

April 19, 1938.

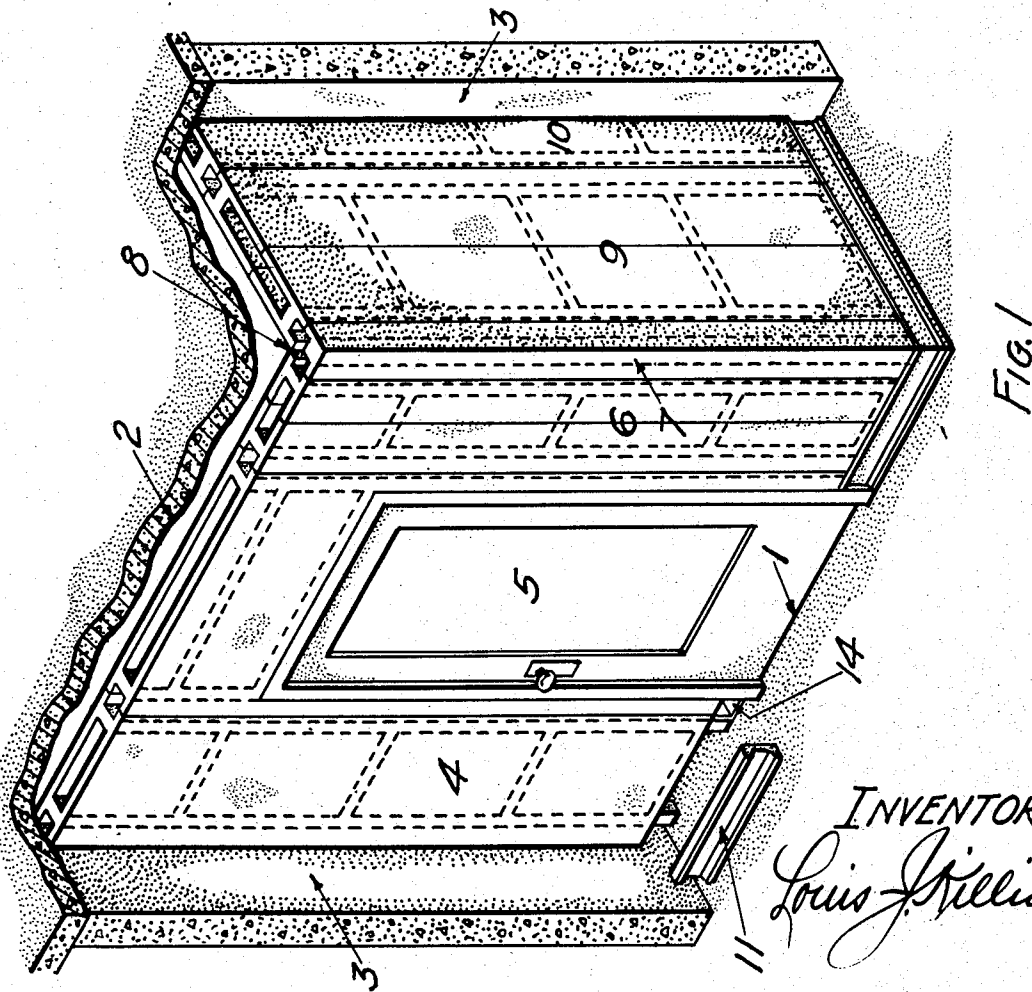
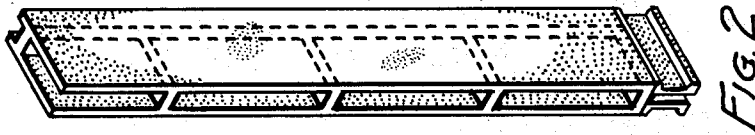
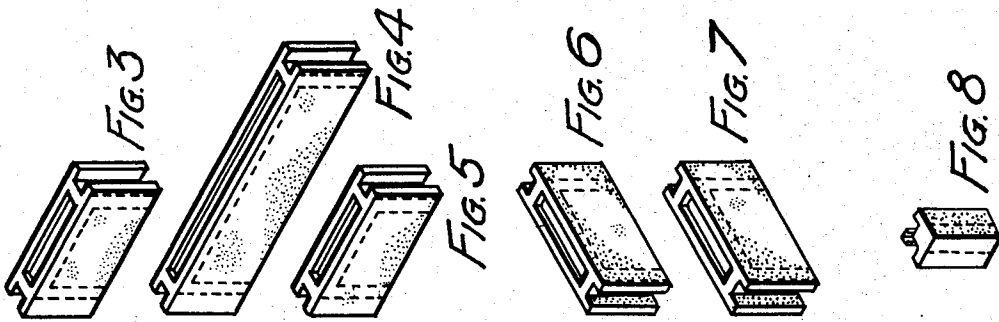
L. J. KILLION

2,114,386

MOVABLE WALL STRUCTURE

Filed Jan. 2, 1935

13 Sheets-Sheet 1



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13 Sheets-Sheet 2

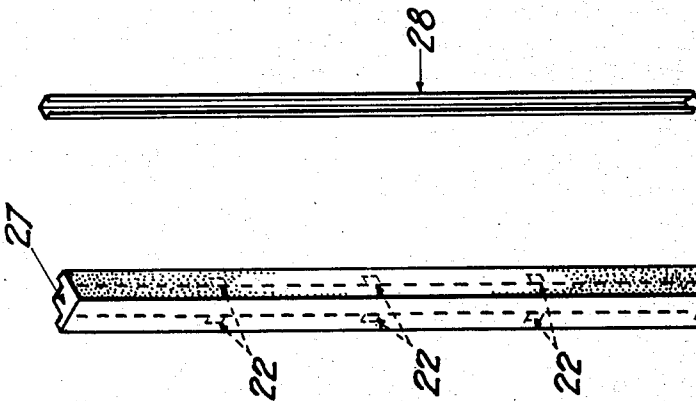


FIG. 11 FIG. 12

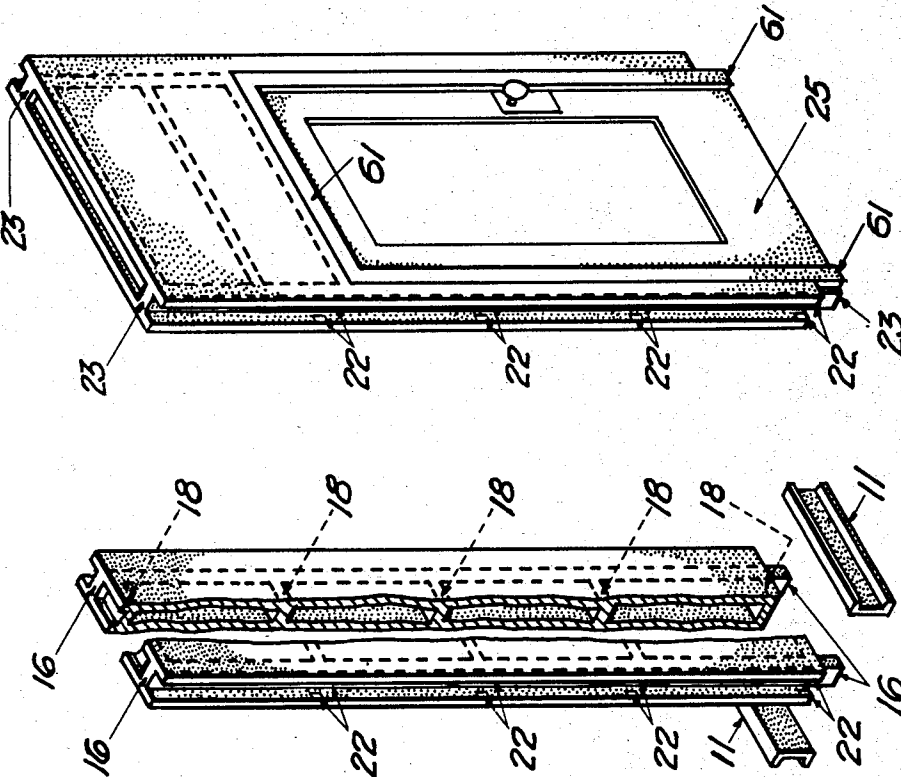


FIG. 9 FIG. 10

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Louis J. Killion

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L. J. KILLION

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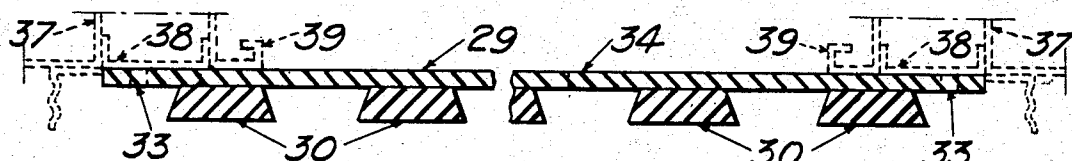


