Oct. 16, 1962 J. J. MARTIN 3,058,551

BUILDING CONSTRUCTION AND ELEMENTS THEREFOR

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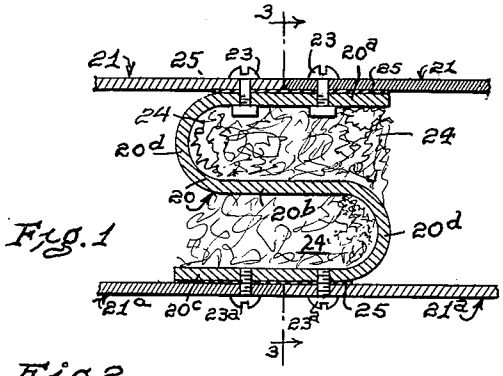

Fig. 1

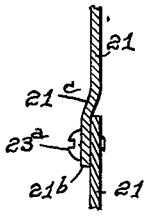

Fig. 4

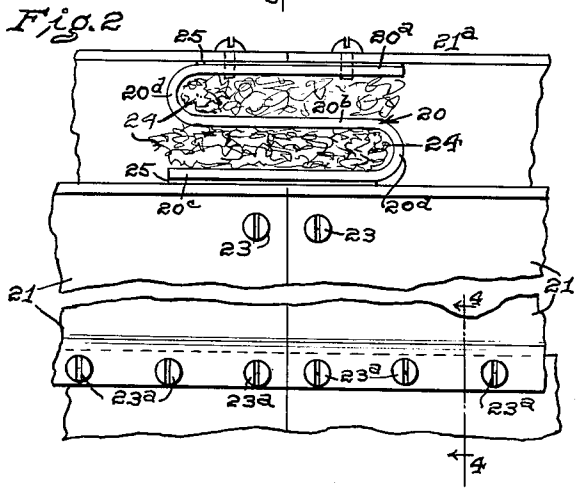

Fig. 2

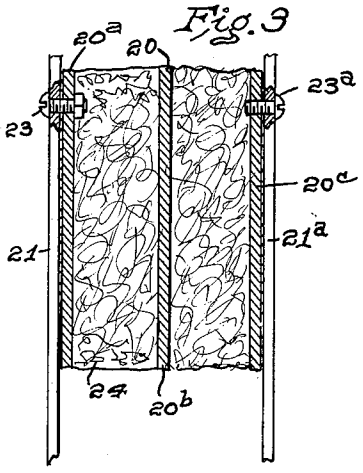

Fig. 3

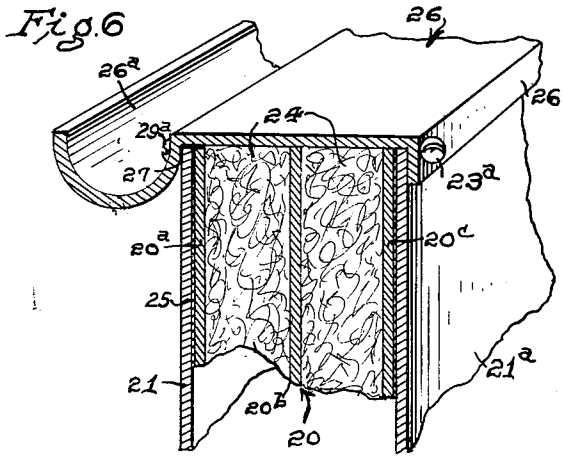

Fig. 6

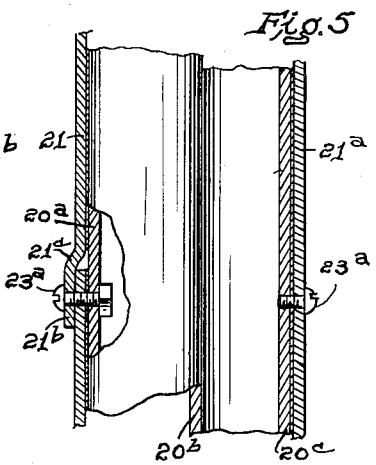

Fig. 5

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Fig. 7.

