This invention relates to houses, cottages, garages, and like structures that may be constructed of concrete or like material poured or otherwise placed between forms or shuttering in such a manner, and with the material in such a condition that it sets or hardens in the position that it is constrained to occupy, and so forms a part, or the whole of the structure.

Existing systems of construction are well known wherein the walls, and other parts of structures, are formed in this way.

It has hitherto been proposed to erect structures of concrete or like material by pouring or placing the material in a liquid or plastic state between suitable moulds or shuttering frames which are either left in position or are removed entirely or in part after the material so placed has set. In such a method of construction it has also been proposed to place or fix in position between the interior and exterior leaves of the mould the frames or joinery for the windows, doors and other openings with which the wall is to be provided, so that such frames are cast integral with the wall structure. It has further been proposed to provide for the plastering of such walls without manual labour by arranging the moulds or shuttering frames to form a cavity into which the material for the plaster layer is placed or piled, the cavity being formed either between two leaves of the mould, or between the face of the erected wall and one leaf of the mould.

This present invention differs from the foregoing both in the method and in the apparatus essential to the method. In the method one difference is that the plaster layer is not confined in any cavity, and is applied to the vertical surface or surfaces of the shuttering before the material for the main body of the wall is placed in position. Another difference in method is that the various frames or joinery for the openings to be provided in the wall are not fixed directly to the shuttering, but are carried in pattern frames which are afterwards removed when the wall has been cast and has set. These removable patterns also form the wall adjacent to openings and in other positions to any desired shape.

In the apparatus the principal difference is in the use of pattern frames previously referred to, and in the construction of the shutter plates with a plurality of easily plugged holes that provide for the attachment of the pattern frames and similar units in any position on the surface of the shuttering.

In order that the system, and the various appliances for use in the system, may be the more fully understood, reference is made to the drawings left with the provisional specification which illustrate the more important details. In these drawings Fig. 1 shows a part of the foundation necessary. Fig. 2 shows the method of erection of part of the shuttering. Fig. 3 shows in sectional plan and front elevation, a typical example of pattern, or fixing unit, for fixing a window frame in position. Fig. 4 shows the shuttering completedly erected.

In erecting a structure by this system, the foundation is first laid either in the usual way, or preferably by means of shuttering similar to that used in this invention for the erection of the walls. This foundation is formed at its top edge with a ridge, as shown in Fig. 1. This ridge is not continuous around the foundation, but is interrupted at intervals by small gaps A. The purpose of this ridge is to separate the shutter plates the distance apart required to form the walls, whilst the gaps A provide a space for the clamps that are used to secure the shutter plates in position. This ridge also provides a ledge upon which the floor joists rest either directly or upon wall plates.

The floor joists are then laid in position, and the shuttering to form the inner face of the wall is erected. This shuttering consists of a number of flat units, of sheet material suitably ribbed and braced for strength, and provided with means for their connection together edge to edge to form a continuous length. The method of edge connection may be by bolts or clamps but is best performed by wedges passed through coincident holes or slots in the adjoining flanges or edges of adjacent plates. Each unit plate is of a suitable width, and is preferably equal in height to one story of the building to be erected. These plates are constructed with one smooth and plain face, and are provided with a number of small holes so that the pattern or fixing units, to which reference has previously been made, may be attached easily by screws, bolts, clamps, or the like. The unit shutter plates may be erected by various ways, but are preferably erected by the
use of clamps and struts as shown in Fig. 2. In this method the shutter units take bearing at their lower edges upon one or more clamps that are located in the gaps in the ridge of the foundation shown at A in Fig. 1. These clamps shown B Fig. 2 are arranged to clamp in position, at the foundation, either the inner shutter plates, or both the inner and outer shutter plates. The top edge of the shutter plates is held in position by struts shown C Fig. 2, that take bearing on the floor joists, or other convenient points at one end, and are attached either permanently or removably to the top of the shutter plates at the other end.

With the foundation laid, and the shutter plates for the inner surface of the wall erected, the construction is substantially as shown in Fig. 2.

