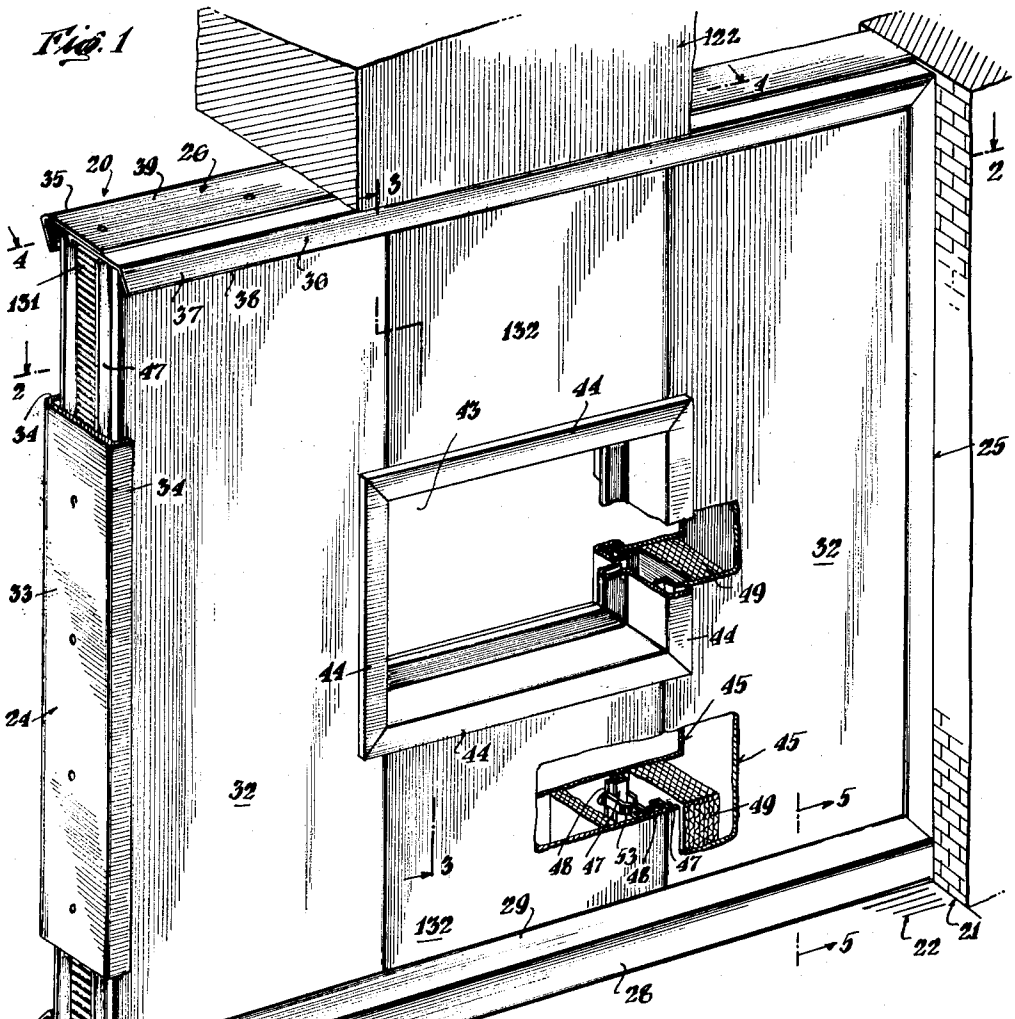
July 7, 1959 G. W. MEEK 2,893,067

STRUCTURAL BUILDING PANELED WALL CONSTRUCTIONS AND PANEL MEANS THEREFOR

Filed May 10, 1955 4 Sheets-Sheet 1

Fig. 1



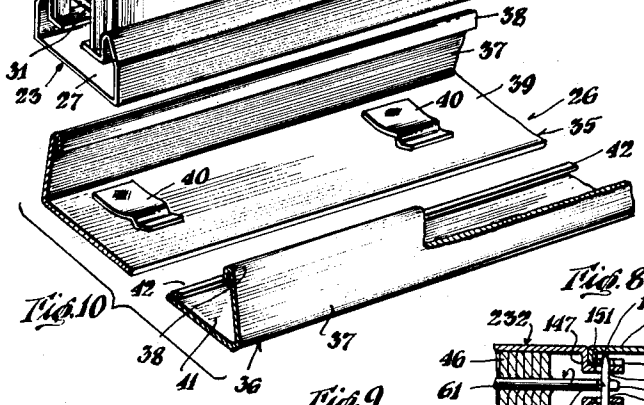


Fig. 10

Fig. 9

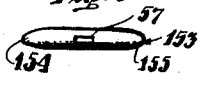


Fig. 8

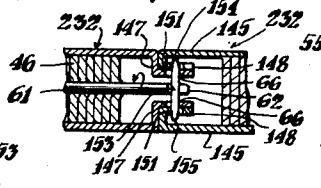
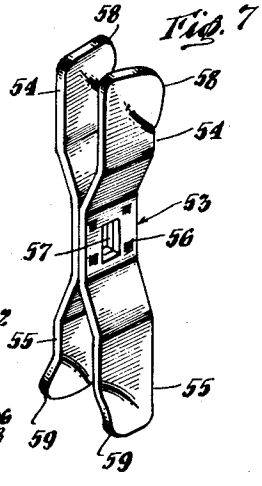


