United States Patent

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[54] **COMBINED BUILDING WALLS PANELS AND ASSOCIATED FORM STRUCTURE**
2 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **249/19,** 249/26, 264/35, 52/435, 249/194
[51] **Int. Cl.** **E04g 11/00,** E04g 13/02
[50] **Field of Search** ..... 25/131 M, 131 P, 131 CM, 131 K; 249/18, 19, 26, 27, 48, 188, 189, 28, 29, 30, 31, 32, 194; 264/35

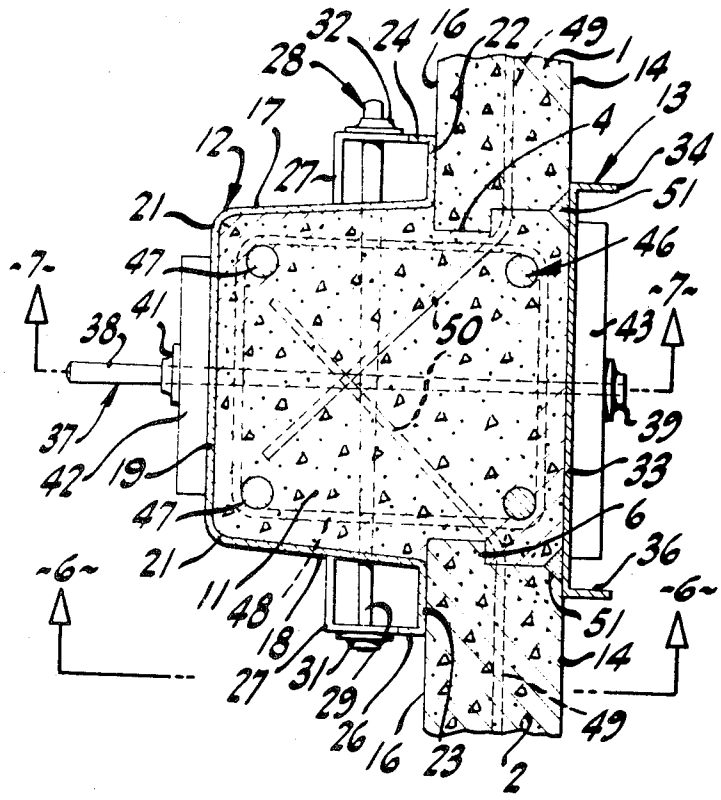
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ABSTRACT: A reusable building form structure defined by two rigid, preformed, self-supporting unitary form members, used in combination with a pair of building wall panels to bridge a space therebetween so that a settable construction material introduced into such space may be held in place while setting. At least one form member is channel shaped having tapered walls to facilitate its separation from the column formed by the settable construction material.