The formed patterns are now attached to the face of the shuttering in the positions required. The patterns, or fixing units, are constructed to hold the various parts of the structure that are to be inserted in the required positions, and they are formed to the shape to which it is required to cast or mold the wall adjacent to the part inserted. A typical pattern, or fixing unit, for the insertion of a window frame, is shown attached to a part of a shutter plate in Fig. 3. In this example D is the window frame which is held by the two parts of the pattern or fixing unit E¹ and E². The frame is provided with anchors F. The two parts E¹ and E² are bolted together with the window frame between them to form one complete unit which is attached to the shutter plate F by the screws G¹ and G². These screws G¹ and G² are inserted through holes in the shutter plates which are previously bored to a hollow or countersink face on the wall side of the shutter plate. The purpose of this hollow or countersink is to retain clay, or like plastic material, which is used to fill the holes in the shutter plates that are not occupied by securing screws or covered by patterns or fixing units. With shutter plates provided over their entire area with holes substantially of this construction it is possible to attach parts in any position on the entire surface and to easily plug or fill the holes not covered or in use so that a smooth and unbroken surface is maintained.

When all the patterns or fixing units carrying the various component parts or sections of the structure requiring to be inserted have been attached in the correct positions on the erected shutter plates, the holes in the plates and the crevices and cracks that might possibly occur in erection are filled or made good with plastic material in order that the structure when cast shall have the required formation and the necessary smooth face.

The surfaces of the shutter plates and of the fixing units attached are now plastered rendered or rough cast. This plastering is preferably performed with a "cement gun" or similar spraying apparatus, as by this means it is the most quickly performed. It is not necessary to float the plaster, or bring it to a smooth surface as the exposed surface merely combines with the concrete of the structure which is subsequently placed in position, whilst the surface in contact with the plates and patterns which ultimately becomes the surface of the wall, is rendered smooth by its contact with the smooth surface of the plates and patterns. The object of this plastering of the inner wall face shutter plates is to enable a good quality material to form the inner surface of the wall, and to enable the impervious composition wall to be faced with the material of porous composition to prevent the "sweating" of the walls in the finished structure.

In order that this plastering may be successfully performed, it is essential that the surfaces of the shutter plates to which the layer of plaster, concrete or like material is applied are so treated as to be smooth, and without any fine interstices into which the material applied can penetrate. Either galvanizing or vitreous enamelling or like finishing will give this necessary smooth surface.

The object of this finish is to impart a smooth surface to the face of the layer of material applied to the surface of the shutter plate, and to ensure that such material when it has set does not adhere to the shuttering.

With shuttering not provided with such a surface, it is always necessary to adopt provisions, such as greasing the shuttering, to prevent the plaster, concrete or like material from adhering to the shuttering when set. This adhesion occurs through the penetration of the concrete plaster or like material into the fine interstices of a surface not smooth, glazed or the like. With a smooth or glazed surface, the material, applied substantially as described, will adhere when in a wet or plastic state, but will cease to adhere when the moisture has dried out from the material. In this method of applying a plaster layer therefore, the adhesion resulting from the presence of moisture in the material is depended upon to retain the plaster layer in position until it has set or hardened. When such material has set or hardened, it remains in position against the face of the shuttering because the various projections such as fixing units and the like act as plaster keys, and the then substantially solid layer is held in position by being attached to these keys at various points.

When applying to the surface of the
shutter plate the layer of concrete, plaster or like material in its wet or plastic state, a thin layer should first be applied over the entire surface of the shuttering that it is required to cover. When this thin layer has partially set or hardened, and is therefore possessed of a greater strength than when first applied, the layer can be built up by the application of one or more layers of material of similar thickness. If the full thickness of plaster layer required is applied in one application, as distinct from being built up by repeated applications, then the adhesion due to the moisture may not be sufficient to support the weight of such a layer in a plastic condition, and it may not remain in the position in which it is applied. By building up the thickness required substantially as described, a layer of the required thickness may be applied with certainty.

In this manner is applied the layer of concrete, plaster or like material with which the wall is to be faced. The outer shutter plates are now erected in position. These plates are similar in construction to those used for the inner wall face as previously described, and they are held in the erected position preferably by clamps connecting with the shuttering for the inner wall face substantially as shown in Fig. 4. In this illustration H is part of the foundation which carries the floor joists J and which has erected upon it the two series of shutter plates F₁ and F₂, of which F₁ is the plate for the inner surface of the wall, whilst F₂ is the plate forming the outer surface of the wall. These plates are preferably held in position by clamps B, which fit in recesses in the foundation, and at the top by the strut C, as previously described. The clamp K at the top of the shutter plates retains the outer shutter plates in the required vertical position. The pattern, or fixing unit E, is shown in position secured to both the outer and inner shutter plates by the screws G₁ and G₂. The shuttering to the inner wall face as well as the parts of the pattern or fixing units shaped to form the wall adjacent to the part it is used to insert are both coated with a layer of plaster or porous composition. Attached to the top of the inner shutter plate is shown the unit L, which is used to form a ridge at the top of the wall cast in situ so that the erection of the walls for the next story can proceed in a similar way to that adopted for the walls of the ground floor.

