames (Fig.2) they are locked into position and to which each of the ceiling frames are secured. The trusses marked 'C' on the Drawing are then placed into position and locked to the trusses marked 'B' thus ensuring a rigid and braced base upon which the truss marked 'A' is secured. When completed the assembly of the trusses provide a secure base upon which the roof panel assembly (as described on Drawing No.15) can be fixed. In each case the trusses comprise a Main Beam (Fig.3), a Head Beam (Fig.4) Vertical Studs (Fig.5) and Braces (Fig.6) all designed to carry the loading and stress required.

DRAWING No.15.

This drawing illustrates the roof panel and roof construction detail. The roof panels (Fig.1) are manufactured to suit the design of the building. (In the building as illustrated on Drawing No.2 a hipped roof with four sloping planes is shown). In this case 8.No. roof panels (Fig.1) are required The panels (Fig.1) are made to interlock and when placed into position are secured to the roof trusses (as described on Drawing No.14). The roof panels (Fig.1) are made up of frames (Fig.2) comprising perimeter members (Fig.3) infill rafters (Fig.4) and swaged sheeting (Fig.5) and they are manufactured to suit the design of building required and are of a size which can be easily handled. The bottom member (Fig.6)

DRAWING No.15 (Cont'd):

of the roof panel is so designed as to accommodate the top edge (Fig.7) of the eaves form (Fig.8). The eaves form (Fig.8) is a metal or plastic sheet folded to a predetermined shape which when placed in position becomes a combined fascia and soffite unit. The eaves form (Fig.8) is secured in position by locking over the top edge (Fig.7) of the bottom member (Fig.6) of the roof panel and to the ceiling joist frames (Fig.9). The eaves form (Fig.8) is provided with perforations (Fig.10) to comply with the Statutory Building Regulations currently in force.

NOTE: Before the roof tiles or slates are fixed an underfelt of bitumen sheet or plastic is laid over the swaged metal, such tiles or slates being secured with harpoons which perforate the bitumen sheet or plastic and secure it into position.

DRAWING No.16

This drawing is a detail of swaged sheeting (Fig.1) it is designed to accommodate roof tiles or slates and comprises metal or plastic form shaped to suit the gauge and lap of any selected tile or slate. The sheet is designed to be fixed to the roof panels (as described in Drawing 15) (or can be used on timber rafters in traditional building construction). The ribs are raised to provide a ledge upon which the appropriate nibs of the roof tile rests and the top of the rib is perforated to provide the facility for a plastic or metal harpoon to secure the tile or slate to the nib.

DRAWING No.17

This drawing illustrates the construction of the internal wall panel which is secured against the main wall frames and becomes the internal skin of the external wall. The panels (Fig.1) are made storey heights to suit the selected room height and of a width which can be easily handled and placed in position. The panels (Fig.1) as shown on Drawing No.17 are of a size to suit the building illustrated on Drawing No.1. The panels(Fig.1) are laminated being made up of a smooth faced board (Fig.2) on the outer face which is backed with a vapour barrier (Fig.3) of foil, felt or plastic sheet. The core (Fig.4) is of insulation material of metal or mineral construction with its innner face (Fig.5) being covered with a building paper or similar material. The panels (Fig.1) are secured in position with the aid of a metal or plastic channel (Fig.6) which is fitted all round. The top and bottom channels forming slots which fit into runners secured to the main frame and the side channels being jointed together with a metal or plastic tongue (Fig.7). When assembled the wall face throughout its height and length is smooth and flat and ready for all chosen decoration.

DRAWING No.18

This drawing shows the design of the external wall cladding panel. The panels when assembled form the weatherproof covering of the building. They are manufactured to a size and detail which can easily be handled and placed in position. The panel illustrated is of brick finish with a bonding to match traditional brickwork so that when assembled becomes a complete brick wall in appearance with a running bond. The Plan marked 'A' coincides with the section line marked 'A' and the plan marked 'B' coincides with the section line marked 'B'; when the lines are made to alternate it will be seen that a bond of brickwork in traditional style has been created. The brick face (Fig.1) of the panel is made up

DRAWING No. 18 (Cont'd):

of brickettes (Fig.2) of clay or concrete which are cast in a mould in a factory and are backed (Fig.3) by concrete or mastic material suitably reinforced (Fig.4) with mesh, rod or fibre as selected. The protruding reinforcement (Fig.4) at the top forms part of a locking device which serves as a hook for hoisting upper panels into position. The protruding reinforcement (Fig.4) serves a third purpose since it is designed to fit into the pocket (Fig.5) and over the exposed end (Fig.6) of reinforcement thus creating an interlocking system which secures the panels to the main frame.

