M. M. SMITH.

METHOD OF CONSTRUCTING WALLS OR BUILDINGS.

APPLICATION FILED SEPT. 13, 1920.

1,402,906.

Patented Jan. 10, 1922.

3 SHEETS—SHEET 1.

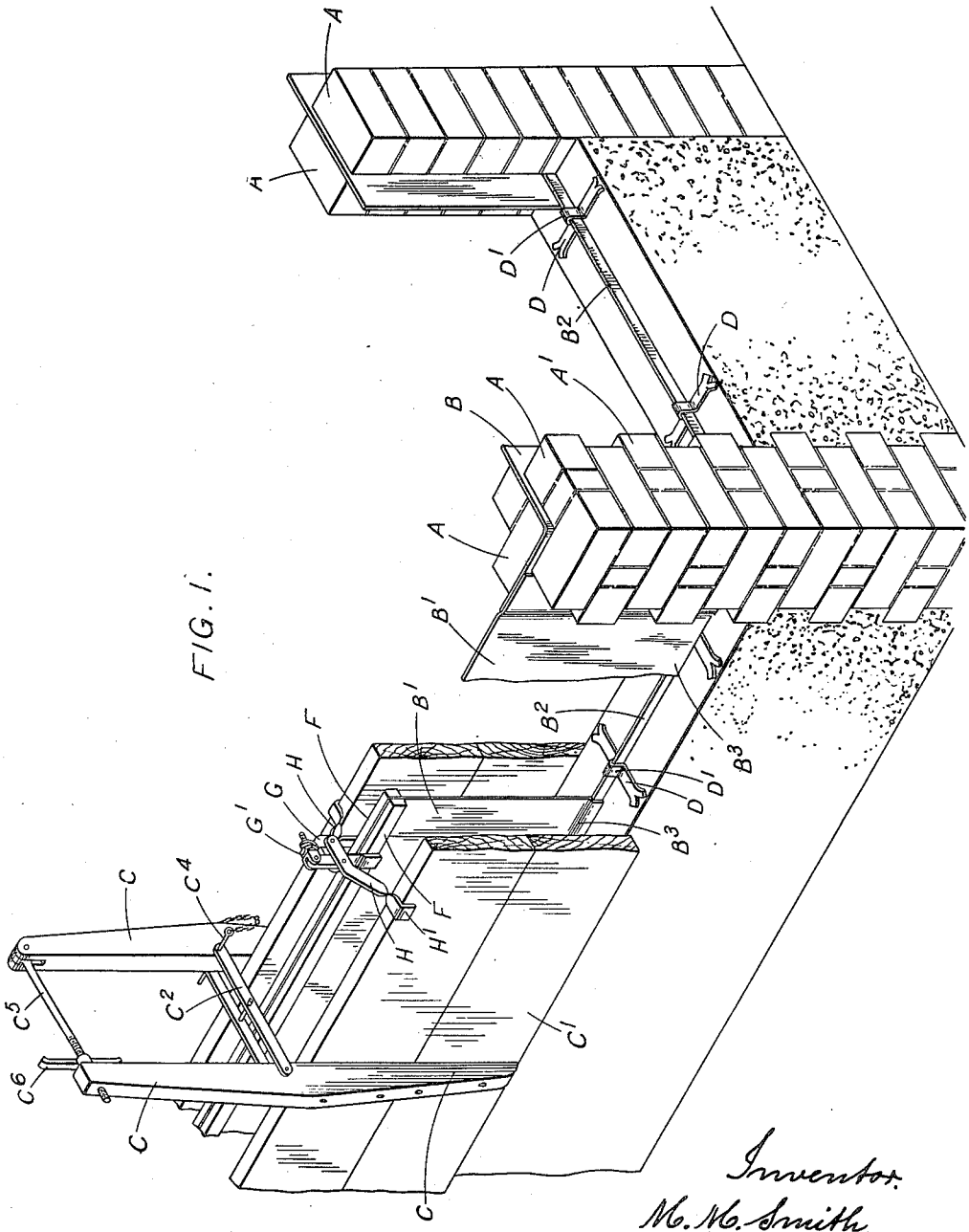


FIG. 1.

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3 SHEETS—SHEET 2.

FIG. 2.

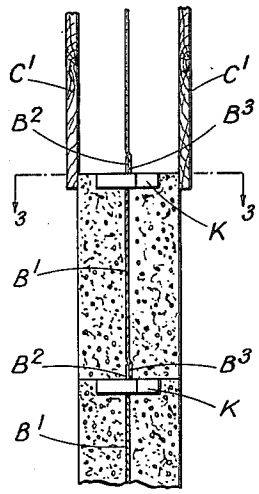


FIG. 3.

