Dec. 20, 1960 D. E. MEEHAN 2,964,821

APPARATUS FOR CONSTRUCTING BUILDING WALLS

Filed July 5, 1956 4 Sheets-Sheet 1

FIG 1

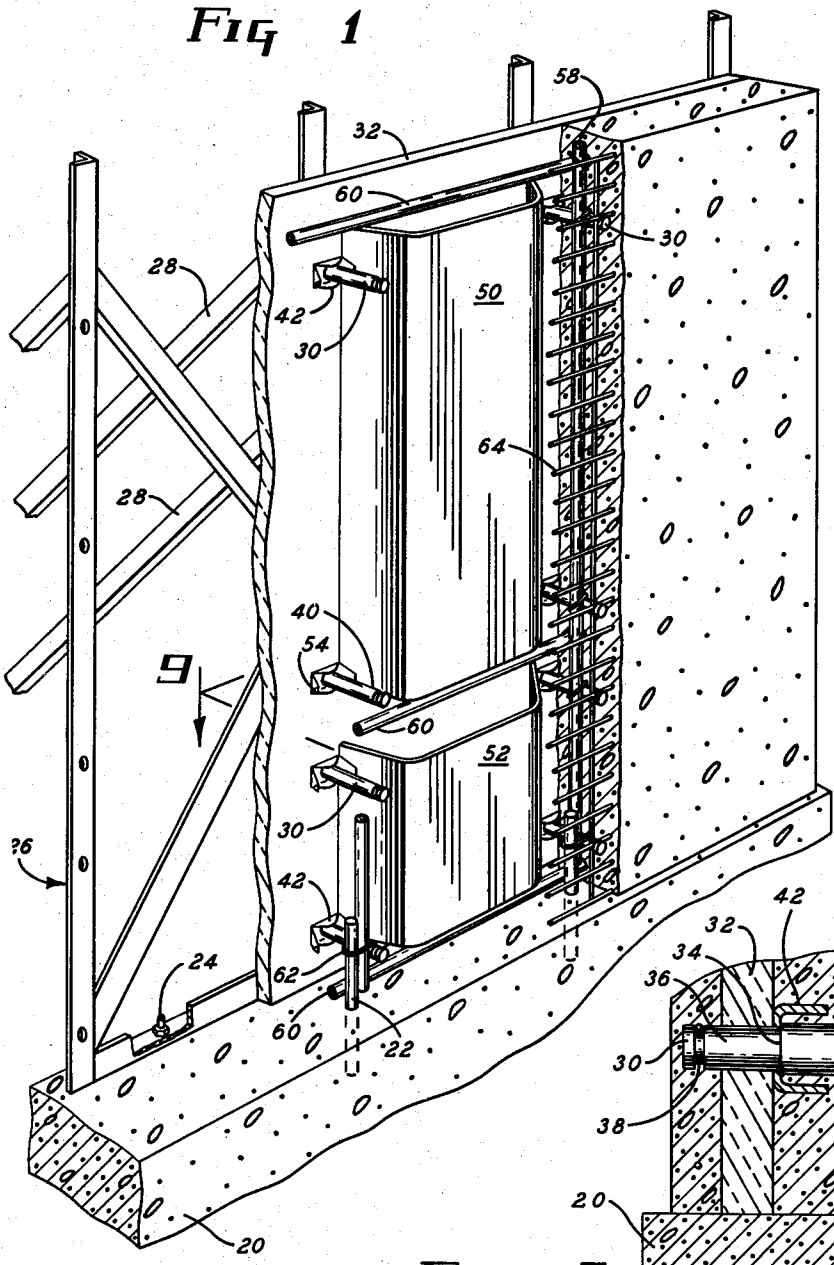


FIG 3

