

Oct. 1, 1940.

J. R. McKEE, JR

2,216,206

CONSTRUCTION MATERIAL FOR ROOFING, SIDING, AND THE LIKE

Filed April 21, 1939

2 Sheets-Sheet 1

Fig. 1.

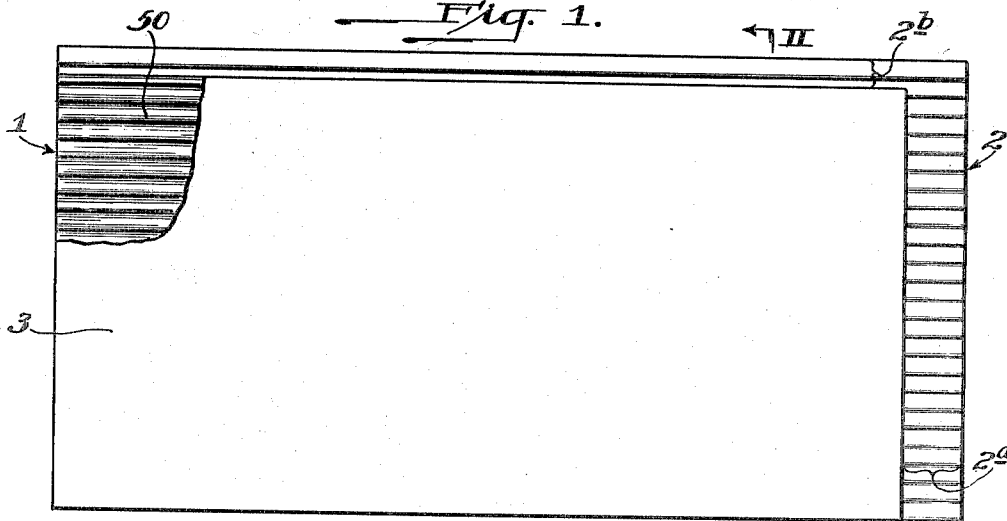


Fig. 2.

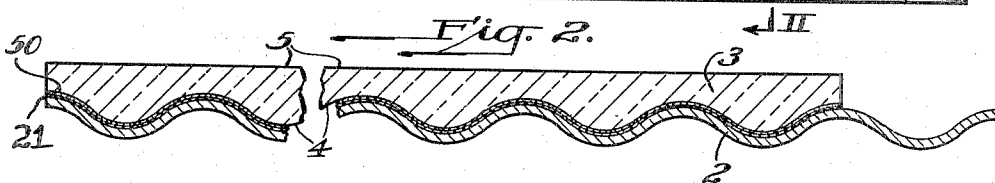
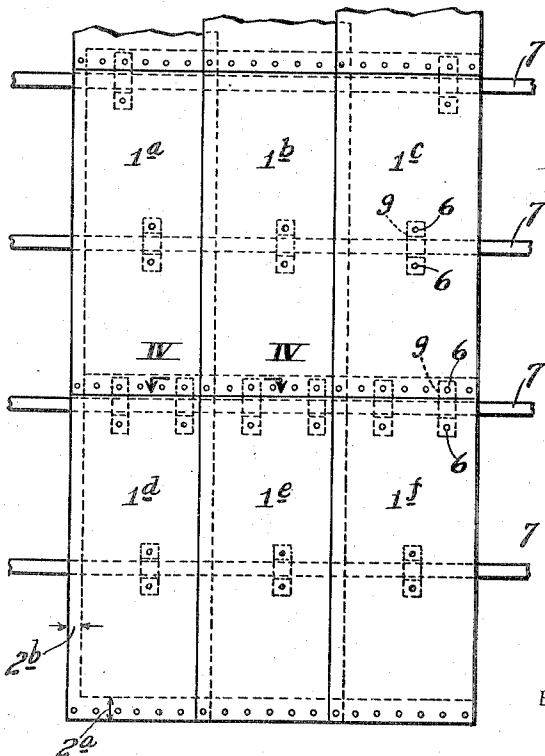


Fig. 3.