NOTE: The assembly of wall panels is illustrated on Drawing No.22.

DRAWING No.19.

This drawing illustrates an alternative external wall panel (Fig.1) manufactured to resemble a plain face, rendered or mock timber framed finish. The panels are made in moulds and are made up from glass fibre concrete or plastic material. The principle of the fixing device is the same as that described in Drawing No.18 excepting that the lock (Fig.2) is screwed into a threaded socket (Fig.3) and a spigot (Fig.4) is cast into the pocket (Fig.5).

DRAWING No.20.

This drawing is a large scale section showing the construction of the ground floor slab, the main wall frame and the external and internal wall cladding panels and how each part relates to the other.

NOTE: The initial foundation and oversite concrete does not form part of the invention.

DRAWING No. 20 (Cont'd).

Following the construction of the ground floor slab (Fig.1) the next procedure in the erection of the structure is to place and secure into position the main wall frame (Fig.2). First the ground floor slab (Fig.1) is coated with a bitumen or other form of waterproof liquid material over which is laid a plastic or bitumen felt waterproof membrane (Fig.3) which covers the entire surface of the ground floor slab. A metal or plastic base plate (Fig.4) is then laid around the perimeter of the ground floor slab and bolted to the ring beam (Fig.5). The base plate is provided with spigots (Fig.6) in predetermined positions which locate the main wall frame (Fig.2) and the external wall cladding panels (Fig.7). When placed in position the wall frames are secured to the base plate and coupled together at the corners to provide a rigid and framed structure. When the wall frame is erected the external wall cladding panels (Fig.7) are placed in position. These panels comprise an inner and an outer lap as shown on Drawing No.22, the outer panel holding the inner panel into position. The inner panel is first placed in position and temporarily held in place while the outer panel is fixed. This is achieved by placing the spigot (Fig.8) of the outer panel over the spigots (Fig.6) in the base plate and securing the outer panel at the top with a fixing device (Fig.9) which clips over the panel back (Fig.10) and a rail (Fig.11) which is attached to the main wall frame. Before the outer panel is placed against the inner panel a plastic bead is located between each panel (as shown on Drawing No.22) which provides a weather-tight joint. This process is carried on throughout the length of the wall which when complete provides the base upon which the next row or panels (Fig.12) are bedded. The process is then continued up the building until the whole wall is finished.

DRAWING No. 21

This drawing is a large scale section showing the construction of the external wall and its intersection with the upper floor. It also shows the detail of the central supporting column and "T" Beam. When the main wall frames (Fig.1) are in position the upper floor frames (Fig.2) are placed and secured into position. (This provides the base upon which the main wall frames (Fig.3) for the 1st and 2nd storey structure can be erected). When the span for the upper floor frames becomes too great to be properly supported between the outer wall frames a central support is necessary. This support comprises an inverted "T" Beam (Fig.4) which is secured to the upper floor frames (Fig.2). The "T" Beam (Fig.4) is supported centrally by the insertion of a column (Fig.5) which is coupled at the top to the "T" Beam (Fig.4) and rests upon the ground floor slab (Fig.6). When the upper floor panels (Fig.2) are secured into position the main wall frames (Fig.3) are then placed and secured into position and the process of fitting the external wall cladding panels (Fig.8) continues (as described in Drawing No.20) until the wall structure is complete.

DRAWING No.22.