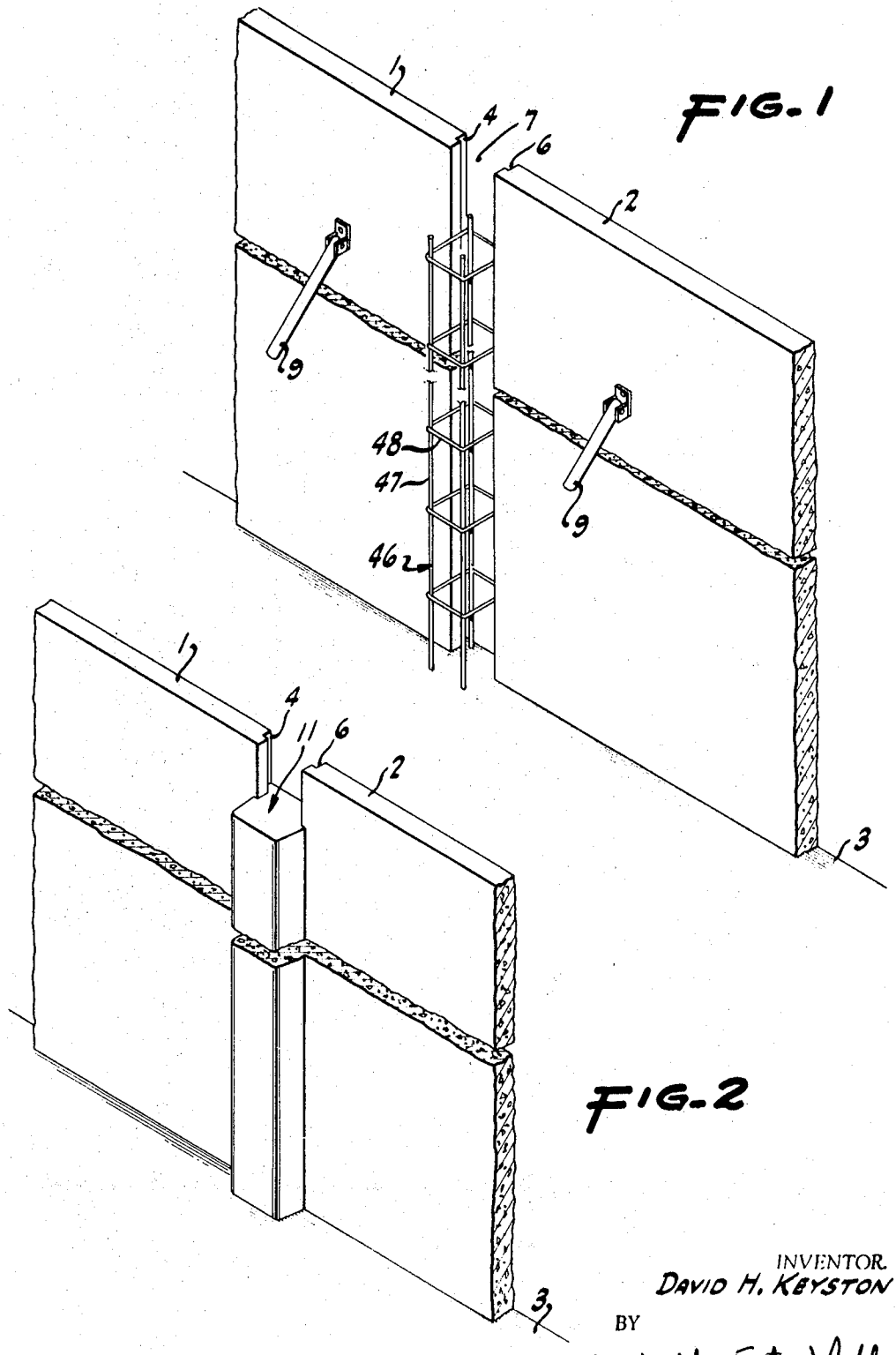


FIG. 1

FIG. 2

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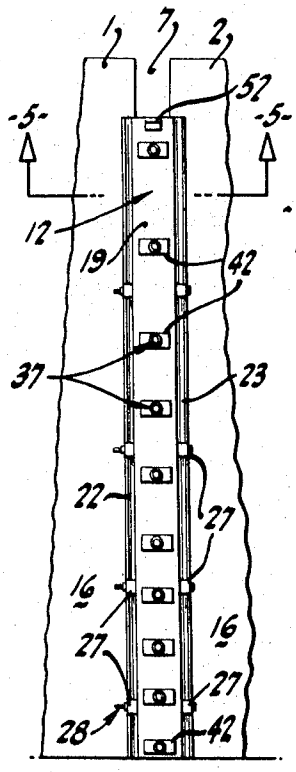