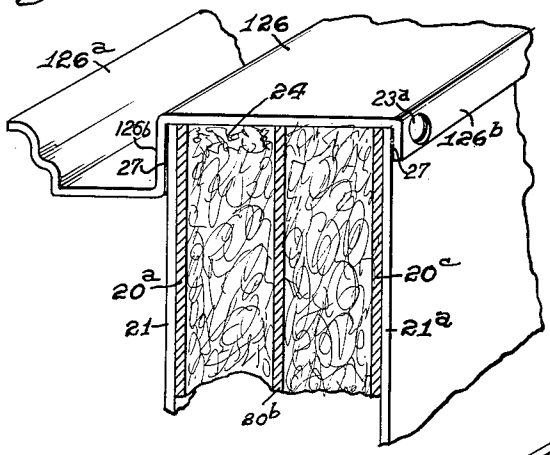

Fig. 8a

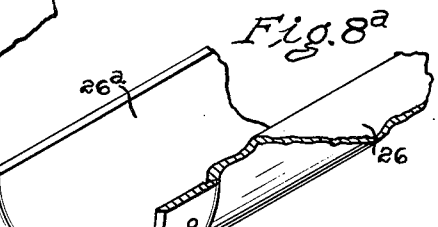

Fig. 8

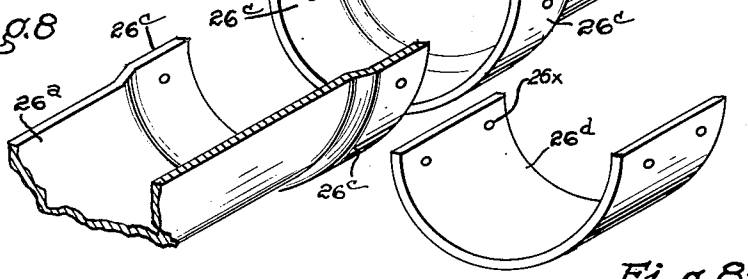

Fig. 8b

Fig. 9

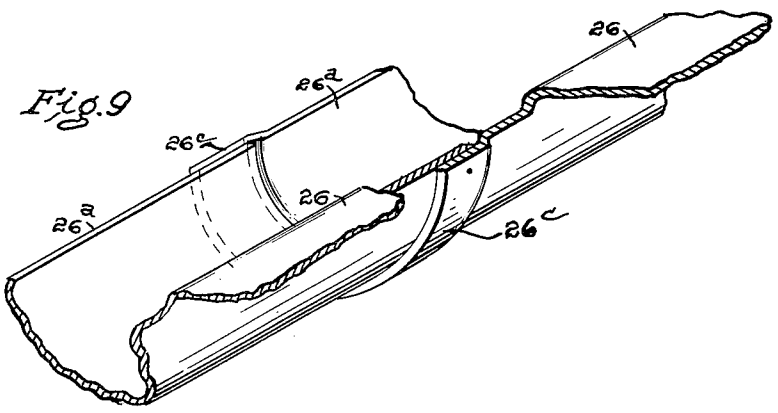

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Fig. 10

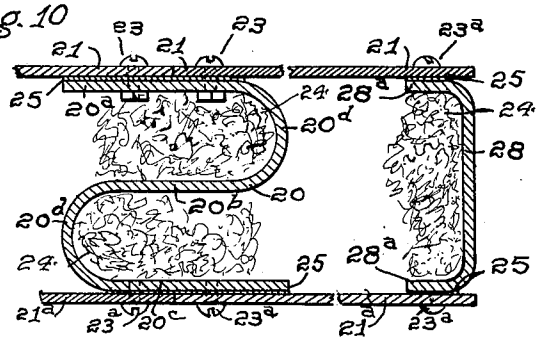

Fig. 11

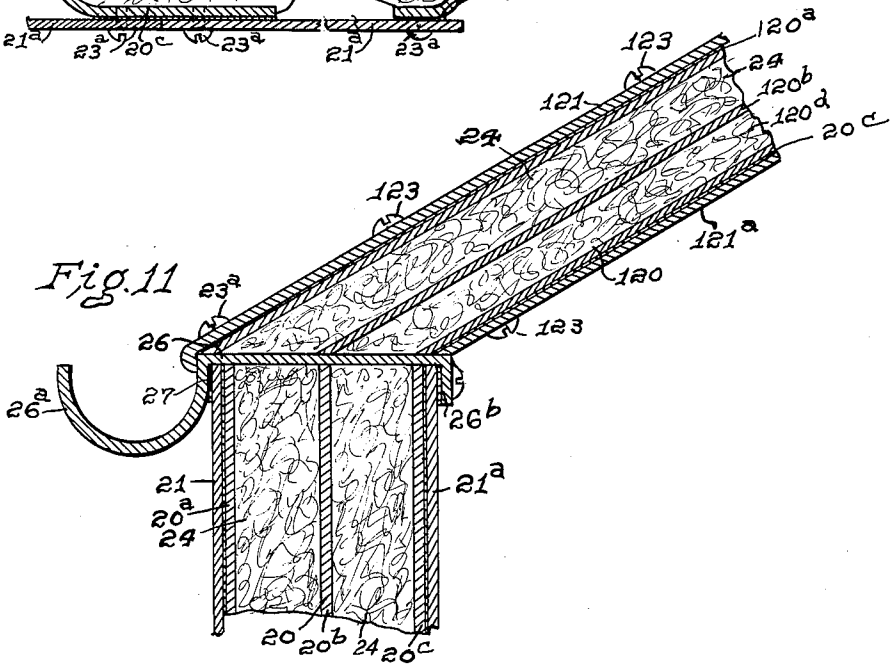

Fig. 12

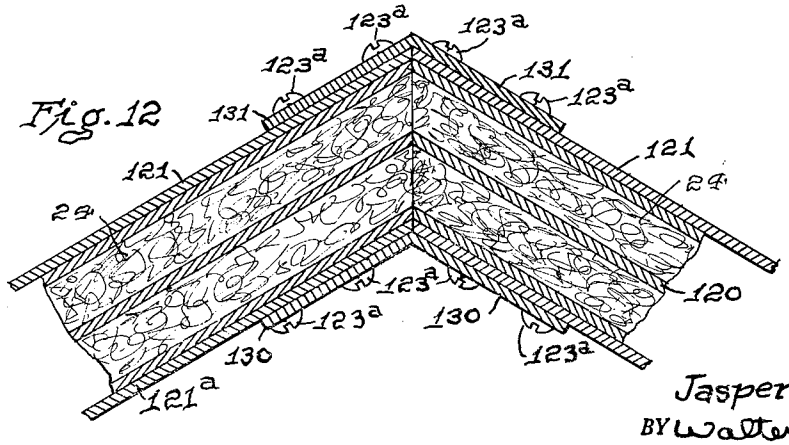

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Fig. 13

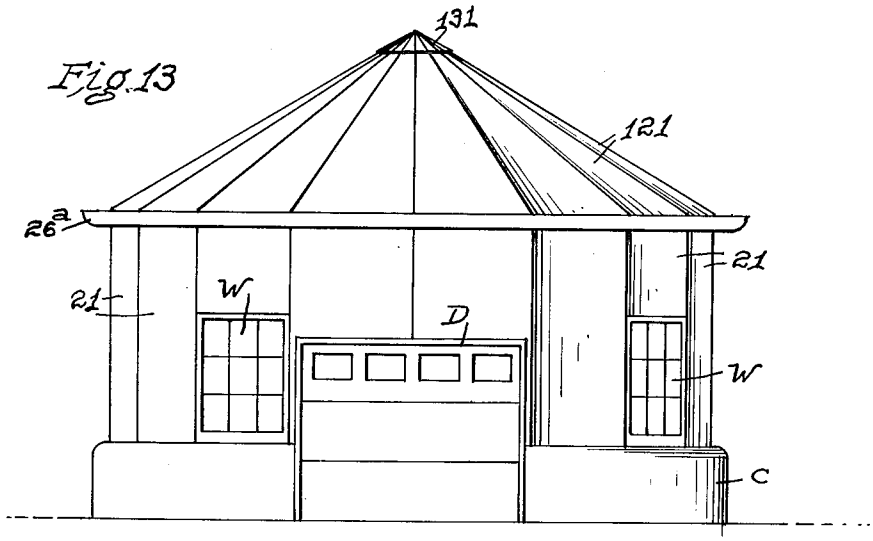


Fig. 14

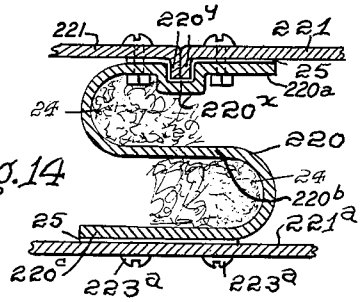


Fig. 15

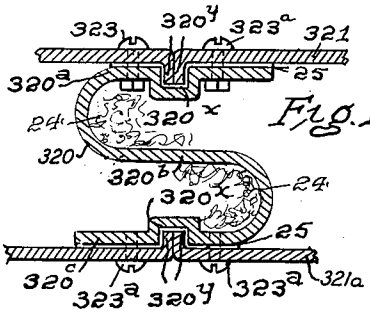


Fig. 16

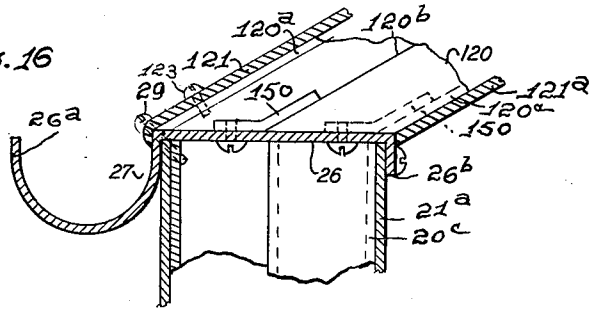
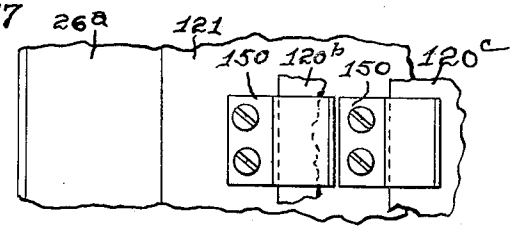