This drawing is a large scale plan which shows the construction of the corner of the building. When the main wall frames (Fig.1) are placed into position on the ground floor slab or the upper floor frame they are secured at the corners with a locking device (Fig.2). The device comprises a swing bolt (Fig.3) which has a spigot (Fig.4) attached. The spigot (Fig.4) fits into a socket (Fig.5) which has been incorporated in the main wall frame (Fig.1) during the manufacturing process in a predetermined position. Attached to the main wall frames (Fig.1) in opposing positions are brackets (Fig.6) which are located to receive the shaft (Fig.3) of the locking device when swung into position. To lock the two main wall frames (Fig.1) together the shaft (Fig.3) of the locking device

DRAWING No. 22 (Cont'd)

is fitted with a screwed end and nut (Fig.8) which falls into a slotted plate (Fig.9) where it is tightened as required, thus locking the frames together. This device is fitted in several places as required at each corner where the main wall frames (Fig.1) meet. The Drawing also shows the external wall cladding panels (Fig.10) held in position. This is achieved by ties (Fig.11) secured to the rail (Fig.12) which in turn is fixed to the main wall frame (Fig.1) at one end and over the hooks (Fig.13) provided at the top of the wall cladding panel (Fig.10). (The method of fixing these panels has been described in Drawing No.20).

CLAIMS

1. An engineered house comprising a steel framed structure designed to support the walls, floors, ceilings and roof and an outer wall panel system which provides a weatherproof and insulated building assembled from factory made components manufactured to engineering standards and tolerances.

2. The structure as described in Claim 1 is designed to be assembled by a system of self-locating and locking devices which provide a rigid and secure structure when all the components are placed in position.

3. The structure as described in Claim 1 is designed to be assembled on preformed foundations (not part of the invention) by people with simple do-it-yourself skills and does not rely upon the skills of trained building operatives.

4. The structure as described in Claim 1 is a designed weatherproof and insulated building shell which enables the interior to be fitted out with partitions and services to any number of alternative selected architectural forms and/or specifications.

5. The structure as described in Claim 1 provides a building, when complete, of traditional appearance; either brick and tile, stone and slate or any combination thereof.

6. The structure as described in Claim 1 is flexible in its concept providing numerous alternative plan and elevational shapes and internal layouts, to suit any specific requirement for living or working uses.

7. The structure as described in Claim 1 and with its main frame being manufactured from non-corrosive and rust protected metal has a life expectancy at least equivalent to similar structures built by traditional building construction methods.

8. The structure as described in Claim 1 being a building designed for ease of assembly by non-professional building operatives provides an opportunity for the acquisition of preformed factory made units for 'self build' purposes which enables such persons or groups who wish to construct and occupy such structures to build for themselves thus saving the need for expensive on-site professional skills.

9. The structure as described in Claim 1 is capable of being constructed to provide a weatherproof structure within a very short time since it is designed to be put together with easy to handle preassembled components and without the need for on-site wet trades (except for the foundations).

10. The structure as described in Claim 1 is suitable to provide a rapid replacement of quality homes which may be required after natural (or otherwise) catastrophies as well as for the individual requirement.

11. The structure as described in Claim 1 and because of the flexible nature of the design, makes it suitable for development in any climate conditions and through any temperature range normally experienced by building structures.

12. The structure as described in Claim 1 and because of the designed method of construction is far less susceptable to damage by fire than structures built with the traditional brick and timber components since the amount of combustable material used in the components of the invention is substantially less than that required for the traditional buildings.

13. The structure as described in Claim 1 is designed to comply with all the appropriate Building Codes and Regulations which presently control the construction of buildings and can be easily adapted to comply with any reasonable amendments which may occur thereto in the future.

14. The structure as described in Claim 1 has a total weight of about half that of a traditional brick built structure of the same accommodation and size and therefore imposes less loading on the ground thus reducing the site foundation size and costs.

15. The structure as described in Claim 1 comprises components designed for ease of transportation and handling such components requiring no more than the normal long wheel-base lorry to carry the largest of the units.

16. The structure as described in Claim 1 requires no more than three persons of reasonable strength and with normal do-it-yourself skills to erect the superstructure assisted only with a small portable crane for hoisting the frames, first floor and roof components in position.

17. All the component parts of the structure as described in Claim 1 which are exposed to the weather conditions are made up from units with maximum weather resistance and therefore the exterior of the finished building has an extremely low maintenance requirement.

Published 1988 at The Patent Office, State House, 66/71 High Holborn, London WC1R 4TP. Further copies may be obtained from The Patent Office, Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd. St Mary Cray, Kent. Con. 1/87.