May 27, 1958 W. M. LEESER 2,836,266

SHEET METAL WALL PANEL STRUCTURE

Filed Dec. 23, 1953 2 Sheets-Sheet 1

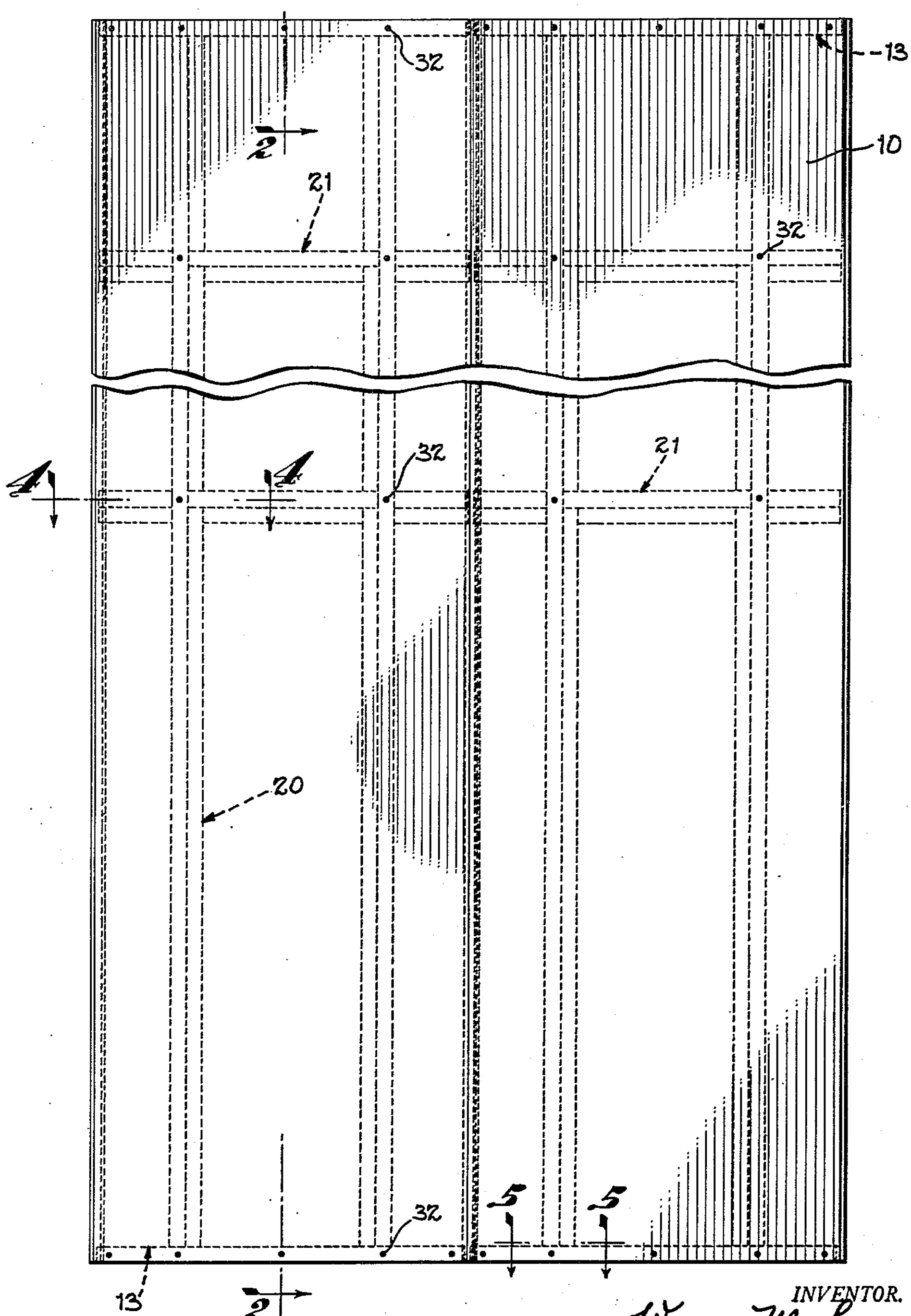

Fig. 1

INVENTOR.
Werner M. Leeser.
BY
Wood, Herron & Evans.
ATTORNEYS.