FIG-3

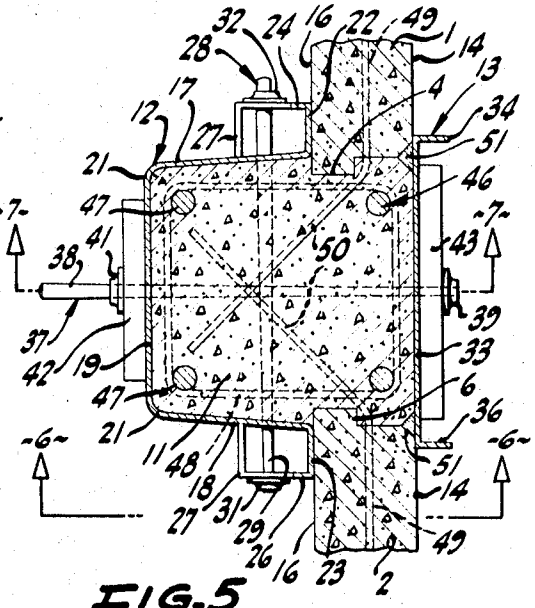


FIG-5

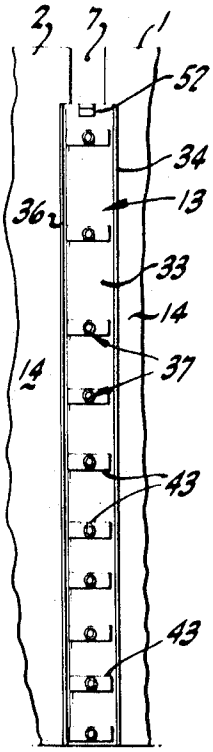


FIG-4

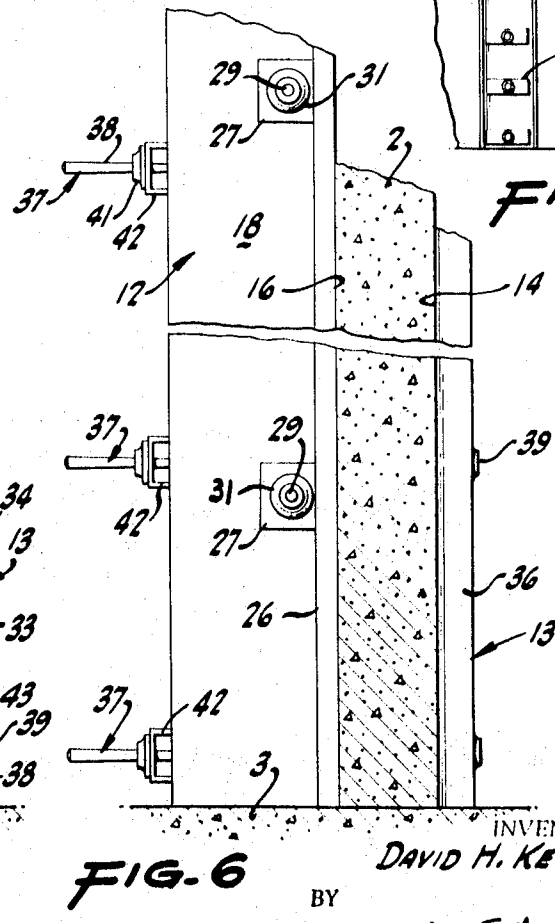


FIG-6

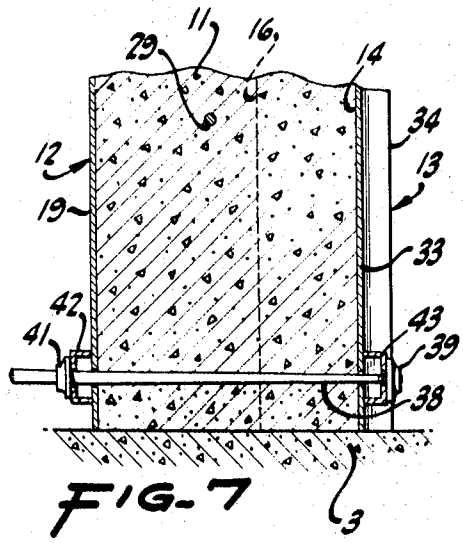


FIG-7

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COMBINED BUILDING WALLS PANELS AND ASSOCIATED FORM STRUCTURE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a division of application Ser. No. 662,265 filed Aug. 8, 1967, entitled "Building Form Structure," now U.S. Pat. No. 3,547,395, dated Dec. 15, 1970.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to the field of building construction, and is specifically directed to an improved construction apparatus and building combination for filling-in the space between two laterally spaced building wall panels which have been positioned to define a portion of the wall of a building being erected. The gap between the opposing edge surfaces of the spaced building wall panels is filled-in with a settable construction material, such as concrete, to provide a continuous section of building wall.

The invention is particularly directed to a building form structure, and its utilization in a building combination, in defining the limits of the space between the building wall panels into which the settable fill-in construction material is inserted. Such form structure is comprised of cooperable elongated form member components which are rigid and self-supporting so that they may be repeatedly used in the construction of numerous building walls, or other related and analogous wall structures.

The form structure disclosed herein has particular utility in conjunction with the erection of tiltup wall buildings in which concrete or like wall panels are formed in horizontal position on the ground and are thereafter tilted into operative position in the vertical orientation. Such procedure results in a space existing between the wall panels which is filled-in by a settable construction material introduced therebetween. The invention has utility, however, in constructing any building in which it is desired or required to fill-in a gap between opposed edge surfaces of spaced wall or like panels.