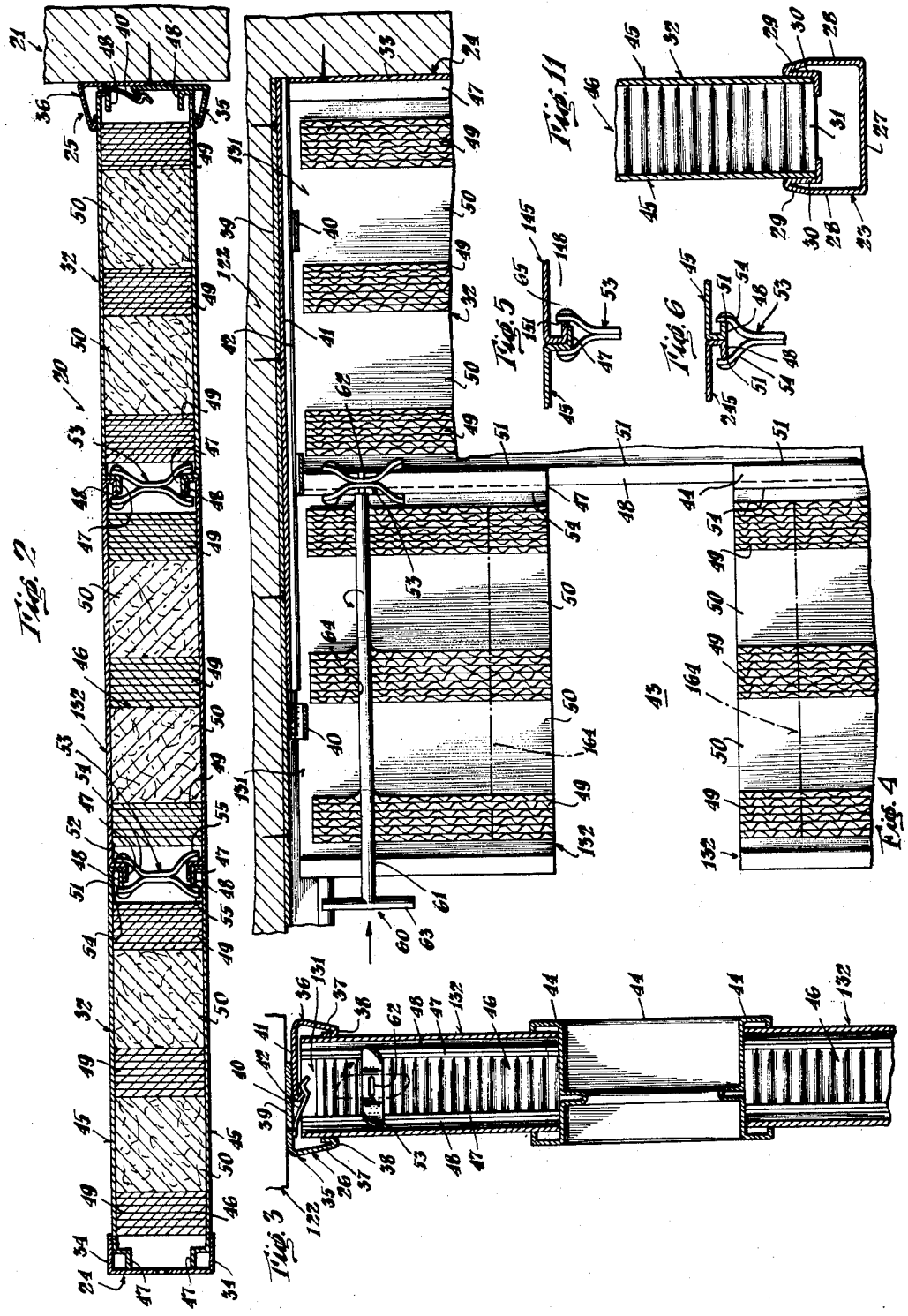
Fig. 7



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STRUCTURAL BUILDING PANELED WALL CONSTRUCTIONS AND PANEL MEANS THEREFOR

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STRUCTURAL BUILDING PANELED WALL CONSTRUCTIONS AND PANEL MEANS THEREFOR