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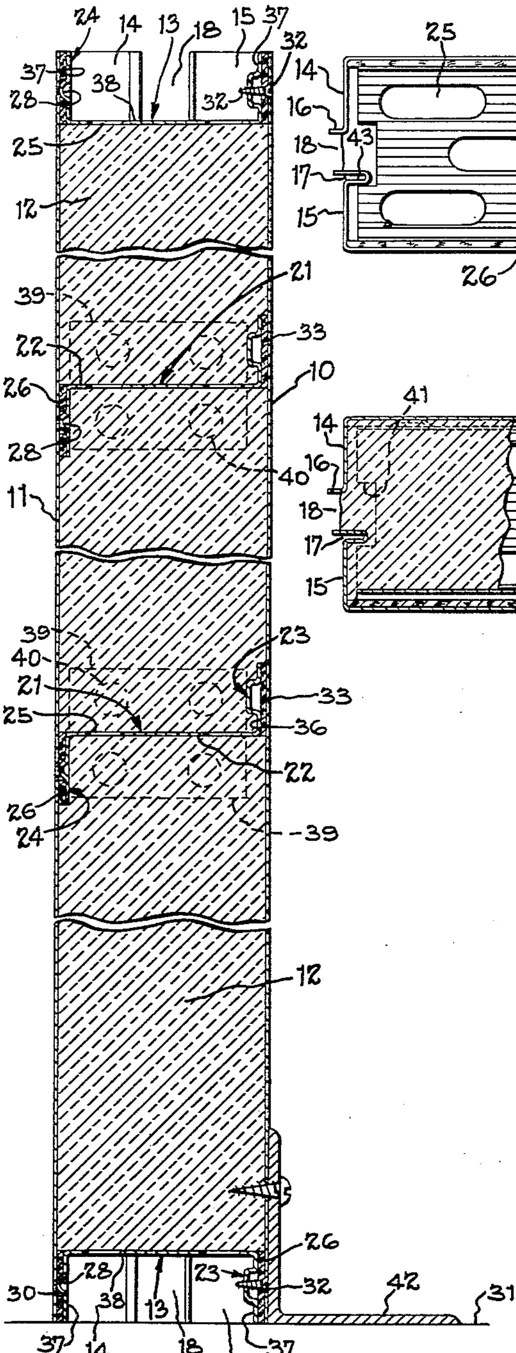

Fig. 2

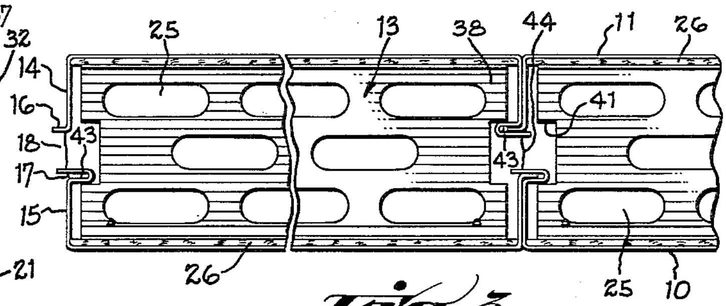

Fig. 3

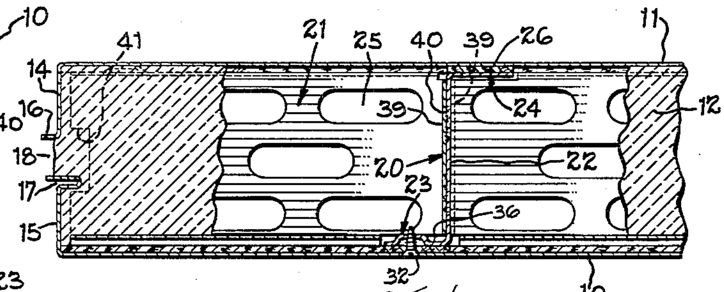

Fig. 4

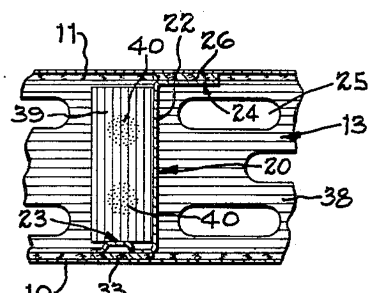

Fig. 5

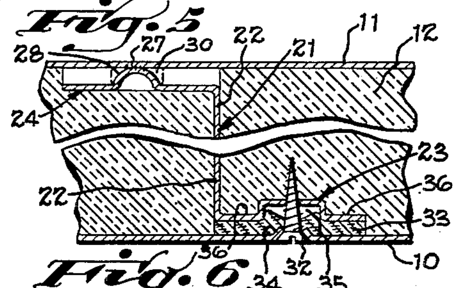

Fig. 6

INVENTOR.