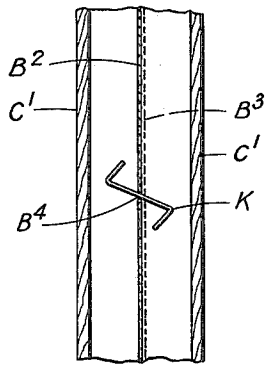
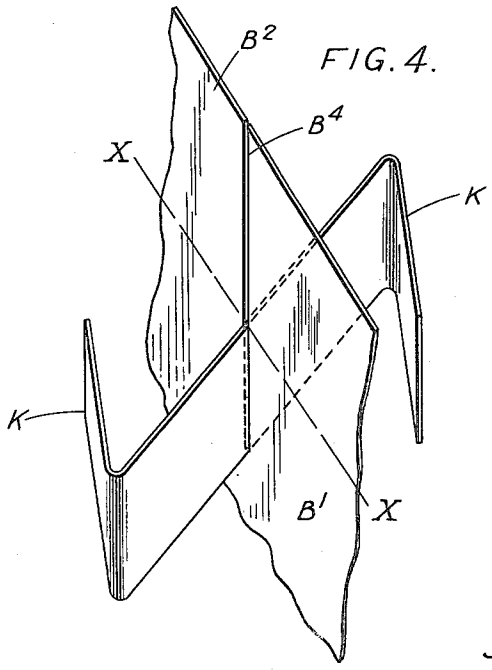


FIG. 4.



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3 SHEETS—SHEET 3.

FIG. 5.

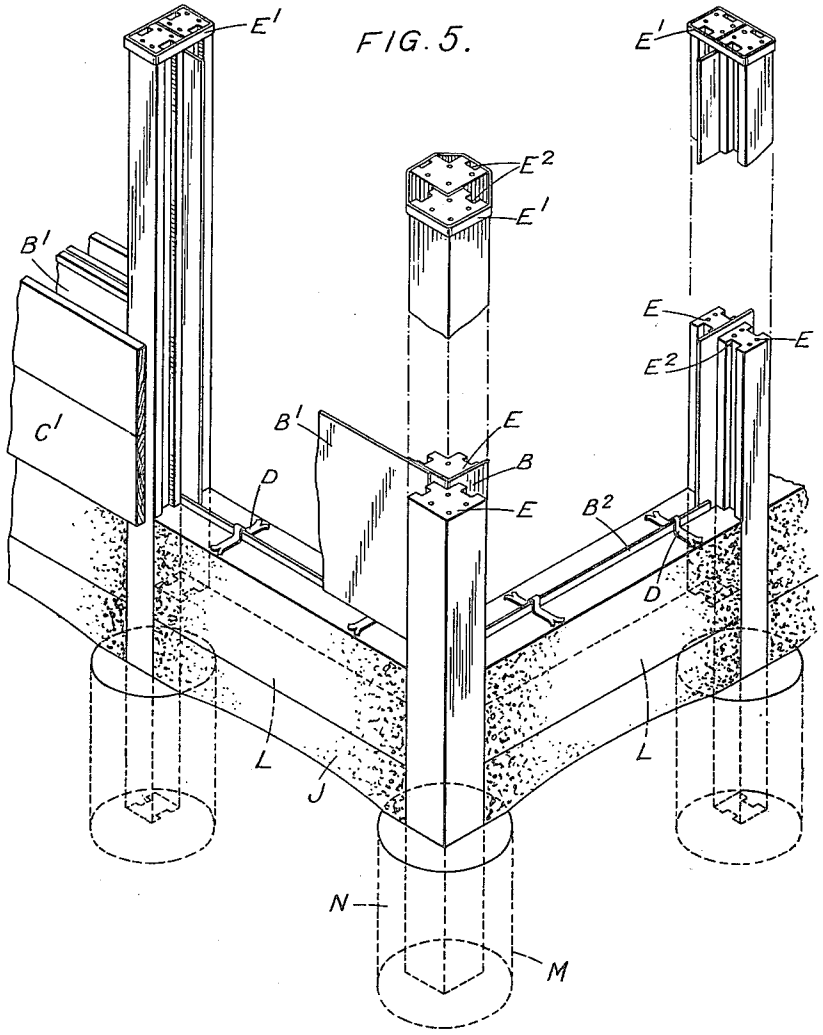
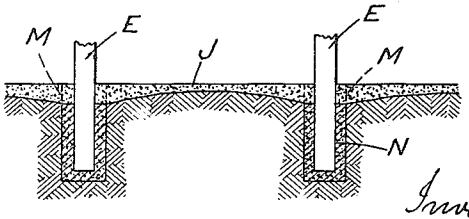


FIG. 6.