2. Description of the Prior Art

It has been generally known in the construction art heretofore to utilize building forms to place definite limits on the space which exists between opposed edge surfaces of building wall panels erected by the tiltup technique. Heretofore, multipiece wooden form structures were employed for that purpose which had to be tailored to meet the requirements of a particular construction project. Such wooden form structures known heretofore were not repeatedly reusable in the construction of numerous building walls because the same were substantially damaged during separation from the wall panels engaged thereby during use. To adapt such wooden form structures for reuse required substantial repair thereof which generally made any attempted reuse uneconomical.

With prior known form structures, it was customary to unite the wooden components thereof together at the site of the construction job. After such components had served their intended function, such components were largely destroyed during removal thereof from the resulting building wall. This common prior art practice was extremely expensive because of the generally skilled labor required to fabricate such wooden form structure in place and because of the wasted materials resulting therefrom. Such prior known form structures required many components, including numerous wooden parts and various types of connectors required to retain the wooden parts securely together during use thereof.

With the improved self-supporting form structure of the present invention, a minimum number of components are required, both in defining the form structure and in maintaining the components of the form structure together during use thereof. Furthermore, the forms of the structure of this invention may be positioned and repeatedly reused by workmen of average skills. Also, preparation of the form structure for such reuse is minimal in that cleaning thereof is not difficult and repair thereto is unnecessary. Thus, labor costs may be greatly

reduced. Also, any increased initial cost of the form structure of this invention compared to the initial cost of wooden form structures is recouped because of the elimination of the waste characteristic of prior constructions.

This invention has the further advantage that removal of the form members of this invention from the building wall formed thereby is simplified because one or both of the subject form members is provided with tapered sidewalls which permits such ease of removal. With prior wooden form structures, such tapered sidewalls were not provided and, as a result, damage to the wooden parts normally resulted during removal thereof from the wall formed thereby.

Also, prior wooden form structures produced undesirable roughened wall surfaces in comparison to the smooth surfaces obtainable when using the form structure of this invention.

Further advantages over the prior art are provided by this invention, including greatly increased ease of handling and positioning of the form members in place, and ease in transporting and storing the form members for reuse.

SUMMARY OF THE INVENTION

The present invention relates to a sturdy, reusable building form structure defined by two elongated, preformed, rigid and self-supporting form members which are to be cooperably positioned in engagement with opposite surfaces of two laterally spaced building wall panels to bridge the space therebetween so that a settable construction material, such as concrete, may be introduced to fill up such space. An improved method of building construction utilizing such form structure also is disclosed herein.

The building forms of this invention are repeatedly reusable without requiring repair thereof. The opposing form members are easily cleaned following their separation from a building wall. Due to the self-supporting and reusable nature of the forms of this invention, there is a large reduction in labor costs in their use because extensive fabrication on the job, and waste, characteristic of prior known wooden form structures, are obviated.

The form structure of this invention comprises only two major form components, and associated means for maintaining the same in position during use. At least one such form is channel-shaped with tapered sidewalls so that separation thereof from the building column defined by the settable construction material introduced therein is facilitated. The forms hereof are appropriately reinforced for strength required to permit their repeated reuse.

From the foregoing, it should be understood that objects of this invention including; the provision of an improved building form structure which is employed to bridge the gap between opposed edge surfaces of a pair of laterally spaced building wall panels; the provision of such a form structure which is repeatedly reusable without requiring repair; the provision of a building form structure defined by a minimum of components; the provision of a building form structure which may be positioned in place across the space between building wall panels by workmen of average skills with minimum labor costs; the provision of a building form structure which may be easily removed from a building wall following use thereof without destruction or damage thereto; and the provision of a building form structure, the components of which may be compatibly used for erecting buildings of varying wall heights and which are nestable for ease of storage and transportation; the provision of a building form structure which produces superior finishes in the resulting wall; and the provision of an improved construction method. These and other objects of this invention will become apparent from a study of the following detailed disclosure in which reference is directed to the appended drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of the spaced building wall panels positioned to receive a body of settable construction material in the gap between opposed edge surfaces thereof.

FIG. 2 is an isometric view corresponding generally to FIG. 1 showing the space between the building wall panels filled in by a column of settable material introduced therebetween.

FIG. 3 is an elevational view showing one side of the form structure of this invention bridging the gap between a spaced pair of building wall panels.

FIG. 4 is an elevational view of the opposite side of the form structure of this invention.

FIG. 5 is a horizontal sectional view through the building wall panels, the building form structure, and the building wall column confined therebetween, taken in the plane of line 5—5 of FIG. 3.