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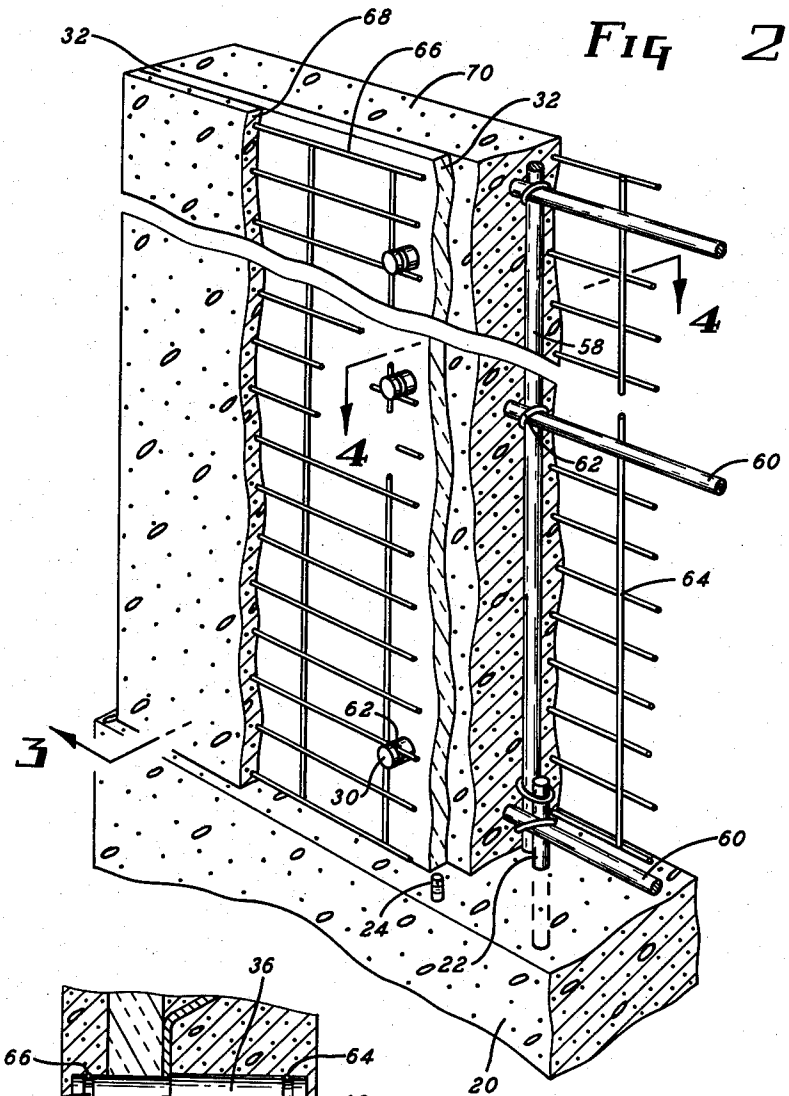
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APPARATUS FOR CONSTRUCTING BUILDING WALLS

