Jan. 15, 1957

A. SCHWARTZ ET AL

2,777,786

THERMAL INSULATION

Filed April 22, 1954

FIG. 1

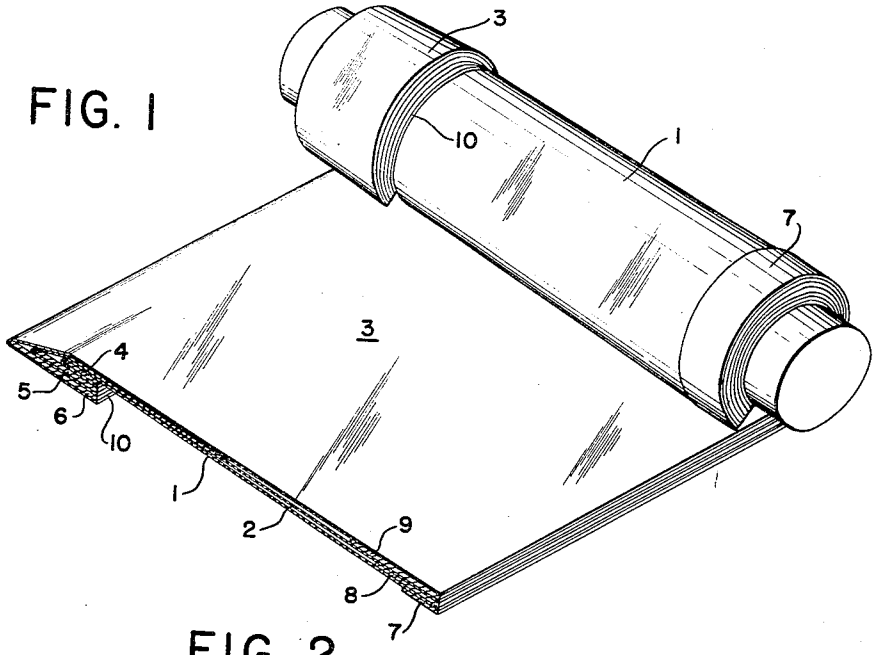



FIG. 2

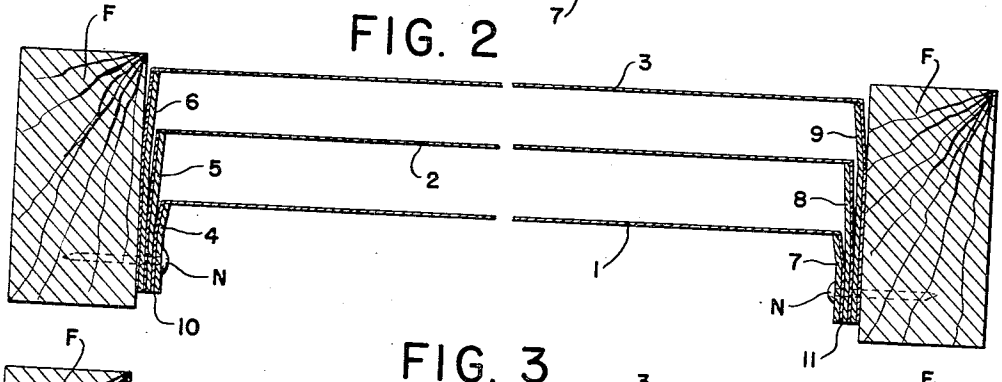



FIG. 3

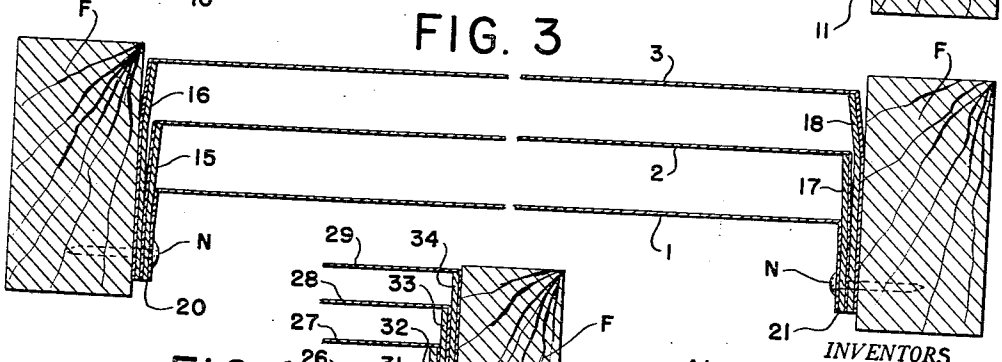
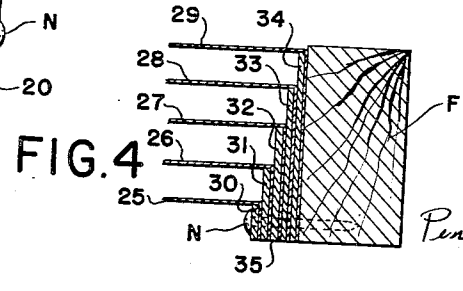