Fig. 17



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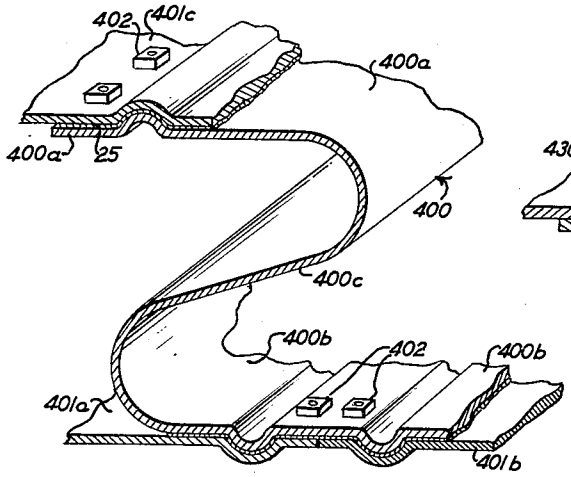

Fig. 18

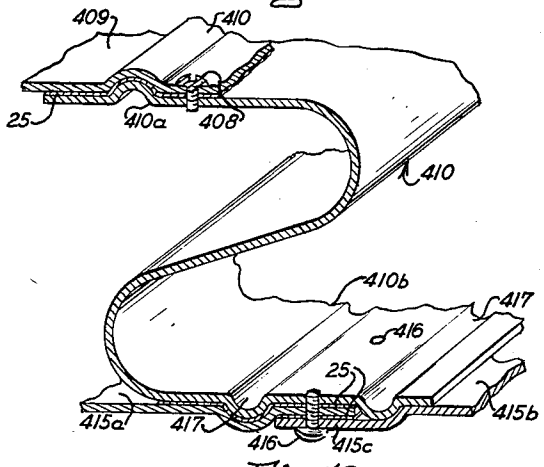

Fig. 19

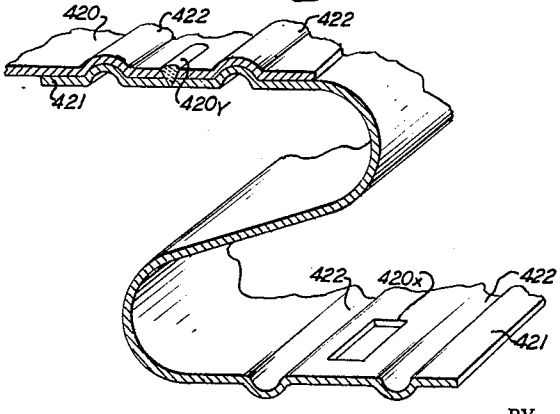

Fig. 20

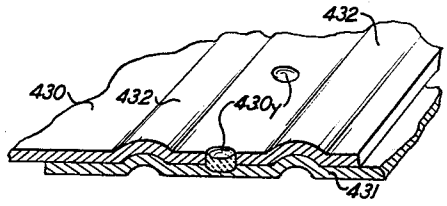

Fig. 22

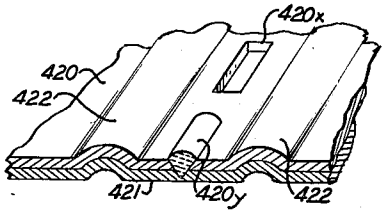

Fig. 21

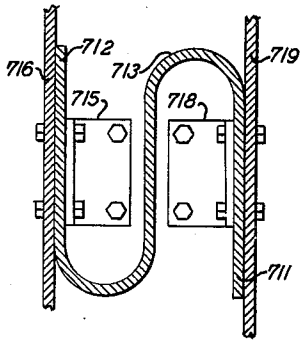

Fig. 26

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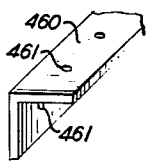

Fig. 23a

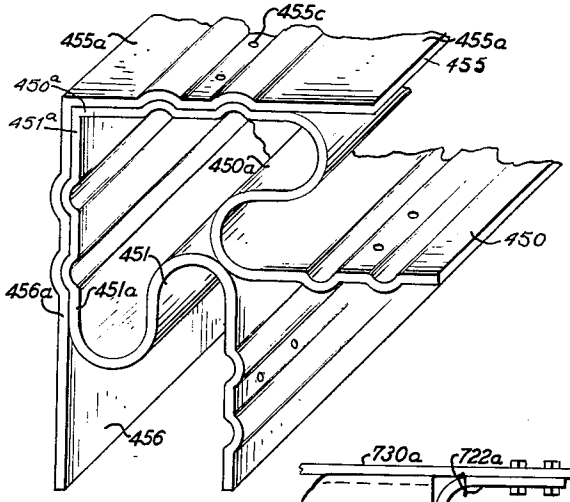

Fig. 23

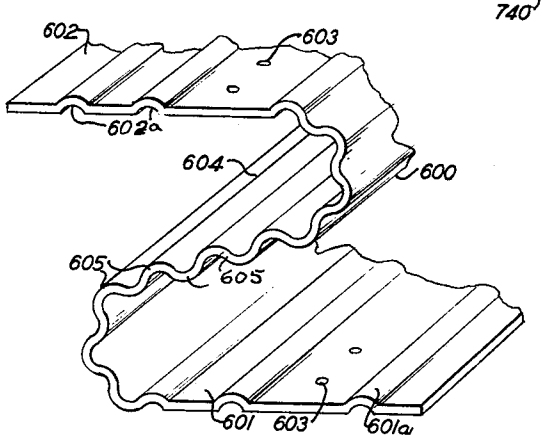

Fig. 24

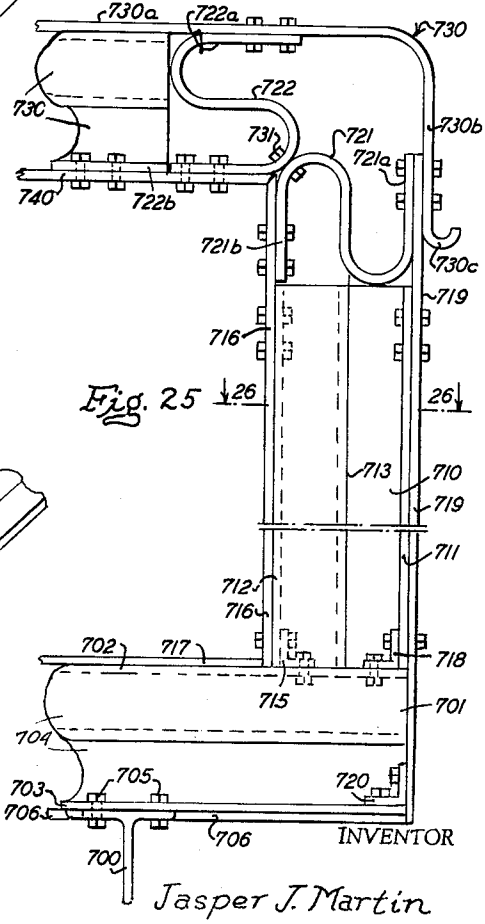

Fig. 25

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United States Patent Office 3,058,551 Patented Oct. 16, 1962

3,058,551
BUILDING CONSTRUCTION AND ELEMENTS THEREFOR

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Filed Oct. 16, 1959, Ser. No. 846,843
3 Claims. (Cl. 189—34)

This invention relates to building elements and particularly to elements for use in structures which may have pre-fabricated parts.