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FIG 2



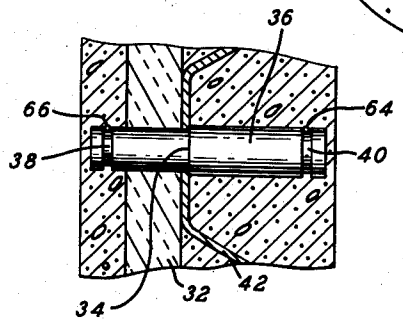


FIG 4

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APPARATUS FOR CONSTRUCTING BUILDING WALLS

Filed July 5, 1956 4 Sheets-Sheet 3

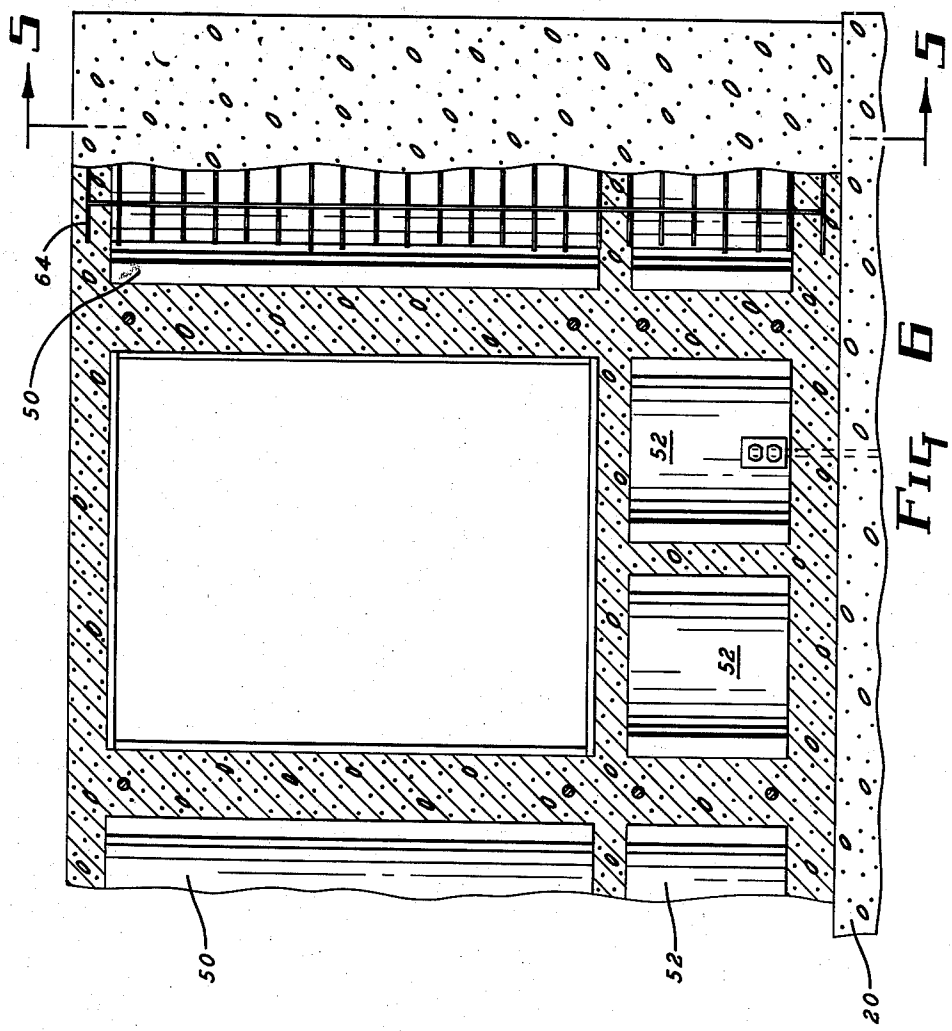


FIG 6

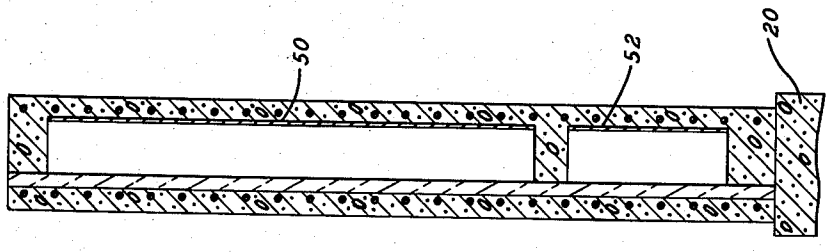


FIG 5

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APPARATUS FOR CONSTRUCTING BUILDING WALLS

Filed July 5, 1956

4 Sheets-Sheet 4

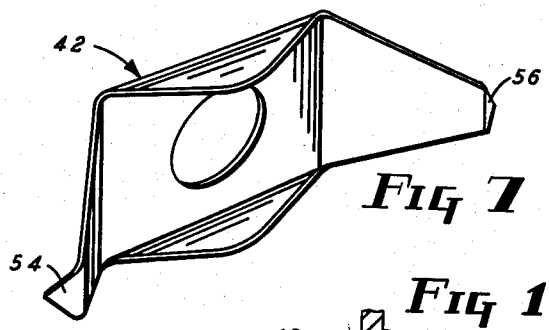


FIG 7

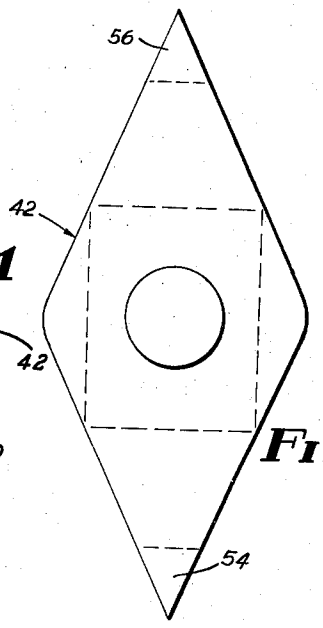


FIG 8

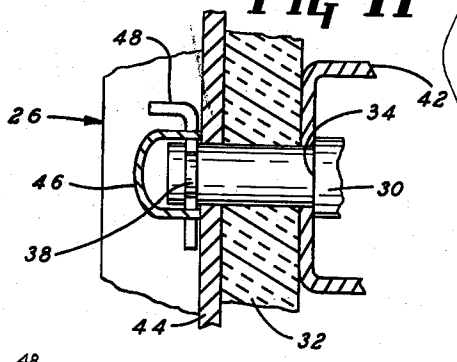


FIG 11

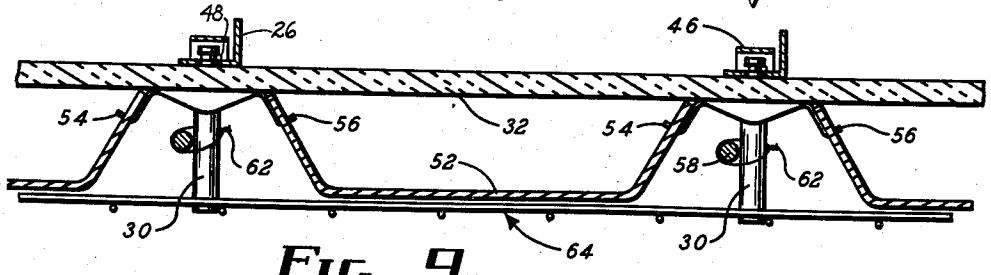


FIG 9

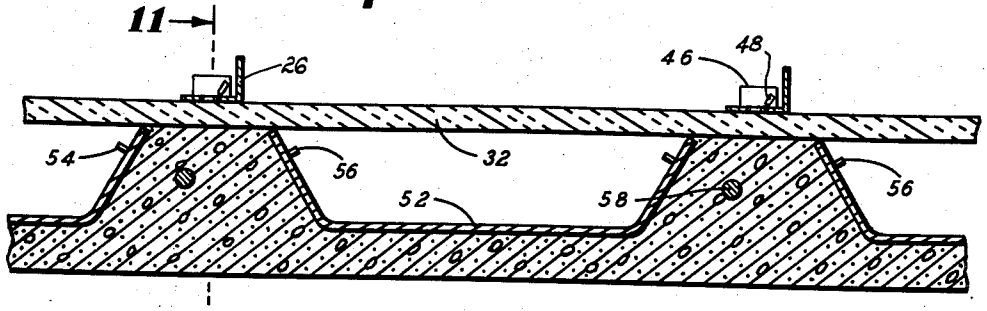


FIG 10

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2,964,821

APPARATUS FOR CONSTRUCTING BUILDING WALLS

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Filed July 5, 1956, Ser. No. 595,923

3 Claims. (Cl. 25—131)

This invention relates to an apparatus for constructing building walls of concrete or any other self-hardening viscous material.

The present invention contemplates low cost mass production type construction of high strength building walls having extremely low heat conductivity, my construction method making the use of pouring forms unnecessary. By employing the apparatus of this invention a wall having either two or three layers may be produced. The two layer wall includes an outer layer of prefabricated panels of material having low heat conductivity, to the inner surface of which is bonded and tied a heavily reinforced relatively thick layer of concrete or other self hardening viscous material, the thick layer including spaced internal voids or hollow spaces of relatively large volume separated by spaced upright and intersecting integral horizontal columns and beams of the cementitious material. The three layer wall includes a reinforced layer of the cementitious material outside the prefabricated insulating panel layer, both of the cementitious layers being bonded to and separated by the insulating layer, and all three layers being tied together by wall tie bars of material having very low heat conductivity embedded in the cementitious layers.

In each case the layers of cementitious material are built up to the desired thickness by discharging droplets of the viscous material directly against a forming barrier at an angle substantially normal thereto, the barrier ultimately constituting an integral part of the wall.