FIG. 6 is a side elevational view, partly in section, of the form structure and wall structure taken in the plane of line 6—6 of FIG. 5.

FIG. 7 is a vertical sectional view through the form structure and wall structure taken in the plane of line 7—7 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIGS. 1 and 2, the manner of utilization of the form structure of this invention will be described. In this regard, while this invention has particular utility when used in conjunction with the tiltup wall construction procedure in which wall panels of concrete or other suitable construction material are formed on the ground in horizontal orientation and are thereafter tilted upright to the vertical orientation, it should be understood that this invention is usable in conjunction with any construction method in which a space between two building wall or like panels is to be filled-in by a suitable settable construction material to provide a continuous wall structure. For purposes of illustration, hereinafter reference is specifically directed to utilization of this invention in conjunction with the tiltup wall construction technique.

As seen in FIG. 1, two preformed building wall panels, designated 1 and 2, are secured to extend upwardly from a supporting base 3 in known fashion. Base 3 and the wall panels 1 and 2 may be formed of any suitable construction material, of which concrete is illustrative. The wall panels are laterally spaced from each other during vertical positioning thereof, and the opposed edge surfaces 4 and 6 of the respective panels together define a vertically extending gap or space 7 therebetween. It is into such space that a settable construction material, such as concrete, is to be introduced to close-off the gap between the wall panels to form a continuous wall structure which is capable of supporting the roof loads to be applied thereto. While the settable material is being introduced into the space 7 and hardening therein, the wall panels are maintained in proper vertical orientation by suitable means, such as by braces 9 interposed between opposite surfaces of the wall panels and adjacent horizontal surfaces, as illustratively shown in FIG. 1.

In most construction situations, it is preferred to fill-in the space 7 between wall panels 1 and 2 to a thickness which is greater than the thickness of the associated wall panels so that an enlarged building column is provided in the area between the opposed edge surfaces 4 and 6 of the wall panels. Such a building column, designated 11, is shown bridging the gap between the wall panels 1 and 2 in FIG. 2. As will be described hereinafter, such column 11 preferably is reinforced and is keyed to the wall panels to provide a strong integral wall structure.

To permit formation of building column 11 between the wall panel opposed edge surfaces, means must be provided to define the limits of the space between the wall panels into which the settable construction material is introduced and to retain the contour of such settable material while the same is hardening. Such means in this invention is defined by a building form structure comprised of only two principal reusable components. The use of only two components is in distinction to the complex and expensive multipiece wooden form structures employed for a similar purpose heretofore.

The principal components of the building form structure of this invention are defined by two elongated, preformed, rigid and self-supporting form members, designated 12 and 13 respectively. The forms 12 and 13, when positioned to receive settable construction material therebetween, are engaged with opposite surfaces of the pair of building wall panels 1 and 2 to define the limits on the space 7 therebetween. As seen in FIG. 5, form 13 engages surfaces 14 of the building wall panels, while form 12 engages the opposite surfaces 16 of such panels.

In the preferred embodiment illustrated, the form structure is designed so that building wall column 11 may be formed between wall panels 1 and 2 with one surface thereof substantially coplanar with the surfaces 14 of such panels. Thus, form member 13 engaged with wall panel surfaces 14 is provided with a generally flat base wall, as will be described. However, the other form member 12 is designed to permit building wall column 11 to project beyond the surfaces 16 on the opposite side of the building wall panels, as will be described. In this connection, however, it should be understood that the concept of this invention may be utilized in forming a building wall structure in which the column provided in the space between the wall panels is generally coplanar with both opposed surfaces of the associated wall panel surfaces, or in which the column projects beyond both such opposed surfaces.

The preferred embodiment of the building form structure shown, however, includes only one form member which permits the building column 11 to project beyond its associated wall panel surfaces. To this end, form member 12, in horizontal cross section, is generally channel shaped and is defined by two vertically extending, laterally spaced sidewalls 17 and 18 which are tapered relative to each other. That is, as best seen in FIG. 5, sidewalls 17 and 18 converge relative to each other in a direction away from surfaces 16 of the building wall panels with which form 12 is engaged. Sidewalls 17 and 18 are integrally connected with each other by a vertically extending base wall 19 which extends therebetween and is connected therewith by rounded corner portions 21. When form 12 is in position, base wall 19 preferably extends parallel to surfaces 16 of the wall panels.