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2 Sheets-Sheet 2

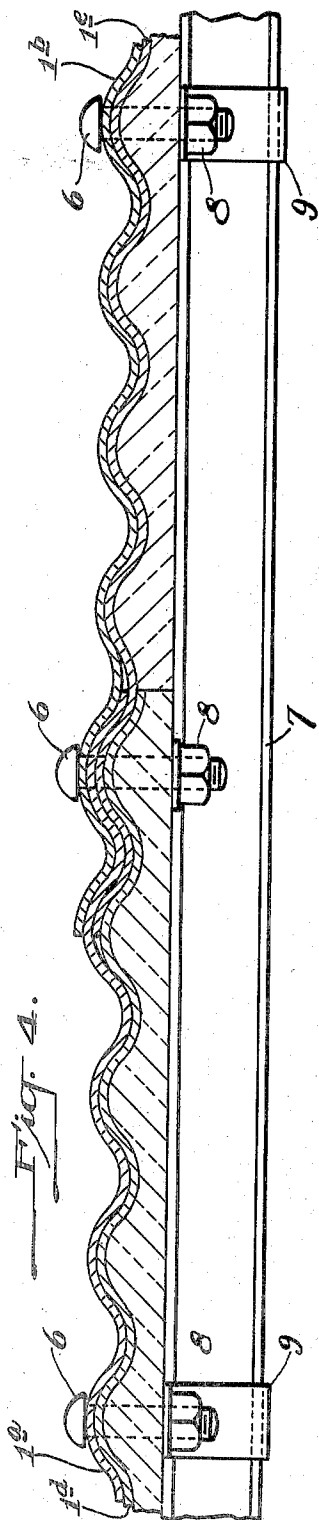


Fig. 4.

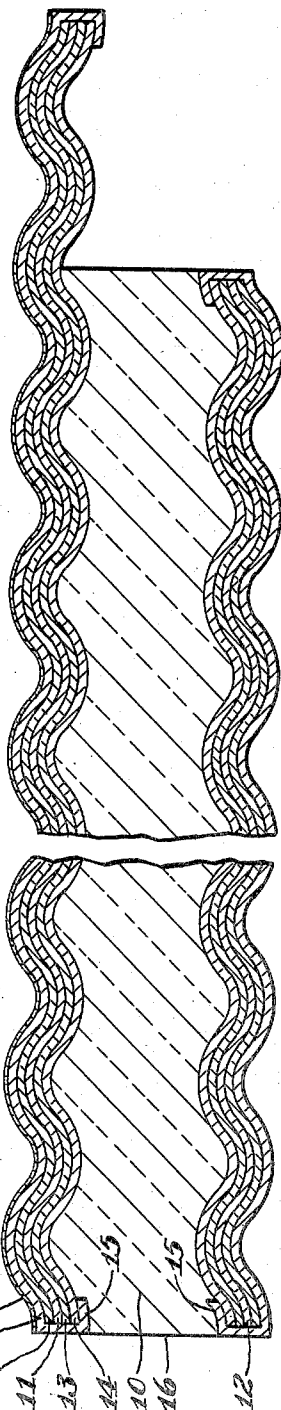
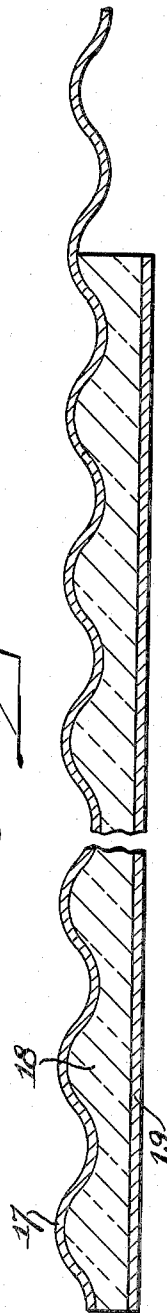


Fig. 5.

Fig. 6.



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UNITED STATES PATENT OFFICE

2,216,206

CONSTRUCTION MATERIAL FOR ROOFING,
SIDING, AND THE LIKE

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Application April 21, 1939, Serial No. 269,125

11 Claims. (Cl. 108—13)

This invention relates to panel-like sheet metal members such as are used for the roofing and siding of buildings, and has among its objects the provision of such members which are insulated against sound and temperature, which have improved resistance to fire, longer life and greater strength, and which are formed for ready and effective connection together. A more specific object is to provide a metal panel or the like to which a panel of insulating material is firmly and permanently bonded.