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UNITED STATES PATENT OFFICE.

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METHOD OF CONSTRUCTING WALLS OR BUILDINGS.

1,402,906. Specification of Letters Patent. Patented Jan. 10, 1922.

Application filed September 13, 1920. Serial No. 409,879.

To all whom it may concern:

Be it known that I, MAXWELL MABERLY SMITH, a subject of the King of England, and residing at Henley-on-Thames, Oxfordshire, in England, have invented a certain new and useful Improved Method of Constructing Walls or Buildings, of which the following is a specification.

This invention relates to an improved method of constructing a wall or building of the kind in which a vertical damp-proof core is disposed between two thicknesses of concrete or the like which are united by suitable ties.

The object of this invention is to simplify the erection of such walls and enable them to be constructed more rapidly and economically than heretofore.

According to this invention a curtain of flexible damp-proof sheeting of approximately the same dimensions as the "course" to be formed is suspended so as to hang vertically and centrally within a mould into which concrete is then poured on either side of the sheeting. When forming horizontal courses, the upper edge of the sheeting projects beyond the edge of the concrete course formed in the mould and the lower edge of a similar sheet in the course then similarly formed above it overlaps this projecting upper edge in the course below it, so as to ensure continuity in the vertical core. Alternatively the wall may be formed as a series of adjacent vertical courses or sections in which case the lateral edges of the sheeting will project beyond the vertical edges of the wall so as to overlap the adjacent edge of sheeting in the section next formed. Since the two thicknesses of concrete are separated throughout the height of the wall by the damp-proof core, means must be provided to unite these thicknesses together and such means must be so designed as not to interfere with the overlap between adjacent sheets of waterproof material. According to this invention the sheeting, (which is preferably of the known bituminous type) has at suitable intervals cuts or slits formed in it through each of which is passed a metal strip disposed on edge and having its ends turned over so as to form the letter Z. The ends of this tie are embedded in the concrete and the pressure of the latter forces the sides of the relatively sticky sheeting into close contact with the surface of the tie, so as to prevent moisture passing therethrough. Such ties may be inserted in the sheeting at suitable intervals before it is hung in the mould, or preferably, the ties are inserted in cuts formed in the upper projecting edges of the sheeting and are pressed down into the concrete before it sets. The overlapping lower edge of the sheeting in the next course will then seal the cut in the projecting upper edge. Alternatively the tie is not pressed down into the concrete but also engages similar slits formed in the overlapping lower edges of the sheet in the course above. As the tie is turned at an angle to the plane of the cuts, when the pressure of the concrete is exerted upon the faces of the sheeting, the two overlapping edges are, as it were, welded together and the edges of the cuts forced into intimate contact with the surfaces of the tie.

Yet again a tie having a bent central portion to bridge the projecting edge of the sheeting may be used and this will not interfere with the overlap since the sheeting being flexible, and to some extent sticky when subjected to pressure, the weight of the concrete will force the overlapping edges into close contact with one another and thus "weld" them together even in the vicinity of the ties.

To facilitate the construction of a concrete wall and in particular to simplify the building of the corners or angles, piers, (having their lateral surfaces recessed or grooved and each comprising two thicknesses of material with damp-proof sheeting disposed vertically between them so as to be overlapped by the lateral edges of the sheeting in the main part of the wall above described) are erected at the angles and at suitable intervals in the length of the wall. Such piers may be formed of brickwork or concrete blocks, built up course by course or may comprise two substantially similar pre-cast posts, having damp-proof sheeting between them and provided with recessed or grooved edges to receive the concrete and secure an overlap with the lateral edges of the sheeting in the poured part of the wall.

Whether such piers are built up from bricks or blocks, or comprise pre-cast posts, they serve as a guide for vertically and constitute a gauge for the poured concrete walls, the ends of the mould boards being made to grip these posts by clamping members hereafter described, so that in effect the piers also form the ends of the mould. When

pre-cast posts are used, these may be erected at suitable intervals or in masses of concrete in cylindrical holes in the ground, a shallow arch of concrete with the earth beneath it as a centering being formed between the cylindrical concrete blocks which thus constitute abutments for the arch and produce a bridge upon which the wall can be erected in the manner described.