FIG. 4




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2,777,786

Patented Jan. 15, 1957



2,777,786

# THERMAL INSULATION

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Application April 22, 1954, Serial No. 424,953

7 Claims. (Cl. 154—45)

This invention relates to thermal insulation of general untility of the type suitable for use in buildings, refrigerators, vehicles, boxes and the like, and has for its object the provision of an improved insulation of this character. More particularly, the invention is concerned with insulation in the form of thin sheets which may be supported in stretched positions by supporting or attaching members. The invention provides composite insulating products or structures formed of a plurality of sheets of insulating material connected to supporting edge strips and arranged to be installed as an integral structure.

The composite insulation of the invention comprises two or more sheets of insulating material such as metal foil, laminated metal foil and paper, asbestos, plastic, or paper. The insulation may be formed entirely of one of these sheet materials or of combinations thereof. In accordance with our invention, we prefer to form the insulation of continuous sheets or webs of more or less indefinite length and to connect the edge portions of the sheets to supporting edge strips of sheet material which provide a means to hold the insulating sheets in spaced relation with respect to each other when installed, and a means for attaching the insulation in the place of use, such as to the framing structure of a refrigerator, box, building, or the like.

The sheets of insulating material are attached along their lengthwise edges to the edge strips which are relatively stiff, narrow strips of sheet material, such as paper, which provides a means for attaching the insulation to the inner opposite faces of adjacent framing structures such as the studs, rafters, or joists of buildings. Insulation of the invention comprising at least two sheets of insulation will comprise at least one edge strip interposed between the longitudinal edge portions of each edge of the insulation in such manner that one sheet, called the "front sheet," is held spaced from the other sheet, called the "back sheet," an appreciable distance when the edge strips are attached to the inner faces of the adjacent framing structures. The insulation of the invention may comprise any desired number of insulation sheets, and either two edge strips for each sheet of insulation, in one embodiment of the invention, or two edge strips for each sheet of insulation less two, in another embodiment of the invention.

One characteristic feature of the insulation is that the plurality of insulation sheets and the edge strip or strips along each edge, as the case may be, are in superposed bonded engagement along their edges forming attachment edges by means of which the insulation may be nailed, stapled, or otherwise attached lengthwise to the framing structures. While the edge strips are formed of a material which is stiff with respect to the insulation sheets and, in view of their narrowness, can support the insulation sheets in spaced relation, they are also sufficiently flexible that the insulation can be arranged in compact flat form and rolled into a roll for packaging.



When the insulation is installed between framing structures with the edges attached as with nails to the inner faces of adjacent frames, the stiff strips lie in substantial parallelism with the frames. At least one of the insulation sheets is attached to an edge strip on the side facing the structure and is folded over the edge of the strip, spanning the space and making similar engagement with the edge strip of the other edge of the insulation sheet. The stiff strips have sufficient resiliency that they hold the sheets of insulation in spaced spanning relation and substantially in contact with the inner faces of the framing structures although attached only along their attachment edges.

In one embodiment of the invention comprising, say, two sheets of insulation, and in which there are two less edge strips than twice the number of insulation sheets, we use but one edge strip attached as with an adhesive along each edge and between the superposed sheets. The front sheet of insulation has relatively narrow edge attachment to the edge strips so that when the two edge strips are held apart and parallel to each other the front sheet is stretched betweeen the insides of the two edge strips and the back sheet passes over the edges of the two edge strips and is stretched in a taut position spaced from and parallel to the front sheet. In this position, the insulation is attached with nails or the like to the inner opposite faces of the framing structures. Because of the resilient character of the edge strips, they hold the insulation sheets in stretched spanning position although the attachment by the nails to the framing structures are along only the attachment edges, the opposite edges of the edge strips being free.