The primary object of this invention is the provision of an improved building construction.

Another object of the invention is the provision of an improved building element for securing plates or other parts together.

Still another object of the invention is the provision of an improved building element for securing plates or other parts together and which will have a maximum resiliency when exposed to the pressure of the wind.

A further object of the invention is the provision of an improved building element for securing plates or other building elements together which has no two parts with sharp angles therebetween, thereby giving a maximum resiliency with a minimum liability of breakage when exposed to wind pressure or when exposed to any outside strains.

Another and further object of the invention is the provision of an improved building element which is adapted for various uses such as a stud, a rafter or a floor beam, in any or all of these uses giving a maximum stiffness where desired and a maximum flexibility where needed.

A still further object of the invention is the provision of an improved building construction wherein is provided a series of overlapping insulation compartments to assist in prevention of the passage of heat.

Still another and further object of the invention is the provision of a building element having an elongated body with an S-shape cross section having oppositely disposed substantially flat portions and an intermediate ogee section, thereby forming a circuitous route for the passage of heat through the ogee section and providing overlapping compartments for the occupation of insulation.

Another and still further object of the invention is the provision of an improved building construction having elongated elements for use as rafters or as studs having an S-shape cross section, with plates secured to opposite sides of the S and with insulation between the plates, thus forming overlapping sections of insulation with a long passage for any escape heat to travel.

Still another object of the invention is the provision of an improved building construction, having outside or inside plates or both, and an element therefor, having a substantially S-shape cross section, with provision for the entry of the edges of the plates into receiving portions of the element, and provision for sealing the plates to the element.

A still further object of the invention is the provision of a building element such as a built up stud, rafter or joist which will have a central elongated element of substantially S-shape or ogee cross section with such thickness and proportions that when rigidly attached to cooperating plates by its substantially plane parallel end portions, will provide a construction within a building, of which it is a part, a substantial weight-carrying wall, roof or floor having any desired flexibility and resiliency, depending upon the said thickness and proportions, and yet after being flexed will return to its normal shape and form after the wind pressure or other outside flexing force, is removed.

Referring to the drawing wherein I have illustrated forms of my invention,

FIG. 1 is a cross section of an element of my invention.

FIG. 2 is a front view showing parts in elevation.

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 1.

FIG. 4 is a detail view of an overlapping joint.

FIG. 5 is a detail sectional view showing the two fastening means illustrated but with the insulation removed.

FIG. 6 is a detail sectional view showing the top plate-gutter member **26** in position.

FIG. 7 is of a modified type of top plate-gutter member **126**.

FIG. 8, FIG. 8*a* and FIG. 8*b* are parts in relative position for assembly to connect the two parts of the gutter together.

FIG. 9 is a detail showing of another way of connecting lengths of gutters together.

FIG. 10 is a detail vertical cross section of the treatment adjacent a door or other wall end.

FIG. 11 is a showing of the element of construction forming a part of my invention when used as a rafter.

FIG. 12 is a showing of the construction as used at the top of the roof of a building where my invention is applied.

FIG. 13 is a showing of a building to which my invention has been applied.

FIG. 14 is a modified form of the structural element having the S-shape cross section but having a sealing groove construction to act to retard the passage of rain water and wind.

FIG. 15 is a further modified form of the element having the S-shape cross section, having two sealing grooves instead of one shown in FIG. 14.

FIG. 16 is a detail elevational view of an additional means to hold the rafter **120** on the top member **26**.

FIG. 17 is a detail plan view of the same portion of the structure, showing the additional holding means disclosed in FIG. 16.

FIG. 18 is a perspective view of my invention with the end portions of the S-shape structure extending outwardly beyond the curved portion of the element to provide better accessibility to the fastening means and grooves in the plates and stud **400** to provide greater stability and strength.

FIG. 19 is a view similar to FIG. 18 but showing a variation in the means for fastening the parts together.

FIG. 20 is a view similar to FIG. 19 but illustrating the two groove-rib constructions on each extending portion of the S-shape member.

FIG. 21 is an enlarged view showing a means for securing the elements together by welding.

FIG. 22 is a detail view showing the parts spot-welded together.

FIG. 23 is a view illustrating the details of a construction at a corner.

FIG. 23*a* is a view showing a structure which is complementary to the structure of FIG. 23.

FIG. 24 is a modified form using corrugated metal sheets in the S-shape studs.

FIG. 25 is a modification illustrating the invention applied to a truck body.

FIG. 26 is a cross-sectional view on the line **26—26** of FIG. 25.

Similar reference characters refer to the same or similar parts throughout the specification and drawing.

Referring particularly to FIGS. 1 to 3, inclusive, **20** designates a building element having, in the illustrated embodiment, a regular S-shape cross section and is made of sheet material. The particular material may be a plastic, a metal, an alloy, or any other suitable substance.

In building constructions, the S-shape member is elongated and is used as a stud or rafter or in any place where an elongated strengthening member might be needed.

Secured to the outer portion **20***a* of the S-shape member **20** are plates **21** which are attached by machine screws and nuts **23** or by sheet metal screws **23***a* or by any other suitable means. The outer plates **21** are preferably abutted at their adjacent edges as shown in FIG. 1. The intermediate portion **20***b* of the element **20** is preferably substantially parallel to the outer portion **20***a* for a purpose to be later made clear.

The inner portion **20***c* of the S-shape member **20** is similar to the outer portion **20***a* just described. Secured to the surface of the inner portion are plates **21***a* which are similar in construction to the plates **21** attached to the outer portion **20***a* of the S-shape element. These plates **21***a* are used when an inner wall is desired.

One of the features of my invention is the construction of the element which as shown, provides a long passage for the escape of heat from the interior of the building of which it is a part or the admission of heat from the outside to the inside when it is desired to have the interior of the building cool as in the summer time. This result is brought about by the long passage necessary for the heat to travel through the curved portions **20***d* and the intermediate portion **20***b*.