Werner M. Leeser.

BY

Wood, Herron & Evans.

ATTORNEYS.

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SHEET METAL WALL PANEL STRUCTURE

Werner M. Leeser, Cincinnati, Ohio, assignor to The Steelcraft Manufacturing Company, Rossmoyne, Ohio, a corporation of Ohio

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3 Claims. (Cl. 189—34)

This invention relates to heat insulating panel structures for erection in multiples to provide curtain walls and internal partition walls of buildings. The panel structure is intended particularly for buildings of the type having an internal structural steel framework which supports the walls and floors.

The steel framework construction is well known and is utilized typically in industrial buildings such as warehouses, factories and the like having framework covered by panels of metal or other material; likewise, in commercial buildings of more expensive construction, for example office buildings, in which the steel framework is enclosed by masonry walls. In either case, the major loads are carried by the structural steel framing members and the walls carry practically no load, whether the building has one or several stories. The present panel structure is intended for erection in any type of building having an internal framework, steel or otherwise, to provide heat insulating external curtain walls. The structure is also intended for internal partition walls and other necessary wall structures in which the walls may rest upon the foundation or floor of the building.

The principal objectives of the present invention have been to provide a sheet metal panel structure which is exceptionally light in weight; which has superior heat insulating qualities; and which is exceptionally strong and rigid in relation to its mass.

Briefly, the present structure constitutes a self-contained panel assembly which is furnished as a unit ready for erection without any trimming or fitting in the field, thereby to promote speed and economical erection. Each panel unit comprises a pair of sheet metal membranes or panels spaced from one another, the spaced panels having a heat insulating material confined between them. The panel units are erected in edge to edge relationship with their adjoining side edges interlocked as explained later, and are attached to the structural framing members of the building, either at the exterior or interior. The erected wall presents a flush surface, both inside and outside, interrupted only by the inconspicuous meeting lines along the adjoining edges of the panels.

Another object has been to provide a dual arrangement of interlocking tongues and grooves along each edge of the panel unit to provide strong mechanical connection between the adjacent panels of an erected wall, the interlocked structure providing an interruption, or air gap, in the continuity of the metal section across the joint to prevent the direct flow of heat from one panel, across the tongue and grooves to the other panel.

For this purpose, the spaced panels have marginal portions at opposite side edges bent at right angles inwardly toward one another to provide flanges delineating the edge walls of the panel assembly. At a given edge of the panel assembly, one flange is bent reversely along its inner edge to form an outwardly facing groove, while the companion flange has its inner edge bent outwardly to provide a tongue, the tongue and groove being spaced from one another to provide the air gap. The tongue and groove along one edge of the panel unit is reversely related to the tongue and groove at the opposite edge, such that the tongue and groove of one panel unit interlocks with the reversely positioned tongue and groove of an adjacent panel unit upon erection. This provides a double tongue and groove connection along each joint as the panels are interlocked one with the other. The interlocked tongues and grooves securely join the adjacent panel structures to one another mechanically such that a force acting against one panel unit in either direction is carried to the adjoining units causing them to reinforce one another collectively. Upon erection, a caulking compound is applied to the interfaces of the tongue and groove joint to provide a weather seal.

A further object of the invention has been to provide a metal spacing structure which resides between the spaced panels and is joined to them to provide a strong mechanical connection, but in which the direct internal flow of heat from one panel to another through the spacer structure is impeded by a non-metallic insulating section interrupting the metal sections.

The spacer members comprise sheet metal strips generally Z-shaped in cross section. These members extend transversely between the spaced panels, heat insulating strips being interposed between the flanges of the Z-shaped members and the internal surface of the panels. In the preferred structural arrangement, the flanges on one side include spaced convex dimples projecting through the insulating strip to the surface of the panel and permanently joined to the panel by spot welding. The flanges on the opposite side are joined to the panel by screws or the like which pass through the panel and insulating strip and engage the flange. Since the relative area of the spaced spot welds and screws is extremely minute in relation to the area of the panel unit, the direct metal to metal transfer of heat through the spacers is substantially eliminated.