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Fig. 12

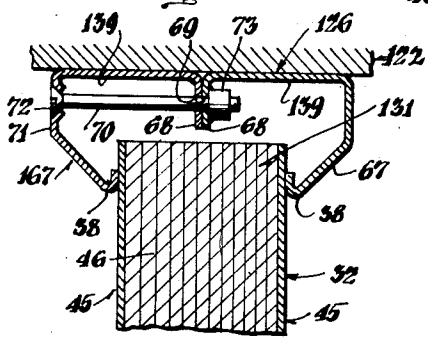


Fig. 13

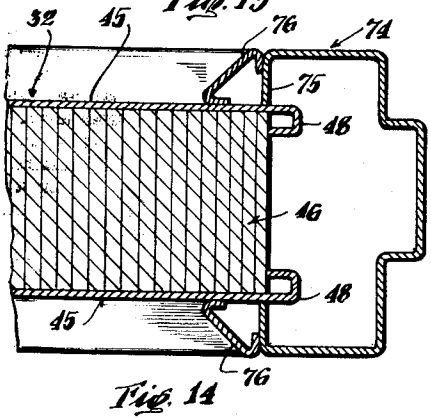


Fig. 14

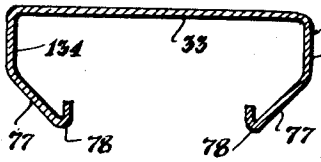


Fig. 15

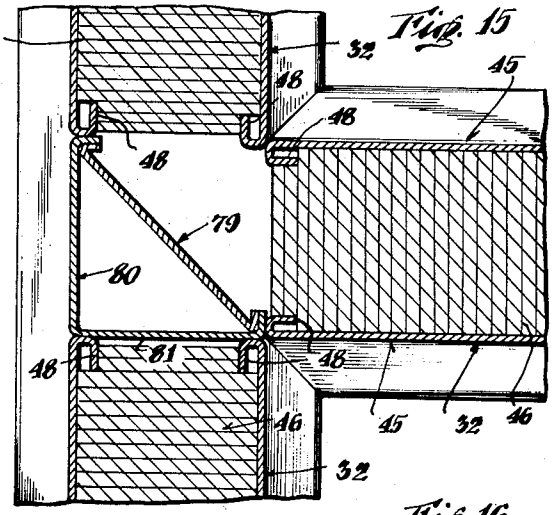


Fig. 16

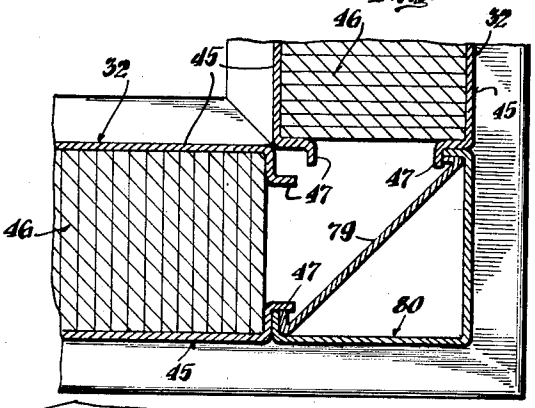


Fig. 17

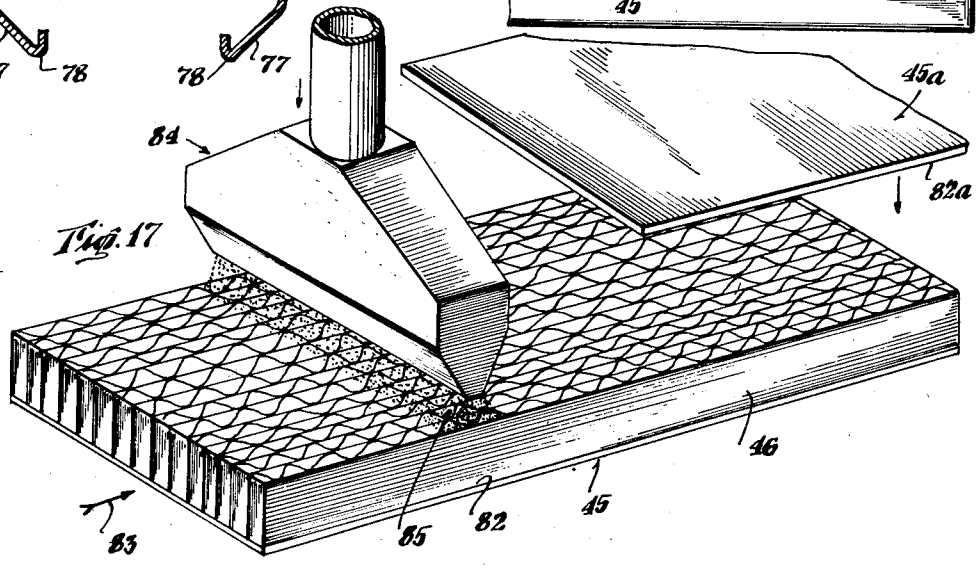


Fig. 18

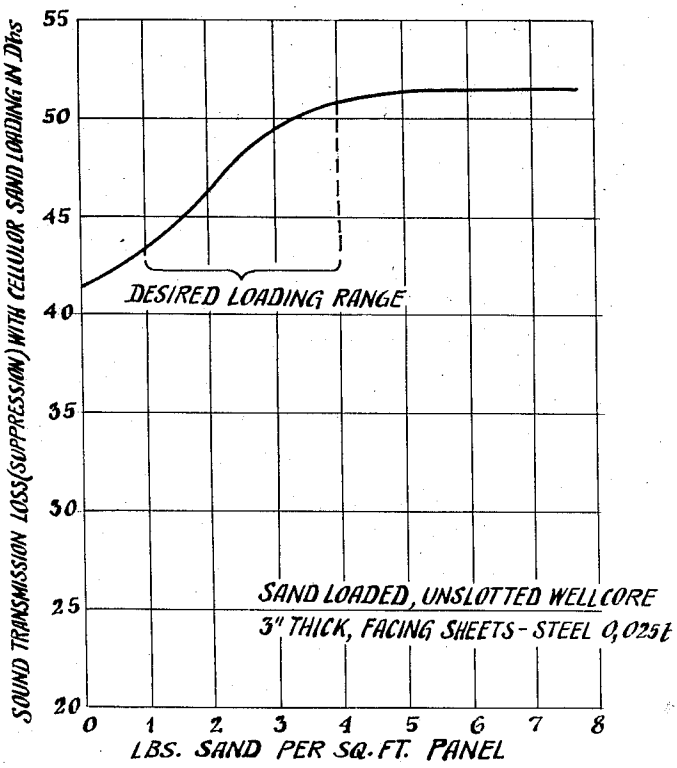
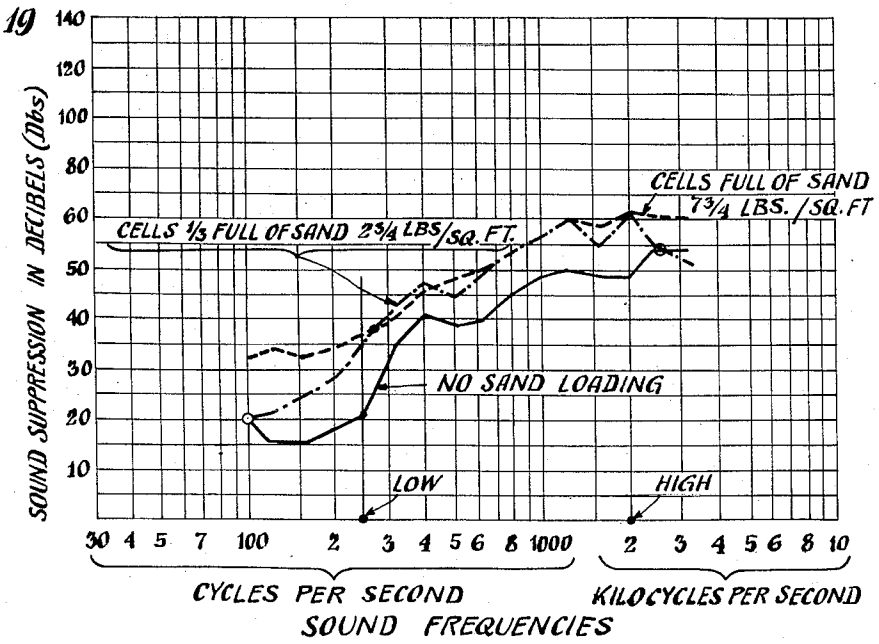

SOUND TRANSMISSION LOSS (SUPPRESSION) WITH CELLULOR SAND LOADING IN Dbs
55
50
45
40
35
30
25
20
DESIRED LOADING RANGE
SAND LOADED, UNSLOTTED WELLCORE
3" THICK, FACING SHEETS - STEEL 0,025t
0 1 2 3 4 5 6 7 8
LBS. SAND PER SQ. FT. PANEL

Fig. 19


SOUND SUPPRESSION IN DECIBELS (Dbs)
140
120
100
80
60
50
40
30
20
10
CELLS FULL OF SAND
7¾ LBS. / SQ. FT
CELLS 1/3 FULL OF SAND 2¾ LBS/SQ. FT.
NO SAND LOADING
LOW
HIGH
30 4 5 7 100 2 3 4 5 6 8 1000 2 3 4 5 6 8 10
CYCLES PER SECOND
KILOCYCLES PER SECOND
SOUND FREQUENCIES

United States Patent Office 2,893,067 Patented July 7, 1959

2,893,067

STRUCTURAL BUILDING PANELED WALL CONSTRUCTIONS AND PANEL MEANS THEREFOR

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Application May 10, 1955, Serial No. 507,251

14 Claims. (Cl. 20—4)

The present invention relates to structural building paneled wall constructions and panel means thereof, preferably in the form of units readily connected together and to other means quickly to form such wall constructions.

A general object of the present invention is to provide such wall constructions of a sturdy nature which are quickly and easily erected with the use of unique panel units readily and securely fastened together in a novel manner and by novel means which assure complete concealment of the latter, and relatively light-weight panel units which may be employed to advantage in such erection and which have unusual sound transfer suppressing characteristics.

A more specific object of the present invention is to provide such panel units in a form permitting secure fastening of juxtaposed edges of adjacent ones thereof by simple concealed fasteners easily manipulated to connecting positions in an unusually simple manner after concealment in junctions between adjacent panel units.

Another object of the present invention is to provide such panel units with interfitting abuttable side edge flanges which may be locked together at a junction remotely from the opposite side edge of one of the units by rotation of clamping clips concealed in the junction.

A further object of the invention is to enhance the sound transmission losses through such panel units and wall constructions made therewith by unique loading of cells in the core bodies of such units with unusual sound suppressing material.

A still further object of the invention is to load cells of core bodies of such panel units which intervene sheathing face sheets of the latter, with free-flowing granular material whereby transfer of sounds of frequencies within a range constituting that which causes the most annoyance to business building occupants is suppressed to an unusual and efficient degree.

Still another object of the invention is to provide structural embodiments which are readily and economically constructed on a mass production basis and which permit efficient use thereof.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a perspective view, with parts broken away and in section, of a typical wall construction embodying panel units connected together and anchored in accordance with the present invention;

Fig. 2 is a sectional view taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a sectional view, with parts broken away, taken substantially on line 3—3 of Fig. 1;

Fig. 4 is a vertical sectional view, with parts broken away, of the wall construction shown in Figs. 1, 2 and 3, taken substantially on line 4—4 of Fig. 1;

Fig. 5 is a sectional detail view to reduced scale, with parts broken away, of a modified form of connecting and fastening means used at junctions of the panel units of the wall construction illustrated by way of example in Figs. 1 to 4 inclusive;

Fig. 6 is a sectional detail view similar to Fig. 5 of a further modification of the fastening and connecting means;

Fig. 7 is an enlarged perspective view of a clamping clip used as a fastening and connecting means at the panel unit junctions of the wall construction illustrated in Figs. 1 to 4 inclusive;

Fig. 8 is a transverse sectional view to reduced scale, with parts broken away, of a further modified form of connecting and fastening means employed at a panel unit junction of a wall construction similar in some respects to that illustrated in Figs. 1 to 4 inclusive;

Fig. 9 is an enlarged side elevational view of the modified form of fastener or clip used in the Fig. 8 junction structure;

Fig. 10 is an enlarged exploded perspective view, with parts broken away, of the ceiling channel assembly shown in Figs. 1, 3 and 4;

Fig. 11 is a vertical sectional view, with parts broken away, taken substantially on line 5—5 of Fig. 1;

Fig. 12 is an enlarged vertical sectional view, with parts broken away, of a modified form of ceiling channel illustrating its use in anchoring to ceiling structure the upper end of panel units of the present invention;

Fig. 13 is an enlarged horizontal sectional view, with parts broken away, of a door buck or frame showing anchorage thereto of the side of a panel unit of the present invention;

Fig. 14 is an enlarged sectional view of a simplified form of ceiling channel;

Fig. 15 is an enlarged horizontal sectional view, with parts broken away, of a typical 90° intersection;

Feb. 16 is an enlarged horizontal sectional view, with parts broken away, of a typical 90° corner construction employing panel units of the present invention;

Fig. 17 is a perspective view graphically illustrating steps in the construction of a panel unit of the present invention and particularly the loading with granular free-flowing material of the cells of the core means before the final application of the last sheathing sheet to the latter;

Fig. 18 is a plotted curve indicating sound transmission loss advantages of loading of the type illustrated in Fig. 17; and in

Fig. 19 is shown three plotted curves illustrating sound transmission loss by various degrees of loading of the type illustrated in Fig. 17 and at various sound frequencies.

Referring to the drawings, in which like numerals identify similar parts throughout, it will be seen from Figs. 1 to 4 inclusive, 7, 10 and 11, that a structural building paneled wall construction **20** may, in accordance with the present invention, comprise the following parts. Such a wall construction preferably is employed as a partition but it is to be understood that if desired such construction may, in certain instances, be employed as outside building wall construction. Let it be assumed that it is desired to employ the wall construction **20** as a partition to extend laterally from a masonry wall unit **21** between suitable floor structure **22** and suitable ceiling structure **122**. There is suitably mounted upon the floor structure **22** a floor channel **23**, laterally-spaced side channels **24** and **25**, and a ceiling channel **26** to receive therebetween

and anchor a plurality of substantially aligned panel units, as hereinafter explained.

