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EXPANSIBLE INSULATION UNIT

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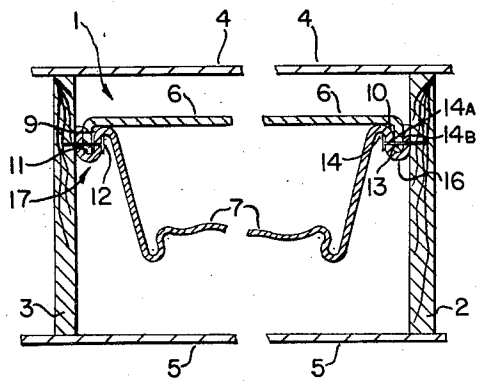



FIG. 1

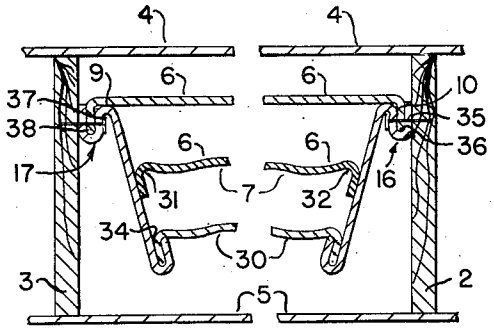



FIG. 3

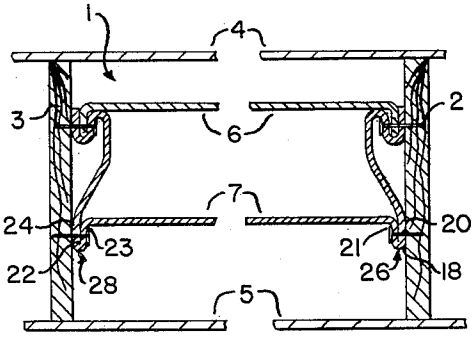



FIG. 2

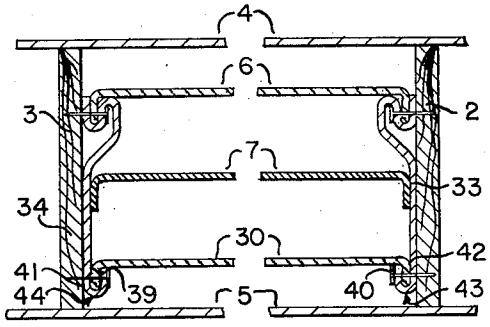



FIG. 4

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# EXPANSIBLE INSULATION UNIT

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5 Claims. (Cl. 154—45)

This invention relates to insulating material, and is more particularly concerned with an expansible multiple layer unit for insulating against the passage of heat, vapor and sound. Such a material is customarily installed in the bays or spaces between studs, beams, rafters or similar parallel spaced construction members in buildings, vehicles or boats, etc.

Insulating material of the type with which this invention is concerned employ thin sheets having heat reflective metal surfaces, in conjunction with air spaces adjacent them, to provide heat insulation. Aluminum foil is especially suitable for this purpose, although any suitable metal may be employed, provided it possesses a low radiation factor, i.e. low surface emissivity.

Upon expansion of such thin sheets they bend readily and exert no appreciable force at their points of contact with the body to be insulated so that they do not work loose from the body to which they are fastened. There is a need for an insulating material of one or more thin metal foils which remain parallel to the major surface of the air space which they insulate throughout the life thereof, and which will not bunch up or collapse in spots to approach the physical condition of a thick sheet with attendant heat transfer disadvantages and a gradual loosening of the sheet from the body to which it is fastened.

There have previously been other attempts at providing units to accomplish insulating by use of expansible multiple layers, the shortcomings of such prior devices has been in their configuration. Different types of heavy paper slabs or sheathings have been proposed, one type comprising layers of corrugated sheets joined into a rigid unit, another type consisting of layers of sheets extending between the supports of the building, all combining the non-transmissive value of quiescent air with materials to which various degrees of insulation value are attributed.

In an attempt to obtain an insulating material having a plurality of spaced thin metal sheets, it has been suggested to employ bracket-like rigid spreader elements to hold the sheets under tension longitudinally so that they remain parallel. Obviously such a unit will have a short life since any appreciable outside pressure, shock or vibration will either collapse or tear the sheets. Furthermore, the requirement of assembling and installing spreader elements with the sheets is a very objectionable time and labor factor with the resultant problem of requiring inspection on the job to assure uniformity in the amount of tension the various spreader elements apply to the sheets. Also, the rigid spreader elements serve as avenues of heat and sound conductivity, and act to defeat the essential purpose of the insulating unit.

Another device which has been proposed provides two parallel metallic foil sheets attached at each end to a triangular shaped bridging member. Due to such end supports in this type of a device, the middle sheet, i.e. a metallic heat reflective foil, does not extend completely across the bay in installed position. Also, the sheets of foil tend to collapse and touch each other near the center due to the lack of any support between the end members. In either event the device loses its effectiveness and does not prevent heat loss and sound loss towards the ends of the sheets.