It is the chief object of the invention to provide a wall construction which is simple, low cost and efficient; which can be carried out by unskilled labor; which produces a finished wall which is much stronger than those produced by conventional methods and which produces walls which have much more efficient insulating characteristics than poured concrete, block walls, or wooden frame walls.

The invention, together with other objects, will be more clearly understood when the following description is read in connection with the accompanying drawings, in which:

Figure 1 is a fragmentary perspective view of a wall being constructed in accordance with my invention, parts being cut away and shown in section to disclose details, the view being taken facing the inner surface of the wall;

Figure 2 is a view similar to Figure 1, but is taken facing the outer surface of the wall, and shows a later stage in the construction;

Figure 3 is a fragmentary vertical transverse sectional view taken along the line 3 of Figure 2;

Figure 4 is a fragmentary horizontal transverse sectional view taken in the plane indicated by the line 4 in Figure 2;

Figure 5 is a vertical transverse sectional view taken in the plane indicated by the line 5—5 of Figure 6;

Figure 6 is a partial vertical longitudinal sectional view taken along a wall constructed in accordance with my

invention, a portion of the inner wall layer being removed to show details;

Figures 7 and 8 are perspective and flat pattern views respectively of a holding clip constituting a part of the apparatus of my invention;

Figures 9 and 10 are fragmentary horizontal transverse sectional views taken in the plane indicated by the line 9 in Figure 1, at different stages in the wall construction; and

Figure 11 is a fragmentary vertical transverse sectional view taken along the line 11—11 of Figure 9.

In the ensuing description like numerals designate like parts. The preferred apparatus of this invention will be explained concurrently.

Referring first to Figures 1 and 2 of the drawings, any desired type of wall foundation 20 is first provided and preferably includes partially embedded upright wall anchor bars 22 and similarly embedded threaded upright studs 24 along its outer marginal top surface.

The bases of a plurality of upright rigid generally planar jig sections 26 are anchored along the outer marginal top surface of the foundation by means of the studs 24, and nuts. These jig sections are held in a vertical plane by rigid slanting struts 28.

Next a plurality of relatively thick insulation panels 32 are secured in a common vertical plane flat against the assembled jig sections, with the lower edges of the panels in contact with the foundation, and their adjacent side edges abutting. Each panel is provided with properly located through apertures through which rigid wall tie bars 30 project as a means of supporting the panels, as clearly shown in Figure 11. These tie bars are preferably of glass fiber reinforced molded plastic construction which gives them the characteristic of very low heat conductivity.

As clearly shown in Figures 3 and 4, these tie bars are formed with a central annular shoulder 34 and a portion 36 of reduced diameter extending outwardly therefrom. Near its opposite ends each tie bar is provided with an annular groove, the grooves being designated by the numerals 38 and 40.

Before the tie bars 30 are inserted through the perforations in the panels 32 each bar is first inserted through a central aperture in a sheet metal holding clip 42, such aperture being smaller in diameter than the tie bar shoulder 34.

As clearly shown in Figure 11, the extreme outer grooved end of each tie bar extends through a correspondingly located aperture in a flange 44 of one of the upright frame members of one of the jig sections 26, and into a U-shaped housing 46 rigidly secured to such flange, as by welding. A tie bar locking pin 48 is inserted through aligned small apertures in the two legs of housing 46, and the apertures are so located that the intermediate portion of pin 48 seats in the annular groove 38 of the tie bar, thus firmly locking and supporting the tie bar in the jig section upright. The tie bars thus not only serve as true tie bars to bind the various layers of the wall together ultimately, but also serve as means for supporting the insulation panels in proper positions during wall construction. They also serve other supporting functions, as will be explained herein.

After the tie bars 30, insulation panels 32, and holding clips 42 have been assembled as just described, a plurality of hollow generally channel section box-like surface masking and void forming members 50 and 52 are mounted on the inner surfaces of the various insulation panels, as clearly shown in Figures 1, 5, 6, 9 and 10. These members will hereinafter be referred to simply as box-like members 50, 52, and their functions will be more fully explained.