In addition, if desired, I provide an insulation material **24**, a section of which is located between each two sections of the building located between two S-shape elements **20**. It will be clear from FIG. 1 that these insulation sections **24** overlap at the element **20***b* and in a case where a workman did not properly install the insulation **24** by proper packing, the construction of the overlapping portions of the insulation would cause a longer path for the circulation of air with a consequent saving in the dissipation of heat, either from within or from outside the structure.

In order to have a tight construction at the place where the plates **21** abut each other and are attached to the outer and inner portions **20***a*, **20***c* of the element **20**, I provide a sealing layer or strip **25** which may be of any suitable material such as a plastic material which may be applied in a sheet strip or applied by brush in liquid or semi-liquid form during or after fabrication of the plates or elements or both.

In case it is necessary to use plates on very long studs or rafters, so that it is not convenient or desirable to use a plate as long as the element **20**, I have provided for an overlapping of the plates **21** or **21***a* or both, at the places where adjacent plates come together. In such cases the bottoms of the plates along a narrow strip **21***b* at the edge, are off-set the thickness of the plates as shown in FIG. 4, at **21***c*. The edges of adjacent plates may be secured in relative rigid positions by the sheet metal screws **23***a* as shown in FIGS. 2 and 4. However, in the ordinary constructions, it is desirable to have as few joints as possible and the ideal construction would have the plates **21** or **21***a* extend the full length of the elements **20**.

In the manufacture of the parts of my construction of elements **20** and plates **21** and **21***a*, the plates may have all or a part of the screw holes put in before coming onto the job or they may have the positions of the centers of the holes indicated by centerpunch marks in which case the openings for the screws are drilled on the job. The actual construction of the openings for the screws **23**, **23***a* may be made by a combined drill and tap or the registering openings in the plates **21**, **21***a* and the S-shape member **20** may be made by a simple drill and the plates secured together by the well-known sheet metal screws.

The insulation **24** may come onto the job secured to the plate **21** or the plate **21***a* and the insulation and plate put in place together, or the insulation may be packed in at the job either loose or in sheets, as desired.

One method of putting my construction together, is to

use machine bolts and screws on the outside of the building construction when both sides of the S-shape element **20** are accessible and secure the inside plates **21***a* by sheet metal screws. In this manner, the machine screws furnish an insurance against unauthorized removal of the plates from the outside by any easy method.

In applying sheets **21** where the overlapping portion **21***b* is used, the overlapping portion may be held in place by machine screws **23** on the outside of the building and by sheet metal screws **23***a* on the inside.

The upper edge of the wall formed by the S-shape member **20** and the plates **21** and **21***a* with the insulation **24** therein is provided with a top cover plate **26** which, if desired has an outer gutter portion **26***a* at the outer edge and a down-turned inner edge portion **26***b*. The gutter portion **26***a* and the turned-down portion **26***b* provide against the entry of moisture. See FIG. 6. To insure against the entry of water by wind pressure against the wall, it is sometimes desirable to have a thin gasket **27** which may be made in a strip or put on in a liquid or semi-liquid state as described for the sealing layer or strip **25**. Without such a sealing strip where water is in contact with the outer wall, a high velocity wind may force rain water upwardly and into the insulation space between the outer plate **21** and the inner plate **21***a*. With the gutter portion **26***a* at the outer edge of the cover plate **26** the rain water is conducted away to proper downspouts and away from the building.

An alternative structure for the top plate is illustrated in FIG. 7 wherein the body of the plate **126** is provided with an inner turned-down edge **126***b* and an ornamental trough-member **126***a*.

To secure the top-plate **26**, **126** to the structure, there are provided sheet metal screws **23***a* at the turned-down edge **26***b*, **126***b* to be held to the upper edge of the inner plate **21***a* and similarly, the gutter portion **26***a* is secured to the outer plates **21** by the sheet metal screws **29***a*, as shown in FIG. 6. When the sheet metal screws **23***a* are in position to hold the top-plate **26** in place, the sealing strips **27** seal the connections between the top-plate **26** and the plates **21**, **21***a* against the entry of water at these edges.

To take care of the passage of water from one section of the gutter **26***a* to another section, I have provided connectors **26***d*. These will now be described. The connectors themselves are strips of the same shape as a short section of the gutter whether it is of the shape shown in FIG. 6, or the shape in FIG. 7.

In fabricating the lengths of the gutter **26**, **26***a*, an offset portion **26***c* is stamped to provide for connection to the connector **26***d* or to the adjacent length or gutter, as will be later made clear.

Referring to FIGS. 8, 8*a*, 8*b* and 9, the gutter portions **26***a* are provided with lap-portions **26***c* at the ends of the sections. These are used where the gutter portions are longer than the length of the usual gutter sections. These lap-portions are larger than the cross section of the gutter so that when the assembly is complete, the inside of the gutter will be continuous as will now be described.

In FIG. 8*b*, the connector **26***d* is shown separated from the gutter lengths **26***a*, and this figure shows the screw holes **26***x* used by the fastening means to secure the sections **26***a* of the gutter together. It is to be noted that when the parts are secured together, the two sections **26***a* with the connector **26***d* form a continuous slope for the rain water in the gutter to carry the water to the downspout. When it is necessary to cut a gutter and top-plate section, because the actual length is shorter than the needed length, the cut end is registered with the lap-portion **26***c* of the adjacent section as shown in FIG. 9. The continuous conformation of the bottom of the trough is maintained with this construction.

When a corner section or a down-spout section is needed, the ends are constructed as heretofore indicated

for the gutter lengths, and the necessary connectors are used to hold the sections together.

When it is necessary to close the end of a section assembly as when a door section or a window section is to be inserted, I provide a special construction which will now be described.

Referring to FIG. 10, the parts **21**, **21***a* **20**, **23**, **23***a* are similar to and perform the same functions of similar parts as already described. In order to close what would otherwise be an open space between the plates **21** and **21***a*, I provide an end closure member **28** which has turned-in edges **28***a* for attachment to the plates **21** and **21***a* as by the sheet metal screws **23***a*.

When using my construction of the S-shape construction element **20**, as a rafter, for which it is well adapted, the construction shown in FIG. 6 is first erected with the top plate and gutter member **26** first secured in place. In order to have a proper bearing surface for the rafter element **20**, it is cut on an angle to a proper degree to have the cut surface bear on the top of the top member **26**, preferably throughtout the length of the cut surface and the full width of the member **26** as shown in FIG. 11. In FIG. 11 the parts **21**, **21***a*, and **26** are as shown in FIG. 6. Secured to the top plate member **26** are the elements **120** serving as rafters for the building construction. The securing means may be of any suitable character as by the screws **29***a* which are threaded into the top plate member **26**. An outer or roof plate **121** is secured to the rafter member **120** as by the sheet metal screws **123**. Similarly, the bottom or inner plate **121***a* is secured to the underside of the S-shape rafter as by the sheet metal screws **123**.