The upper and lower ends of the panel assembly are provided with closure plates which retain the insulating material within the panels. The closure plates are attached to the panels in a manner generally similar to the spacers in order to prevent the cross flow of heat at these areas. The closure plates and spacer strips are provided with elongated holes which are staggered in relation to one another. These holes reduce the overall weight of the structure; they allow the circulation of air internally within the panel assembly to prevent condensation of moisture; and they provide a tortuous path across the metal section of the closure plates and spacers to impede further the direct flow of heat across the internal structure.

The panels are furnished to the user in assemblied condition, trimmed to their final dimension ready for erection upon the existing framework or between the floor and ceiling of the building. They are installed rapidly and conveniently in a fraction of the time required for masonry construction; consequently, the overall cost is a great deal less than conventional construciton. By virtue of their construction, they provide a very efficient heat insulation factor; although they are light in weight, their internal truss construction and interlocked relationship provides a mechanically strong wall surface which is capable of withstanding wind pressures and other live loads with substantially no deflection. The panels are constructed either of aluminum, glavanized steel or stainless steel. The metal surfaces may be enamelled in desired colors or they may be utilized in natural color.

Various other advantages of the invention will be brought out in the following detailed description taken in conjunction with the drawings.

In the drawings:

Figure 1 is a face view of a pair of erected wall panel units, illustrating the general arrangement of the structure.

Figure 2 is an enlarged vertical sectional view, taken on line 2—2, Figure 1, detailing the structural features of the panel unit and showing the lower edge of the panel mounted upon the foundation or floor of a building.

Figure 3 is an enlarged fragmentary top plan view, illustrating the double tongue and groove joint between adjacent side edges of a pair of panels in interlocked relationship, and illustrating the closure strips which are provided along the upper and lower edges of the panel assembly.

Figure 4 is an enlarged sectional view taken on line 4—4, Figure 1, illustrating an edge portion of the panel, particularly the longitudinal and transverse Z-shaped spacer strips which extend between the panels to reinforce and hold them in spaced relationship.

Figure 5 is a sectional view taken on line 5—5, Figure 1, illustrating the attachment of the longitudinal Z-shaped reinforcing strips to the closure plate along the bottom edge of the panel.

Figure 6 is an enlarged sectional view detailing the flange structure of the Z-shaped spacers.

Described generally with reference to Figure 2 of the drawings, the panel assembly consists of a pair of sheet metal membranes or panels indicated at **10** and **11**, the panel **10** representing the internal wall surface, and the panel **11** the external wall surface. In the present disclosure, the panels **10** and **11** are flat although, if desired, one or both panels may be fluted vertically to provide an architectural finish which harmonizes with the design of the building.

For heat insulating purposes, the space between the panels is packed with insulating material, indicated at **12**, such as glass fibre or similar material which is light in weight and which possesses the desired resistance to the passage of heat. As best shown in Figure 2, the upper and lower edge portions of the panel assembly are enclosed by the closure plates, indicated generally at **13**, which are spaced inwardly from the upper and lower edges of the panels and extend transversely across the assembly. The closure plates confine the insulating material between the panels, but have openings to provide air flow within the panel so as to reduce the condensation of moisture. The openings also lighten the panel to impede the direct flow of heat from one panel through the closure plates to the other panel, as described later.

Referring to Figures 3 and 4, the marginal side portions of the two panels **10** and **11** are bent inwardly at right angles to the panels and project toward one another to provide the companion side closure flanges **14** and **15**. The inner edge of flange **14** is provided with a tongue **16** which is bent outwardly at right angles from the plane of the flange. The inner edge of flange **15** is provided with a generally U-shaped reverse bend which provides an open groove **17** to receive and confine the tongue **16** of an adjacent panel upon erection (Figure 3). The opposite side edge of the panel assembly is provided with similar flanges having a tongue and groove configuration; however, the tongue and groove at the opposite edge are located in symmetrically opposite positions, that is, they occupy relatively reversed positions so as to interlock with the tongue and groove of an adjoining panel as shown. It will be noted at this point, that the tongue and groove are spaced apart from one another as at **18** to interrupt the continuity of the metal flanges **14** and **15** and thereby prevent the direct flow of heat across the flanges from one panel to the other.