The floor channel **23** may, as will be seen from Figs. 1 and 11, comprise a base web **27** and side flanges **28, 28**. The edge portions of the side flanges **28, 28** may each be shaped in the manner best seen in Fig. 11 to provide oblique sections **29, 29** merging with the upright main portions of these flanges, and additional interior, laterally-spaced and opposed, L-shaped flanges **30, 30**. The L-shaped flanges **30, 30** cooperate to receive and support the bottom end portion **31** of a suitable panel unit **32**, a plurality of the latter being abutted edge-to-edge for substantial alignment to form the partition.

The side wall channel **24** may be of simple construction including a transverse web **33** flanked by a pair of side flanges **34, 34** between which a side edge of panel unit **32** may be seated, as seen in Fig. 1. The other side wall channel **25** may be of two-part construction, similar if desired to the ceiling channel assembly **26** (as indicated in Fig. 2), so that a plurality of panel units, such as **32**, may be assembled in the floor channel **23**, edge-to-edge, substantially to fill up the wall gap, with the parts of the side wall channel **25** then being assembled or wedged into position from opposite sides, as will be more fully understood in connection with the description of the ceiling channel **26**.

As illustrated in Figs. 1, 3, 4 and 10, the ceiling channel assembly **26** preferably is formed of two companion parts or sections **35** and **36**, each of general L-shaped configuration in cross-section. Each of the L-shaped channel sections **35** and **36** has a sloping side flange panel **37** with its free edge provided with a reverse bend **38** to trim the junction with the panel units and between which the top end portions **131—131** of the latter are snugly clamped, as is best seen in Figs. 3 and 6. The L-shaped section **35** has a lateral web panel **39** to the underside of which is affixed by suitable means, such as spot welding, a plurality of longitudinally-spaced spring clips or tongues **40—40**. The channel section **36** also has a lateral web panel **41**, the free edge of which is provided with a reverse bend **42** to form an enlarged bead which may be wedged between the web panel **39** and the plurality of clips **40—40**, permitting the latter to snap in behind the bead and secure the two channel sections **35** and **36** together, thus forming the channel assembly **26**. It will be understood that such channel assembly structure permits the two sections **35** and **36** thereof to be inserted from opposite sides of the panel units in a relatively small space intervening ceiling structure **122** and the upper end portions **131—131** of the panel units. The channel section **35** preferably is suitably fastened in position against ceiling structure **122** by suitable means, such as nails or screws, at the time floor channel **23** and side wall channel **24** are mounted. After the panel units (such as **32**) are assembled in the floor channel **23** with their top end portions **131—131** swung up into fixed channel section **35**, the other channel section **36** may be driven inward from the opposite side with its lateral web panel **41** received below the lateral web panel **39** of the fixed channel section **35**, so that the bead **42** will snap in between the latter and the clips **40—40** to the locked position illustrated in Fig. 3. As previously suggested and as is illustrated in Fig. 2, the side channel **25** may be an assembly similar to that of ceiling channel **26**, and the parts thereof may be mounted in similar fashion.

Consequently, the plurality of panel units **32** may be assembled edge-to-edge in substantial alignment to provide the partition wall construction **20** by first inserting the bottom end portion **31** of one panel unit in the previously mounted floor channel **23** while the panel unit is in a tilted position and swinging the top end portion **131** of the panel unit upward to substantially vertical position with nesting of the top end portion in the previously mounted channel section **31** and with one face abutted against reverse bend **38** of this fixed channel section. Then the panel unit **32** is slid laterally along floor channel **23** to insert the far side edge of the former into the side wall channel **24**. The succeeding panel units, such as **32** and **132** as illustrated in Figs. 1 and 2, may thereafter be progressively added in a similar fashion with edge portions of adjacent panel units brought to abutment in junctions so as finally to fill the wall gap. Subsequently, the second ceiling channel section **36** is mounted in the indicated manner, i.e. its lateral web panel **41** is inserted between the top end portions **131—131** of the upright panel units and lateral web panel **39** of the fixed channel section **35**, and then it is driven inwardly to snap bead **42** in behind the clips **40—40**, locking the parts together. Finally the second section of side wall channel **25** is mounted in similar fashion to complete the partition wall construction **20**. During the successive mountings of the panel units **32—32** and **132—132** to fill up the wall gap, suitable fastening elements are added and manipulated effectively to lock together the adjacent substantially aligned panel units at their junctions, as will be understood from the description here following.

If desired, the partition wall construction **20** may embody framed openings, such as doors and/or windows. For example, a window opening **43** may be provided by inserting a pair of vertically-spaced shorter panel units **132, 132**, which are similar in all other respects to the longer panel units **32—32**, and the window opening may be suitably framed with sections **44—44** of trim channel, as will be understood from Figs. 1 and 3.

Each wall panel unit **32** or **132** includes a pair of transversely-spaced sheathing face sheets **45, 45** intervened by suitable core means **46**. Such wall panel units **32** and **132** may be standardized as rectangular structures of convenient dimensions, such as about eight feet long and one or more feet wide. Although in the illustrated embodiment of the invention, as may appear from Figs. 1, 2 and 4, each of the panel units **32** and **132** may be several feet in width, it is preferable that they be in the form of planks, such as about one foot in width, so as to facilitate shipping and handling. The sheathing sheets **45, 45** may be formed of a variety of materials, such as sheet metal, e.g. sheet steel or aluminum, fiber or wood sheets, asbestos board, etc., and may, if desired, be of laminated construction. For example, the sheathing sheets **45, 45** may be formed of suitable plywood with the plies thereof laminated or bonded together by suitable adhesive and natural wood grain in outside plies may constitute a desirable decorative feature or provide a desired pleasing ornamental effect. The faces of all such panel units or planks may be ornamentally enhanced by reeding or other configurations. Also, obscuring coatings may be employed, such as paint or wallpaper. Structurally, such panel units **32** and **132** may be constructed in the manner proposed in Munters Patent 2,417,435 of March 18, 1947, wherein the sheathing sheets, which may be of steel sheeting of about No. 20 to No. 26 gauge (0.031″ to 0.015″), are intervened by suitable porous core means in the form of corrugated material providing or defining transverse core chambers or cells extending transversely between the inner faces of the sheets. Such sheathing sheets **45, 45** may be provided in pre-cut and shaped form and assembled with intervening bodies of core means **46** with the application of bonding adhesive between the inner faces of the sheets and the outer faces (or edges of the through cells) of the core means. For example, such a panel unit may be constructed in a width of about one foot (1′), with the use of sheathing sheets of steel of a thickness of 0.025″ and with the core means **46** formed of paper impregnated with asphalt or phenolic resin, the overall thickness of the plank being about three inches (3″). Such panel unit planks are light in weight and can readily be handled and shipped economically. Also, such planks can be trimmed on the job to adapt them to ceiling heights different from

the standard lengths of the planks by light-weight mechanized hand saws.

The core means **46** which intervenes the sheathing face sheets **45, 45** is readily pierced by a stiff rod such as the elongated stem of a steel fastener-manipulating tool, as will be more fully explained hereinafter, and is exposed for access in the side edges of the panel units by transverse spacing of shaped edge portions **47, 47** and **48, 48**. The core means **46** may be of uniform construction throughout a plank, such as in the form of the cellular corrugated configuration described above, or, as is indicated in Figs. 2 and 4, laterally-spaced vertical zones between the facing sheets **45, 45** may be filled with such core means, such as at **49, 49**. The intervening vertical spaces **50—50** may be filled with any other suitable material, such as mineral wool or particulate insulating material, or left free for running plumbing and electrical wiring. When the spaces **50—50** are loaded with filler material the latter also preferably is of a type which will permit ready piercing by and passage of stiff rods.