The upper ends of the rafter members **120** are cut at the proper angle or angles to coact with the other rafter members **120** as shown in FIG. 12. In the case of a cylindrical building, the rafter members **120** are cut on two angles to fit the two adjacent rafter members **120** where these parts come together at the point of the roof. In case of a building having a ridge, the angle of cut at the upper end of the rafter member **120** is in accordance with the angle of the roof to bring the two opposite rafter members **120** in vertical contact with each other. Secured to the underside of the rafter members **120** is a plate construction which may be of a general conical shape as shown at **130** in FIG. 12 or this member may assume the shape of a long bent plate to conform to the shape of the ridge of the roof of the building. Above the rafter members **120** is a cap member **131** which, as in the case of the member **130**, may be of a shape as a cone or as a double ridge board covering the upper edges of the plates **121**. All of this is clear from an inspection of FIG. 12 in connection with this description.

In FIG. 13 I have ilustrated the general shape of a building construction, using my invention, and of a cylindrical shape. The particular building shown is well adapted for use as a service or filling station for gasoline and automobile accessories. In actual practice, the width of the panels is such that the width of doors and windows will coincide with the edge of a panel so that practically any desirable width of the same may be obtained.

It will be noted that the roof panel **121** in FIG. 13 is of triangular shape. If the type of roof was one having a ridge at the upper extremity, the panels would, of course, be of the appropriate shape and size. The construction lends itself to different uses. For example, if the window W was desired to be in the panel to the right of the door D, it could be easily changed. In constructing the base of the outside wall, the whole structure could be supported on the concrete wall C and at the end of the fabrication of the building, the edge could be sealed to shut out the rain. The concrete wall would, of course, be of a proper thickness to guard against accidental displacement by contact from automobiles.

In FIG. 14 there is shown a modifled form of the S-shape structural element for use as a stud, rafter, floor joist or other use where a stiffening member is needed. In this form, an elongated member **220** of S-shape is provided having the same characteristics generally as the element **20**. This element **220** has the outer portion **220***a* and the inner parallel portion **220***c* with the intermediate portion **220***b* connecting the outer and inner portions together.

The modification consists in the groove **220***x* in the portion **220***a*. To conform to this groove, the plates **221** are turned at right angles to their main surfaces, which turned portions fit into the groove **220***x* side by side. These turned portions are designated **220***y*. If desired, the groove **220***x* may be supplied with a sealing compound **25** to give the portions **220***y* a tight water-proof joint as will be well understood by those skilled in the art.

In FIGS. 16 and 17 I show an additional or alternate way of securing the rafters **120** and the plate **26** of FIG. 11 together. In FIGS. 11 and 16, there is a thrust outwardly of the inside plates **121***a* against the vertical plates **21***a*. In this construction the screws **23***a*, **29**, are depended upon to hold the outside wall and the roof together. However an additional means may be provided. This means will now be described.

At the proper places where the rafters **120** are to contact the plate **26**, I provide an angular member **150** which may be riveted, welded or otherwise secured to the top plate **26**. Such members **150** are shown in side elevation in FIG. 16 and in plan view in FIG. 17. They are made so that one portion will be secured to the top plate **26** and the other angular portion will be of an angle to receive thereunder, the intermediate portion **120***b* and the inner portion **120***c* of the rafter **120**. The outer portion of the rafter is held by the screw **29** which may pass through the plate **121**, the outer portion **120***a* and the top plate **26**. In this way the roof is securely held in place.

The portions **320***a* and **320***c* of the element **320** are provided with the grooves **320***x* to receive the turned-in portions **320***y* of the plates **321**, **321***a*. The securing bolts **323** and/or the screws **323***a* are provided to hold the parts together.

If desired, as in the other forms sealing means **25** may be provided between the adjacent parts. Insulating means may be provided as at **24** to retard the passage of heat from one side of the structure to the other.

In FIGS. 18 to 22 are modifications wherein elongated beaded grooves capable of registration with similar grooves and beads of the adjacent parts, constitute, together with the bolts, screws or other fastening means, the securing devices for rigidly connecting the several parts of the structure together to form an elongated solid but flexible stud structure.

In FIG. 18 is illustrated an elongated stud body member **400** having opposite substantially flat portions **400***a*, **400***b*, with an intermediate portion **400***c* of S-shape connecting the substantially flat portions **400***a* and **400***b* together to form an integral stud structure. In this modification, it is to be noted that the sheet material is relatively thinner than the forms shown in FIGS. 1 to 17, already described and the S-shaped portion is not so pronounced as those of the type of FIGS. 1 to 17. However, this form still provides for the overlapping of the folds in the S-shape, and the desired flexibility is maintained, to provide for the three features which are important to this invention: (1) the long path for heat to travel from the outside wall through the flat portion **400***a* to the other flat portion **400***b* to the inside wall; (2) the overlapping of the folds of the S-shape structure to provide for the space for the rock wool or other insulation and (3), the resiliency of the whole structure including the connecting portion **400***c* whereby although the individual parts of the assembly are rigidly secured together, the construction as a whole may have a greater or lesser degree of resiliency depending upon the thickness of the parts,

the material and the angularity of the connecting portion of the S-shape structure.

This resilient feature is present in all the structures illustrated in the drawing to a varying degree, depending upon the material used in the various parts, its length, its thickness and as already pointed out, the angularity of the connecting portion of the stud.

In order to obtain the best results with this invention used as an outside wall exposed to the weather, it is necessary to have tight joints. To bring this about, I provide on either the outside wall or both the outside and inside and inside walls, a gasket **25**, similar to the gaskets already described and it is to be understood that such a gasket may be used on any and all the places where the parts are secured together and where it is desired. This gasket is illustrated in the upper part of FIG. 18 and may be in liquid or semi-liquid form when applied, and be painted on or applied with any suitable instrument such as a putty knife or it may be in the form of a soft plastic strip of proper material and width to cover the joint, thereby making it tight.

When applied to the joint disclosed in FIG. 18, the soft or semi-soft plastic gasket **25** is applied to the joint where the stud portion **400***a* and the plate **401***c* and/or **400***a* come together, and before the bolts, screws or other fastening members **402** are applied. As the fastening members are tightened, the plastic material surrounds the bolts or other fastening means and fills the space between these plates and the stud portion **400***a* or **400***b*.

When the securing members **402** are finally tightened, a rigid structure is produced at the joint and the resiliency of the stud and plates depends upon the resiliency in the bodies of the parts themselves and their change in shape as the outside forces, such as wind pressures, change the shape of the structure. As these exterior forces are released, the resiliency of the parts returns the parts to normalcy without disturbing the tightness of the joints or changing the set of the material itself.

In the same way, in the joint shown at the lower side of FIG. 18, the gasket **25** may be applied to the adjacent surfaces of the joint where the two plates **401***a*, **401***b* abut and contact with the substantially flat portion **400***b* of the stud. See lower part of FIG. 18. Then when the securing fastening members **402** are tightened, the plastic material of the gasket is caused to flow out between the surfaces of the stud portion **400***b* and the contacting surfaces of the plates **401***a*, **401***b* and also between the abutting surfaces of the plate ends and around the shanks of the securing means **402**. When the securing means **402** are tightened, a weather-tight joint is formed to make a rigid joint between the parts while still retaining the resiliency of the structure as a whole.