These and other objects will appear from the following description.

The invention will be described with reference to the accompanying drawings in which Fig. 1 is a plan view of a construction unit made in accordance with the preferred practice of the invention; Fig. 2 a cross-section, on an enlarged scale, taken on line II—II, Fig. 1; Fig. 3 a plan of an assembly formed from a plurality of the units shown in Figs. 1 and 2; Fig. 4 a cross-section, on an enlarged scale, taken on line IV—IV, Fig. 3; and Figs. 5 and 6 cross-sections similar to Fig. 2 illustrating modified embodiments of the invention.

The instant invention relates to a roofing, siding, and the like construction including at least one sheet metal member that is contoured, commonly corrugated. Such constructions have commonly taken one of several forms. For instance, flat sheet insulating material is disposed between inner and outer layers of corrugated sheet metal, the inner layer corrugated sheets being carried by purlins. Or, corrugated metal sheet carried by purlins is covered with flat sheet insulation to the outer surface of which there is applied built-up roofing, such as several plies of felt impregnated with asphalt.

These and similar roofing and siding constructions are open to disadvantages, among which the following are of major character. Spaces are formed between the sheet insulation and the grooves of the corrugated metal which create a chimney effect in case of fire, thus increasing its intensity and the likelihood of its spreading throughout the structure. The joints between the corrugated sheets tend to loosen, permitting leakage of air and rain, and it is difficult or impossible to avoid this, especially with the use of inner and outer corrugated sheet, because the resiliency of the corrugated metal makes it difficult to maintain a tight joint. Also, condensation within the structure causes deterioration of the insulating material. These structures are erected in the field from their constituent ele-

ments, with attendant high cost burdens as compared with structures built from preformed units.

Furthermore, the insulating materials commonly used in the past, when flexible enough to withstand handling and erection have not been highly fire retardant. Or, if highly fire retardant, have been so brittle as to permit cracking and separation of the insulation from the base sheet.

In accordance with this invention there is provided a preformed roofing and siding unit comprising a contoured, or corrugated, metal sheet having associated with its inner surface a premolded insulating body member, one surface of which is contoured to conform closely to the contour of the sheet member so that their contiguous surfaces fit snugly against each other. An important feature of the invention resides in this, that the body member is of such size and shape that one side and one end of the corrugated sheet extend beyond the premolded body member. These protruding portions of the corrugated sheet member adapt the units for assembly into a strong, durable, water-proof, and weathertight construction. The other surface of the premolded body member may be similarly contoured, or it may be flat.

The premolded body member may be of any self-form-sustaining material suited to provide the qualities desired, such as moisture resistance, fire resistance, or insulation against heat and sound; thus it may be made from vegetable or wood fibers, cork, rubber or bituminous compositions, mastics, and other materials or compositions of a nature to provide the desired properties. For most purposes insulation against heat and sound is the major criterion. The preferred material consists of a wood or vegetable fiber board throughout the body of which is admixed a sufficient amount of expanded vermiculite to produce a high degree of fire resistance. Such boards have been shown to possess greatly increased fire resistance.

Another important feature of the invention is that at least the side of the metal sheet to which the insulating body member is applied is first protected by one or more layers of material of the type used in protected metal structures as is well known in the art. It has been found that only by applying the insulating body member to protected metal sheets of this character can a dependable, permanent bond be effected between them.

To further assist in creating a highly fire retardant article, the insulation is attached to the

protected metal sheet by means of an adhesive treated for fire retardance, such, for instance, as asphalt admixed with chlorinated naphthalene.