The shaped flanges **47, 47** and **48, 48** are made complementary to each other for interfitting juxtaposed edges of adjacent panel units or planks at junctions. For example, the edge portions **47, 47** may be turned inwardly transversely of the panel unit and then laterally outward to provide L-shaped flanges, and the edge portions **48, 48** may be turned inwardly transversely of the panel unit and then laterally in behind the facing sheets **45, 45** to form reverse bends. The reverse bends at **48, 48** mate with or nest in the L-shaped flanges at **47, 47**, as will be seen from Fig. 2. Thus the two transversely-spaced, L-shaped side flanges **47, 47** along one side edge of a panel or plank unit **32** or **132** together form tongue means which seats into a longitudinally-extending groove provided or defined in the other edge of the panel unit or plank by the transversely-spaced pair of reverse bent side flanges **48, 48**. Also, as illustrated in Fig. 2, in the nesting of a reverse bent flange **48** with an L-shaped flange **47** the free edge **51** of the reverse bend extends laterally in behind facing sheet **45** farther than the free edge of the L-shaped flange **47**, and this free edge **51** forms one of a pair of abutment means. The transversely-extending web of the L-shaped flange **47** has a back face **52** which serves as the other of the pair of abutment means, with those two abutment means **51** and **52** facing in opposite directions.

The nested or mated pairs of L-shaped and reverse bent flanges **47, 48** are, as best seen from Fig. 2, adapted to be connected or clamped together by suitable fastening means so that the adjoining planks or panel units are fastened together at their junction. As illustrated in the embodiment of Figs. 1 to 4 inclusive and 7, such clamping means may be in the form of a plurality of fasteners or clamping clips **53—53**. Each of said clamping clips **53** preferably is an elongated structure having opposite end portions with each end portion forked or bifurcated to provide two pairs of laterally-spaced fingers, **54, 54** at one end and **55, 55** at the other end, with those two pairs of laterally spaced fingers being like but shaped in reverse order so as to have leading and trailing edges arranged in the same clockwise order. As will be best seen from Fig. 7, such clamping clip **53** has an intermediate portion **56** provided with a tool-receptive hole **57** which is other than round in configuration, such as rectangular, to receive the complementary shaped end of a tool stem for rotating the clamping clip. Assuming that the clip **53** as illustrated and viewed in Fig. 7 is to be rotated in a clockwise direction, the leading corners **58, 58** of the laterally-spaced fingers **54, 54** are bent outwardly so as to facilitate reception therebetween of paired abutment means when the clip is rotated. Likewise, the leading corners **59, 59** of the laterally-spaced fingers **55, 55** on the opposite end portion of the clamping clip **53** are bent outwardly for a like purpose. Also, the paired fingers **54, 54** and **55, 55** are so shaped that the spaces therebetween are generally V-shaped so as to apply wedging action to the received pairs of abutment means. Such a clamping clip **53** may be readily formed from two shaped strips of sheet steel suitably spot welded together in the mid-section **36**, as will be understood from Fig. 7.

A tool **60** for rotating each of the clamping clips **53** may be in the form illustrated in Fig. 4 comprising an elongated rod-like stem **61** having a free end **62** shaped complementary to the hole **57** in the clip, thus preferably being flatted or generally rectangular in cross-section. The opposite end of the tool stem **61** is conveniently provided with an enlarged head, such as a cross bar **63**, to permit ready manual rotation thereof. Such tool **60** preferably is formed of steel and thus has appreciable stiffness, permitting it to be pierced through the core means **56** from one exposed edge thereof between flanges **47, 47** to the other exposed edge thereof between flanges **48, 48**. Thus, a plurality of the tool **60** may be employed to pierce through the core means **46**, at suitable vertically-spaced locations, laterally-extending passages for reaching through to the clips **53—53** for rotational operation thereof. It will be understood, however, that such lateral passages, such as that indicated at **64** in Fig. 4 as being formed by piercing with the tool stem **61** and to be formed at **164—164**, may be pre-formed by any other suitable means in the manufacture of the panel units or planks.

In constructing the partition wall construction illustrated at **20** in Figs. 1 to 4 inclusive, the first panel unit **32**, which will be found on the left side of Figs. 1 and 2, will be positioned in the floor channel **23** and the side wall channel **24** in the manner indicated above. Then the next adjacent panel unit is added, e.g., foreshortened planks **132, 132** are juxtaposed to the first plank with their L-shaped flanges **47, 47** received in between the reverse bent flanges **48, 48** of such first plank. Prior to juxtaposing the foreshortened planks **132, 132** to the first plank **32**, a plurality of the tools **60—60** are pierced laterally through the core means **46** of the foreshortened planks at suitably selected locations, such as is illustrated at **64** and indicated at **164** and **164** in Fig. 4. The leading shaped end **62** of the tool is pushed out to extend beyond the far side edge of the plank **132** there to receive one of the clamping clips **53** temporarily to carry the same until the juxtaposed plank can be fastened or connected to the first plank by the clips. Then plank **132**, carrying the plurality of tools **60—60** with the plurality of clips **53—53** supported on the protruding ends **62—62** thereof, is moved to position adjacent the first plank **32**, with its side edge carrying the pair of transversely-spaced L-shaped flanges **47, 47** abutted against the opposed side edge of the first plank which carries the transversely-spaced reverse bent flanges **48, 48**, to mate the flanges together. Then each tool **60** is rotated 90° in a counterclockwise direction so that the laterally-spaced fingers **54, 54** swing down to receive therebetween the paired flanges **47** and **48** at one face of the panel units, and the other laterally-spaced fingers **55, 55** swing up to receive therebetween the other paired flanges **47** and **48** at the other face of the panel units, as the clip **53**, carried by this particular tool, is rotated to a horizontal transverse position. Thus clip **53** is rotated from the dotted line free position indicated in Fig. 3 to the full line clamping or locked position shown therein. In rotation of each of the clips **53** by its tool **60**, the spread tips **58, 58** of the laterally-spaced fingers **54, 54** engage to the outer sides of the pair of oppositely facing abutment means provided by the free edge **51** of the reverse bent flange **48** and the back face **54** of the L-shaped flange **47**. Upon further rotation of the clip **53**, those paired abutments **51** and **54** are wedged deeper into the V-shaped space between the fingers **54, 54** so as securely to clamp the paired flanges **47** and **48** together. The laterally-spaced

fingers 55, 55 on the opposite end portion of the clip 53 perform a like clamping action upon the paired flanges 47 and 48 at the opposite face of the panel units simultaneously with the clamping of the paired flanges at the other face so as thus securely to fasten the juxtaposed edges of the adjacent planks together in their junction. This is accomplished within a concealed joint with the clips 53—53 hidden therein behind the faces of the panel units or planks. Each of the plurality of clamping clips 53—53 is successively rotated to a transverse position in this manner by its own rotating tool 60, and after the forked or bifurcated end portions of the clips have respectively engaged and clamped therebetween the paired flanges 47, 48 and 47, 48 at the opposite faces of the panel units the tools are withdrawn to be used in the setting of the clamping clips for the next successive plank.

As indicated in Fig. 5, the paired abutment means may be provided by modified flange structure such as the back side of L-shaped flange 47 and the outermost edge 151 of a slot 65 in reverse bent flange 148. Also, as indicated in Fig. 6, the paired abutment means which preferably face in opposite directions to be engaged between the laterally-spaced fingers, such as 54, 54 of clip 53, may be provided as free edges 51, 51 of like reverse bent flanges 48, 48 and with those paired reverse bent flanges abutted together in face engagement rather than being nested as with respect to the mated flanges 47 and 48.