FIG. 14

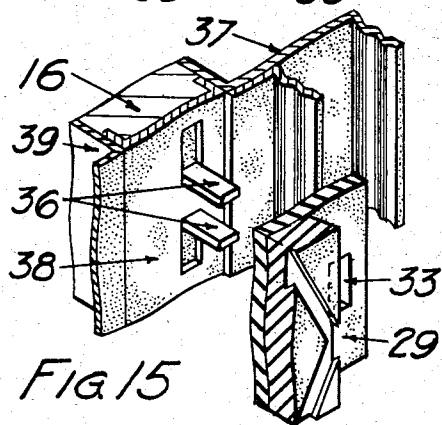


FIG. 15

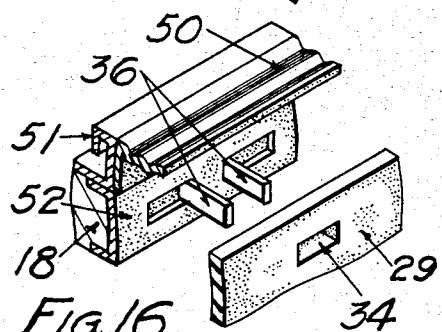


FIG. 16

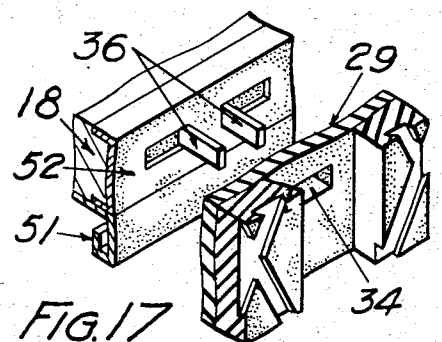


FIG. 17

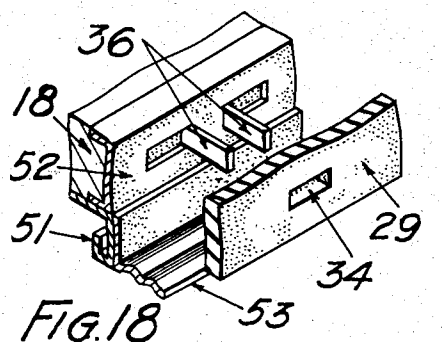


FIG. 18

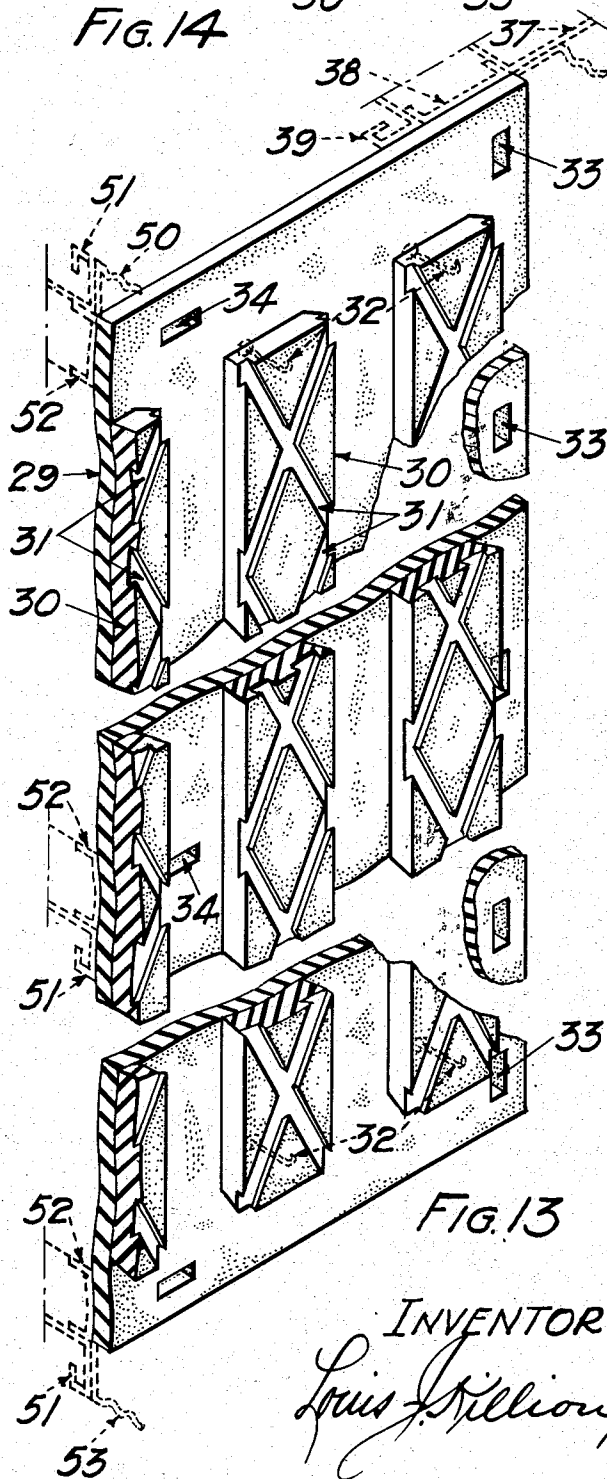


FIG. 13

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Louis J. Killion

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L. J. KILLION

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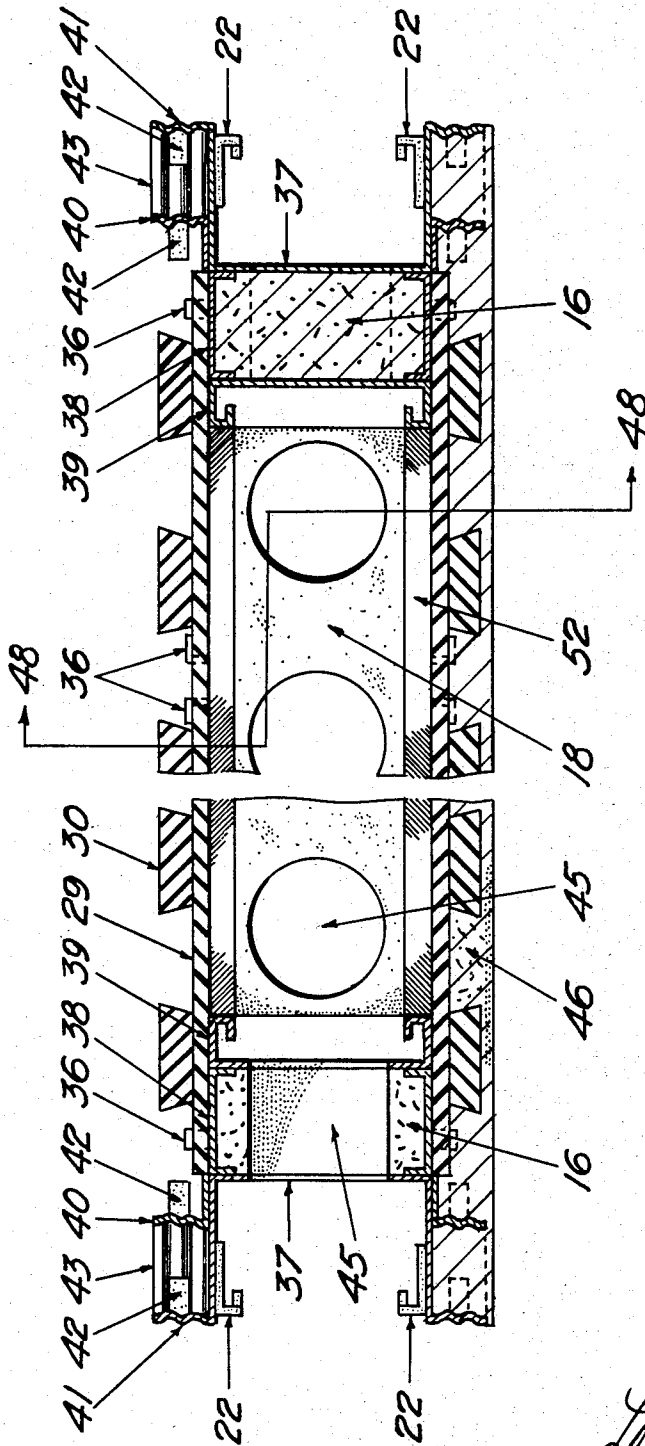


FIG. 19

INVENTOR
Louis J. Killion

April 19, 1938.

L. J. KILLION

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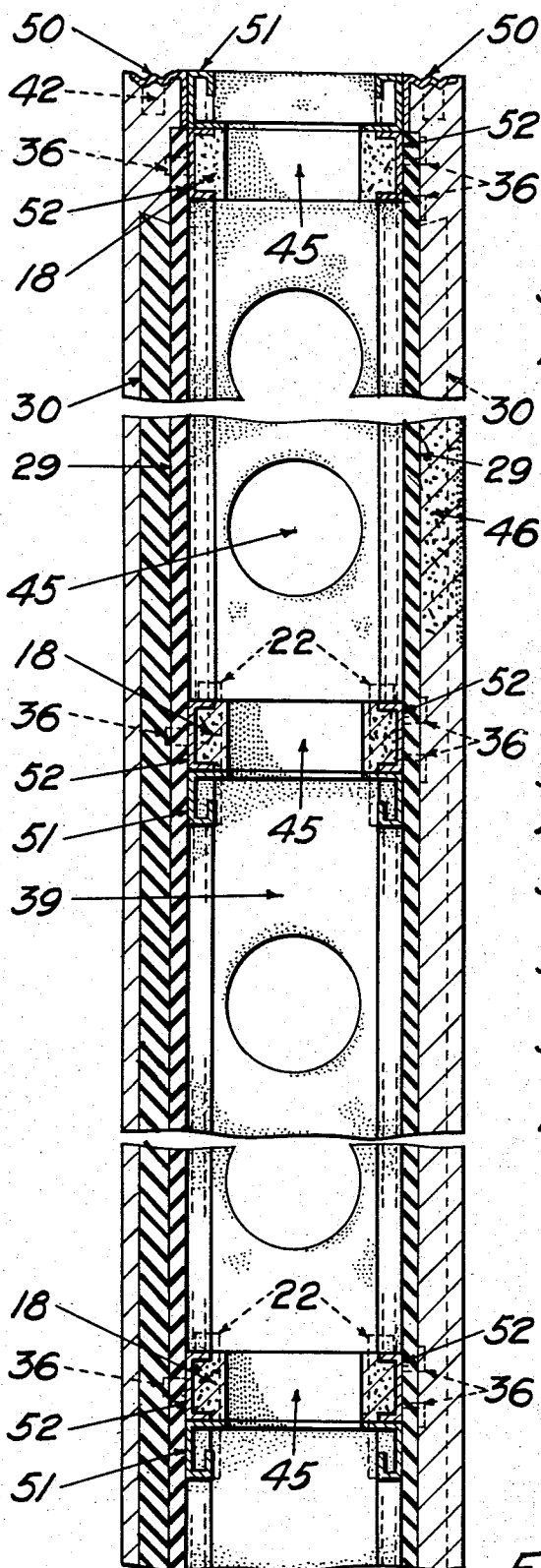


FIG. 20

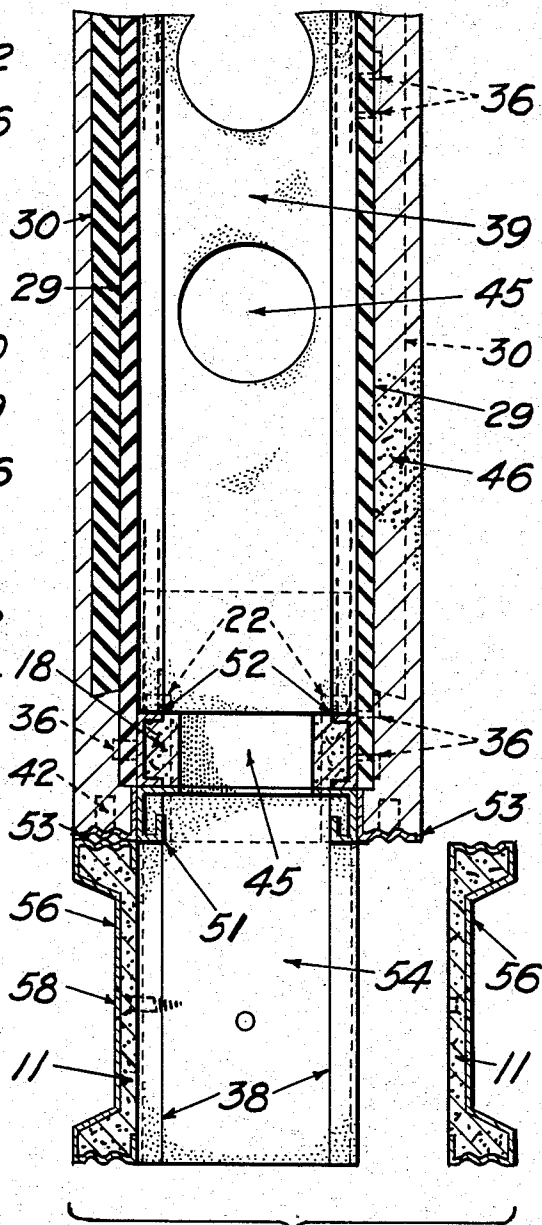


FIG. 21

INVENTOR
Louis J. Killion

April 19, 1938.

L. J. KILLION

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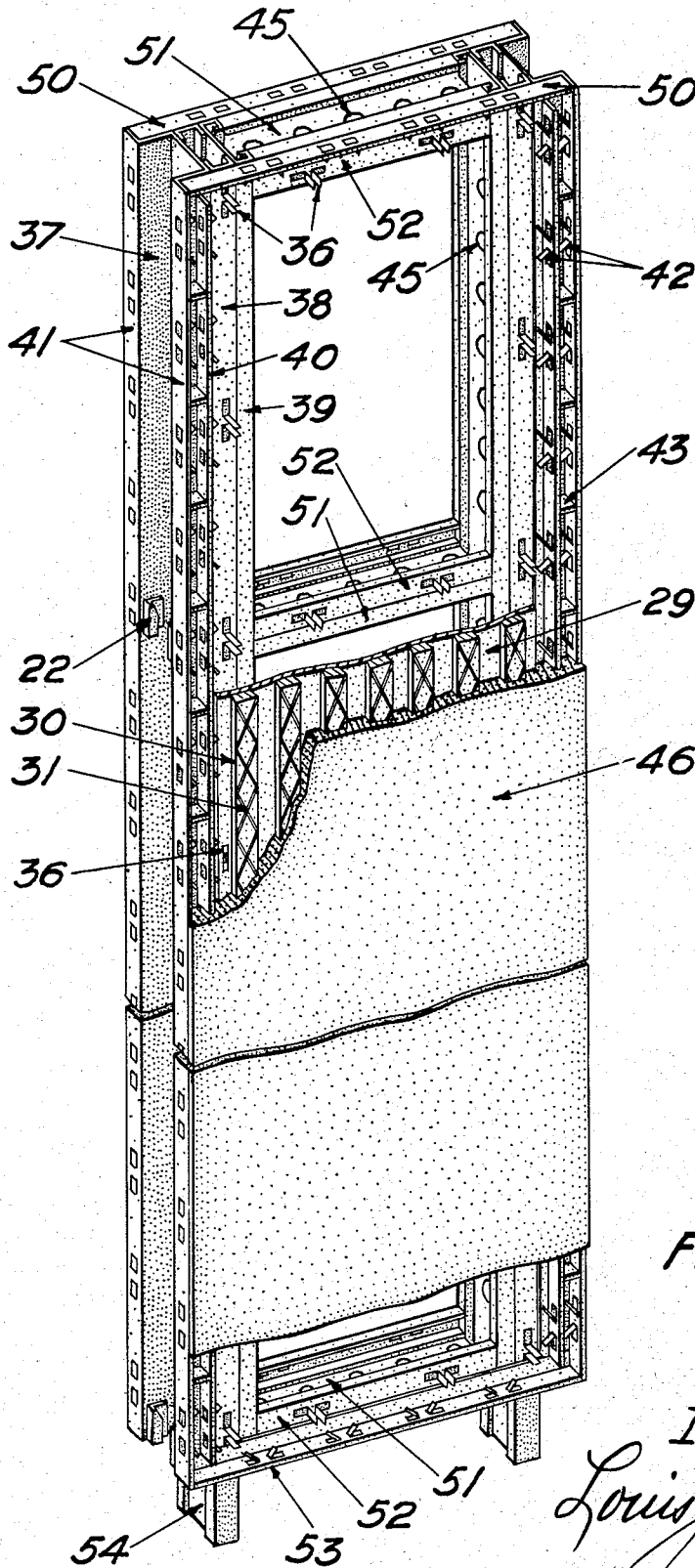


FIG. 22

INVENTOR

Louis Killion

April 19, 1938.