As clearly shown in Figures 1 and 9, the box-like

members 50, 52 are held in position on panels 32 by means of the opposite triangular shaped knife-like ends 54, 56 of the clips 42. The clip construction is clearly shown in Figures 7 and 8. After the box-like members are positioned against the panel surface, it is only necessary to manually force the ends of clips 42 through the side flanges of adjacent box-like members. Incidentally the box-like members are preferably made of corrugated paper board, or similar material.

As indicated in Figure 6, these box-like members 50, 52 are preferably arranged in spaced vertically aligned rows as well as in spaced horizontally aligned rows.

Next vertical reinforcing bars 58 and intersecting horizontal reinforcing bars 60 are positioned in the vertically and horizontally aligned spaces between the various box-like members, these reinforcing bars being supported in the mentioned positions by wires 62 anchoring them to the tie bars 30, and to each other, as clearly shown in Figures 2 and 9. If it is desired to enclose electrical conduits, water supply pipes, heat ducts, etc. in the wall such conduits and pipes are similarly located and supported temporarily by being suspended from various ones of the jig supported tie bars.

Reinforcing mats 64 of heavy mesh wire are next arranged edge to edge and flat against the inner webs of the box-like members 50, 52, and are supported in such position by having certain of their horizontal strands seated in the annular grooves 40 at the inner ends of the tie bars 30, as clearly shown in Figures 1, 3 and 9.

The basic skeleton structure of the wall is now complete, and a self-hardening viscous material is now applied from the inner side of the wall directly against the exposed portion of the insulating panels, against the box-like members, in and around the reinforcing bars, pipes, conduits, etc., until all the skeleton structure thus far described, including the wire mesh reinforcing mats are completely covered, and the vertical and horizontal spaces between the sides and ends of the box-like members are completely filled with the viscous material. This viscous material, concrete mix, or the like may be applied by hand by throwing the material through the wire reinforcing mat with a trowel or similar tool, if desired. However, the material is preferably applied by discharging it in droplet form through a nozzle, under pressure. Several types of pressure apparatus for applying such material are commercially available. It is ordinarily applied in a direction substantially normal to the forming barrier, which in this case comprises both the unmasked or exposed portions of the insulating panels, as well as the exposed surfaces of the box-like members.

While it may appear to those unfamiliar with this art that viscous or cementitious material applied in this manner would fall downward into the open ends of the box-like members 50, 52 and fill their interiors, such is not the case, and there is no need whatever to provide closures for the upper ends of these box-like members.

After application, the viscous cementitious material is given time to set or harden until it becomes self-supporting.

Immediately thereafter, or at any other desired time thereafter, the small lock pins 48 are removed from the grooves 38 in the outer ends of the tie bars, the nuts are removed from the threaded studs 24 in the foundation, and all jig sections 26 are removed from their association with the wall. The outer surfaces of the insulating panels may now be coated with paint or any other suitable coating material, or may be covered and protected by stucco or by a veneer layer of bricks.

Preferably, however, my invention contemplates the completion of the wall thus far described by arranging a plurality of heavy wire mesh reinforcing mats 66 (Figure 2) adjacent and substantially parallel to the outer surfaces of the insulating panels 32, and supporting these mats in the positions shown in Figure 2 by seating certain horizontal strands thereof in the grooves 40 of certain of the tie bars, and using tie wires 62, if necessary, to properly anchor the mats.

Next a layer of the self-hardening viscous cementitious material is applied against the outer surface of the assembled insulating panels to completely cover and embed the reinforcing mats and projecting ends of the various tie bars, in the manner previously described with respect to the inner portion of the wall. After this outer layer 68 of cementitious material has hardened the wall is complete.

The wall thus formed includes a heavily reinforced outer cementitious layer 68 firmly anchored to a heavily reinforced inner layer 70 of cementitious material by means of completely buried tie bars having very low heat conductivity, completely separated by a layer of insulating material to prevent transmission of heat, cold and moisture in either direction through the wall. In addition the wall is provided with spaced voids or dead air spaces, and with solid integral upright and horizontal beams which give it extreme strength to resist compression forces as well as horizontally applied bending loads arising from high velocity winds.