A modified form of the concealed or hidden fastening means which connect juxtaposed edges of adjacent panel units or planks together within the scope of the invention is illustrated in Figs. 8 and 9. As there indicated, one of the panel units 232 may be provided with transversely-spaced, slotted reverse bent flanges 148, 148 along one edge, and the opposite edge thereof, which will be the same as the juxtaposed edge of the next adjacent panel unit 232, is provided with a pair of transversely-spaced, slotted L-shaped flanges 147, 147. In such a structure the outermost edge 151 of the slot in either of the reverse bent flanges 148 constitutes one abutment of a nested pair and the outermost edge 66 of the slot in the mated L-shaped flange 147 constitutes the opposed abutment of this pair. In such case, the fastening device 153, as is best seen in Fig. 9, may consist of an elongated bar medially provided with slot 57 to receive the shaped end 62 of the tool stem 61 and with its opposite ends 154 and 155 tapered to wedge into the aligned but offset pair of slots in the mated flanges 147 and 148. Thus, as the fastener 153 is rotated, its tapered ends 154 and 155 wedge into the pairs of aligned slots at opposite faces of the juxtaposed panel units, gradually spreading apart the paired opposed abutments 66, 151 and 66, 151 to draw the flanges 147, 147 snugly about and against the flanges 148, 148.

As shown in Fig. 12, the ceiling channel assembly provided at 26 or the side wall channel assembly provided at 25 in Fig. 1 may be modified. Such modified channel assembly 126 (or 125) may comprise two similar channel half-sections 67 and 167, each of which has a downwardly-extending flange 68 provided on the free edge of its lateral web 139 and adapted to be abutted against that of the other. The abutted flanges 68, 68 are provided with a plurality of longitudinally-spaced, aligned holes 69—69 through which elongated tie bolts 70—70 may be received. The side wall 71 of channel half-section 167 is also provided with a plurality of longitudinally-spaced holes 72—72, each preferably of countersink shape and transversely aligned with one of the holes 69 in the flange 68 of this channel half-section. Consequently, with channel half-section 67 mounted in any suitable manner to ceiling structure 122 and with the top end portion 131 of a panel unit 32 abutted against its reverse bent flange 38, the other channel half-section 167 can be positioned on the opposite side of the panel unit with its reverse bent flange 38 bearing against the opposite face of the panel unit for anchorage of the latter when the two channel half-sections are tied together. The flange 68 of channel half-section 67 may carry a captive nut 73 aligned with each of its holes 69 so that when a tie bolt 70 is pushed through the aligned holes 72 and 69 of the companion channel half-section 167, the externally-threaded leading end of the bolt will engage into the captive nut to draw the two channel half-sections tightly together.

As indicated in Fig. 3, panel units or planks 32 of the present invention may have their longitudinal edges readily and easily fitted with door framing or a buck column 74. The buck column 74 may be of hollow construction, having a slot in the back side 75 thereof into which the reverse bent flanges 48, 48 of panel unit 32 may be projected snugly to fit therein, as shown. If desired, trim molding 76, 76 of any suitable construction and desired shape may be fitted and anchored in any suitable manner in the angles between the sheating face sheets 45, 45 of the panel unit 32 and the slotted side 75 of the buck.

Anchoring channel for such panel units may be of simplified construction, as is illustrated at 124 in Fig. 4, wherever ready access is permitted. For example, channel 124 may be substituted for side wall channel 24 of the partition wall construction 20 illustrated in Fig. 1 and may comprise web 33 and side flanges 134, 134 with the latter shaped to provide sloping panels 77, 77 having their free edges reversely bent, as indicated at 78, 78.

Panel units or planks of the present invention may be employed to construct typical 90° intersections, such as that illustrated in Fig. 15. As there proposed, three panel units or planks 32—32, each having its sheathing face sheets 45 provided along one side edge with the reverse bent flanges 48, 48, may be brought together in a T-shaped joint for such intersection, with the reverse bent flanges 48, 48 of the intermediate panel unit or plank substantially abutted at right angles respectively to one such reverse bent flange 48 of the other two longitudinally-spaced and substantially aligned panel units or planks. An oblique bridging strip 79 covered with a right-angled flange 80 is anchored in any suitable manner to fill out the corner between one of the aligned panel units 32 and the intermediate panel unit 32, and to provide a flat web 81 against which reverse bent flanges 48, 48 of the third panel unit 32 are abutted. As shown in Fig. 16, the structure of Fig. 15 may also provide a right-angled corner, the bridging strip and covered flange 80 having their nested edges seating on L-shaped side flange 47, 47 of the juxtaposed panel units or planks 32, 32 which are aranged normal to each other.

Since embodiments of the present invention are particularly advantageous and specially designed for use in the erection of structural building paneled wall constructions, the transfer of sound therethrough is an important problem. One feature of the present invention solves this problem by providing simple means for suppressing sound transfer to an unusual degree. This is accomlished by loading the cells or through chambers of the core means 46, which extend transversely through the latter from sheathing face sheet 45 to the other sheathing face sheet 45, with granular material in a free-flowing condition. By reference to Fig. 17, it will be seen that the loading of the cells of the core means 46 may be readily accomplished by first cementing a body of the core means 46 to the inner face 82 of one of the sheathing sheets 45 and then passing its sub-assembly along in the direction of the arrow 83 beneath a nozzle 84 to spill into the open cells a flow of granular material indicated at 85. Following the passage of the sub-assembly of sheathing sheet 45 and the superimposed body of core means 46 beneath the nozzle 84 to load the cells with granular material, the second sheathing sheet (45*a*) is then placed down upon the top of the core body with a suit-

able cement interposed to adhere the inner face (82*a*) of the second sheet to the core body, thereby completing the construction of the panel unit, such as that indicated at 32 or 132. It will be understood, of course, that side edges of the sheathing sheets 45 and (45*a*) preferably will, prior to cementing to the core body 46, be suitably shaped to provide the interlocking flanges, such as 47, 47 and 48, 48. Such loading of cells may constitute one step of a continuous procedure of manufacture disclosed and claimed in my copending patent aplication Serial No. 435,826, filed June 10, 1954.

The granular loading material to be employed in attaining sound suppression in accordance with one aspect of the present invention is to be of a character as to provide in the cells a loose free-flowing mass of relatively coarse particles having appreciable weight. It is known that transfer of sound through wall structures which have transversely-spaced sheathing face sheets intervened by various core means is attributable to an appreciable extent to the tendency for the sheathing sheets to act as coresponsive vibratory diaphragms. Sound waves striking one sheathing sheet vibrate it. The core means and/or cells of air extending transversely therethrough cause transfer of such vibrations to the opposite sheathing sheet and the resultant drumming effect of the latter sets up sound waves, and this transfer constitutes the sound transmission factor. It has been found in accordance with the development of the sound suppression feature of the present invention that loading spaces intervening the sheathing face sheets, such as transverse core cells, with light-weight insulating material, such as mineral wool or small hollow bodies of the perlite type, does not effect the desired sound suppression. As contrasted with such results, partial to substantially full loading with granular relatively heavy material does provide appreciable sound suppression. It is not fully understood to what this desirable result is attributable but it is believed that the presence of the masses of loose free-flowing granular material produces a damping effect with responsive vibration of the free particles absorbing energy which otherwise would be transmitted to produce transferred sound. Strangely enough the sound suppression does not bear a direct relation to the amount of loading. At certain frequencies, chiefly in the range of those of sounds of the type which cause the greatest trouble and anoyance in the occupancy of business buildings in cities, full loading shows no appreciable improvement over loading of a degree less than 50% of full loading. It is logical to assume that as the amount of granules is increased the greater will be the amount of energy absorbed since there is a greater number of granules responsively to vibrate for such absorption. However, as full loading is progressively approached there is decreasingly less space in which the granules can vibrate freely and there may be more loading of lower granules by greater masses of others resting thereon. Thus it is not improbable that the tendency for increases in the number of granules to increase the amount of energy absorbed is offset to a degree by the attendant limitation on the freedom of the granules to vibrate. This is important from the weight factor standpoint as heavily loaded planks or panels are more costly to package and ship and are more difficult to handle and install.