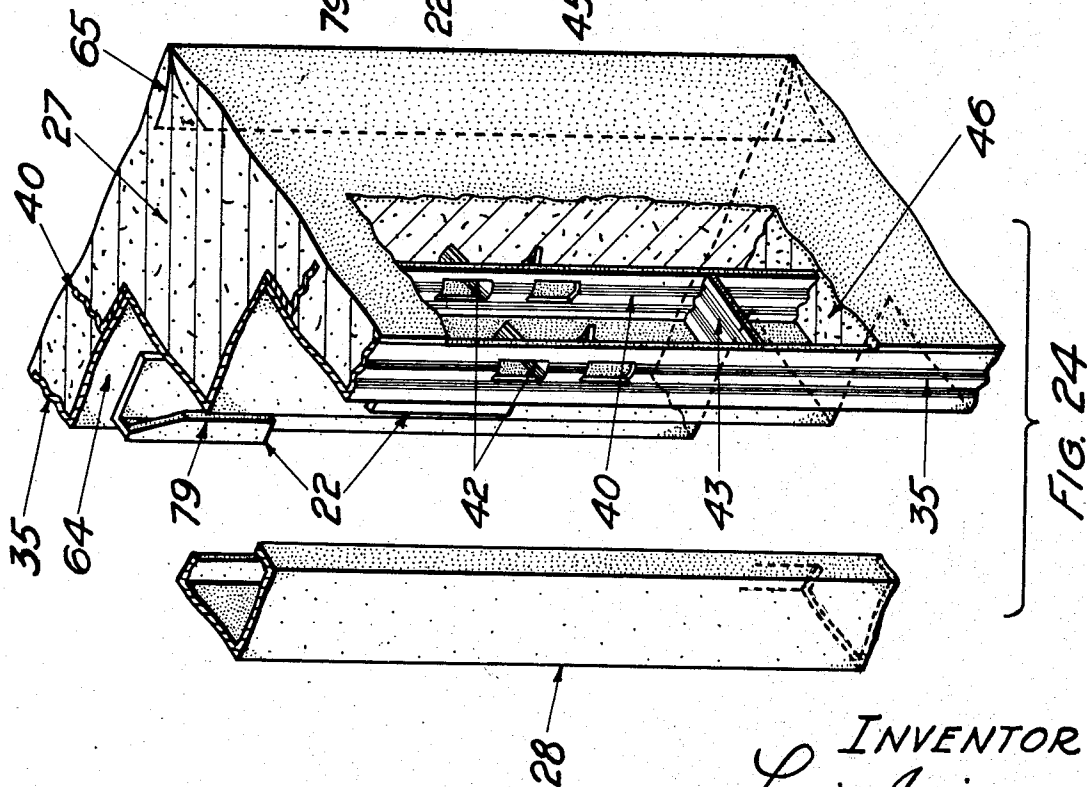
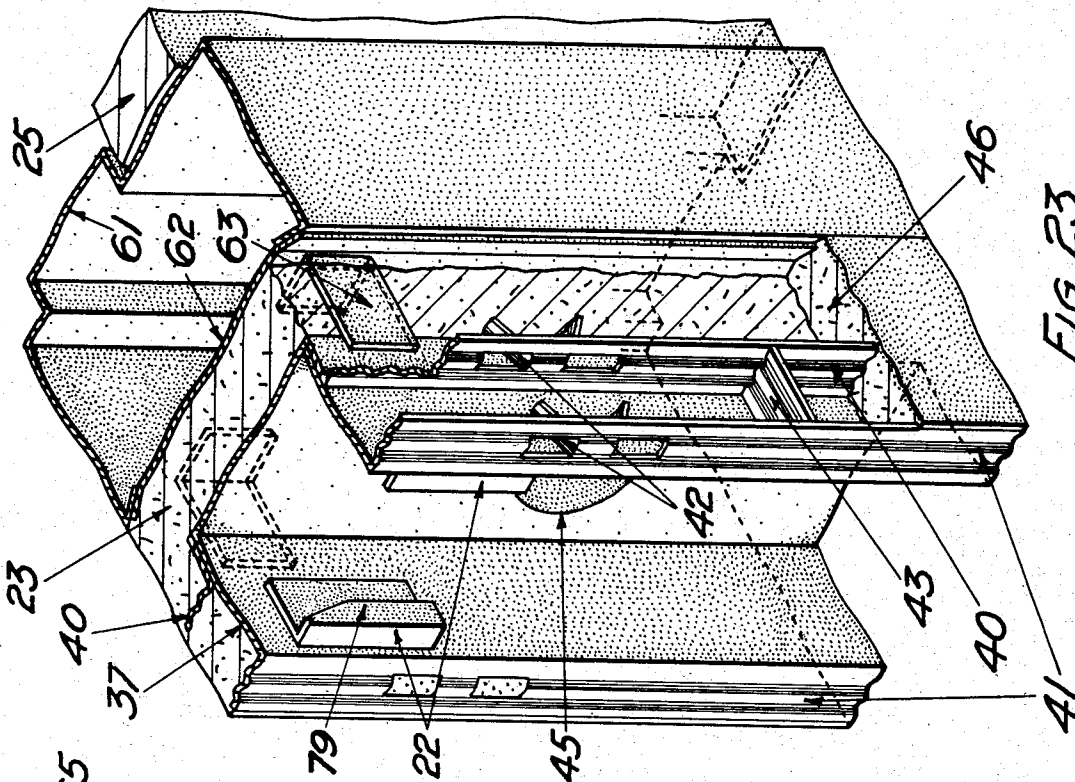
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INVENTOR
Louis J. Killion

April 19, 1938.

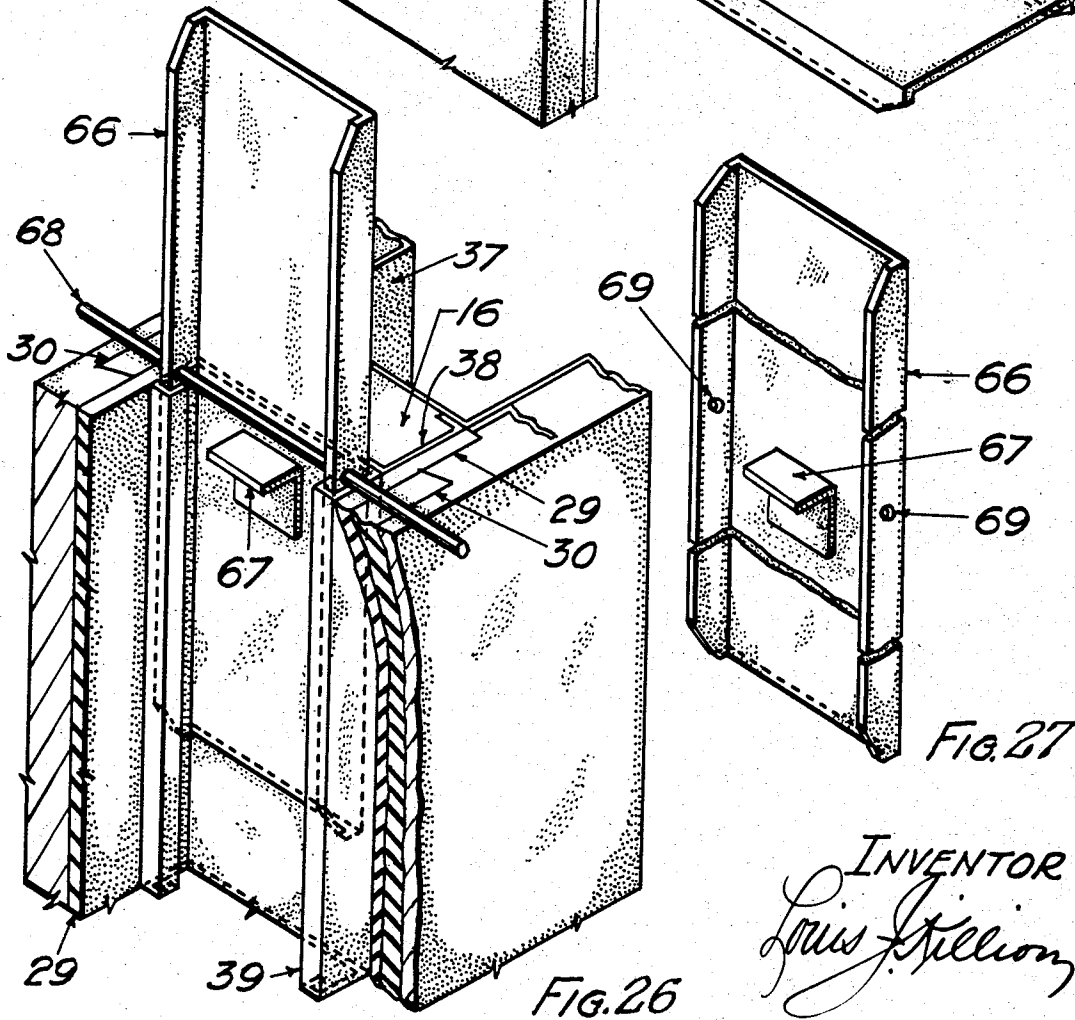
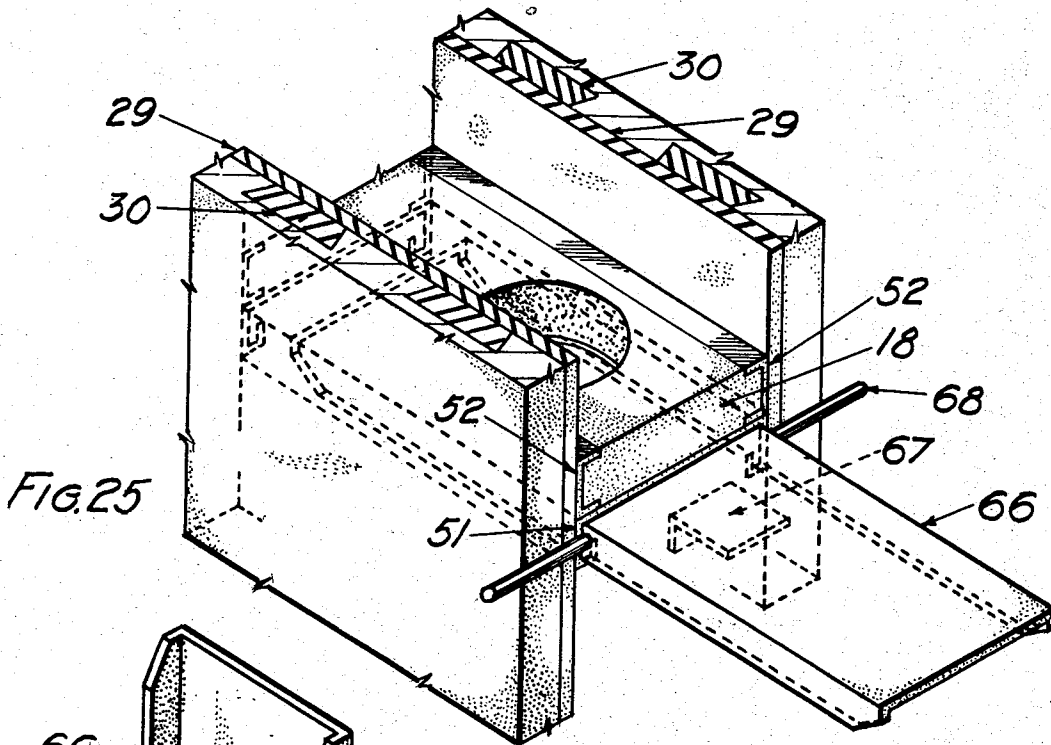
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INVENTOR
Louis J. Million

April 19, 1938.