Having reference now to the drawings, Figs. 1 and 2 show a unit 1 in accordance with the preferred embodiment. It comprises a contoured base sheet member 2 which, in the preferred embodiment, is corrugated sheet metal. Associated with one side of sheet 2 is a premolded insulating body member 3 having one surface 4 contoured to mate snugly with the corrugations of sheet 2, so that there are no substantial spaces between sheet 2 and premolded body member 3. The two members are held in place by suitable means. For instance, an adhesive, such as asphalt 50, is applied to sheet 2 before positioning member 3 thereon. As seen in Fig. 1, member 3 is so shaped and sized that sheet 2 has an end portion 2a and a side portion 2b that extend beyond the premolded insulating body to facilitate securing a plurality of units together with production of permanently tight joints. Although the exposed areas of sheet 2 may be varied, desirable results are had with 33-inch wide sheet by having side portion 2b one and one-half corrugations wide, and end portion 2a about six inches long.

It is a feature of this invention that a very secure bond is formed between the insulating body 3 and metal sheet 2. Accordingly, the metal sheet itself is of the type known as "protected" by which is meant a metal sheet to at least one side of which a thin flexible sheet of protective fabric 21 has been cemented by melted asphalt or the like (not shown). Such a protected metal sheet is described in Patent No. 1,959,610, granted to American Steel Band Company, the assignee of this application, which points out that the protective fabric may be felt, paper, asbestos, or like material, such as bitumen-impregnated fibrous sheet material. The flexible fabric adheres securely to the metal sheet and forms a surface of a character to which the insulating body 3 can likewise be securely and permanently cemented by the intermediate layer of asphalt 50, because this asphalt has a greater affinity for the protective fabric 21 than for metal. The fire-retardant character of the unit may be increased by using an asphalt 50 processed to reduce its inflammability, such as asphalt admixed with chlorinated naphthalene.

The outer surface 5 of the premolded insulating body may be made flat, as shown in Figs. 1 and 2, and a finishing layer or layers of impregnated felt or other covering, or of paint, or fire-proofing, may, if desired, be applied thereto. Normally, surface 5 will be carried by the purlins, or other supporting elements, to be exposed to the interior of the building, with the corrugated sheet 2 exposed exteriorly.

In accordance with this invention the insulating body is preferably a composition board consisting of wood or vegetable fibers with which a sufficient quantity of expanded vermiculite has been mixed to cause the board to be highly resistant to fire.

Thus it will be seen that the invention provides solid construction units which may be wholly built up at the factory, such assemblage being cheaper than where the construction is wholly done in the field. Or, if desired for any reason, the premolded insulating bodies may be assembled with the contoured sheets in the field, with economies over existing modes of construction.

The preforming of the insulating body member results in the simple, rapid and cheap production of a durable, lasting and well-built building construction. The entire area of the premolded body member contacts and is secured to the base sheet, so that no weakly supported or loose portions are formed in the construction unit. Also, a smooth, well-secured base is provided by the premolded member so that one or more layers of finishing material can readily be placed thereon, if desired.

The unit described differs from others known to me in that in the latter there have been openings or channels between the corrugated metal and the sheet insulation, which are not present in the solid construction which characterizes this invention. From this flows one of the most important advantages, namely, the functioning of the unit in case of fire, in which event the construction of the unit, being solid, offers no flues to permit rapid carrying and growth of fire, thus avoiding a disadvantage common to prior constructions. The vermiculite in the insulation, and the processed asphalt adhesive, operate to increase fire resistance tremendously. The body member may be made from totally fire-proof material, if desired.

Furthermore, the air spaces of prior constructions permitted the sheet insulation, disposed between corrugated metal sheets, to sweat and the condensate formed thereby naturally was injurious to the insulation. Air circulation in such spaces either reduces the insulating value of the unit or makes necessary the use of expensive closures and flashings. In the present unit the insulation is exposed directly to the building interior, and there are no openings or air spaces, whereby such disadvantages are overcome, and by this positioning desired acoustical properties of the body may be provided.

The construction of this unit also provides another important feature, namely, the ability to form and maintain tight, weather-resistant joints, as will be understood from the manner in which structures are made from these units. To illustrate this, Figs. 3 and 4 show a panel formed from six units 1a, 1b, 1c, 1d, 1e and 1f by lapping the end and side portions 2a and 2b, respectively, of each unit over the side and end portions of the next adjacent units, the laps being disposed so that the premolded insulating bodies of the adjacent units abut to form a continuous surface.