The tapered sidewalls 17 and 18 of form 12 are very important in that they greatly facilitate removal of the form from the column 11 following setting of the material from which the column is produced. This is in distinction to prior multipiece wooden form structures in which such tapered side walls were not employed, and as a result of which separation of the wooden form components from the column could be effected in most cases only by destruction of the form components, thereby precluding their reuse.

Form 12 further includes a pair of vertically extending, laterally spaced flanges 22 and 23 which extend in opposite directions from the respective sidewalls 17 and 18 of which they form direct continuations. Such flanges 22 and 23 lie generally in the same plane and are adapted for direct engagement with the surfaces 16 of the building wall panels, as best seen in FIG. 5. It will be noted from FIG. 3 that the side walls, base wall, and flanges are vertically coextensive. In this regard, for most uses, the forms 12 and 13 shown herein are manufactured in a length sufficient to provide a building wall column 11 therebetween which meets a wide variety of building wall requirements. However, if desired, other similar form members may be placed end to end with the forms shown when it is necessary to provide a building wall column of a length in excess of that capable of formation by a single pair of forms.

Flanges 22 and 23 terminate in reversely bent generally parallel edges, designated 24 and 26 respectively, which project in a direction away from surfaces 16 of the associated building wall panels. Such edges are provided to impart additional rigidity to the form 12.

It should be understood that the construction material introduced between forms 12 and 13 to define the column 11 therebetween exerts substantial forces on the forms which tend to separate the forms and to distort the sidewalls 17 and 18 of form 12 laterally outwardly away from each other. It has

been found, therefore, that means should be provided to counteract such forces and to overcome their detrimental effect so that a uniform building column having smooth surfaces may be produced. Such means in the embodiment illustrated includes braces interposed between the edges 24 and 26 and the sidewalls 17 and 18 of form 12 associated therewith.

In the preferred embodiment, such braces are not coextensive with their associated edges 24 and 26 and flanges 22 and 23. To effect savings in weight and material, such braces are provided at predetermined spaced locations along the vertical extent of the form 12, and are defined by generally L-shaped brace members 27. As best seen in FIG. 5, one leg of each L-shaped brace is secured to an associated edge 24, 26 as a substantial planar continuation thereof, while the other leg thereof extends generally at right angles to the first leg and is secured to an associated sidewall 17, 18. The braces may be secured to their associated sidewalls and flange edges in any suitable fashion, such as by welding.

As also seen in FIG. 5, the legs of the respective braces which are connected with the flange edges along opposite sides of form 12 extend generally parallel to each other and define seats for other means to assist in precluding distortion of form 12 during use thereof. In the illustrated embodiment, such other means for precluding distortion comprises a series of bolt and nut assemblies, collectively designated 28, each of which is defined by a tapered bolt 29 having a nut 31 on one threaded end thereof and an enlarged head or another nut 32 on the other end thereof, as best seen in FIG. 5. The bolt and nut assemblies 28 shown in the drawings are standard commercial items obtainable on the open market. Bolts 29 are tapered from one end toward the other thereof to facilitate their lengthwise removal from the column 11 after the same has hardened.

It should be noted from FIG. 3 that braces 27 and the bolt and nut assemblies 28 extending laterally therebetween have their vertical spacing altered from one end of form 12 toward the other. That is, adjacent the lower end thereof where the pressure exerted on form 12 is the greatest, such braces are spaced closer together than they are at the upper end thereof where the pressure is less. Thus, more resistance to distortion is provided adjacent the base or lower end of form 12.

It should also be understood that each of braces 27 and sidewalls 17 and 18 in the areas thereof in line with such braces are provided with aligned apertures therethrough through which the respective bolts 29 of the bolt and nut assemblies 28 may be extended. Such bolt and nut assemblies preferably are positioned laterally through the form 12 prior to introduction of the settable construction material into the space defined thereby with the building wall panels.

The other form 13, as seen in FIGS. 4 and 5, is of shallow channel shape in horizontal cross section and is defined by a vertically extending flat base wall 33 along opposite lateral margins of which are provided a pair of vertically extending, laterally spaced flanges 34 and 36 which project outwardly from the base wall in generally parallel relationship away from surfaces 14 of the associated building wall panels 1 and 2. Such flanges impart desirable rigidity to the form 13. As noted previously, the flat base wall of form 13 is intended to be engaged directly with surfaces 14 of the wall panels so that the building column 11 will provide a surface which lies in substantially coplanar relationship with such wall panel surfaces when the forms 12 and 13 are removed following setting of the material which defines the column 11.