L. J. KILLION

2,114,386

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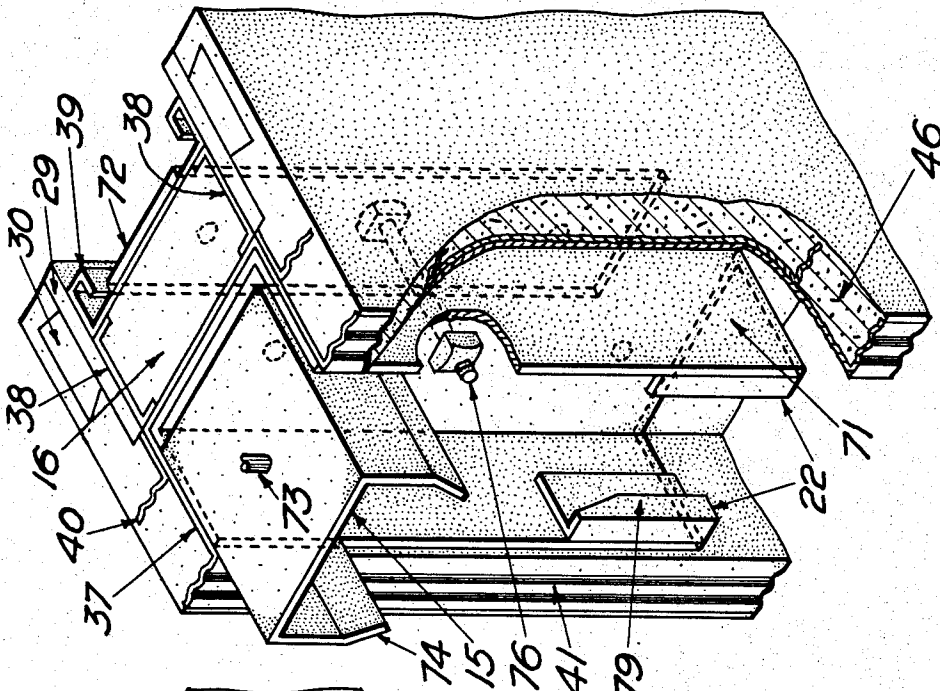


FIG. 28

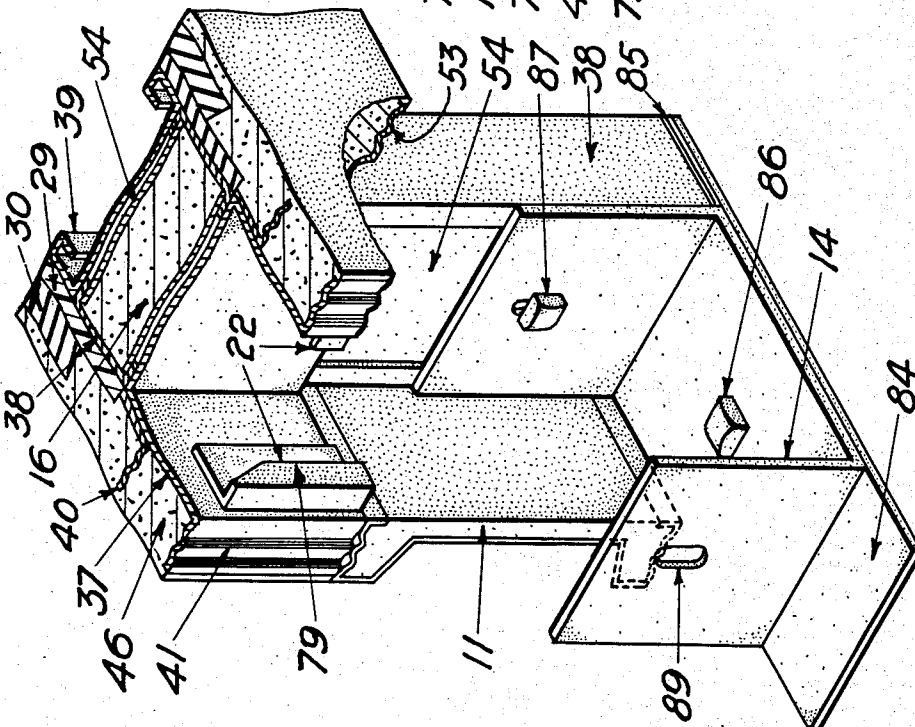


FIG. 29

INVENTOR
Louis Killion

April 19, 1938.

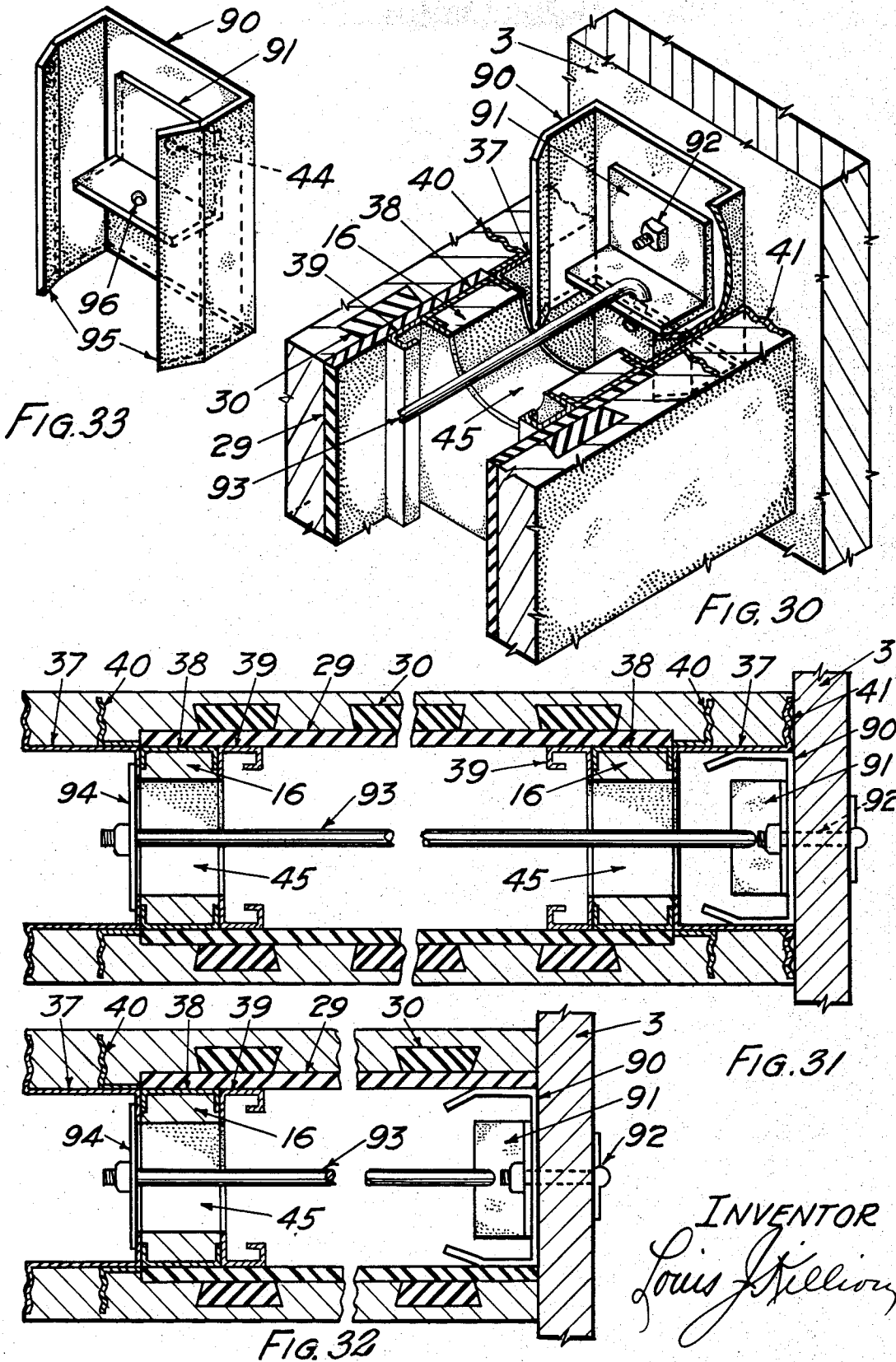
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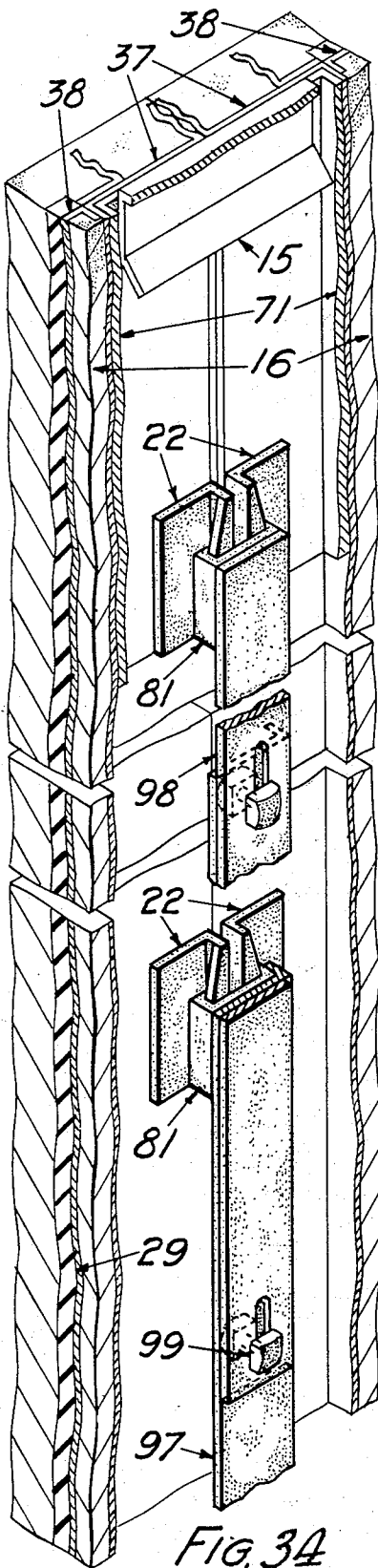


FIG. 34

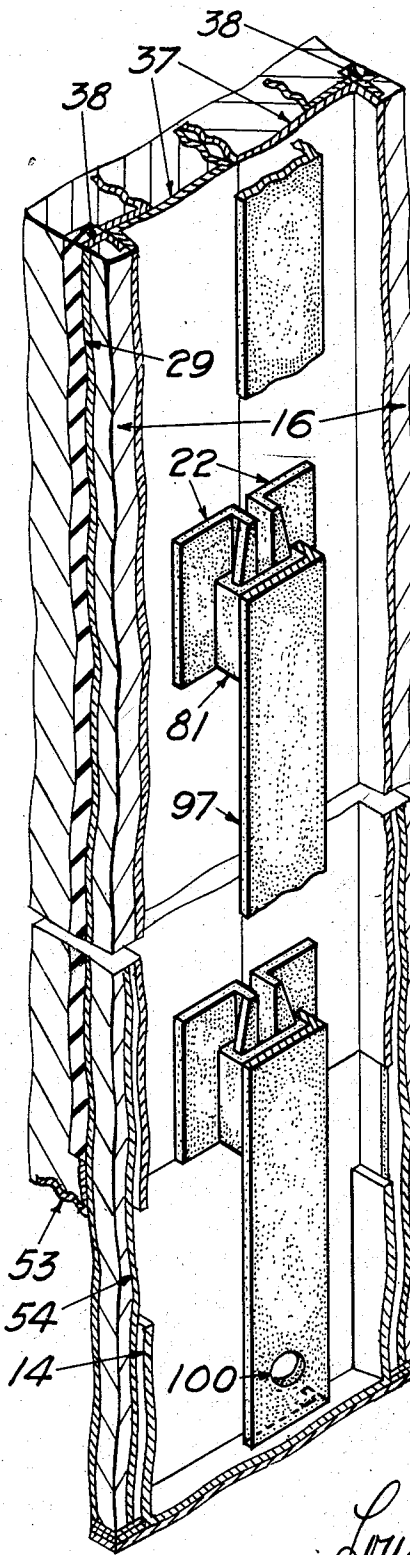


FIG. 35

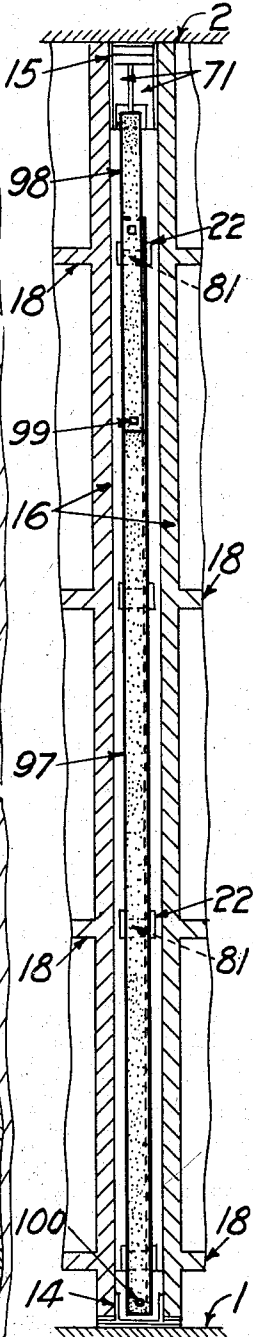


FIG. 36

INVENTOR
Louis J. Killion

April 19, 1938.