The apparatus employed to suspend the sheeting within the mould and to clamp the mould boards in place may vary, one construction being illustrated in the accompanying drawings by way of example and hereafter more fully described.

In the accompanying drawings,

Figure 1 is a perspective view showing a portion of a building in the course of erection with brick piers.

Figure 2 is a vertical cross section through a concrete wall in the course of construction showing an alternative form of wall tie.

Figure 3 is a plan on the line 3—3 of Figure 2.

Figure 4 is a perspective view, on an enlarged scale, of the wall tie shown in Figures 2 and 3.

Figure 5 is a perspective view, similar to Figure 1, showing a building in the course of erection having pre-cast piers, and

Figure 6 is a diagram, on a reduced scale, showing in vertical section one method of supporting in the ground the lower ends of pre-cast piers and of forming a bridge-like foundation.

In constructing a building or wall as illustrated in Figures 1 and 2, the ground is prepared by digging a relatively shallow trench of the necessary width and filling it with concrete. On the surface of the concrete is laid a damp course of suitable material and brick or block piers are now erected at the angles and such intermediate points in the length of the wall as may be desirable, the height of each pier being approximately equal to that of the first course of the concrete wall. Each pier comprises two layers of brickwork A preferably having toothed sides as shown at A′ and the waterproof sheeting B is disposed between the two layers of brickwork. The lateral edges of the sheeting extend beyond the toothed sides of the piers as shown in Figure 1. Mould boards are now erected between two adjacent piers and fixed in position by means of the apparatus shown on the left hand side of Figure 1. In the construction illustrated in Figure 1, it is assumed that the wall has already been carried up above the foundation level and the ends of the mould boards, which in practice grip the outer surfaces of the piers, are shown broken away so as to illustrate more clearly the characteristic features of the invention.

The apparatus used to support the mould boards in position comprises a pair of vertical board-supporting members C the lower ends of which are preferably bolted or otherwise connected to their respective boards C′. A short distance above the upper edges of the mould boards C′ the members C are pivotally connected by a cross tie or distance piece C^2 which may be provided with a series of holes C^3, thus enabling the gauge or distance between the boards to be varied, adjustable pins C^4 at one or both ends of the links C^2 serving to connect the vertical members to the link. A screw-threaded strut C^5 is pivotally connected to the upper end of one of the members A and adapted to engage a socket in the upper end of the opposite member, this strut being provided with an adjustable nut or the like C^6 whereby the distance between the upper ends of the arms C can be varied.

In operation, the tie C is set to the required gauge corresponding to the width of a pier and the lower edges of the mould boards are made to grip the upper edges of a completed course as shown in Figure 2. The effective length of the strut C^5 is then adjusted by means of the nut C^6 to cause the lower edges of the mould boards to grip the completed portion of the wall, thus providing a mould for the next course which is free from any cross connections or interruptions of any kind. The length of the mould boards and the number of supporting members C will vary in accordance with the nature of the wall.

In the construction illustrated in Figure 1 the damp-proof sheeting B′ is suspended from the top of the mould boards by means of battens F which grip the upper edge of the sheeting during the pouring process. The battens are secured to arms G, the upper ends of which are held apart by means of a screw-threaded strainer G′ so as to cause the battens to grip the sheet. This clip thus formed is provided with lateral extending arms H which rest upon the upper edges of the mould boards C′, the ends of these arms being preferably flanged or bent over as at H′ to engage the outer faces of the boards and so centre the sheeting.

In all cases as the cross tie connecting the mould boards is disposed above the upper edges of these boards, so that the boards are maintained parallel to each other and at the required distance apart, the part of the wall being moulded is free from any cross ties or other loose members which will perforate the core or sheeting.

As illustrated in Figures 1 and 2 the waterproof sheeting B′ is so suspended that its vertical edges overlap the projecting lateral edges of the sheeting B interposed between the piers so that in a vertical direction there is no break. The concrete is poured to a height to leave about one or two

inches of the upper longitudinal edge of the sheeting projecting from the concrete. Such a projecting portion is illustrated at B^2 in Figures 1 and 2. Wall ties D (see Figures 1 and 5) are now placed on the top of this concrete course, each tie comprising a strip of wrought iron or other suitable material having its central portion D′ doubled upon itself at right angles to the ends so as to form a loop. When placed in position, as shown in Figure 1, the central portions D′ of the ties bridge over and embrace the projecting edge B^2 of the sheeting while the ends of the ties lie on the top of the concrete course. In this way the whole of the first course of concrete is poured by proceeding round the building.