In FIG. 19, there is illustrated an assembly comprising the S-shape stud structure **410** similar to that illustrated on FIG. 18, but showing a form wherein the plates **415***a* and **415***b* are overlapped as at **415***c*.

This structure is illustrated on the lower portion of FIG. 19, which would normally be the outside or weather side of the structure. In this form, one row only of fastening means **416** is used, this row being between the two ribs and grooves **417**. The fastening means **416** pass through the overlapping portions of the parts **415***a* and **415***b* and that portion of the stud member **410***b* located between the ribs **417**. As in the forms previously described, gaskets **25** may be applied to the contacting surfaces to make tight joints between the parts. When the securing means **416** are tightened, all three parts **415***a*, **415***b*, **410***b*, are substantially rigidly secured together while the flexibility and resiliency of the whole structure are retained.

At the upper portion of FIG. 19 is illustrated a form wherein the fastening means **408** is attached to the plate **409** on the opposite side of the rib **410**. In the same manner the gasket **25** may be placed between the plate **409** and the flat portion **410***a* of the stud **410** in a manner already described.

On FIGS. 20, 21 is shown a form of spot-welding wherein slots **420***x* may be punched in the plate **420** and welds **420***y* made in the slots to the substantially flat portions **421** of the stud members. The beaded groove portions are indicated at **422**.

A suitable method of fastening the plates to the substantially flat portions of the studs is illustrated in FIG. 22 wherein the plates **430** are spot welded as at **430***y* to the substantially flat portions **431**.

In the forms illustrated on FIGS. 18 to 22, the method of assembling is slightly different. An approved method is to secure a plate to one stud which may be itself secured in place as at its base. The second and subsequent studs are secured at top and bottom to the plate by, for example, screw fasteners which hold the grooves of the stud in registration with the grooves of the plate, while the remaining fastening means are made secure.

The building of the whole structure with its parts rigidly secured together and its elongated studs of S-shape cross-section permits the making of the studs of sufficient size to give them their weight-carrying strength, while still retaining the resiliency necessary to permit yielding under wind pressure or other outside influences and return the parts to normal positions.

The S-shape cross-section in a plane perpendicular to the length of the stud as shown throughout the figures of the drawing and the integral structure between the two substantially plane surfaces of the stud and the fact that the transitions between these plane surface portions and the S-shape portion are without sharp edges, permits of a continuous resilient action throughout the stud and tend to give the stud a longer life.

The studs and plates may be made of any metal, alloy, plastic or other suitable material as long as it has the desired weather-resisting and resilient qualities needed to make it suitable for use as an outside wall with weather resisting ability and other qualities including the necessary resilient give-and-take ability to return it to normalcy after distortion resulting from the wind pressure.

Both studs and plates may be made of various materials or of the same material and may be made of various thicknesses or of the same thickness to fit the conditions for which they are designed.

This structure having an outside wall of weather resisting material is used in contact with outside weather and due to the construction of the stud with S-shape cross-section may be made with greater or lesser resiliency as desired to flex when exposed to wind pressure, the hard knocks of an automotive garage or other conditions in service and its resiliency, due to its material and construction will permit it to return to normal condition when released.

The means for securing the individual parts together may be bolts, rivets, spot-welding, line welding or any other suitable means. These means may be used to rigidly secure the individual parts together while still retaining the desired flexibility and resiliency of the assembly as a whole.

By a suitable selection of the means for securing the parts together, the material and its thicknesses at the several points and the angle of the intermediate portion of the studs, any desired resiliency may be obtained to take care of the effects of wind pressures and other outside pressures, and return the parts to normalcy after these outside pressures are removed.

In constructing buildings using this invention, it has been found to be good practice to secure the outer plates in place before the inner plates are attached. This is for the reason that the backs of the outer plates are accessible. After this has been done, the inner plates may be secured in place by any suitable means. By this construction it is possible to give the outer connections more security against unlawful entry.

In FIGS. 18 to 22, where the grooves of the plates and studs register, it is found convenient in some constructions to have the contacting groove surfaces of the studs and plates of slightly different radii to facilitate the making of a tight joint and hold the gasket to a more or less constant thickness.

In all of the structures illustrated in this drawing, it is to be understood that the overlapping chambers of the S-shape stud and the space between the outer and inner walls may be filled with rock wool or other heat insulation material, although in some of the illustrations, the showing of this insulation has been partially or wholly omitted for the sake of clearness of illustration.

In FIG. 23, is illustrated a suggestion for treatment of a corner of a rectangular building construction utilizing my improved stud construction.

As shown, two S-shaped studs **450**, **451** are placed with one substantially flat portion of each stud as **450***a* and **451***a* with their edges close together at the building corner and the corresponding edges **455***a*, **456***a* of the plates **455** and **456** together, the grooves and ribs of the respective studs and plates being in proper registry with each other.

Suitable openings **455***c* are provided for the securing means to assist in forming a rigid connection between the parts while still retaining the resilient features as already described for the other stud constructions.

An angle plate **460** as shown in FIG. 23*a* with suitable openings **461**, may be provided to cooperate with the plates **455**, **456** to provide a corner angle for the building construction. Suitable gaskets **25** may be provided to make the corner sections **460** water tight.

In FIG. 24, I have illustrated a stripped-down small section of my S-shaped stud member, the plates and insulation being removed for sake of clearness of illustration. In this form of the invention the substantially S-shaped stud **600** is provided with substantially flat portions **601**, **602** which have rib grooves **601***a*, **602***a*, which perform the same functions as similar rib-grooves constructions already described. The holes **603** are provided for the usual securing means as selected and as desired.

That portion of the S-shaped studs **600** which connects the two substantially flat portions **601**, **602**, I have designated as **604**. This connecting portion **604**, I have provided with corrugations **605**, which provide further pliability, flexibility and resiliency to the stud while still retaining the long passage for heat to travel from one side of the structure to the other, when the stud is incorporated in a building construction. It is to be noted in this construction that there are no sharp corners to facilitate breakage because of bending.

My invention is adapted for use in stationary building constructions and in movable building constructions such as in the construction of vehicles and even in boats. It is well adapted for use in a truck body—particularly where the truck is to be used for transportation of articles which are desired to be kept either cold or hot.

In FIG. 25 is illustrated a detail of the cross section of a truck body using my invention. In this view, the reference character **700** has been used to designate the longitudinal frame member of a truck which member rests upon the main supporting springs of the truck. Upon these frame members **700** are secured cross floor beams **701** which comprise the substantially flat members **702**, **703**. These members **702**, **703** are connected integrally with the S-shaped connecting portion **704**, the parts **702**, **703**, **704** being the counterpart and equivalent of the S-shaped stud members already described.