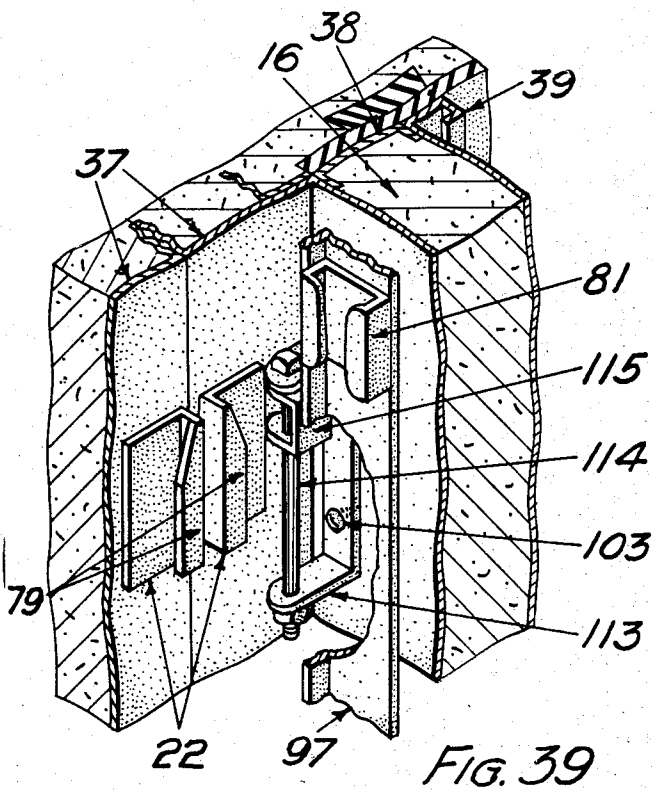
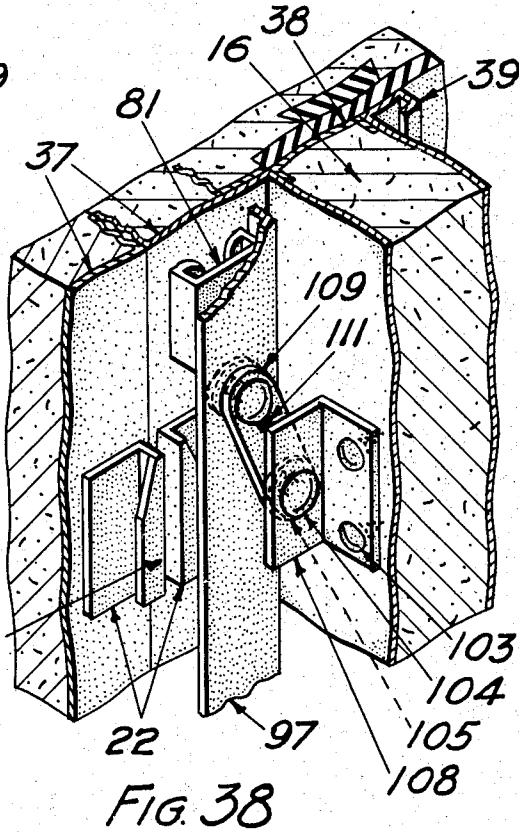
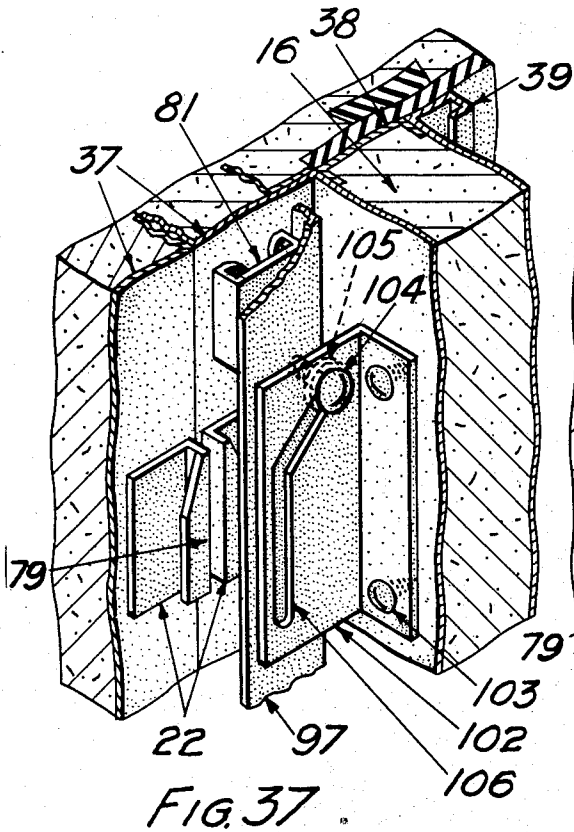
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INVENTOR
Louis Killion.

April 19, 1938.

L. J. KILLION

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FIG. 40

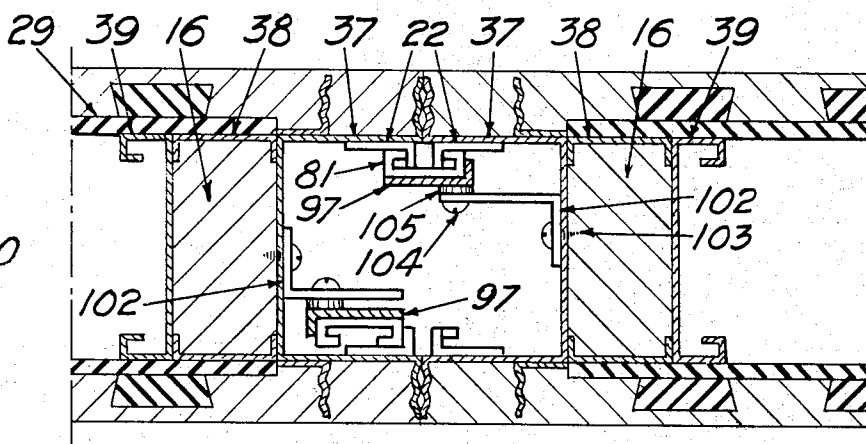


FIG. 41

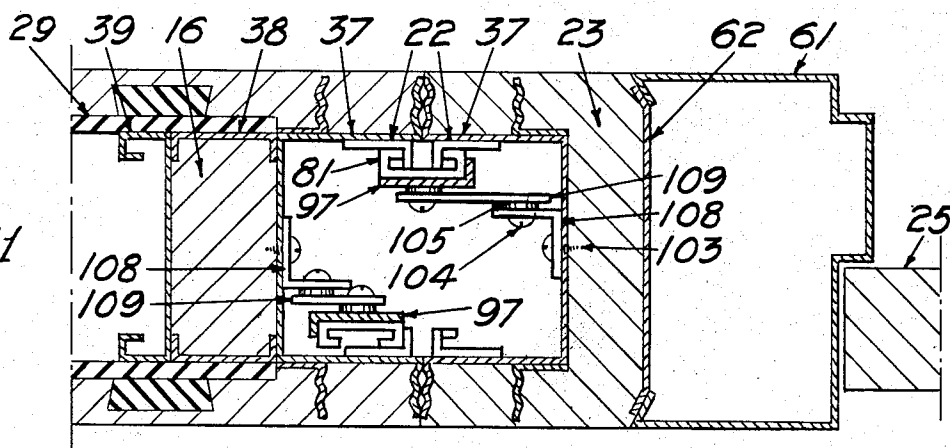
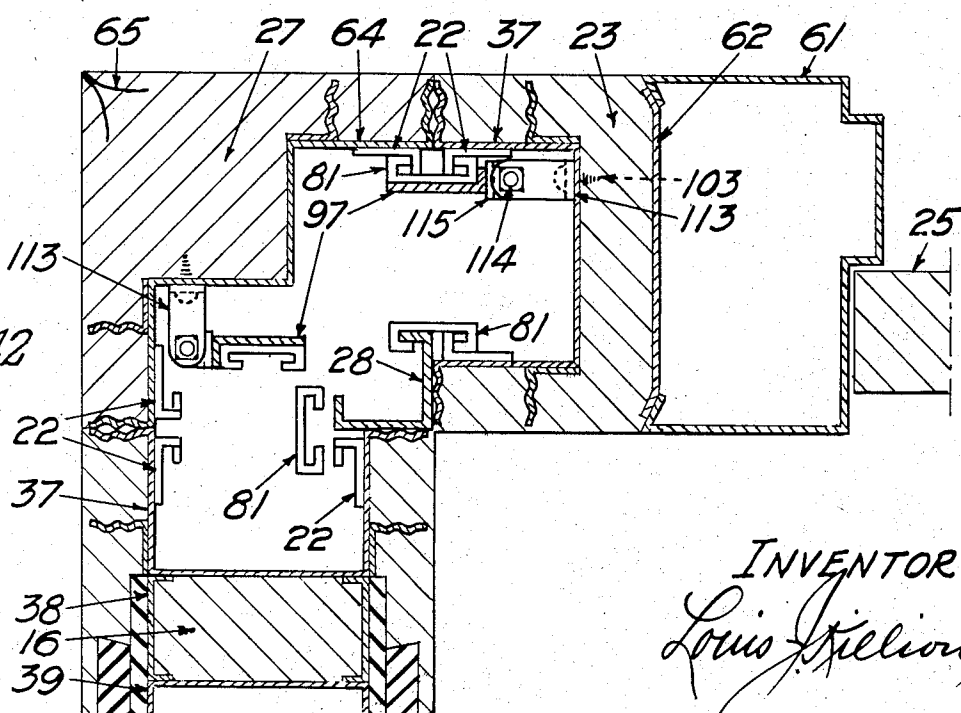


FIG. 42



INVENTOR
Louis Killion

UNITED STATES PATENT OFFICE

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MOVABLE WALL STRUCTURE

Louis J. Killion, Roxbury, Mass.

Application January 2, 1935, Serial No. 32

16 Claims. (Cl. 72-1)

This invention relates to movable wall structures of that type which comprises an assembly of integral wall units presenting facings of plaster or other plastic material. Said type is to be distinguished from the sheet metal partition walls now in wide use, and likewise from those walls in which the supporting structure of studs or other framework is erected first, and preformed building board is applied subsequently to one or both sides of said supporting structure.

My invention provides a wall which not only resembles a plaster wall but which is actually a plaster wall and is adapted to be erected in conjunction with permanent plaster walls already in place and to extend as an integral structure from floor to ceiling of any normal height room, regardless of said height. Moreover, my invention contemplates units which are complete integral units, adapted to be erected in the field without preliminary framework and without requiring the filling in of areas above units which are too short for their location.

My invention makes available for the first time units which may be easily and economically manufactured, safely handled in shipment and storage, easily and economically erected or dismantled in whole or in part with complete salvage of the part or parts removed, and in any assembly of which door and panel units may be easily interchanged. Moreover, the panel unit may be easily and economically altered in respect to height and width, and cut to meet obstructions, and may be re-altered and re-used indefinitely. Said wall units are not easily damaged and are of such character as to be easily and perfectly repaired. In accordance with my invention, the number of different standard units is kept to a minimum while fulfilling all normal requirements of layout. Moreover, the units of my invention are arranged to be fastened in identical manner and may be installed without the necessity of levelling the floor or providing a level foundation for the wall. Neither the layout nor erection work requires extensive preliminary engineering and the units may be easily selected and ordered and carried on inventory in storage.

My invention includes within its scope a novel panel unit for a movable wall structure, which unit includes a metallic frame, a non-metallic sheet secured at its inner face to said frame and having projections, such as cleats on its outer face, and a covering of plastic material such as plaster or gypsum molded upon the outer face of said sheet. The metallic frame may be advantageously constructed by welding together sep-

arate members of thin sheet steel having one or more angles and may be stiffened by struts of plastic material molded within the confines of said members. Flange portions of the metallic frame may be utilized as metallic binders for the edge surface of the unit. In its preferred form the panel unit of my invention has similar composite slabs upon opposite faces, is of hollow construction with a vertically disposed recess in each end face, and fastening and splicing mechanisms are provided within the hollow body of the unit, which mechanisms are entirely concealed in the finished wall.

My invention permits the use of units of identical structure extending continuously from floor to ceiling except for a portion at the base which is removable for access to the fastening mechanism in erecting or dismantling the wall.