Bolts 6 extending through the lapped portions of the units serve to tighten the joints at the overlaps and to connect the units to the purlins or other supporting members 7, shown in this embodiment as channel-shaped purlins. These bolts thereby are anchored so that, when tightened by nuts 8, taking tension against washers 8a, they can pull together the overlapped base sheets and form a permanently tight joint therebetween, because the premolded insulating body snugly contacts both the purlin and the base sheet and thus serves as a backing for the sheet when the nuts are tightened, whereby deformation of the sheets with loosening of the joints is avoided. The units may be, and preferably are, anchored further, if desired, by straps 9 (Fig. 4) carried by the bolts and passed around the purlin, as well as other bolts disposed in such a manner as to create tight joints for the entire structure. This is indicated in the fragmentary assembly view of Fig. 3, which shows straps 9, secured by bolts 6, disposed at the center and sides

of the sheets to anchor the structure and to tie the body members to the sheets.

In contrast with the structure of the invention, the insulating layers of prior building units including contoured sheet members are not in contact with the entire surface of the sheet members and thereby the sheets are not properly supported to permit a bolt to extend through the entire siding at the laps and produce a water-tight joint for, in that case, the bolt merely distorts the lapped contoured sections. Therefore, a common practice is to join the overlapping portions of the external contoured sheets by the use of sheet metal screws, which does not aid in tying the complete structure together, and the joints loosen with passage of time. A tight lap between the sheets is best obtained by drawing the overlapped sections tightly together with equal tension on each side of the overlapped sheets, but this does not result when a bolt is passed through the lapped section of a double wall of contoured sheets having a flat sheet of insulation between. Additional bolts have had to be used to secure the remainder of the siding or roofing to the base sheets in prior constructions. The premolded insulation of this invention permits equal tension at overlapped sections and thus permits one bolt to extend through and secure together lapped sections of siding or roofing with formation of a water-tight joint therebetween, and with elimination of a number of bolts and bolt holes, whereby reduced assembling costs and a better water-proof surface result than from the prior practice. Also, bolts passing through central portions of the structure, as for attaching straps as shown in Fig. 3, aid in tying the premolded body tightly to the contoured sheet and drawing the entire assembly to the building frame, thus reducing or eliminating looseness such as may be encountered in prior types of construction.

As indicated hereinabove, the gist of the invention resides in a unit comprising a protected metal corrugated base sheet having snugly fitted thereto by a fire-retardant adhesive a premolded and fire-resistant insulating body of such size that an end and a side of the sheet project therebeyond. The sheet and body may be covered or coated in many ways without departing from the invention, as by the means and in the manner known in the protected metal roofing art. The flexible protective sheet adheres securely to the metal sheet, and the more rigid insulating body likewise adheres securely to the protective sheet.

In Fig. 5 there is shown one of various possible modifications of the invention. In this embodiment, the unit 10 is particularly designed for use as a siding and has two corrugated surfaces formed by corrugated metal base sheets 11 and 12 which may be similar, as shown, or may have dissimilar corrugations, or contouring, as desired. A layer 13 of suitable adhesive, e. g., bitumen or asphalt, or other suitable material, is applied to the inner and/or outer surface of one, or both, of the sheets for adhesively securing a layer 14 of bitumen-impregnated felt or like fibrous material to one or both surfaces of one, or both, of the sheets 11 and 12. The edges 15 of one of the layers 14 preferably overlap the edges of the sheet to totally enclose the sheets in fibrous material, as customary in the art. Although any suitable material may be used to form the layers 14, they preferably are made from asbestos felt which has been impregnated

with a bituminous material to form a serviceable, protective coating for the sheet, and they may be provided with a top coat 13a of asphalt. As seen in Fig. 5, the layers are pressed against the entire surface of sheets 11 and 12 and thereby follows the sheet contour. Since both surfaces of sidings are often exposed to the atmosphere and at least one to the weather, the outer protective layers function to protect the base sheets from injury thereby and generally act to preserve the material forming the sheets. To form the solid, built-up unit 10, a corrugated, premolded, insulating body member 16 is secured between the protected metal sheets 11 and 12, as in the embodiment described hereinabove.