Referring to Figure 1, the internal Z-shaped reinforcing or spacer strips, which are indicated in broken lines, consist of longitudinal strips indicated generally at **20** and transverse strips indicated generally at **21**. The respective strips are properly located with respect to the edges of the panel to provide uniformly spaced reinforcements when the several panels are erected as indicated in Figure 1. The spacer strips or webs maintain the inner and outer panels in spaced relationship and reinforce the assembly longitudinally and transversely against forces or loads acting at an angle to the plane of the panels. Tests have indicated that the deflection of the erected panel assembly under such live loads is considerably less than the permissive deflection specified in building codes relating to structures of this class.

Referring to Figure 2, which represents the attachment of either the longitudinal or transverse spacer strips to the panels, each strip is Z-shaped in cross section and comprises a web **22** having its side edges bent at right angles to the plane of the web to provide an upwardly projected flange **23** and a downwardly projected flange **24** at respective opposite edges. This configuration expedites the operation of spot welding the spacer flanges to the panels, as explained later, since the spacers offer no obstruction to the introduction of the welding electrodes. The web **22** is provided with oblong holes **25** as detailed in Figure 4, the holes being arranged in rows extending longitudinally and staggered relative to one another such that the holes provide a tortuous path between the spaced panels and decrease the weight of the assembled panel unit. It is to be noted at this point, that the upper and lower closure plates **13** are provided with identical holes **25** as indicated in Figures 3 and 5, such that a flow of air is provided vertically through the fibrous insulating material to prevent the condensation of moisture between the panels.

In order to prevent the direct flow of heat across the spaced panels through the Z-shaped spacer strips, the flanges **23** are insulated from the metal panel **10** by nonmetallic strips **26** formed of heat insulating material, such as cork or the like, interposed between the flanges and the internal surface of the panel. The flange **24** is attached by spot welding as at **27** (Figure 6), preferably to the exterior panel **11**, thus avoiding the exposure of corrosive parts to the weather. For this purpose, the flange is provided with convex dimples **28** formed at spaced points along the flange and projecting outwardly from the plane of the flange into contact with the surface of panel **11**. To accommodate the dimples, the cork strip **26** is provided with matching holes **30** through which the dimples project into contact with the panel surface.

The spot welding operation may be executed in a conventional manner utilizing spaced electrodes, one applied directly to the dimples and the other applied to the external surface of the panel. With the two surfaces in contact, a charge of current is passed through the electrodes to spot weld the contacting portion of the dimple to the panel as indicated at **27**. By virtue of the relatively minute area of the spot welds which are spaced along the flange, only a small portion of the flange is in actual contact with the panel. In the preferred form of the invention, the remaining area of the flange is insulated from the panel by the cork strip **26**; however, the cork strip is not absolutely necessary since the dimples space the flange proper from the panel and provide an air gap or barrier which restricts the heat flow. For this reason, it is contemplated in some instances, to omit the cork strip at the welded flange of the spacer as indicated in Figure 6.

The flange **23** along the opposite edge of the reinforcing strip is attached to the opposite panel preferably by means of self-tapping sheet metal screws **32** which pass through the panel and into threaded engagement with the flange. A heat insulating strip **33**, preferably formed of cork similar to strip **26**, is interposed between flange **23** and panel **10**. For this purpose, holes may be drilled through the flange at the assembly to receive the screws as described in detail later. The screws **32** preferably are of the flat head type and reside flush with the surface of the panels, the punched holes being countersunk by dimpling the panel, as indicated at **34** in Figure 6. As shown in Figure 1, the screws **32** preferably are located at the intersections of the transverse and longitudinal reinforcing strips. The spot welds **27** at the opposite side of the assembled panel may be located, by way of example, at 16" spacing along the reinforcing strips to provide a strong mechanical connection.

The flange **23** is configurated to provide a channel **35** extending longitudinally of the flange and spaced inwardly from the insulating strip **33**. The channel stiffens the flange longitudinally and provides clearance for the dimples **34** which bulge the cork strip into the space provided by the channel as indicated in Figure 6. The configuration of flange **23** also improves the mechanical connection to the panels since the channel provides two seating areas **36—36** residing against the cork strips along opposite sides of the screws.

The foregoing description of the spacer and reinforcing strip applies both to the longitudinal and transverse reinforcing strips **20** and **21** which are identical in construction. The upper and lower closure plates **13** are also similar to the reinforcing strips in all respects except that both flanges **37—37** project in the same direction from the web **38**. In other words, the closure strips are generally U-shaped as distinguished from the Z-shaped reinforcing strips. It will be noted that the flangees of the upper and lower closure strip are provided with dimples as described above which are spot welded to the same panel **11** as the reinforcing strips.