Means are provided to maintain the forms 12 and 13 in secure operative engagement with the opposite surfaces 14 and 16 of the wall panels, as seen in FIGS. 5 through 7. Such means in the embodiment illustrated comprises a series of vertically spaced bolt and nut assemblies, collectively designated 37, each of which extends through the space 7 limited by the forms 12 and 13 and the opposed edge surfaces 4 and 6 of the wall panels. Bolt and nut assemblies 37 correspond in construction to the assemblies 28 described previously and each includes a tapered bolt 38 having a removable nut 39 on one threaded end thereof and an enlarged head or nut 41 on the other end thereof. Bolts 38 are longitudinally tapered to facilitate their lengthwise removal from the column 11 following setting of the material thereof.

Thus, it should be appreciated that the form structure of this invention is made up of a minimum of components, consisting of only two forms and a comparatively small number of bolt and nut assemblies. As a result, positioning of the form structure may be easily and rapidly effected.

To provide seats for the bolt and nut assemblies 37, and to reinforce and rigidify the respective forms 12 and 13 in the transverse direction across the respective base walls thereof, a series of vertically spaced, apertured reinforcing ribs are formed integral with the base walls, as seen in FIGS. 3 and 4. The ribs on form 12 are designated 42 and the ribs on form 13 are designated 43. By comparing FIGS. 3 and 4, it will be noted that the respective ribs 42 and 43 are provided on the respective forms in vertical alignment with each other so that the bolt and nut assemblies 37 may be extended between the forms in generally horizontal orientation as seen in FIG. 7.

In the preferred embodiment shown herein, each of the ribs 42 and 43 on the respective forms 12 and 13 is defined by a generally U-shaped channel, as best seen in FIG. 7, which is integrally secured to the respective forms in any suitable fashion, such as by welding. The ribs on the respective forms thus provide flat seats for engagement by the nut and bolt assemblies so that the flanges 22 and 23 or form 12 and the base wall 33 of form 13 may be held in secure engagement with the opposite surfaces 14 and 16 of the building wall panels.

As also noted from FIGS. 3 and 4, the spacing between the ribs 42 and 43 on the respective forms varies from the lower ends of the forms toward their upper ends. That is, more ribs are provided adjacent the lower ends of the forms. This variance in vertical spacing is effected to adapt the forms to counteract more effectively the greater forces applied thereto adjacent their lower ends by the weight of the settable construction material. Thus, more bolt and nut assemblies are required adjacent the base of the column.

In this regard, it will also be noted that preferably two or more reinforcing ribs 42 (and associated bolt and nut assemblies) are provided between each pair of braces 27 on form 12. This preference is effected to adapt the forms 12 and 13 to be more resistant to spreading apart when the material of column 11 is inserted therein. The frictional contact of flanges 22 and 23 of form 12 with the surfaces 16 of the building wall panels assists in resisting any tendency of the walls 17 and 18 to spread apart during use. Therefore, less lateral reinforcement is required between the sidewalls of form 12 than between the respective forms 12 and 13.

When forms 12 and 13 are positioned as seen in FIG. 5, settable construction material may be introduced into the space therebetween in any known manner, such as by a conventional nozzle and hose apparatus, to provide the building wall column 11. Forms 12 and 13 are maintained in place until the column has completely hardened, following which the respective nut and bolt assemblies 28 and 37 are removed, and the forms are separated from the column for cleaning and subsequent reuse as desired. The tapered sidewalls 17 and 18 of form 12 greatly facilitate its separation from column 11 without risking damage to the form or to the column.

It should be further noted, by referring to FIG. 1 and FIG. 5, that the column 11 preferably is tied in with, or keyed to, the wall panels 1 and 2 between which it is interposed. Such keying together is effected by a suitable reinforcing structure, generally designated 46 in FIG. 1, which cooperates with reinforcing means formed in the wall panels. As seen in FIGS. 1 and 5, reinforcing structure 46 includes a series of vertical reinforcing rods 47 positioned in a generally rectangular pattern which are coupled with a series of spaced horizontal reinforcing rods 48 each of which is formed with a generally rectangular configuration corresponding to the general configuration of the column 11 to be formed therearound. Additionally, a series of vertically spaced horizontally extending

reinforcing rods 49 (FIG. 5) are generally positioned in the wall panels with their ends 50 projecting from the edge surfaces of the building wall panels 1 and 2 into the space within the confines of the reinforcing structure 46. Thus, when column 11 is poured in place between forms 12 and 13, the reinforcing structure 46 and rods 49 couple the column and the wall panels together into a unitary assembly.