In addition to the above described panel unit, my invention contemplates an assortment of interchangeable units in which is included doors, sash or other openings, or which may serve as corner portions in the wall.

Important features of my invention reside in the splicing mechanism which aligns and fastens two sections of cut panel units together to form a spliced unit. The novel design of this mechanism permits units to be altered to any desired size, height, or width. Preferably each unit is provided with elongated tubular or channel shaped members, open ended to receive aligning connectors, and these tubular or channel members are effective to receive said connectors at the top edge, or at any cut edge, horizontally or vertically, in a unit. Moreover, a unit thus spliced may be separated into its component sections by moving said connectors longitudinally in the tubular or channel members so as to clear the line of joint between said sections.

The invention also includes as another important feature, a mechanism for aligning and fastening adjacent units to one another in the wall. This includes a carrier member for movable clips, which member is mounted within the recess in the end face of the unit and arranged for movement, first, transversely from a position out of line with the joint between the units into operative relation with fixed clips on the units, and second, in a direction to effect the desired fastening operation. Moreover, the reverse operation disengages said clips and then moves carrier out of line with the joint between the units.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment

thereof, selected for purposes of illustration and shown in the accompanying drawings, in which

Fig. 1 is a view in elevation of a typical wall constructed in accordance with my invention

5 showing the various forms of wall units in place;

Fig. 2 is a view in perspective of a panel unit which has been cut both vertically and horizontally;

Figs. 3 to 8 inclusive are views in perspective 10 representing remainder portions of horizontally cut units;

Fig. 9 is a view in perspective of a standard panel unit with portions broken away;

Fig. 10 is a view in perspective of a standard 15 door unit;

Fig. 11 is a view in perspective of the outside portion of a standard corner unit;

Fig. 12 is a similar view of the inside portion of a corner unit;

Fig. 13 is a view in perspective of the reinforcing sheet of a standard panel unit with portions broken away;

Fig. 14 is a view of the reinforcing sheet in horizontal cross section;

Figs. 15 to 18 are fragmentary views in perspective showing details of the connection between the parts of the panel unit;

Fig. 19 is a view in horizontal cross section of a standard panel unit, the plastic facing being 30 omitted from one side of the unit;

Figs. 20 and 21 are views of a standard panel unit in vertical cross section on line 48-48 of Fig. 19;

Fig. 22 is a view in perspective of a panel unit 35 with portions broken away to show the metallic frame, also a portion of the reinforcing sheet attached thereto and a lesser portion of the plastic facing;

Fig. 23 is a fragmentary view in perspective of 40 a portion of a standard door unit;

Fig. 24 is a fragmentary view in perspective of the outer and inner portions of a standard corner unit;

Figs. 25 to 27 are views in perspective illustrating 45 details of the panel unit splicing devices;

Fig. 28 is a fragmentary view in perspective of the upper corner portion of a standard panel unit, showing the fasteners for securing it to the ceiling;

Fig. 29 is a fragmentary view in perspective of 50 the lower corner portion of a standard panel unit showing the fasteners for securing it to the floor;

Fig. 30 is a fragmentary view in perspective illustrating details of the connection of the panel 55 unit with an intersecting wall;

Figs. 31 and 32 are views in horizontal cross section of standard and cut panel units respectively;

Fig. 33 is a view in perspective of the wall fitting;

Figs. 34 and 35 are views in perspective illustrating the unit fastening clips in position within standard panel units showing particularly the 65 carrier for the movable clips;

Fig. 36 is a view of the same in elevation and on a smaller scale;

Fig. 37 is a fragmentary view in perspective illustrating further details of the panel unit fastening clip mechanism and showing particularly 70 the means of controlling the movement of the carrier for the movable clips;

Fig. 38 is a fragmentary view in perspective showing a modified means of controlling the 75 movement of the carrier for the movable clips;

Fig. 39 is a fragmentary view in perspective showing a second modified means of controlling the movement of the carrier for the movable clip;

Fig. 40 is a view in horizontal cross section 5 showing the arrangement of the panel fastening mechanism of Fig. 37 within abutting panel units;

Fig. 41 is a view in horizontal cross section showing the arrangement of the panel fastening mechanism of Fig. 38 within abutting panel and 10 door units; and

Fig. 42 is a view in horizontal cross section showing the arrangement of the panel fastening mechanism of Fig. 39 within abutting panel, corner and door units. 15

Before proceeding with a detailed description of the units composing my invention reference is directed to Fig. 1 which illustrates in condensed form the conditions to be encountered and the application of the units of this invention to these 20 conditions. The units extend vertically from the floor 1 to the ceiling 2, the floor and ceiling being of any construction, and horizontally between two intersecting walls of any character 3. All units have been cut off at the top to fit between floor and ceiling. 4 represents a panel 25 unit of standard width abutting an intersecting wall. 5 represents an adjacent door unit. 6 an adjacent panel unit of width less than standard made by combining two sections each cut preferably from separate standard units. 7 and 8 represent the outside and inside portion of an adjacent corner unit. 9 represents an adjacent panel unit of width greater than standard made preferably by combining the excess portions obtained in making the panel unit 6. 10 represents an adjacent portion of a standard unit abutting an intersecting wall. 11 represents a removable portion at the base of panel units. 35

Attention is called to two items of outstanding 40 importance, first that only three standard units, panel unit, door unit and corner unit are necessary to construct this typical wall structure and, second that there is no waste, as all excess portions of the units are usable for splicing purposes. These two items together with the two 45 fundamental requirements namely that the wall have the characteristics of a plaster wall and that it be movable, both of which requirements are fulfilled as hereinafter shown make this invention 50 of noteworthy importance to the building industry.

I will first proceed to describe the construction of what I may term the standard panel unit which is the principal unit of the movable wall structure of my invention. This unit comprises a rigid metallic frame composed of various sheet metal angle members, and in the term angle members I include channel forms and all sheet metal forms having one or more angles therein. 60 As shown in Figs. 19, 22, and 23, the frame comprises at each side edge a vertically disposed channel member 37 having outturned flanges 41. Preferably and as herein shown, said flanges 41 are longitudinally corrugated and serve as bindings for the side edge of the unit. The channel member 37 forms a metal bound recess in the edge face of the unit which serves purposes later described. Located in parallel spaced relation to the back of channel member 37 is a vertical 70 channel member 39 with inturned flanges forming an open ended guideway for splicing or aligning connections as will be presently explained. The channel members 37 and 39 are preferably of the same length and extend continuously from 75

top to bottom of the plastic slab portion of the unit which is hereinafter described. Between the backs of channel members 37 and 39 and disposed at right angles thereto are two oppositely disposed channel members 38 which are welded to,

and serve as spacing connectors for said channel members 37 and 39. The channel members 38 may be continuous or they may consist of relatively short lengths spaced vertically at intervals. Vertical angle members 40 are welded to the side flanges of the vertical channel member 37 and disposed with their outturned, corrugated flanges in parallel spaced relation to the exterior flanges 41. Horizontal struts or braces 43 of corrugated construction may be interposed between the vertically extending members, as shown in Figs. 22 and 23, and serve to stiffen the whole structure and divide the side edge portions of the panel unit into pockets or compartments that serve to localize any possible damage to the panel unit and also facilitate repair of such damage. Tongues 42 are struck out of the material of these flanges and serve as anchoring means for the plastic facing of the unit, as will be presently described.

The vertical members 37 of the unit are held in rigid spaced relation by horizontally disposed members welded at their ends to the vertical assembly. Sectional views of these members are also shown in Figs. 20 and 21. The upper of these horizontal members comprises a channel member 51 which is welded at its ends to the flanges of vertical channel members 39. Channel member 51 has overhanging flanges forming a guideway for splicing and aligning connectors and it is preferably similar or identical in section to vertical channel member 39. On each of the upstanding flanges of channel member 51 is secured an angle member with out-turned corrugated flange 50 having struck out tongues 42 which serves as a binding for the upper edge of the unit. On the back of channel member 51 and disposed at right angles thereto are two oppositely disposed channel members 52 which are preferably similar or identical in section to vertical channel members 38 and which may be continuous or may consist of relatively short lengths at spaced intervals horizontally. At intermediate points within the unit are provided channel members 51 welded at the ends to vertical channel members 39 and having channel members 52 welded to the backs thereof. The lowermost horizontally disposed member comprises guideway channel member 51 welded at its ends to vertical channel members 39 and having channel members 52 welded to the back thereof. Each downstanding flange of guideway channel member 51 has secured thereto an angle member with out-turned corrugated flange 53 having struck out tongues 42 which serves as a binding for the bottom edge of the slab portion of the unit.

Each of the vertically disposed metallic assemblies formed as described above by channel members 37, 38 and 39 may be strengthened as shown by molding a bar of plastic material 16 within the confines of said members, this composite assembly being horizontally perforated by circular or other shaped openings 45 to reduce weight and permit access for the reception of concealed wiring and the like. Moreover, each of the horizontally disposed metallic assemblies formed as described above by channel members 52 and 51 may be strengthened as shown by molding a bar of plastic material 18 within the confines of said members, this composite assembly being verti-

cally perforated by circular or other shaped openings 45 to reduce weight and permit access. The above described plastic bars 16 and 18 are preferably poured before the individual metallic assemblies are framed together.

The non-metallic reinforcing sheet 29 used in the standard panel unit is best shown in Fig. 13 and may be constructed of fibre, composition such as bakelite, or any other tough and strong, sound insulating material. Each of these sheets 29 is of such dimension as to cover substantially one side of the metallic frame and is provided with vertical slots 33 and horizontal slots 34 at such locations as to receive the tongues 36 which are struck out of the members of the metallic frame, all as shown on fragmentary views Figs. 15 to 18. These tongues are clenched upon the outer face of the sheets 29 holding them in place upon opposite sides of the metallic frame although it may be understood that any other suitable fastening means may be employed. Each sheet 29 is provided upon its outer face with a series of projecting cleats 30. The horizontal space between said cleats 30 is arbitrarily shown as being equal to the width of said cleat 30, but it is to be understood that other ratios are permissible. Furthermore, the cleats 30 may extend horizontally instead of vertically as shown. The cleats 30 are shown as being fastened to the body of sheet 29 by clinch nails 32 but any suitable fastening means may be employed, or in some cases it may be desirable to make the cleats as an integral part of the sheet. The outer face of each cleat 30 is provided with undercut grooves 31 preferably extending obliquely and forming anchoring recesses for the plastic covering of the unit. Furthermore, each cleat 30 is undercut on all edges for the same purpose. Sheet 29 overlaps horizontal channel member 52 at top and bottom and vertical channel member 38 at each side a sufficient amount to insure proper fastening for tongues 36.

Each face of the standard panel unit is completed by molding plaster, gypsum or other plastic compound upon the outer face of each of the two sheets 29 so that the plastic material extends continuously between the vertical out-turned flanges 41 and the out-turned flanges 50 and 53 of the upper and lower horizontal members. The plastic material 46 thus encloses the projecting cleats 30 and fills the space between the vertical flanges 40 and 41, being anchored in place by the cleats 30 and their grooves 31, and the corrugations of and the tongues struck out from the out-turned flanges 40, 41, 50, and 53. The out-turned tongues 36 by which sheets 29 are secured to the metallic frame also afford anchoring means for the body of the plastic material. The layer of plastic compound forming the face is such as to take the finish of an ordinary plaster wall and the remainder may be homogeneous thereto or may be a cheaper and more porous mixture.

It will thus be seen that the standard panel unit of my construction includes a rigid metallic frame which is concealed except for the peripheral binding flanges and the two spaced composite slabs, each comprising the non-metallic, cleat carrying sheets 29 and the finished covering of plaster or plastic material, all permanently manufactured in a comparatively light, rigid, sound-proof unit.

The panel unit above described may be manufactured in quantity and maintained in stock in standard size, but it is contemplated that it will

be necessary on each erection job to adjust the height of the unit to fit ceilings of various heights, generally lower but sometimes higher than the unit, and furthermore to employ one or more units of width less or greater than standard. The construction of the unit is therefore designed to permit sawing on horizontal or vertical lines and the splicing together of the cut sections, and furthermore, the splicing of a cut section directly to the top of the unit. In cutting a unit horizontally or vertically it is entirely practical to saw through the sheet steel of the frame members and the non-metallic sheets 29 without injuring the plastic portions of the unit.