In another variation of this form of the invention, one or more other sheets of insulation may be arranged in overlying relation to the aforementioned sheets, each having an interposed edge strip attached thereto. In other words, the longitudinal edge portions of the composite insulation may comprise a plurality of stiff edge strips, each having an attached sheet of insulation, the edge strips and insulation being attached one over the other. The innermost edge strips, the ones attached to the front sheet, are the narrowest in width and each successively applied edge strip is an amount wider sufficient to provide the required spacing between the successive sheets of insulation, the widest edge strips being the ones in closest contact with the framing structures.

In another embodiment of the invention, the composite insulation comprises a plurality of insulation sheets, each of which is attached along its longitudinal edge to an edge strip, the innermost edge strip being the narrowest, the adjtcent strips being progressively wider in an amount such as to provide the required spacing between the adjacent sheets of insulation, the widest edge strips being the ones closest to the framing structures, the edge portions of the several insulation sheets with their attached edge strips lying one over the other and being attached together along their edge portions. When this form of insulation is arranged in position for insulation with the edge strips held apart and parallel to each other, the edge portions provide a means for attachment to the inner opposite faces of the framing structures as by means of nails. The opposite longitudinal edges of the edge strips remain free but by reason of their resiliency they each hold their attached sheet of insulation in stretched spanning relation between the framing structures and in close contact therewith.

The sheets of insulation are so proportioned in width with respect to the distance between the framing structures and the resilient character of the edge strips that when the insulation is installed the sheets are supported in a taut spanning position.


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These and other objects of the invention will be better understood after considering the following discussion taken in conjunction with the accompanying drawing in which:

Fig. 1 is a perspective of insulation of the invention illustrating one manner of rolling the insulation into a form suitable for packaging;

Fig. 2 is a cross-sectional view of one embodiment of insulation of the invention when attached to framing structures;

Fig. 3 is a cross-sectional view of another embodiment of insulation of the invention attached to framing structures, and

Fig. 4 is a fragmentary cross-sectional view illustrating another embodiment of insulation of the invention.

The insulation illustrated in the drawings, and particularly that shown in Fig. 1, comprises two or more sheets of insulating material formed of any suitable sheet material, such as aluminum foil, laminated aluminum foil and paper, plastic, asbestos, or paper, or of combinations of these sheet materials. We prefer to form the insulation of at least one sheet of aluminum foil or laminated aluminum foil and paper and at least one other sheet of suitable insulating material.

In all embodiments of our invention when we use aluminum foil, the foil should be preferably dead soft aluminum varying, say, from 0.00025 to 0.006 inch in thickness. When paper is used, we prefer to use kraft paper of any suitable weight, say, from 18 pounds to 100 pounds base weight and preferably paper treated with fire, vermin and fungus retarding agents.

The insulation illustrated in Fig. 2 comprises a front sheet **1**, an intermediate sheet **2**, and a back sheet **3**, each of which is of indefinite length and a width sufficient to form a composite insulation which can assume the position illustrated between the framing structures F, for example, standard framing structures of a building which are spaced 16 inches between centers. The edge strips **4**, **5**, **6**, **7**, **8** and **9** can be formed of any suitable relatively stiff sheet material that will support the insulation sheets in the position illustrated. The edge strips are also of indefinite length and each of these strips is attached as by means of an adhesive or any suitable stitching to its contacting side of an insulation sheet. The attached sheets and edge strips are arranged in superposed relation and attached to each other in the position shown. It will be noted that the strips **4** and **7** attached to the front sheet are the narrowest and that the successively overlying edge strips are progressively wider by a distance equal to or slightly greater than the distance between the insulation sheets, the widest edge strips being **6** and **9** which are closest to the framing structures F.

One important feature of this insulation is that when the edge strips are held apart and parallel to each other, the insulation may be inserted between the inner faces of the framing structures and the overlying attached edge strips and insulation sheets provide relatively firm and strong edge portions **10** and **11** which are readily accessible for nailing the insulation to the framing structures as illustrated. It will be noted that although the insulation is only attached along these edge portions **10** and **11** with the nails N that the edge strips, by reason of their resilient character, dimensions and attachment, urge the insulation sheets in their taut spanning position and hold them in close contact with the inner opposite faces of the framing structures.