In assembling the panel structure, the longitudinal and transverse reinforcing strips **20** and **21**, and closure plates **13** are joined together in the form of a web as shown in Figure 1 before being installed in the panels. The longitudinal and vertical strips are joined together at their points of intersection by a spot welding operation. For this purpose, the ends of the transverse strips, which intersect the longitudinal strips, are provided with end flanges **39** (Figure 2) which engage the surface of the web **22** of the longitudinal strips at opposite sides. The flanges are spot welded as at **40** to the opposite sides of the web. The ends of the longitudinal strips are provided with similar end flanges **39** which are spot welded as at **40** to the closure plates as shown in Figure 5. The outer ends of the transverse strips have their flanges cut out as at **41** (Figure 4) to clear the groove member **17**; the ends of the closure plates are similarly cut as shown in Figure 3.

The length dimension of the panel may vary for the reasons explained later, and the location of the transverse strips is dictated by the length of the panels. After the strips and closure plates are spot welded together at their points of intersection, the cork insulating strips **26** and **33** are applied to the respective flanges. Preferably, the cork strips are treated with pressure sensitive adhesive such that the strips are simply pressed in position upon the respective flanges, the strip **26** for the dimpled flanges being perforated to accommodate the dimples as explained earlier.

The assembled web structure is then installed upon the panel **11** and located accurately relative to the panel ends and relative to the side flanges **14** and **15**. The strips and closure plates are then permanently joined to the panel by applying electrodes under pressure against the dimples and panel from opposite sides to force each dimple into contact with the surface of the panel and to spot weld it.

After the assembled web is spot welded in, the insulating material **12** is packed upon the panel between the spacer strips and closure plates, the assembly preferably being disposed in a horiznotal position for convenient handling of the insulating material. Thereafter, the panel **10** is placed in position upon the spacers and closure plates for attachment.

To facilitate production, the panel **10** preferably is prepunched to accommodate the sheet metal screws **32**, and as an incident to the punching operation, the holes

are dimpled or countersunk for the heads of the screws. With the panel accurately located upon the spacers, it is utilized as a template or pattern in drilling the holes for the screws in the flanges of the reinforcing strips and closure plates. As shown in Figure 1, the screws are located at relatively closely spaced points along the upper and lower edges of the panel, securing the panel to the closure plates. In the body of the panel, the screws preferably are located only at the points of intersection of the reinforcing strips. Experiment has indicated that this arrangement of screws, in combination with the spot welds, imparts a high degree of strength and rigidity to the panel structure. After application of the screws **32** the panel unit is completely assembled and ready for erection.

As indicated earlier, the panels are utilized either as curtain walls which are mounted upon the structural steel framework of the building or as interior partition walls. According to the typical curtain wall installation shown in Figure 2, the panel is shown in erected position with its lower end resting upon a concrete floor slab or footing **31**. It is secured in position by an angle iron **42** which is suitably anchored upon the slab **31** by anchor bolts or the like. The angle iron represents the framework of the building and holds the several erected panels accurately in alignment with one another; the panels being attached to the web of the angle iron either by wellding, toggle bolts, or self-tapping sheet metal screws, the latter being illustrated in Figure 2.

The upper end portion of the panel may be attached to a similar angle iron forming a part of the building framework if the panel is utilized as an external curtain wall. In the event that the panel units are erected as an internal partition wall, the angle irons may be attached directly to the floor and ceiling of the building.

If the wall is more than one story high, the panels may be installed one upon the other, a suitable framing member being disposed along the meeting ends of the upper and lower rows of panels, with the adjacent meeting portions of the panels attached in common to the intermediate framing member. In this event, a sheet metal flashing strip may be installed between the meeting ends of the panels for water drainage. The room structure of the building is joined to the upper edge of the panels in a conventional manner for example, it may overhang the panel, with a sheet metal rake closure or eave extending from the edge of the roof and overhanging the upper end of the panels. It will also be understood that suitable corner members are provided to enclose the adjoining end portions of the panels at the corners of the building. The window and door openings are delineated by suitable framework of conventional construction which extends around the edges of the panels at the opening, with the wall space above the opening enclosed by panels which are cut to length. Since the present invention is directed particularly to the structure of the panel, these various details, which form no part of the invention, have been omitted from the disclosure.