The substantially flat members **703** are secured in place on the longitudinal frame members **700** as by suitable bolts **705** which pass through the lower flat portion **703** and through the flanges of the longitudinal frame member **700**. Suitable closure plate members **706** are provided to close the spaces between the substantially

S-shaped floor beams **702**, **703**, **704**. Suitable heat insulating means as rock wool is preferably provided to keep heat within or without the truck body as desired. For sake of clearness of illustration and in view of the fact that it is contemplated, when desired, to use it with all the several constructions this insulation has been omitted from all parts of this figure of the drawing.

Adjacent the ends of the cross frame floor supporting means **701**, are secured in vertical position, the stud members **710** for supporting the sides and top of the truck body. These stud members comprise the substantially S-shape members **710** which have flat portions **711**, **712** and a connecting integral S-shape portion **713**. The inner substantially flat portions **711**, **712** of these stud members **710** are secured to angle brackets **715** which are suitably bolted to the upper plates **702**. To these flat portions **712** are secured the inside lining plates **716**, which serve as inside vertical walls of the truck body.

Abutting against these vertical walls **716** and resting on and secured to the cross floor beams **701** are the floor plates **717**. These floor plates **717** are preferably very rough on their upper surfaces to assure firm footing for the truck operators during loading and unloading operations. The floor members may be made of any suitable material.

At the outer ends of the cross floor beams **701** and on their upper sides are secured angle members **718** which are suitably bolted in place. To these angle members **718** are bolted the outer substantially flat members **711** of the studs **710**.

To these outer substantially flat members **711** are secured plate members **719** which serve as the outer surface of the truck body. The lower portions of the plates **719** extend downwardly to adjacent the lower edge of the substantially flat portion **706**.

The lower edges of the plates **719** are secured to angle members **720** which are bolted or otherwise secured to the cross floor beams.

The upright stud members **710** at their upper ends are bolted or otherwise secured to the inner plate members **716** and the outer plate members **719**. These inner and outer plate members extend upwardly above the upper end of the S-shape member **710**, in the present embodiment and between their upper ends there is secured a horizontal S-shape member **721**. The substantially flat portions **721***a* and **721***b* of the S-shape member **721** are bolted or otherwise secured to the outer plate member **719** and the inner plate member **716**, respectively.

Parallel to the S-shape member **721** is another S-shape member **722**. These S-shape members **721**, **722** are similar in general shape to the S-shape members **701** used as floor beams and **710** used as studs. The outer substantially horizontal members **721***a* and **722***a* are respectively at the sides and top of the structure and provide stiffening means for the structure as a whole. A top member **730** is provided with a top portion **730***a* which provides the vehicle body or other structure with top weather protection and is provided with a portion **730***b* which is in a substantially vertical plane. The lower edge of this vertical portion **730***b* is preferably provided with a gutter **730***c* for the collection and delivery of rain water in a well-known manner.

In order to increase the efficiency of the parts **721**, **722** as stiffening members while still retaining the resiliency of the whole, the two may be bolted or otherwise secured together as by the bolts **731** which are located adjacent the plane where the inner portions **721***b*, **722***b* form a right angle to each other.

The plate or plates **716**, already described, extend upwardly to be bolted or otherwise secured to the inner portions **712** and **721***b* of the S-shape members **710**, **721** already referred to. In a like manner, the ceiling of the truck body is provided with a plate or plates **740** which are bolted or otherwise secured to the S-shape

members 722 and 730. The upper edge of the plate or plates 716 and the right edge of the plate 740 illustrated in FIG. 25, come together as illustrated in FIG. 25, to form an interior lining for the truck body.

In the construction of the front truck end and the rear doors and the side and front openings it is believed that the structures set forth throughout the description of the invention are sufficient to enable one skilled in the art to produce a building construction with a chamber having a resilient construction as a whole while still retaining the flexibility and heat insulating qualities necessary for such a structure when it is desired to keep heat in or shut it out according to the use of the structure.

The construction is such that while the adjacent parts are firmly held together, portions may be resilient and pliable independently of other parts.

This application is a continuation in part of my copending application Serial No. 470,003, filed November 19, 1954, now abandoned.

While I have illustrated and described embodiments of my invention in detail, it is to be understood that the disclosure is merely illustrative and that the construction and details are applicable to all types of buildings, that any material suitable for the purpose may be used and that modifications and changes may be made without departing from the spirit of the invention and within its scope as claimed.

Having described my invention, what I claim is:

1. An outside-type building wall construction which is designed to provide an elongated integral sheet material weight-carrying stud member having a generally S-shaped cross-section, which wall may be expected to be exposed to strong outside forces, such as wind, said construction comprising, in combination:

(*a*) an elongated flexible resilient sheet material weight-carrying stud member having

(*b*) a generally S-shaped cross-section in a plane perpendicular to its length and having

(*c*) outer and inner substantially parallel plane surface portions

(*d*) an outer weather-proof wall plate of sheet material securely fastened to one of the outer parallel plane surfaces of the stud,

(*e*) the outer parallel portions of the stud being connected integrally to the intermediate portion by resilient curved portions, the

(*f*) transition between the parallel and curved portions being gradual and without sharp turns, whereby there is permitted resilient action in a plane perpendicular to the stud length and between the outer parallel portions as when the structure is submitted to outside pressures.

2. An outside-type building wall construction which is designed to provide an elongated integral sheet material weight-carrying stud member having a generally S-shaped cross-section, which wall may be expected to be exposed to strong outside forces, such as wind, said construction comprising, in combination:

(*a*) an elongated flexible resilient sheet material weight-carrying stud member having

(*b*) a generally S-shaped cross-section in a plane perpendicular to its length and having

(*c*) outer and inner substantially parallel plane surface portions,

(*d*) an outer weather-proof wall plate of sheet material securely fastened to one of the outer parallel plane surfaces of the stud,

(*e*) the outer parallel portions of the stud being connected integrally to the intermediate portion by resilient curved portions, the

(*f*) transition between the parallel and curved portions being gradual and without sharp turns, whereby there is permitted resilient action in a plane perpendicular to the stud length and between the outer parallel portions as when the structure is submitted to outside pressures,

(*g*) and having the outer wall plate and adjacent portion of the stud provided with coacting groove and flange interlocking portions.

3. An outside-type building wall construction which is designed to provide an elongated integral sheet material weight-carrying stud member having a generally S-shape cross section, which wall may be expected to be exposed to strong outside forces, such as wind, said construction comprising in combination:

(*a*) an elongated flexible resilient sheet material weight-carrying stud member having

(*b*) outer and inner substantially parallel plane surface portions,

(*c*) an outer weather-proof wall plate of sheet material securely fastened to one of the outer parallel plane surfaces of the stud,

(*d*) the outer parallel portions of the stud being connected integrally to the intermediate portion by resilient curved portions, the

(*e*) transition between the parallel and curved portions being gradual and without sharp turns, whereby there is permitted resilient action in a plane perpendicular to the stud length and between the outer parallel portions as when the structure is submitted to outside pressures,

(*f*) and having the outer wall plate and adjacent portion of the stud provided with coacting groove and flange interlocking portions, and

(*g*) having a sealing compound for sealing the joint between the coacting groove and flange.

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