It has further been suggested to mount a pair of metal foils in spaced relation by interposing an accordion plaited foundation of paper with the plaits arranged longitudinally of the unit. While such a construction does maintain the metal foil layers in spaced relationship, the intermediate foundation layer divides the intervening quiescent air spaces into triangular sections. This type of arrangement does not allow for the maintaining of a uniform air space of an optimum width extending along every point adjacent the reflective surface, since the intermediate foundation contacts both foils at numerous places throughout its length. This optimum air spacing, e.g. ¾ inch for lateral heat flow, has been determined by many experimenters in the thermal insulation field to be a value which cannot be diminished without materially decreasing the insulating value of the reflective air space.

There has thus been present a continuous and real need for an insulation unit which, when installed, provides continuously extending sheets which remain parallel and are maintained taut over the entire width of the construction bay to be insulated, and wherein the edges of the insulation adjacent the construction members are not areas of weak thermal resistance. Such sheets could be of alternate low (e.g. aluminum) and high (e.g. paper) surface emissivity value.

It is therefore an object of this invention to provide an insulating material formed of a plurality of thin sheets having the same or alternately different surface emissivity values, which are spacedly held apart in parallel relationship. It is a further object of my invention to provide an insulating material formed of a plurality of thin sheets which are so constructed as to be sufficiently rigid as a unit as to withstand the normally encountered outside pressures, when installed. and maintain the sheets taut and in proper spaced relationship. It is a still further object of this invention to provide an insulating material formed of a plurality of thin sheets having alternately different surface emissivity values which will remain substantially indefinitely in the form in which it is applied, even under the influence of normal outside pressures, vibration and shock. Another object of my invention is to provide for the installation of continuously parallel sheets of low, or alternately high and low surface emissivity, which cover, while remaining parallel, the entire width of the construction bay to be insulated.

Further objects and advantages will become readily apparent from a consideration of the description hereinafter following and from the accompanying drawings forming a part of this specification, and in which:

Figure 1 is a cross-sectional view of a portion of a wall having an insulating unit partially installed according to the invention, with the thickness of the sheets and end portions slightly exaggerated in detail,

Figure 2 shows the unit of Figure 1 in completed installation,

Figure 3 is a cross-sectional view of another embodiment of the invention in partial installation in a construction bay, and

Figure 4 is a cross sectional view showing the unit of Figure 3 in completed installation.

In ordinary frame building construction it is common to space the wood framing members so that they are approximately 16″ on centers. Variations in materials, construction, or both, frequently result in variation in spacing amounting to an inch or even more, plus or minus, and thus the spaces between studs, which are ostensibly spaced 16″ on centers, is actually 13⅜″ to

15⅜". When the unit of my invention is applied to the construction bays in such building walls it is made with a width of approximately 14⅜". It is also quite common in construction to find spacings of 12" or of 24" on center, etc., and similar considerations would apply as to the unit of my invention.

As used hereinafter, the term "construction bay" is intended to define the space between studs, beams, rafters, etc. in buildings, vehicles, boats, etc. The term "plait" is intended to define a section of sheet having a plurality of folds. Also, as used above and as used hereinafter, the word "wall" is intended to include within its scope a floor or any continuously extending construction surface, e.g. ceiling.

In the insulation unit of this invention, the edges of the various sheets are so plaited as to create a plurality of flanges or elements of flanges for enabling the attachment of the unit in the construction bay in a two stage operation. I have found that such a two stage installation ensures a mechanically rigid parallel spacing for the sheets with each one supported out of contact from the others and spaced therefrom at different levels. The unit **1** shown in Figure 1 may be of a width corresponding with the space between the studs **2** and **3** is shown as being partially installed in a building wall section having a siding or exterior wall section **4** and an interior wall or sheathing **5**. The sheets shown in Figure 1 are exaggerated in thickness in order to make clear the interrelationship thereof. The unit **1** includes a top sheet **6** which serves as the reflective sheet and a support sheet **7**, which may have one or both surfaces reflective. The sheets **6** or **7** may be made of metallic foil which is reflective to heat and has a low infra-red surface emissivity, e.g. aluminum of a thickness suitable for fabrication, or a paper-foil laminate. Such reflective sheets will serve to stop both convection currents and heat rays from transporting heat across the bay. The support sheet serves to form the flanges and lend rigidity to the structure and may be made of suitably treated paper, foil, plastic or cloth, or combinations thereof.