The assembled panels are furnished in a standard width and lengths which are cut to suit the height or floor levels of the building. Preferably they are furnished in standard width of 24", with narrower units provided for fill-in use. The structure provides rapid, easy erection since no fitting is required, the panels simply being placed along side one another with their tongue and groove edges interlocked and are attached to the framing members by screws or other means as indicated above.

As each panel unit is erected, a liquid caulking compound is applied to the groove **17** and, if desired, to the faces of the flanges **14** and **15** before the panel is interlocked with its companion panel. The caulking compound, which is indicated at **43** in Figure 3, provides a weather proof joint between the contiguous panels. It will be noted in Figure 3, that the edge portion of the insulating material **12**, which is exposed between the flanges **14** and **15**, lies in contact as indicated at **44** when the panels are joined, and thus provides a continuous insulating sheet. The interlocking tongue and grooves mechanically join the panels to form a continuous external wall surface. Moreover, the interlocking joint reinforces the panels mechanically, since forces acting at an angle to the plane of the panel from either direction is carried by the tongues and grooves to adjoining panels, such that they reinforce one another collectively. As a consequence, the assembled wall will resist wind pressures and other live loads up to thirty pounds per square foot with a deflection considerably less than the minimum set up in approved building codes.

Although the panels provide an interlocking engagement, they are readily removable to accommodate remodeling of the building. The panels may be erected either in vertical alignment as illustrated, or they may be installed in horizontal courses, one upon another, if the design of the building so requires. By virtue of the light weight construction of the panel units, they are particularly economical as curtain walls for buildings of several stories since the panel weighs only a fraction of an equivalent masonry area; consequently, the structural framework and foundation may be made considerably lighter in construction.

The panel units are furnished in steel, aluminum or stainless steel. In the event the ordinary steel is utilized it may be galvanized, or galvanized and enameled in colors. If desired the panel units may be made up of a combination of the above to provide the desired exterior and interior appearance.

The panel units are erected far more rapidly than masonry construction and at a considerable saving in labor and cost of material.

From the foregoing it will be understood that the dual tongue and groove joints provide a strong mechanical connection between the panels, but by virtue of the spacing of the tongues and grooves, the metal section is interrupted across the joint to prevent the direct flow of heat from one panel to the other. The cork strips interposed between the metal panels and metal reinforcing webs, perform the same function in the body of the panel. Thus the structural arrangement, combined with the fibrous insulating material, provides a strong rigid assembly having exceptionally efficient heat insulating qualities.

Having described my invention I claim:

1. A heat insulating sectional building wall formed of rectangular, prefabricated panel units, said panel units having adjoining side edges secured to one another, each of said prefabricated panel units comprising a pair of spaced, parallel sheet metal panels, a plurality of elongated sheet metal spacer strips residing between said panels and extending longitudinally and transversely thereof, each of said spacer strips being generally Z-shaped in cross section providing a web having a pair of flanges along opposite sides thereof, one of said flanges having a series of spaced convex dimples projecting outwardly therefrom into contact with the internal surface of one of said panels and welded thereto, said dimples spacing the flange outwardly from the panel and thereby providing an air gap obstructing the flow of heat from the said panel to the flange and spacer, the other of said flanges residing against the adjacent internal surface of the other panel and attached thereto, said spacer strips securing the panels in spaced relationship and resisting displacement of the panels relative to one another longitudinally and transversely, each of said panels having a pair of companion flanges along opposite side edges, said flanges projecting inwardly toward one another generally at right angles to the plane of the panels and in plane with one another, the pairs of flanges forming partial closures along opposite side edges of the panel unit, the inner edges of each pair of companion flanges being spaced apart from one another, heat insulating material confined between said spaced panels and having side edges partially confined by said companion flanges, the unconfined edge of the heat insulating material being exposed across said air gap at opposite sides of the panel unit, the companion flanges of adjoining panel units of the building wall being in facial contact, one flange of each panel unit having an open recess therein, the facially contacting flange of the other panel unit having a tongue element projecting outwardly parallel to the plane of the panel unit and interfitting said recess, the interfitting recess and tongue element being spaced from the inner edges of the companion contacting flanges a distance less than one-third the total spacing of said sheet metal panels, said spacing providing an air gap which obstructs the flow of heat across said companion flanges from one panel to the other, the exposed insulating material at the side edges of adjoining panels being in contact and providing a continuous heat insulating sheet extending across the panel units of the sectional wall structure.