Fig. 6 shows another possible modification of the invention, in which the outer sheet member 17 and the premolded insulating body member 18 are as in the preferred embodiment. In this case, the unit is completed by a flat metal sheet 19 that is secured to the flat inner surface of the insulating body by a suitable adhesive to form a stronger construction unit therewith; this also reduces fire hazards further and prevents damage by abrasion and the like.

It will be appreciated that other modifications of the invention may be made without changing the primary inventive concept of securely bonding premolded insulating material to protected metal base sheets for construction usage so that a solid unit which is resistant to the progress of fire results even though irregularly surfaced base sheets are used. While reference has been made to disposing the units with the flat insulation surface exposed to the interior of the building, it will be appreciated that they can equally be placed so that that surface is exposed to the exterior. In the latter case it will be desirable to apply a water-proof coating to the exposed insulation surface. Furthermore, the embodiment shown in the drawings provides for an overlap which is one and one-half corrugations wide, which is preferred where the invention is applied to roofing. In constructing siding, however, an overlap of one corrugation will generally afford satisfactory results, and it will be understood, therefore, that the invention is not restricted to the overlap shown, and that other widths than shown or described may be used if desired for any reason.

Also, from what has been said it will be understood that although the invention has been illustrated and described with reference to a regularly undulatory protected metal sheet, the invention is not restricted to that specific contouring but is applicable generally to protected metal sheets contoured in the various ways used for construction purposes, so that the word "corrugated" as used herein and in the claims is to be understood as applying generally to contoured, i. e., non-plane surfaced, protected metal sheets.

This application is a continuation-in-part of my copending application Serial No. 209,935, filed May 25, 1938, for Construction materials for roofing, siding, and the like.

In accordance with the patent statutes, I have illustrated and described what I now consider to be the preferred embodiments of my invention. However, I wish to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically shown and described.

I claim:

1. A roofing, siding, or the like building construction comprising a supporting structure, and

a plurality of construction units carried by said structure with their edges in abutting relationship, said units comprising the combination of a sheet of corrugated metal having at least one side provided with a protective layer of bitumen-treated fibrous material adhesively affixed thereto in snug conformity with the corrugations thereof, a pre-molded insulating and fire-resistant body having one side contoured to conform to the corrugations of said sheet applied to said protective layer with its applied surface snugly fitting the corrugations of said sheet and adhesively cemented to said layer, said combination providing no draft or flue action for assisting combustion or for conduction of flame over the structure, and said fabric and insulating body strongly resisting active combustion as well as maintenance of combustion upon removal of extraneous flame, whereby the structure is highly resistant to destruction by combustion and highly retardant to progression of combustion under active fire conditions.

2. A roofing, siding, or the like building construction comprising a supporting structure, and a plurality of construction units carried by said structure with their edges in abutting relationship, and means associated with said units connecting them to said structure, said units comprising the combination of a sheet of corrugated metal having at least one side provided with a protective layer of bitumen-treated fibrous material adhesively affixed thereto in snug conformity with the corrugations thereof, a pre-molded insulating and fire-resistant body composed of vegetable fiber and expanded vermiculite having one side contoured to conform to the corrugations of said sheet applied to said protective layer with its applied surface snugly fitting the corrugations of said sheet and adhesively cemented by asphalt to said layer, said combination providing no draft or flue action for assisting combustion or for conduction of flame over the structure, and said fabric and insulating body strongly resisting active combustion as well as maintenance of combustion upon removal of extraneous flame, whereby the structure is highly resistant to destruction by combustion and highly retardant to progression of combustion under active fire conditions.

3. A roofing, siding, or the like building construction according to claim 1, said bodies of said units being of such size and so arranged relative to said sheets as to expose a side and an end portion thereof, and said units being positioned with said bodies in abutting relationship and with the exposed portions of said sheets lapped over the immediately adjacent units.

4. A roofing, siding, or the like building construction according to claim 2, said bodies of said units being of such size and so arranged relative to said sheets as to expose a side and an end portion thereof, and said units being positioned with said bodies in abutting relationship and with the exposed portions of said sheets lapped over the immediately adjacent units.