The panel unit may be cut horizontally on any line below the uppermost channel members 52 when it is desired to reduce the height of the unit. I contemplate a standard height of unit of ten feet or thereabouts and this is sufficient to take care of rooms of ordinary height by cutting off a comparatively narrow section from the top of the unit, which narrow section is not thrown away but is retained for splicing purposes. It is to be noted that the top of the standard unit and all horizontally cut sections thereof present a pair of perfectly aligned splicing channels 39. In adapting any unit, standard or cut, to a higher room, that is to increase the height of the unit, splicing connectors 66 shown in Figs. 25 to 27 are employed. Said connector 66 comprises a short channel iron having the ends of its flanges chamfered or tapered to facilitate insertion and having an abutment angle 67 secured to the inner face of its web. Moreover said connector 66 is provided with a centrally located transverse hole 69 extending through its flanges for the insertion of a rod 68 which extends outwardly on both sides of the connector. In making a vertical splice, a connector 66 carrying a rod 68 is forced into each of the splicing channels 39 of one component section all as shown in Fig. 30. The splicing channels 39 of the complementary section are then forced onto the projecting connector ends and the two sections are forced toward one another until separated only by rod 68. Rod 68 is now removed and closure is completed with connector 66 substantially centered with the line joint between sections, which line joint is hidden by the painting of the completed wall.

It will be understood that in most cases the uppermost edge of the unit will comprise a cut edge, although in those cases where the height of the unit corresponds to the height of the ceiling, the upper edge of the unit will be bound by the corrugated flange 50 of the uppermost horizontal member.

In Figs. 3 to 7 are represented horizontal sections cut from the upper ends of several units in adapting said units to the ceiling height. One or more of these sections may be utilized to increase the height of any unit of either standard or altered height, all as described above. It will be seen, therefore, that in carrying my invention into effect, I have the advantage of a supply of cut sections always available for splicing purposes.

In Fig. 2 is represented a vertical section formed by making a vertical cut through a unit that had previously been horizontally cut off at the top. This section presents at its vertically cut edge the perfectly aligned open ends of the cut horizontal splicing channels 51 and this section may be united to any other vertically cut section to form an integral unit by means of

splicing connectors 66, the procedure being similar to that described above for making the vertical splice. Moreover, since the width of the completed unit is the combined widths of the component sections, proper selection of sections will produce a unit of any desired width, standard or otherwise.

When it is desired to separate a spliced unit into its component parts, connectors 66 are forced longitudinally in the splicing channels 39 or 51 in either direction to clear the line of joint and the two sections automatically fall apart. Moreover, each of the sections is immediately available for re-use and these operations may be repeated indefinitely. Any convenient bar engaged against buttress angle 67 will serve to move the connectors 66.

This invention contemplates alternative structures providing a unit of standard height such as 10 feet. In the first example, the unit proper is in one piece, full height, in which case the width of the unit will preferably be one half the width of the door unit. In the second example, the unit proper is in two pieces, a lower section approximately 8 feet high, and an upper section approximately 2 feet high, the construction of the two sections being similar. In this case the width of the unit will preferably be the width of the door unit. It is contemplated that just before actual erection, the upper section will be mounted onto the lower section by the splicing detail described above. When this unit is dismantled and returned to storage it is further contemplated that it will be separated into its upper and lower sections to facilitate handling, likewise as described above.

In preparing the upper edge of a unit for connection to the ceiling, whether the unit has been cut, or spliced or not, it is proposed to insert a vertical reinforcing channel member 71 between the flanges of the channel member 37. This is best shown in Fig. 28 and is adapted to be placed in the top of the unit and flush with the upper edge thereof. The reinforcing channel member 71 is held firmly in place by bolts 76 passing through the webs of channel members 37 and 39 and the plastic body of the strut 16 between and a reinforcing plate 72 which is positioned upon the inner face of the splicing channel member 39. The panel is thus reinforced in that portion which is to be connected to the ceiling. The reinforcing channel member 71 carries upon its side walls a pair of fixed clips 22, which clips are a spaced distance from the top of said channel member 71 and hence will automatically be installed a definite distance from the ceiling, an important feature of this invention, all of which will be referred to hereinafter.

Connection is made between the upper edge of a standard, or cut, or spliced unit and the ceiling by channel shaped ceiling fittings 15, shown in Fig. 28. Fitting 15 has flanges with converging portions 74 for easy entrance into the hollow body of the unit, and the web portion thereof is perforated at 75 to receive a lag screw or expansion bolt 73. In erecting a wall, a series of ceiling fittings 15 is first secured to the ceiling with the individual fittings aligned and spaced so as to lie between the vertical stud members of adjacent units as best shown in Fig. 28. Preferably, the fittings are centered on the vertical line of juncture and thus serve accurately to align adjacent units at the ceiling. It will be understood that the ceiling connection may be identical for panel and door units and that if necessary a

similar connection may be employed in the case of corner units.

Before proceeding to describe the connection between the panel unit and the floor, further description of the bottom edge of the unit will be given. It will be understood that the lower edges of the non-metallic sheets 29 and the plastic filler 46 are bounded by the lower horizontal assembly of frame members, the plaster being bound by the out-turned corrugated flanges 53, as best shown in Figs. 21 and 29. The oppositely disposed channel members 38 of the vertical studs of the unit, however, extend below the flanges 53 and constitute in effect legs which space the composite slabs of the unit approximately five inches above the floor, thus affording access to the interior thereof for purposes which will be presently described. Said channel members 38 are supplemented at the bottom by two side plates 54 which extend upwardly into the body of the unit and enclose the side faces of plastic column 16 which would otherwise be exposed. The plates 54 may be inserted inside the flanges of the channel members 38 and welded in place prior to pouring the plastic body of the stud column 16. Each unit, therefore, is provided with a leg adjacent to each lower corner and the unit may be levelled and permanently supported by shimming up these legs independently regardless of the condition of the flooring upon which the wall is to be installed.

Connection is made between the legs above described and the floor by means of channel shaped floor fittings 14, best shown in Fig. 29. Fitting 14 is perforated in the web portion at 88 to receive lag screw 86 and is provided with vertical slots 89 in its upstanding flanges to receive bolts 87 through or into the leg of the unit. In erecting a wall, these floor fittings are secured in place in alignment and with proper spacing to fit against the legs of adjoining units. In practice the floor fittings 14 will be located vertically beneath the ceiling fittings 15. In Fig. 29 is shown a plate 84 positioned beneath a floor fitting 14 to afford a fair bearing therefor. Shim plates 85 are also shown as interposed between the plate 84 and the bottom of the leg of the unit.

After the wall structure has been erected, the open space beneath the horizontal flanges 53 may be filled by cover members 11 of proper width to fill the space between the flange and the floor and perforated so that they may be attached to the legs of the unit by screws 58 or other means. The cover members 11 as shown in Fig. 21 comprise a molded metallic facing 56 shaped with upper and lower corrugated flanges, similar to those already described in connection with the standard unit, and a filling of gypsum or other compound. The outer face of each cover member 11 is recessed longitudinally so that it may be used to contain wiring if desired, and it is contemplated that the assembled cover member may be concealed by a conventional base of metal or other building material.

The connection between the vertical edge of a standard or vertically cut unit and an intersecting wall may be made by wall fittings 90, shown in Figs. 30 to 33. The fitting 90 is channel shaped and is provided with converging flange portions 95 for easy entrance into the hollow body of the unit. It is also provided with an angle iron 91 secured in place between its flanges and having a perforation 96 in the outstanding flange. The entire fitting is perforated at 44 to receive a toggle bolt or lag screw 92. Wall fittings 90 are secured to the face of the intersecting wall struc-

ture 3 in aligned relation and spaced so that the hole 96 in the angle iron 91 lies opposite to one of the horizontal openings 45 in the vertical stud member of the unit. A hook bolt 93 is passed through the opening 45 and engaged through perforation 96 with the angle iron 91 of the wall fitting 90. In the case of the standard unit such as represented in Fig. 31, the hook bolt will be of length sufficient to pass through both vertical studs of the unit. A perforated plate or washer 94 is provided at the outer end of each bolt and by taking up the nut, the unit may be drawn firmly into engagement with the intersecting wall 3 and held rigidly in place. In the case of a vertically cut unit such as is represented in Fig. 32, the hook bolt will be of length sufficient to pass through the vertical stud member of the cut unit. These hook bolts may be supplied as rods of random length threaded at one end in which case they are bent to proper length by the workman on the job.

In order to align the vertical edges of adjacent units and to fasten the units together, the following mechanism is provided. Each unit has a series of fixed clips 22 secured in spaced relation to both of the inside faces of the flanges of the vertical channel members 37. The clips 22 are arranged one above another at predetermined heights with respect to the lower end of the vertical stud members of the unit. Accordingly, when two units are brought into abutting relation in the wall structure, two of these fixed clips 22 will lie adjacent to each other and in opposite relation on opposite sides of the line of juncture between the units. Referring to Fig. 34, it will be plain that each fixed clip 22 has a corresponding oppositely disposed clip located opposite to it in the adjacent unit and that the clips are arranged in pairs upon both of the flanges of each abutting channel member 37 so that both of the spaced slabs of the units will be fastened as will presently appear. Referring to Fig. 39, each of the clips 22 is provided with a flange having an overhanging rib 79 and the ribs may be bevelled or chamfered at one or both ends for the reception of a movable connecting clip 81. The clip 81 is a channel member designed to engage the flanges of two fixed clips 22, to fit over the ribs 79 and to draw the two clips toward each other, as shown in Fig. 34. In addition to the function of firmly holding the units together at their line of juncture, the clips have the additional function of accurately aligning the units so that their outer surfaces shall exactly coincide and be flush in the wall structure.

As a convenient means for positioning and interlocking the movable clips 81 with the fixed clips 22 I provide a carrier which is best shown in Figs. 34 to 36, which comprises a vertically disposed angle bar 97 to which is welded or otherwise secured one movable clip 81 for each pair of fixed clips 22 on the units, vertical spacing of said clips to be identical. An extension bar 98 is adjustably connected to the upper part of bar 97 by bolts 99 and to the upper end of bar 98 is secured the upper movable clip 81. Bar 98 may be adjusted vertically to locate the upper movable clip 81 properly for interlocking engagement with the uppermost pair of fixed clips 22. Said uppermost fixed clips 22 are secured to the flanges of reinforcing channel member 71 and are always a fixed distance from the ceiling as hereinbefore explained. Due to variable ceiling heights, the distance between said uppermost fixed clips 22 and the pair immediately below which are mount-

ed uppermost on the unit proper will likewise be a variable distance and extension bar 98 may be adjusted vertically on angle bar 97 to bring the uppermost movable clip 81 into the same relation with respect to the uppermost pair of fixed clips 22 which the lower movable clips 81 bear to the lower fixed clips 22 in the unit. It will be understood that all the movable clips 81 are simultaneously presented by the carrier above described into position to be interlocked with the whole series of fixed clips 22 on one face of the units in securing the edges of adjacent units together. At its lower end each bar 97 is provided with a hole 100 which is located in the open space at the bottom of the unit in position where a bar or other tool may be inserted for driving the carrier downwardly and interlocking the movable clips 81 with the fixed clips 22. Similarly, if it should be desired to remove a unit from the wall structure, the carrier may be moved upwardly to disengage the clips.

One of the carrier assemblies above described is mounted in the vertically disposed recess at each side edge of the standard unit. The general location of the carriers is best shown in Figs. 40 to 42 and it will be understood that in any unit the carriers are mounted so that in facing the edge recess, the carrier is always located at the same side of the recess, for example, always at the left side of the recess. The result is that when two units are brought into abutting relation, the carrier members occupy diagonally opposite positions in the space formed by the two vertically extending recesses, one carrier member operating on each face of the units.

In mounting the carrier assembly in the unit a pair of bracket members 102 is utilized and secured to the face of channel member 37 by screws 103. (Figs. 37 and 40). Said bracket member 102 has an outstanding flange provided with a cam slot 106 having a lower vertical portion and an upper inwardly inclined portion and the carrier bar 97 is connected thereto by a stud or screw 104 which is arranged to travel in the cam slot 106 and is provided with a washer 105 interposed between the back of the carrier bar 97 and the outstanding flange of the bracket 102. As a result of this connection, the carrier assembly in its downward movement travels first, transversely with respect to the joint into a position in which the movable clips 81 are located vertically above the flanges of the fixed clips 22, and second, downwardly, carrying the clips into interlocking relation. It will be noted that in its initial position the carrier assembly is located entirely at one side of the line of juncture between the units so that it does not interfere in any way with the insertion or removal of the unit from the wall structure. Different mechanism for mounting the carrier assembly is fully illustrated in Figs. 37 to 39. Fig. 37 shows the carrier assembly in its initial position, the clips being unfastened and the carrier being in in-operative position. After the carrier assembly has completed its transverse movement it stands directly behind the line of juncture between the units, and in its final position the clips are fully interlocked.