Having described the apparatus of this invention with sufficient clarity to enable those familiar with this art to construct the wall, I claim:

1. Apparatus for aid in constructing a building wall on a preconstructed foundation comprising a rigid self-supporting holding jig structure which is independent of any permanent part of the wall structure to be produced, and adapted to be removably mounted on said foundation in a generally vertical plane within the upwardly projected outlines thereof, a plurality of tie bar socket members carried by the jig structure in predetermined spaced relation on the outer face thereof, a plurality of elongated wall tie bars arranged above said foundation with their long axes normal to the plane in which said jig structure lies and with the respective opposite ends thereof disposed within but adjacent to the upwardly projected outlines of the foundation, said wall tie bars extending through the plane of the jig structure and having their outer end portions seated within and detachably connected to the respective socket members, a plurality of flat rigid panel members arranged adjacent to and generally parallel to the jig structure, said panel members being arranged in edge to edge relation in a common plane with the lower edges of the lowermost panels in contact with the top surface of the foundation, all of said panels being provided with openings in registry with the socket members in the jig structure and through which apertures the wall tie bars pass, thereby to support the panels from said jig structure, the free ends of said tie bars projecting beyond the surface of the panel members remote from the jig structure, and panel positioning means carried by said wall tie bars in position to engage the face of the panel members remote from said jig structure to position the panel members with respect thereto, void forming members mounted on the face of the panel remote from the jig structure, and means provided on the wall tie members for positioning the void forming members and for securing them in position on the face of the panel, said panel positioning means and said void-forming-member positioning and securing means comprises clip members mounted on the respective tie bars, the clip members comprising a central portion having an aperture to receive the tie bar and portions extending laterally of the tie bar and engaging the adjacent face of the panel members, said central portion of the clip members having edge portions which engage and define the position of the void forming members, said clip members also including bendable prongs which are pressed into supporting engagement with the void-forming members to support the same in position on the panel members.

2. Apparatus for aid in constructing a building wall on a preconstructed foundation comprising a rigid self-supporting holding jig structure which is independent of any permanent part of the wall structure to be produced, and adapted to be removably mounted on said foundation in a generally vertical plane within the upwardly projected outlines thereof, a plurality of tie bar socket members carried by the jig structure in predetermined spaced relation on the outer face thereof, a plurality of elongated wall tie bars arranged above said foundation with their long axes normal to the plane in which said jig structure lies and with the respective opposite ends thereof disposed within but adjacent to the upwardly projected outlines of the foundation, said wall tie bars extending through the plane of the jig structure and having their outer end portions seated within and detachably connected to the respective socket members, means detachably connecting the tie bars within said socket members comprising aligned apertures provided in the walls of said socket members, a transverse locking pin passed through said apertures and engaged with a transverse shoulder formation provided on the tie bar, a plurality of flat rigid panel members arranged adjacent to and generally parallel to the jig structure, said panel members being arranged in edge to edge relation in a common plane with the lower edges of the lowermost panels in contact with the top surface of the foundation, all of said panels being provided with openings in registry with the socket members in the jig structure and through which apertures the wall tie bars pass, thereby to support the panels from said jig structure, the free ends of said tie bars projecting beyond the surface of the panel members remote from the jig structure, and panel positioning means carried by said wall tie bars in position to engage the face of the panel members remote from said jig structure to position the panel members with respect thereto, void forming members mounted on the face of the panel remote from the jig structure, and means provided on the wall tie members for positioning the void forming members and for securing them in position on the face of the panel, said panel positioning

means and said void-forming-member positioning and securing means comprises clip members mounted on the respective tie bars, the clip members comprising a central portion having an aperture to receive the tie bar and portions extending laterally of the tie bar and engaging the adjacent face of the panel members, said central portion of the clip members having edge portions which engage and define the position of the void forming members, said clip members also including bendable prongs which are pressed into supporting engagement with the void-forming members to support the same in position on the panel members.

3. The apparatus described in claim 2 wherein said tie bar members are provided with transverse shoulder formations engaged with the adjacent faces of the respective clip members and urging said clip members into surface contact with the inner face of said panel members when the locking pins are engaged with the ends of the tie bar members disposed within said socket members.

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