The top sheet has folds **9** and **10** at each end thereof. The support sheet has a double fold **11**, **12** and **13**, **14** at each end thereof. Referring to the fold **13** (which is similar to fold **11**), it is readily seen that the sides **14***a* and **14***b* of this fold receive the folded over end of sheet **6**. These elements form a first flange **16**. The sides of folds **11** and **9** also cooperate to form a similar flange **17**. The sides of these folds which form the flanges **16** and **17** are affixed one to the other as by glue or any other fastening means to hold them in assembly. The flanges **16** and **17** serve as the means by which the sheet **6** is affixed to the constructional members **2** and **3** to hold it taut. Means such as stapling are commonly used to accomplish this step. Similarly the sheet **7** (which is shown in Figure 1 as being partially unfolded) has folds **18** and **22** (see Figure 2). The sides **20** and **21** of fold **18** and the sides **23** and **24** of fold **22** form second flanges **26** and **28**, respectively. These flanges are also in turn affixed to the constructional members **2** and **3** as a second step in installing the unit **1**. This last step serves to stretch sheet **7** taut.

Figures 3 and 4 show another embodiment of my invention wherein, in addition to the reflective sheet **6** and the space-dividing sheet **7'**, a second reflective sheet **30** is used. Obviously, the number of space-dividing sheets **7'** and additional reflective sheets **30**, may be increased to any number desired, although practical limitations as to cost and space in the bay will probably limit the number.

The top sheet **6** is identical with the sheet **6** of Figures 1 and 2, having folds **9** and **10** at the ends thereof. The space dividing sheet **7'** has only the single folds **31** and **32** at the ends thereof. In this embodiment there are support members **33** and **34** at the ends of the unit. There are also made of paper, foil, etc. The members **33** and **34** have the ends of the space dividing sheet **7'** affixed thereto by glueing or other suitable means. The supporting member **33** has a double fold **35**, **36** at its upper end, and the supporting member **34** has a double fold **37**, **38** at its upper end. In a manner similar to that shown in Figure 1, the sides of the double folds of members **33**, **34** cooperate with the folded over ends of sheet **6** to form first flanges **16'** and **17'**. These flanges **16'** and **17'** serve as the means by which the sheet **6** is affixed to the constructional members **2** and **3** to hold it taut. In Figure 3 both sheets **7'** and **30** are shown as being partly unfolded. Sheet **30** has folds **39** and **40** at the ends thereof (see Figure 4). The supporting members **33** and **34** have folds **42** and **41**, respectively, at the lower ends thereof. The sides of the fold **41** and the sides of the fold **42** cooperate with the folded over ends of sheet **30** to form flanges **44** and **43**, respectively. These flanges **43** and **44** serve as the means whereby the sheets **7'** and **30** are drawn taut, when they are affixed to the constructional members **2** and **3**.

It is thus seen from both of the embodiments described above that the insulation unit of the invention embodies two pairs of flange means which are separably affixed to the constructional members in a construction bay to draw different sheets taut and maintain them in parallel spaced relationship, and extending across the entire width of the space to be insulated. Any desired depth or number of intervening air spaces may be designed into the unit, and it will be maintained throughout the width of the construction bay or wall space to be insulated.

It will be readily apparent to those skilled in the art that various substitutions and modifications, such as further increasing the number of stapling flanges, may be made in the above described preferred embodiments without departing from the scope of the appended claims.

What I claim as my invention is:

1. An insulation unit adapted to be installed between a pair of framing members and a wall member forming a construction bay open only on one end as viewed in cross-section, comprising a plurality of thin sheets which are to be maintained in fixed taut spaced relationship and at least two pairs of flange means to affix said sheets in position from the open end of said bay; a first of said sheets being a heat reflective sheet to be affixed in said bay opposed to the wall member, a second of said sheets being a supporting sheet to be affixed in said bay outwardly of said first sheet, said pairs of flange means being formed in part by folded ends of the first and the second sheet and extending in a direction away from said wall and towards the open end of said bay, a first pair of flange means which when affixed one to each framing member is adapted to draw the first sheet taut in a plane normal to said framing members, a second pair of flange means which when affixed one to each framing member is adapted to draw at least the second sheet taut in spaced planar parallel relationship to said first sheet, said pairs of flanges being so constructed and arranged that they can be affixed to said framing members from the open end of said bay, whereby a continuous uninterrupted air space of substantially uniform depth is established between said tautened sheets extending from one framing member to the other.

2. The unit of claim 1 comprising a top and a bottom sheet, the top sheet being of a material having low heat-ray emissive surfaces and having single folds at its ends, and the bottom sheet having plaited ends.

3. The unit of claim 2 wherein the plaited ends of the bottom sheet each consist of single lower folds and double upper folds, the upper fold of a bottom sheet cooperating with a folded over end of said top sheet to provide one of the flanges of said first pair of flange means and the lower fold serving as one of the flanges of said second pair of flange means.

4. The unit of claim 1 comprising three sheets, all of said sheets having single folds at their ends, and including a pair of supporting members, the folded over ends of the

sheets being affixed each to one of said supporting members.

5. The unit of claim 4 wherein the supporting members each provide a lower fold and an upper plaited end, the upper plaited end of a supporting member cooperating with a folded over end of the top sheet to provide one of the first flange means and the lower fold of a supporting member cooperating with the folded over end of the bottom sheet to serve as one of the second flange means.



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