With these appliances erected in this manner the cavity between the shutter plates is now filled with concrete or like material of an impervious nature to prevent the penetration of moisture. When this concrete has set or hardened the shutter plates are removed, the clamps withdrawn, and the various patterns or fixing units unbolted from their positions in the various sections or component parts that they have been used to insert. The walls forming successive stories are erected in a similar way whilst the party walls and partitions required in the structure are erected either by similar means, or by the usual lath and plaster or slab construction.

To facilitate the erection of party walls or partitions, vertical reisses are formed in the inner face of the outer walls by suitable forming units attached to the surface of the inner shutter plate at the positions where the party walls or partitions abut so that a register, key, or bonding is formed between the two walls. In casting internal walls in situ a material of porous nature may be used as these walls are not required to be weatherproof or to resist water percolation. In these walls, therefore, the preliminary plastering need not be applied to the surface of the shutter plates, the porous material being placed direct between the shutter plates after the attachment of whatever fixing or forming units are required for the formation of these walls.

Although metallic reinforcement is not essential in the type of structure for which this system is primarily intended, such metallic reinforcement may easily be inserted during the erection of walls constructed according to this method. To reinforce the plaster layer applied to the surface of the shutter plate either to strengthen it in its erected state, to ensure its complete amalgamation with the main body of the wall, or to facilitate either the use of wire or wire in the form of areas or strips of mesh netting would be used. This wire would be arranged vertically near the surface of the inner shutter plate to provide a key or reinforcement for the plaster in which it would be either partly or completely imbedded. To reinforce the main body of the wall over openings, at corners, or at other places where increased strength would be desirable, metal rods of the form generally used in reinforced concrete would be secured in the required position prior to the erection of the outer shutter plates. Such reinforcement would be secured by suspension or by support from the fixing units, or by special fixings preferably attached through the holes in the shutter plates.

What I claim is:

1. A method of casting a wall in situ between shuttering, comprising the temporary erection of one side of the shuttering, the attachment thereto of a core mould, the plastering of the inner face of the erected shuttering and parts of the core mould, the temporary erection of the other
side of the shuttering in spaced relation to the side first erected, the filling of the remaining space between the shuttering with a suitable composition for the main body of the wall and afterwards the removal of the shuttering and core mould.

2. A method of casting a wall in situ between shuttering comprising the laying of a foundation with a recessed ridge, the temporary erection of one side of the shuttering clamped to said recessed ridge, the attachment to the erected shuttering of a core mould, the plastering of the inner face of the erected shuttering and parts of the core mould, the temporary erection of the other side of the shuttering in spaced relation to the side first erected, the filling of the remaining space between the shuttering with a suitable composition for the main body of the wall, and afterwards the removal of the shuttering and core mould.

3. A method of casting a wall in situ between shuttering comprising the temporary erection of one side of the shuttering, the attachment thereto of a core mould carrying detachably an aperture frame to be embedded in the wall and the plastering of the inner face of the erected shuttering and parts of the core mould adjacent thereto prior to the erection of the other side of the shuttering and to the filling in of the material for the main body of the wall.

4. Apparatus for casting a wall in situ upon a foundation, comprising a shutter plate adapted to be clamped on said foundation, said shutter plate having a number of countersunk holes distributed over its surface, a core mould constituted in detachable sections adapted to carry an aperture frame and to be secured to said shutter plate by devices penetrating certain of said holes, and a second shutter plate adapted to be clamped on said foundation in spaced relation to said first shutter plate.

5. Apparatus for casting a wall in situ upon a foundation, comprising a shutter plate adapted to be clamped on said foundation, said shutter plate having a number of countersunk holes distributed over its surface, a core mould adapted to be secured to said shutter plate by devices penetrating certain of said holes, and a second shutter plate adapted to be clamped on said foundation in spaced relation to said first shutter plate.

In testimony that I claim the foregoing to be my invention, I have signed my name this 16th day of March, 1927.

GEORGE WILLIAM RAWLINGS.