2. A heat insulating sectional building wall formed of rectangular, prefabricated panel units, said panel units having adjoining side edges secured to one another, each of said prefabricated panel units comprising a pair of spaced, parallel sheet metal panels, a plurality of elongated sheet metal spacer strips residing between said panels and extending longitudinally and transversely thereof, each of said spacer strips being generally Z-shaped in cross section providing a web having a pair of flanges along opposite sides thereof, one of said flanges having a series of convex dimples projecting outwardly into contact with the internal surface of one of said panels and welded thereto, said dimples spacing the flange from the surface of the panel, the other of said flanges being generally channel shaped in cross section providing a web spaced inwardly from the internal surface of said other panel, heat insulating material interposed between said channel shaped flange and said other panel, metallic attachment elements passing through said other panel and through said web and attaching the panel to the channel shaped flange, said dimples and channel shaped flange providing a three-point connection betwen said panels and Z-shaped spacer strip and obstructing the flow of heat from one panel through the spacer strip to the other panel, said spacer strips securing the panels in spaced relationship and resisting displacement of the panels relative to one another longitudinally and transversely, each of said panels having a pair of companion flanges along opposite side edges, said flanges projecting inwardly toward one another generally at right angles to the plane of the panels, the pairs of flanges forming partial closures along opposite side edges of the panel unit, the inner edges of each pair of companion flanges being spaced apart from one another, heat insulating material confined between said spaced panels and having side edges partially confined by said companion flanges, the unconfined edge of the heat insulating material being exposed across said air gap at opposite sides of the panel unit, the companion flanges of adjoining panel units of the building wall being in facial contact, one flange of each panel unit having an inner edge portion bent to provide a pair of spaced limbs residing parallel to the plane of the panel unit and delineating a recess having an open side facing outwardly, the facially contacting flange of the other panel unit having an inner edge bent to provide a tongue projecting outwardly parallel to the plane of the panel unit and interfitting said recess, the interfitting recess and tongue being spaced from the inner edges of the facially contacting companion flanges and providing an air gap which obstructs the flow of heat across the companion flanges from one panel to the other, the exposed insulating material at the side edges of the adjoining panel units being in facial engagement and providing a continuous heat insulating sheet extending across the panel units of the sectional wall structure.

3. A heat insulating sectional building wall formed of rectangular, prefabricated panel units, said panel units

having adjoining side edges secured to one another, each of said panel units comprising a pair of spaced, generally parallel sheet metal panels, a plurality of elongated sheet metal spacer strips residing between said panels and extending longitudinally and transversely thereof, each of said spacer strips being generally Z-shaped in cross section providing a web having a pair of flanges, one of said flanges having a series of convex dimples spaced apart from one another and projecting outwardly into contact with the internal surface of one of said panels and welded thereto, the other of said flanges being generally channel shaped in cross section providing a web spaced inwardly from the other of said panels, insulating material interposed between said channel shaped flange and panel, attachment screws passing through said panel and through said web, said attachment screws clamping the channel shaped flange into pressure engagement with said insulating material and panel, said dimples and channel shaped flange obstructing the flow of heat from one panel through the spaced strip to the other panel, said spacer strips securing the panels in spaced relationship and resisting displacement of the panels relative to one another longitudinally and transversely, each of said panels having a pair of companion flanges along opposite side edges thereof, said flanges projecting inwardly toward one another generally at right angles to the plane of the panels, and in plane with one another, the inner edges of each pair of companion flanges being spaced apart from one another, the inner edge portion of one of said companion flanges having a tongue extending outwardly at right angles from the flange and parallel to the panel unit in a plane spaced inwardly thereof, the edge portion of the other companion flange being bent to provide a pair of spaced limbs residing parallel to the plane of the panel unit and spaced inwardly thereof, said spaced limbs delineating a recess having an open side facing outwardly, the companion flanges of adjoining panel units mating in facial contact with one another, the tongue of each flange projecting into the recess of the mating flange and providing a double interlocking joint between the adjoining panel units, said mating tongues and recesses of the companion flanges being spaced apart from one another and providing an air gap which obstructs the flow of heat across the flanges from one panel to another, said interlocking joint locking the adjoining panel units in plane with one another and adapting the panel units collectively to resist forces acting at an angle to the plane of the wall structure.

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