5. A roofing, siding, or the like building construction comprising a supporting structure, a plurality of construction units carried by said structure, and means associated with said units connecting them to said structure, said units comprising the combination of a sheet of corrugated metal having at least one side provided with a protective layer of asphalt impregnated fibrous material adhesively affixed thereto in snug conformity with the corrugations thereof, a

pre-molded insulating and fire-resistant body composed of wood fiber and expanded vermiculite having one side contoured to conform to the corrugations of said sheet applied to said protective layer with its applied surface snugly fitting the corrugations of said sheet, and asphalt adhesively cementing said body to said layer, said bodies being of such size and so arranged relative to said sheets as to expose a side and an end portion thereof, and said units being positioned with said bodies in abutting relationship and with the exposed portions of said sheets lapped over the immediately adjacent units, said combination providing no draft or flue action for assisting combustion or for conduction of flame over the structure, and said fabric and insulating body strongly resisting active combustion as well as maintenance of combustion upon removal of extraneous flame, whereby the structure is highly resistant to destruction by combustion and highly retardant to progression of combustion under active fire conditions.

6. A factory assembled building unit comprising the combination of a sheet of corrugated metal having at least one side provided with a protective layer of bitumen-treated fibrous material adhesively affixed thereto in snug conformity with the corrugations thereof, a pre-molded insulating and fire-resistant body applied to said protective layer and having its applied surface contoured to snugly fit the corrugations of said sheet and adhesively cemented to said layer, the said combination providing no draft or flue action for conduction of flame or for assisting combustion, and said fabric and insulating body strongly resisting active combustion as well as maintenance of combustion upon removal of extraneous flame, whereby the combination is highly resistant to destruction by combustion and highly retardant to progression of combustion under active fire conditions.

7. A unit according to claim 6, said body being cemented to said layer by an intervening layer of asphalt.

8. A factory assembled building unit comprising the combination of a sheet of corrugated metal having at least one side provided with a protective layer of asphalt-impregnated fibrous material adhesively affixed thereto in snug conformity with the corrugations thereof, a pre-molded insulating and fire-resistant body composed of combustible fibrous material and inorganic fireproof material applied to said protective layer and having its applied surface contoured to snugly fit the corrugations of said sheet, and a layer of adhesive cementing said body to said layer, the said combination providing no draft or flue action for conduction of flame or for assisting combustion, and said fabric and insulating body strongly resisting active combustion as well as maintenance of combustion upon removal of extraneous flame, whereby the combination is highly resistance to destruction by combustion and highly retardant to progression of combustion under active fire conditions.

9. A factory assembled building unit comprising the combination of a sheet of corrugated metal having at least one side provided with a protective layer of asphalt impregnated felt adhesively affixed thereto in snug conformity with the corrugations thereof, a pre-molded insulating and fire-resistant body composed of fibrous vegetable material and expanded vermiculite applied to said protective layer and having its applied surface contoured to snugly fit the corrugations

of said sheet, and a layer of adhesive cementing said body to said layer, the said combination providing no draft or flue action for conduction of flame or for assisting combustion, and said fabric and insulating body strongly resisting active combustion as well as maintenance of combustion upon removal of extraneous flame, whereby the combination is highly resistant to destruction by combustion and highly retardant to progression of combustion under active fire conditions.

10 10. A building unit according to claim 9, said fibrous vegetable material being wood fiber, and said body being cemented to said layer by an intervening layer of asphalt.

15 11. A factory assembled building unit comprising the combination of a pair of protected metal sheets at least one of which is corrugated, a pre-

molded insulating and fire-resistant body composed of combustible material and expanded vermiculite disposed between said sheets and having its surfaces contoured to snugly fit said sheets with no spaces therebetween, and an asphalt adhesive cementing said body to said sheets, the said combination providing no draft or flue action for conduction of flame or for assisting combustion, and said fabric and insulating body strongly resisting active combustion as well as maintenance of combustion upon removal of extraneous flame, whereby the combination is highly resistant to destruction by combustion and highly retardant to progression of combustion under active fire conditions.

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