A variety of types of granular loading material will serve this sound suppression purpose. Coarse particulate minerals or granular inorganic materials of relatively heavy mass will serve, such as particulate quartz in the form of sand; crushed stone such as broken mica, shale, slate and mineral ores; small agglomerates of diatmaceous earth, clay, Portland cement and the like; beads of glass and other relatively heavy inorganics; metal particles such as filings; etc. By "relatively heavy" is meant specific gravities greater than that of water, preferably of the order of 2 and above, sand which is largely granular quartz having a specific gravity of 2.5 to 2.8, and sand may be preferred granular loading material because of its cheapness and ready availability. The sizes of the granules or coarse particles may vary widely, for example, from about 0.01 to about 2.0 millimeters in diameter (sand particles vary in diameter from about 0.06 mm., in the form of slit, to about 2.0 mm., particles larger than the latter being considered small gravel). The effects of such loadings and the comparative results thereof with respect to the amounts employed are hereinafter set forth by way of example with respect to sand as the loading material due to the effectiveness of its use, its ready availability and the extremely low cost of its employment.

The following table indicates the advantageous suppression of sound transfer attained by such loading of the core cells with granular material.

(I) *Transmission loss of partition sections in decibels at certain frequencies*

Cycle Frequency	Pekin [1]	Douglas [2]	Plain Wellcore [3]	Wellcore Tilted Slots [4] (No Sand Loading)	Sand Loaded Slotted Wellcore,[4] #/Sq. ft. Loading			
					1.1	1.4	2.52	7.5
128	24	24	20	16	17	19	23	33
256	20	24	21	20	25	25	35	36
512	35	35	50	39	40	44	47	49
1,024	44	41	50	49	50	53	56	58
2,048	50	49	55	50	52	52	60	61
3,000	50	48	55	54	53	54	52	60
Average	37.1	36.5	41.5	38	39.3	41.1	45.3	49.3

In the compilation of the data set forth in Table I above partition sections of like dimensions were employed. Each section was 3 inches thick with the two sheathing face sheets of each formed of steel sheeting 0.025" thick. The Pekin [1] structure is standard in which the two sheathing sheets are intervened by core means in the form of a cellular structure having the cells extending transversely from sheet to sheet and defined by figure 8 or candy ribbon shaped strips of 60 lbs. kraft paper impregnated with 12–15% phenolic resin. The Douglas [2] structure is also standard in which the core means intervening the sheathing sheets is in the form of a honeycomb with the six-sided cells extending from sheet to sheet and defined by like phenolic resin-impregnated paper. The plain Wellcore [3] structure is that of Munters Patent 2,417,435 dated March 18, 1947, in which the core means is in the form of corrugated material with the cells also extending from sheet to sheet and defined by kraft paper which in the test samples was 30 lbs. kraft impregnated with about 15% of asphalt. The Wellcore structure [4] featuring tilted slots had slits extending laterally through the core means from side edge to side edge, each slit being about 0.8" wide and bisected by the mid-plane of

the core means while making an acute angle of about 40° to a horizontal transverse plane across the plank, and with those tilted slots being spaced apart longitudinally of the plank about 0.75". The sand loaded planks were 3" slotted Wellcore planks [4], described above, in which the cells were loaded with various indicated amounts of sand expressed in terms of weight of loading in pounds per square foot of plank face area. 7.5 lbs./sq. ft. of sand loading constitutes practically complete filling of cells while 2.52 lbs./sq. ft. of sand closely approximates one-third filling of cells.

Although the range of frequencies of noticeable sounds most common to business building occupancy and in which the sounds causing most of the annoyance fall is from about 250 cycles per second to about 2000 cycles per second, the sound transmission losses which have been tabulated in Table I above were determined over a wider range of from the lower frequencies of 128~/sec. to the higher frequencies of 3,000~/sec. to ascertain the sound suppressions in the fringe zones. It will be noted from this tabulated data that while at the unusually low frequency of 128~/sec. the Pekin and Douglas planks seemed to provide more sound suppression that plain unloaded Wellcore and slotted unloaded Wellcore with the latter least effective, sand loading of the slotted Wellcore greatly improved its sound suppression characteristic. Further, it is there shown that at the unusually high frequency of 3,000~/sec. both plain and slotted Wellcore planks gave better sound suppressions than did the Pekin and Douglas planks and that fractional sand loading gave no appreciable improvement until complete filling was approached. In contrast therewith, in the range of usual frequencies of about 250~/sec. to 2,000~/sec. both plain and slotted unloaded Wellcore planks were as good and in many cases better suppressors than Pekin and Douglas planks with the slotted Wellcore plank being less effective than the plain Wellcore plank. However, when the slotted Wellcore plank was sand loaded its sound suppression ability was materially improved with the one-third loading (2.52 lbs./sq. ft.) being surprisingly close to the complete loading in the range of usual frequencies. Thus, from a practical standpoint one-third loading is the ideal of this feature of the present invention since full loading makes the planks and panel units too heavy for ready and economical shipping and easy handling. It has been found that appreciable sound suppression advantages are attained within the practical loading range of about 1 lb./sq. ft. to about 4 lbs./sq. ft. (about ⅛ to about 1/12 full loading), and that such loading will similarly improve various types of panel units and planks having transversely-spaced sheathing face sheets intervened by core means characterized by transverse cells extending from sheet to sheet. The curve of Fig. 18 graphically illustrates such loading effects for 3" plain and unslotted Wellcore panel units or planks having facing sheets of steel 0.025" thick, the practical range of sand loading and the ideal of the latter, and the same curve for loaded slotted Wellcore panel units or planks would be of similar shape but a few decibels lower all along.

In order further to illustrate graphically the advantageous effect of sand loading in the suppression of transmitted sound there are plotted in Fig. 19 three curves representing sound transmission loss (suppression) in decibels (in the ordinates) with respect to sound frequencies (in the abscissae) for three different loading conditions of 3" slotted Wellcore of the type described above. It will there be noted that while sand loading appreciably improves sound transmission loss in the usual range of frequencies of 250~/sec. to 2,000~/sec. approximately one-third of full loading shows almost as much improvement of that characteristic in that range as does full loading. Also note that although full sand loading improves sound transmission losses for frequencies below 250~/sec. and above 2,000~/sec. the advantages attained by one-third of full loading drop off to none at ultra-low frequencies of about 100~/sec. and ultra-high frequencies of about 2,500~/sec.

Normally the core means occupies from 3% to 12% of the total confined or intervening volume between the facing sheets. Thus the space available for the free-flowing granular mass is of the nature of 88% to 97% of the confined volume between the facing sheets. The desired loading will therefore result in the filling of from about 15% to 60% of the volume when using a loading material with a density similar to that of sand. Perhaps a loading material with greater density should occupy a proportionately lower percentage of the confined volume and a loading material with lower density should occupy a proportionately higher percentage of the confined volume.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

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

1. A structural building paneled wall construction comprising, in combination; a plurality of substantially aligned panel units defining opposite wall faces, each of said panel units comprising a pair of transversely-spaced sheathing sheets and core means located between and spacing said sheets, said core means having a plurality of lateral passages extending therethrough from side portion to side portion of each panel unit for reception of a tool stem through said core means, each of said panel units having side edges of their sheathing sheets transversely-spaced for tool access to said passages with said side sheet edges abutted to those of the adjacent panel unit in a panel junction, said abutted side edges of said sheathing sheets at at least one of said wall faces being provided with opposed abutment means located back of said sheathing sheets with those of one panel unit being paired with those of the adjacent panel unit; and a plurality of tool-rotatable fasteners each aligned with one of said lateral passages and rotated to fastening engagement of said paired abutment means thereby securing them together and fastening adjacent panel units to each other.