Instead of using the wall ties D shown in Figures 1 and 5, a tie similar to that shown in perspective in Figure 4 and in plan in Figure 3 is preferably employed. Such a tie, which can be cheaply formed from strip metal, comprises an approximately Z-shaped member K adapted to be inserted in a slit B^4 cut in the sheeting B^2 to a depth which enables the tie being forced into the concrete below the top of the course as shown in Figures 2 and 4, the dotted line x—x indicating the level of the top of the course in Figure 4. The upper part of the slit B^4 will be sealed by the overlap of the edge B^4 next above it. Alternatively the slit B^4 need not extend below the line x—x and a similar cut will be formed in the lower edge of B^4 of the overlapping sheet. Yet again, instead of the slit B^4 being formed at the edge of the sheet it may be cut with a knife at some point away from the edges of the sheet and the tie K inserted therein before the sheet is suspended in the mould.

In all cases the plane of the cut B^4 is made at right angles to the plane of the sheet, and since the tie K is not at right angles to the plane of the sheet, the edges of the cut or slit will be slightly distorted from the plane of the sheet. When therefore the pressure of the concrete bears upon the opposite faces of the sheet, the edges of the cut are pressed back into their original plane and so closely grip the metal tie, the sticky nature of the sheeting ensuring a damp-proof union between the tie and the edges of the slit.

When the first course has been completed the piers can be built up to the next stage, i. e. to the height illustrated in Figure 1, whereupon the next concrete course is poured in the same way, the lower edges of the mould boards C′ gripping the upper edge of the completed course, as illustrated, and the ends of the mould boards as before gripping the outer faces of the piers. The damp-proof sheeting B′ is suspended between the mould boards by means of the apparatus already described so that its lower edge B^3 will overlap the projecting upper edge B^2 of the sheeting in the completed course next below it.

Where pipes are to be carried through the walls, the necessary holes are made in the damp-proof sheeting and pipes or wooden plugs laid in to form a core while the concrete is being poured. Where internal walls at an angle to the main wall are required, wooden pieces of the necessary dimensions may be inserted in the moulds of the main wall so as to form on its interior recesses to receive the ends of internal walls as these are subsequently poured. Metal ties as above described are employed in the piers to engage the two thicknesses thereof, their operation being the same as in the length of the concrete wall.

Referring to the constructions illustrated in Figures 5 and 6, in place of the built-up piers above described, pre-cast concrete posts or piers are employed at angles of the building and at suitable intervals in the length of the wall. Each pier comprises a pair of pre-cast posts E disposed one behind the other with damp-proof sheeting B between the posts. Each post is substantially rectangular in cross section and in the arrangement illustrated the outer post in each pair is of such length that a portion of it can be sunk into the ground while that part extending above the ground level has a height equal to that of the wall it is desired to build. The inner posts in each pair are bedded upon the horizontal damp-course as shown at L in Figure 5. Alternatively, the posts may be formed in sections adapted to interlock with one another or extension members of the desired length may be attached to the upper ends of the posts to give them the necessary height. Each pair of posts is tied together by one or more straps such as E′ or keys may be provided.

The lateral edges of each post are grooved or recessed at E^2 or these surfaces of the posts may be otherwise formed to ensure engagement with the concrete extending between the pairs of posts.

In operation, damp-proof sheeting B is clamped between each pair of posts so as to extend laterally therefrom and the lower ends of the posts are placed in a hole in the ground of suitable depth. Preferably, cylindrical holes M (Figure 6) are formed in the ground by means of an earth borer and a concrete bed is laid at the bottom of the hole. The lower ends of the posts are bedded on the concrete and the space around the post is then filled in and rammed with concrete or other material to form a seal against water percolation at the base of the footing.

Between the several pairs of posts the wall (which is formed in the manner already described) is carried on a comparatively shal-

low trench since such a wall can be arranged to take a bearing at each of its ends on the deeper foundation constituted by the concrete filling N of two or more pairs of piers. Thus the wall extends after the manner of a bridge between the posts or between the concrete fillings N in the holes M. Such a bridge can be either reinforced or in the form of a flat arch with the earth beneath it as a centering. The cylindrical masses of concrete N constitute abutments for the arch or bridge J, a trench of the desired shape communicating at each end with the holes M being preferably dug before the posts are connected, so that as soon as the posts have been set up the concrete arch J may be poured and thus formed in one with the abutments N. Alternatively, pre-cast bridge members J, which may be reinforced, are employed where the nature of the wall renders such a course advisable.