In Fig. 40 which shows a portion of a panel unit abutting a portion of another panel unit in plan view, one carrier assembly is shown in locked position and the other in its initial inoperative position. In Fig. 38 I have shown an alternative manner of mounting the carrier assembly in the standard panel unit. As shown in this figure, a pair of angle brackets 108 are secured to the face

of the channel member 37 by screws 103 and carrier bar 97 is connected to these brackets by means of parallel links 109. Link 109 is secured to angle bracket 108 by pivot pin 104 provided with a washer 105 and the link is connected at its outer end to carrier member 97 by a pin and slot connection the slot 111 being shown in Fig. 38. The links 109 maintain the carrier bar 97 always in a vertical position and insure its transverse movement to align the clips and then through the pin and slot connection permit it to be moved vertically to interlock the clips. In Fig. 41 which shows a portion of a panel unit abutting a portion of a door unit in plan view one carrier assembly is shown in locked position and the other in its initial in-operative position.

A second alternative form of mounting the carrier assembly is shown in Fig. 39. In this construction a pair of hinge brackets 113 are secured to the face of channel member 37 by screws 103. The member 113 carries a vertical hinge pintle 114 which passes through a U-shaped hinge member 115 which is fastened to the flange of the bar 97 of the carrier assembly. The carrier is thus permitted to swing through substantially 90° from an inoperative position, into a position shown in Fig. 42, in which the movable clips 81 are in alignment with the fixed clips 22 and the carrier bar 97 stands directly behind the junction between the adjacent units. The carrier assembly may then move downwardly, the hinge member 115 sliding upon the hinge pintle 114 and the clips are thus brought into interlocking engagement.

In Fig. 42 which shows a portion of a panel unit abutting a corner unit which in turn abuts a portion of a door unit in plan view, one carrier assembly for the outer portion is shown in locked position and the other carrier assembly for said outer portion in its initial in-operative position. The fastening of the panel and door unit to the corner unit inside portion will be referred to hereinafter.

In all of the constructions above described it will be seen that the carrier assembly may be moved to an inoperative position when desired, in which it does not obstruct the insertion or removal of the unit in which it is located. Moreover, all the necessary manipulation of the carrier mechanism may be effected by access afforded through the space at the bottom of the unit.

The standard panel unit has now been fully discussed and the description of the door unit now follows. As hereinbefore explained in connection with the standard panel unit, this invention contemplates alternative structures providing a door unit of standard height such as ten feet. In the first example, the door unit proper is in one piece, full height, in which case it will preferably be twice the width of the corresponding panel unit so that it will be interchangeable with two panel units in the wall structure. In the second example, the door unit proper is in two pieces, a lower section approximately eight feet high which contains the door frame, and an upper section approximately two feet high which is similar in construction to the corresponding section of the panel unit, and the two sections will be assembled before erection into a single unit in the same manner as outlined for the panel unit. In the second example the width of the door unit will preferably be the width of the panel unit so that it will be interchangeable with one panel unit in the wall structure. It is to be understood,

however, that any other desired ratio of widths may be adopted. The side edges and the upper portions of the door and panel units are identical in structure.

Referring now to Figs. 10, 23 and 41, the door frame comprises a formed, tubular member preferably constructed from a substantially channel shaped member 61 and a tie plate 62. The channel shaped member 61 has inturned flanges converging inwardly and these are welded to corresponding flanges formed on tie plate 62. The tubular metallic door frame extends entirely around the two sides and top of the opening for door 25 (Fig. 10) which may be hinged to the door frame in any desired manner. The door frame is secured to the metallic framework of the unit by a series of angle brackets 63 best shown in Fig. 23. One flange of bracket 63 is welded or otherwise secured to tie plate 62 and the outstanding flange is welded or otherwise secured to the flange of interior angle member 40 thus supporting the door frame in rigid spaced relation to the channel member 37. The space between the tie plate 62 and the channel member 37 is preferably filled with gypsum or other plastic material forming an integral stud 23 which stiffens the whole structure and which corresponds substantially to stud 16 of the standard panel unit although it may vary somewhat in thickness. The vertical assembly thus formed is provided with spaced horizontal openings 45 corresponding in location to the openings in the standard panel unit studs. It will be understood that the door unit includes the same edge recesses and the same fixed clips 22 as the standard panel unit, so that they may be installed and secured in place in exactly the same manner, all as already fully explained. The opening for the door may be of any desired height and may include a transom opening. The construction of that portion of the unit above the door is similar in all respects to that of the standard panel unit.

A description of the corner unit shown in Figs. 11, 12, 24, and 42 now follows. This comprises two separate parts which have no physical connection until assembled in the wall structure. For convenience, they will be termed the outer and inner corner portions. The outer corner portion comprises a metallic angle member 64 which has a centrally disposed exterior right angular portion merging into side portions having out turned corrugated flanges 35 with struck out tongues 42, similar to those of the channel member 37 of the standard panel unit. In fact, each longitudinal half of the channel member 64 corresponds substantially to half of the channel member 37, already described. Secured to the side portions of member 64 are the same interior angle members 40 and struts 43 which are employed in the standard panel unit. The external corner of the outer portion 27 includes a corner bead 65 of any commercial design and is formed by pouring gypsum or other plastic compound into a mold shaped suitably to produce a form of right angular cross section. The main portion of the body thus formed is substantially square in cross section, with diverging side portions disposed at right angles to each other. At its lower end, the outer corner portion is shouldered at a height corresponding to the corrugated flange 53 which determines the lower edge of the slab portion of the standard panel unit. The walls of the metallic member 64 are equipped with fixed clips 22 corresponding in location to those of the standard panel unit, and it will be understood

that the outer corner portion may be fastened to any standard panel or door unit in a manner already described but at one side only of the recess in the side edge of the panel or door unit. The outer corner portion is secured in place by movable clips 81 mounted on carriers of the character already described and these carriers may be operated through the open space at the bottom, partly in the adjacent panel or door unit and partly in the lower end of the outer corner portion.

The inner portion of the corner unit comprises a metallic member presenting an exterior right angle and having in-turned flanges. When properly located with respect to the outer portion of the corner unit, it outlines therewith a square. The in-turned flanges of the member 28 are arranged to co-operate with the fixed clips 22 of the standard panel or door unit, permitting the movable clips 81 to be used in securing the two together. The details of this connection are well shown in Fig. 42. In this connection, no carrier bar is required for the movable clips 81 since the connection is made before the outer corner portion is put in place and disconnection is made after the outer corner portion is removed so that the workman has free access to the interior of the unit.

The general nature of my invention will be clear from the foregoing description of the specific construction selected for purposes of illustration as illustrating a preferred embodiment of the invention. It will be understood that the dimensions of the various units may be varied within wide limits and that other materials than those specifically described may be employed in the construction of the units.

I prefer to employ thin gauge sheet steel in the metallic portions of the frame because this may be easily shaped and worked in constructing the units and cut in adapting them for erection. The longitudinal corrugations appearing in the binding flanges not only stiffen and hold straight these portions of the frame but serve as efficient protection for the units in storage and in transportation.

It will be apparent that the employment of a wall constructed in accordance with my invention eliminates the necessity for field plastering as well as the use of mortar. The capacity for cutting to size eliminates the end condition heretofore encountered in movable wall structures and the cut sections of the units have a complete salvage value and may be reused indefinitely, being attached or detached to other unit sections as many times as desired. Similarly, connection is made to ceilings irrespective of ceiling height.

The edge construction of the individual units is of particular importance in that the binding flange is stiffened and held straight by reinforcement extending between it and the internal flanges of the frame. This reinforcement may take the form of horizontal struts, as herein illustrated, or of curved or angular supporting members engaging the inner face of the binding flange. The pockets formed by such reinforcement may be filled, if desired, with special damage-resisting plastic compound.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A panel unit for a movable wall structure comprising a self-supporting metallic frame having out-turned marginal flanges, a cleat-carrying reinforcing sheet secured to said frame, and a

layer of plastic material molded upon said sheet and bound at its edges by said marginal flanges.

2. A panel unit for a movable wall structure comprising a self supporting frame of sheet metal angle members united together and having tongues struck out at intervals therein, a reinforcing sheet secured to the frame by said tongues, and a covering of plastic material molded upon said sheet, covering the tongues and providing a finished surface for the unit.

3. A hollow panel unit for a movable wall structure comprising a self supporting frame of sheet metal members including a vertically disposed channel with out-turned flanges at each side edge of the unit, and reinforcing sheets secured to the metal frame in spaced relation and faced with a covering of plastic material which is so disposed as to be bound by the out-turned flanges of the metal frame.

4. A hollow panel unit for a movable wall structure comprising a self supporting frame including spaced sheet metal channel members disposed in back to back relation, reinforcing sheets overlapping the side walls of said channel member in spaced relation to each other, transverse struts interposed between the inner faces of said sheets, and a covering of plastic material molded upon the outer faces thereof.

5. A hollow panel unit for a movable wall structure comprising outwardly directed sheet metal channel members disposed vertically at the side edges of the panel and connected by horizontal inwardly directed channel members, an integral bar of plastic material molded between said horizontal channel members, reinforcing sheets secured to the outer faces of said horizontal and vertical channel members in spaced relation to each other, and a covering of plastic material molded upon the outer faces of said sheets.

6. A hollow panel unit for a movable wall structure comprising outwardly directed sheet metal channel members disposed vertically at the side edges of the panel, oppositely disposed channels secured in pairs and in spaced relation at right angles to the back of said vertical members, a bar of plastic material molded between said channels, reinforcing sheets secured to said channels, and a covering of plastic material molded upon the outer face of each sheet.

7. In a movable wall structure, adjacent panels each including a metallic supporting frame having elongated side members adapted to support the panel upon the floor and covering means providing two opposing wall surfaces and provided with a metal bound edge spaced above the lower ends of said side members, and a series of locking clips spaced upon the adjacent edges of said panels and adapted to be operated to lock or unlock said panels through the space beneath said metal bound edge.

8. A movable wall structure comprising hollow panels disposed in edge to edge relation, each having a metal frame to the opposite sides of which are secured covering means providing two opposing wall surfaces, guide members located inside the panels near the edges thereof and presenting open ended channels, and sliding connectors telescopically received therein.

9. In a movable wall structure comprising hollow panels having abutting edges, a joint comprising a series of stationary clips oppositely ar-

ranged adjacent to said edges, and a carrier having a series of movable clips interlocked into the stationary clips, said carrier being mounted to move first in a direction parallel to the joint to disengage the clips and then in a direction to clear the joint and thus permit the removal of the panel from the wall structure.

10. A hollow panel for a movable wall structure having a frame of sheet metal members including vertical side members and a bottom member located above the lower ends of the side members, and plastic-covered sheets secured to opposite sides of said frame in spaced relation to each other with the lower edge of one sheet bound by said bottom member, thereby leaving an elongated narrow space at the floor affording access to the interior of the panel.

11. A hollow panel for a movable wall structure having a metallic frame with covering means providing two opposing wall surfaces secured thereto, said frame including vertically disposed channel members in the upper portion of the panel and presenting open ended channels, and aligning connectors telescopically received therein at their ends in uniting cut sections to produce a panel of height different from the standard panel.

12. A hollow panel for a movable wall structure having a metallic frame with covering means providing two opposing wall surfaces secured thereto, and horizontally disposed channel members included in said frame, coextensive with the intermediate portion of the panel and presenting open ended channels, and aligning connectors within their channels at their cut ends uniting two cut sections to produce a panel of width different from the standard panel.

13. A wall panel comprising outwardly directed metallic channel members disposed vertically at the side edges of the panel, horizontal inwardly directed channel members connecting the same, reinforcing sheets secured to the outer faces of said vertical and horizontal channel members in spaced relation to each other, and a covering of plastic material molded upon the outer faces of said sheets.

14. A wall panel comprising outwardly directed metallic channel members disposed vertically at the side edges of the panel, oppositely disposed channels secured in pairs and in spaced relation at right angles to the back of said vertical members, reinforcing sheets secured to said channels, and a covering of plastic material molded upon the outer face of each sheet.

15. In a wall structure comprising panels having abutting edges, a joint comprising a series of fixed clips oppositely arranged adjacent to said edges, and a carrier having a series of movable clips engaged with the fixed clips, said carrier being mounted to move so as to disengage the clips and clear the joint and thus permit the removal of the panel from the wall structure.

16. In a wall structure comprising panels having vertical abutting edges, a joint comprising oppositely disposed clips located within the edges of the panels and a carrier member having cooperating clips mounted within the panel for movement to position and then to engage the clips.

LOUIS J. KILLION.