To further assist in keying together column 11 with the wall panels, the opposed edge surfaces 4 and 6 of the wall panels 1 and 2 preferably are provided with stepped contours (see FIGS. 1 and 5) with which the column 11 interlocks when poured in place.

To enhance the appearance of the wall structure when form 13 is removed from engagement therewith, a pair of generally triangular wooden or like strips 51 are formed with the wall panels 1 and 2 and are positioned in alignment with the intended line of juncture between the edge surfaces of the wall panels 1 and 2 and the column to be poured in place therebetween. Such strips are removed from the wall when form 13 is removed, thus leaving generally triangular indentations or grooves running the full extent of the wall which is visible from the side of the wall defined by surfaces 14. Such grooves produce an appearance of regularity between the wall panels and the column which might not otherwise exist if the wall panels and the column were joined without utilizing such strips.

To insure the necessary rigidity which permits repeated reuse of the forms 12 and 13 of the subject building form structure, it has been found that the same should be formed from a sturdy material such as steel. However, it is contemplated that other materials of lesser weight than steel, such as aluminum alloys or rigid plastics, which possess the requisite strength, may be employed if preferred. Three sixteenths inch steel plate has been found particularly effective.

To permit forms 12 and 13 to be positioned in place to bridge the gap between the wall panels, irrespective of the material from which such panels are constructed, a lifting attachment, designated 52, is provided adjacent the upper edge of each of the forms as seen in FIGS. 3 and 4. Such attachment may be defined by a short length of angle bracket having a hole therein adapted to receive a hook member connectable with a lifting cable of a crane so that the forms may be mechanically positioned in engagement with the opposite surfaces of the wall panels.

Forms 18' in length have been found suitable for most construction projects. Where longer columns are required, two or more forms may be connected together in end to end relationship.

The form members described provide a building column 11 having smooth exterior surfaces superior in finish to those producible heretofore with wooden building forms. Also, the forms of this invention are simple to clean following use thereof and accordingly may be prepared for reuse with minimum labor costs. Furthermore, because of the tapered side walls of the form 12, a quantity of such forms may be stored or transported in nested fashion, thereby reducing space requirements during transportation or storage.

The foregoing disclosure of a preferred embodiment of this invention is intended to be illustrative rather than limiting. The scope of the invention should be interpreted in light of the claims appended hereto, and modifications to the preferred embodiment which incorporate therein the spirit of this invention are intended to be encompassed within such scope.

I claim:

1. In combination,

A. a pair of preformed building wall panels having an elongated vertical space therebetween to be filled with a settable construction material,

B. a reuseable building form structure positioned to bridge the vertical space between adjacent edges of said wall panels, consisting of

1. a first integral unitary preformed, rigid and self-supporting elongated form engaging one surface of each of said building wall panels and straddling said space between said adjacent edges thereof, and

2. a second integral unitary preformed, rigid and self-supporting form engaging the other opposite surface of each of said building wall panels and straddling said space between said adjacent edges thereof,

3. at least one of said unitary forms being generally channel shaped in transverse cross section and being defined by a pair of opposed sidewalls which are integrally connected with each other by an intermediate portion which extends between and integrally connects said sidewalls, and a flange extending laterally outwardly from each of said sidewalls to engage said surfaces of said building wall panels engaged by said one form,

4. said forms closing off and confining said space between said adjacent edges of said building wall panels so that a settable construction material may be introduced into and retained in said space to fill in the same, and in which

5. said flanges in said one form lie generally in the same plane and are positioned for engagement with said other surfaces of said building wall panels,

6. apertured braces spacedly interposed between the lateral margin of each of said flanges and the sidewall associated therewith from which such flange extends,

7. said braces providing reinforcement for said sidewalls and forming seats for other means provided to preclude distortion of said sidewalls,

8. said other means comprising bolt and nut assemblies extending transversely through said sidewalls of said one form and the braces positioned thereon, and removable means extending through and between said forms through said space and maintaining said forms in secure engagement with said opposite surfaces of said building wall panels during introduction into and setting of said construction material in said space.

2. The combination of claim 1 in which each of said braces comprises

a. a generally L-shaped member, one leg of which is integrally connected with the lateral margin of its associated flange, and the other leg of which is integrally connected with an associated sidewall.