A building having walls in accordance with this invention may comprise brick corner piers and pre-cast intermediate piers or vice versa. Where doorways, windows or like openings are required, the waterproof sheeting is made to project into the opening so as to overlap the lintels, sills, framework or the like which is subsequently inserted into such openings.

Although primarily intended for use with walls of concrete, the invention is equally applicable to walls of brick, blocks or slabs, and the mould supporting apparatus and other parts of the invention can also be employed with any wall which, though not formed actually of concrete, is composed of some substance of a like nature which can be poured and which subsequently sets.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A method of building a wall which consists in suspending flexible damp-proof sheeting so as to hang vertically within a mould, pouring concrete into the mould on either side of the sheeting and thus forming a course above which the edge of the sheeting projects, superimposing on said course another similar course so that the lower edge of the sheeting in the upper course overlaps and makes contact with the sheeting projecting above the level of the under course and uniting the two layers of concrete on either side of the sheeting in each course by metal ties so shaped and disposed as not to interefere with the overlap of the sheets.

2. A method of building a walled-structure which consists in erecting at the angles and at suitable intervals in the length of the wall piers having recessed lateral edges and a vertical damp-proof core which extends laterally into the recessed edges, attaching mould-boards to said piers so that the piers constitute the ends of the mould and serve as a guide for verticality and gauge, suspending vertically within the mould a strip of flexible damp-proof sheeting so that the vertical edges of the sheeting overlap the lateral edges of the sheeting projecting into the recessed sides of the piers, pouring concrete into the mould on either side of the sheeting so as to form a course having a central damp-proof core whose upper edge projects above the top of the course, superimposing on said course a similar course so that the lower edge of the sheeting in the upper course overlaps and makes contact with the sheeting projecting above the level of the under course and uniting the two layers of concrete on either side of the sheeting in each course by metal ties so shaped and disposed as not to interfere with the overlap between adjacent sheets.

3. A method of building a walled-structure which consists in erecting at the angles and at suitable intervals in the length of the wall piers formed from blocks of the same gauge as the wall, having grooved lateral edges and each comprising two thicknesses of concrete and a central core of damp-proof sheeting projecting into the grooved sides of the block, attaching mould-boards to said piers so that the piers constitute the ends of the mould and serve as a guide for verticality and gauge, suspending vertically within the mould a strip of flexible damp-proof sheeting so that the vertical edges of the sheeting overlap the lateral edges of the sheeting projecting into the recessed sides of the piers, pouring concrete into the mould on either side of the sheeting so as to form a course having a central damp-proof core whose upper edge projects above the top of the course, superimposing on said course a similar course so that the lower edge of the sheeting in the upper course overlaps and makes contact with the sheeting projecting above the level of the under course and uniting the two layers of concrete on either side of the sheeting in each course by metal ties so shaped and disposed as not to interfere with the overlap between adjacent sheets.

4. A method of building a wall which consists in suspending flexible damp-proof sheeting so as to hang vertically within a mould, pouring concrete into the mould on either side of the sheeting and thus forming a course above which the edge of the sheeting projects, superimposing on said course another similar course so that the lower edge of the sheeting in the upper course overlaps and makes contact with the sheeting projecting above the level of the under course and uniting the two layers of concrete on either side of the sheeting in each course by bent metal ties adapted to engage vertical slits in the sheeting said

slits being so positioned that the overlap of the sheets is not interrupted.

5. A method of building a walled-structure which consists in erecting at the angles and at suitable intervals in the length of the wall piers having recessed lateral edges and a vertical damp-proof core which extends laterally into the recessed edges, attaching mould-boards to said piers so that the piers constitute the ends of the mould and serve as a guide for verticality and gauge, suspending vertically within the mould a strip of flexible damp-proof sheeting so that the vertical edges of the sheeting overlap the lateral edges of the sheeting projecting into the recessed sides of the piers, pouring concrete into the mould on either side of the sheeting so as to form a course having a central damp-proof core whose upper edge projects above the top of the course, superimposing on said course a similar course so that the lower edge of the sheeting in the upper course overlaps and makes contact with the sheeting projecting above the level of the under course and uniting the two layers of concrete on either side of the sheeting in each course by bent metal ties adapted to engage vertical slits in the sheeting said slits being so positioned that the overlap of the sheets is not interrupted.

In witness whereof I have signed my name to this specification.

MAXWELL MABERLY SMITH.