2. A structural building paneled wall construction comprising, in combination; a plurality of substantially aligned panel units defining opposite wall faces, each of said panel units comprising a pair of transversely-spaced sheathing sheets and core means located between and spacing said sheets, said core means having a plurality of lateral passages extending therethrough from side portion to side portion of each panel unit for reception of a tool stem through said core means, each of said panel units having side edges of their sheathing sheets transversely-spaced for tool access to said passages with said side sheet edges abutted to those of the adjacent panel unit in a panel junction, said abutted side edges of said sheathing sheets at both of said wall faces being provided with opposed abutment means located back of said sheathing sheets with those of one panel unit being paired with those of the adjacent panel unit; and a plurality of tool-rotatable fasteners each aligned with one of said lateral passages, each fastener being elongated and extending transversely with one end thereof rotated

to fastening engagement of said paired abutment means at one wall face and the other end thereof simultaneously rotated to fastening engagement of said paired abutment means at the other wall face, thereby securing said paired abutment means together at both of said wall faces and fastening adjacent panel units to each other.

3. A structural building paneled wall construction comprising, in combination; a plurality of substantially aligned panel units, each of said panel units comprising a pair of transversely-spaced sheathing sheets defining opposite faces thereof and readily pierceable core means located between said sheets, said panel units having side edges of their sheathing sheets transversely-spaced for lateral piercing access exposure therebetween of said core means with said side sheet edges abutted to those of the adjacent panel units in meeting panel junctions, said abutted side edges of said sheathing sheets at at least one face of said units being provided with abutment means located back of said sheathing sheets with those of one panel unit being paired with those of the adjacent panel unit and facing in opposite directions away from the junctions of the panel units thereat; and a plurality of rotatable clamping clips each having a bifurcated end providing a pair of spaced fingers rotated to face engagement of said paired abutment means and clamping the latter therebetween thereby fastening adjacent panel units together.

4. A structural building paneled wall construction comprising, in combination; at least a pair of substantially aligned panel units, each of said panel units comprising a pair of transversely-spaced sheathing sheets defining opposite faces thereof and readily pierceable core means located between and coupling said sheets together, one of said panel units having the side edge portions of its sheathing sheets transversely-spaced for lateral piercing access to said core means with the latter provided with a plurality of vertically-spaced lateral pierced passages extending through from side edge to side edge of said unit for reception of a through tool stem, the spaced side edge portions of said sheets of one side edge of one of said panel units being abutted in both faces to those of one side edge of the adjacent panel unit to form a panel junction; paired abutment means mounted on said abutted edge portions of said sheets at both faces of said junction inaccessibly inside said panel units, each pair of said abutment means having laterally-spaced engageable faces facing in opposite lateral directions; and a plurality of tool-rotatable clamping clips concealed in said junction each having a tool-engaging portion aligned with one of said pierced passages and transversely-spaced bifurcated ends, each of said bifurcated ends providing a pair of laterally-spaced fingers rotated to face engagement of one of said pair of abutment means and clamping the latter therebetween, each of said clips extending transversely of said junction with one bifurcated end thereof holding together the sheathing sheets of the adjacent panel units at one face and the other bifurcated clip end holding together the sheathing sheets of the adjacent panel units at the other face.

5. A structural building paneled wall construction comprising, in combination; a plurality of substantially aligned panel units defining opposite wall faces, each of said panel units comprising a pair of transversely-spaced sheathing sheets and core means located between and spacing said sheets, said core means having a plurality of lateral passages extending therethrough from side portion to side portion of each panel unit for reception of a tool stem laterally through said core means, each of said panel units having side edges of their sheathing sheets transversely-spaced for tool access to said passages with said side sheet edges abutted to those of the adjacent panel unit in a panel junction, said abutted edges of said sheathing sheets at both of said wall faces being turned back behind said sheathing sheets and mated, said mated sheet edges of adjacent panel units being shaped to provide opposed abutment means paired at both of the wall faces; and a plurality of tool-rotatable fasteners each aligned with one of said lateral passages, each fastener comprising an elongated body means having opposite end portions with one end portion engaging and securing together mated sheet edges of a particular panel junction at one wall face and the other end portion engaging and securing together the mated sheet edges of the same panel junction at the other wall face.

6. The paneled wall construction as defined in claim 5 characterized by said mated sheathing sheets at one panel junction providing at each of both wall faces a pair of laterally-spaced abutments laterally facing away from each other, said paired abutments being transversely spaced in the junction with the fastener associated therewith being located in the space between the paired abutments, said fastener having both of its end portions forked with said paired abutments wedged therein by fastener rotation.

7. The panel wall construction as defined in claim 6 characterized by each pair of mated sheet edges as comprising one sheet edge of one panel unit turned back inwardly and then laterally behind its sheet to form a reverse bend terminating in an abutment edge, and the mating sheet edge as comprising an L-shaped flange in which the reverse bend is nested with the main leg of the latter facing in the lateral direction opposite to that in which said abutment edge faces to serve as the second of the paired abutments with said oppositely facing abutments wedged into one of said forked end portions of one of said fasteners, said reverse bent edges of one panel unit forming in a side edge of the latter a groove and the L-shaped flanges of the adjacent panel unit together serving as tongue means seated in said groove.

8. In a structural building panel wall construction a junction structure between a pair of adjacent panel units comprising a pair of transversely-spaced sheathing sheets intervened by spacing core means constituting a side edge portion of one of the panel units, the transversely-spaced edges of said sheets being shaped inwardly toward each other to provide a pair of flanges, another pair of transversely-spaced sheets intervened by spacing core means constituting a side edge portion of the other panel unit which is abutted against said first panel edge portion, the transversely-spaced edges of said second pair of sheets being shaped inwardly toward each other to provide a second pair of flanges juxtaposed to the first pair of flanges, the juxtaposed flanges of the pair of panel units on either side providing a pair of opposed abutment means, and an elongated rotatable fastener having opposite end portions and extending transversely across said junction structure with one end portion engaging and securing together one of said pairs of abutment means and the other fastener end portion engaging and securing together the other of said pairs of abutment means.

9. The paneled wall junction structure as defined in claim 8 characterized by said transversely-spaced shaped edges of the sheathing sheets of one of said panel units defining a longitudinal groove with said transversely-spaced shaped sheet edges of the adjacent panel unit defining tongue means seated in said groove with said shaped edges interfitted.

10. The paneled wall junction structure as defined in claim 9 characterized by said interfitted shaped edges of said adjacent panel units providing two pairs of mated flanges, one at each of the two junction faces defined by general alignment of said sheathing sheets, each of said pair of mated flanges providing a pair of said abutment means with the latter facing in opposite lateral directions, said rotatable fastener being in the form of an elongated clamping clip having each of its end portions in the form of a fork rotated to reception therein and clamping engagement of one of said pair of abutment means thereby holding said mated flanges together.

11. The paneled wall junction structure as defined in

claim 10 characterized by each end portion fork being generally V-shaped with its clamped pair of abutment means wedged therein.

12. The paneled wall junction structure as defined in claim 11 characterized by the provision of a plurality of said clamping clips vertically-spaced and concealed in said junction structure, each of said clips being aligned with one of a plurality of lateral passages each extending through said core means of one of said panel units for reception therethrough of an elongated stem of a clip-rotating tool.

13. The paneled wall junction structure as defined in claim 12 characterized by said core means of each of said panel units being pierceable by stiff rod means with said tool stem serving as said rod means and forming each of said lateral passages as a pierced hole.

14. The paneled wall junction structure as defined in claim 11 characterized by one of each of said pair of

mated flanges being L-shaped and the other thereof shaped as a reverse bend seated within said L-shaped flange, the back side of said L-shaped flange serving as one of said paired abutment means with the terminal edge of said reverse bent flange serving as the other of said paired abutment means, said nested flanges being wedged into one of the V-shaped end portions of said clip by rotation of the latter with clamping bearing on the back side of said L-shaped flange and the terminal edge of the reverse bent flange.

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