The embodiment of insulation illustrated in Fig. 3 is generally similar to that of Fig. 2 comprising an inner sheet **1**, an intermediate sheet **2**, a back sheet **3** and edge strips **15**, **16**, **17** and **18**. It will be noted that, while there are three sheets of insulation, there are only two edge strips along each edge thereof. The front sheet **1** is attached as with an adhesive along its entire area of contact surface to the sides of strips **15** and **17**, while insulation sheet **2** is bent over the edges of edge strips **15** and **17** and attached as with an adhesive to the opposite sides. Edge strips **15** and **17** accordingly support both sheets **1** and **2** in the spaced spanning positions illustrated.



Insulation sheet **3** is bent over the edges of edge strips **16** and **18** and attached along one side thereof as with an adhesive. The superposed longitudinal edge portions of the insulation sheets and the edge strips are attached together in the position illustrated, providing the attachment edge portions **20** and **21**. These edge portions provide a means for attaching the insulation to the framing structures F as with the nails N. The edge strips **15**, **16** and **17**, **18** have the width relation necessary to provide the spaced spanning position of the insulation sheets and they also hold these sheets in their taut spanning relation and in close contact with the framing structures.

Fig. 4 illustrates a further embodiment of the invention comprising insulation sheets **25**, **26**, **27**, **28** and **29**, each being attached along the longitudinal edges to edge strips **30**, **31**, **32**, **33** and **34**, respectively. The sheets of insulation and the edge strips are arranged in the superposed position shown and attached to each other as with an adhesive so as to provide edge portion **35** by means of which the insulation may be attached to a framing structure F as with nails N. Any suitable number of insulation sheets may be attached to edge strips as shown and these may be constructed, either as in Fig. 4 or Fig. 3.

While any desired spacing may be provided between the adjacent sheets of insulation, it is advantageous to so proportion the widths of the edge strips that the insulating sheets are held approximately ¾ inch apart and this is particularly desirable when the adjacent sheets are formed, either entirely of aluminum foil or of laminated paper and aluminum foil. The highly reflective and very low emissive surface of aluminum foil does not offer effective retardation to the transfer of radiant heat when in contact with other material and any individual surface has a progressive diminution in effectiveness as the distance between the sheets approaches zero.

Fig. 1 illustrates one effective means of packaging the insulation of the invention. Insulation of the type shown in Figs. 2, 3 or 4 can be so folded that the insulation sheets are in close overlying position with the edge strips folded into parallelism therewith. The edge strips are preferably formed of such sheet material that the innermost convolutions of the roll may have a diameter of, say, 3 inches. The insulation is preferably packaged in roll form and when removed from the package can be unrolled and cut in the length desired to cover the entire space between the framing structures. The mechanic simply turns the superposed longitudinal edges to a position with the edge strips spaced apart and parallel to each other and nails the attachment edges to the framing structures as shown.

We claim:

1. An improved thermal insulation which comprises a plurality of insulating sheets at least one of which is aluminum foil, the sheets being relatively narrow and of indefinite length and superposed one over the other, said sheets consisting of a front sheet, at least one intermediate sheet, and a back sheet, each of said insulating sheets having a flanged edge portion on each of the edges thereof, a plurality of relatively stiff edge strips of different widths, one of each of said edge strips extending along and attached to each of the flanged edge portions of the insulating sheets, the narrowest edge strips being attached directly to the front sheet, the widest edge strips being attached directly to the back sheet, the edge strips of intermediate width being attached to an intermediate sheet and to the back sheet, the flanged edge portions of the insulating sheets and the edge strips being connected together and forming attachment edge portions, the insulating sheets being of different widths, the back sheet being widest, the intermediate sheet being narrower and the


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front sheet being the narrowest, the attachment edge portions being arranged to lie close to framing structures, whereby the stiff edge strips resiliently hold their respective attached insulating sheets taut, said insulation being adaptable to being rolled into package form and when unrolled and the edge strips are held apart and parallel to each other the insulating sheets are held spaced apart.

2. An improved insulation according to claim 1 in which the edge strips progressively increase in width from the narrowest to the widest approximately ¾ inch thereby supporting the insulating sheets at least about ¾ inch apart.

3. An improved insulation according to claim 1 in which at least two of the sheets comprise aluminum foil.

4. An improved insulation according to claim 1 in which the flanges of the several insulating strips extend forwardly and the forwardly-extending portions of the rear sheets lie opposite the flanges of the front sheet.

5. An improved thermal insulation which comprises a plurality of insulating sheets at least one of which is aluminum foil, the sheets being relatively narrow and of indefinite length and superposed one over the other, said sheets consisting of a front sheet and at least one other insulating sheet, each of said insulating sheets having a flanged edge portion on each of the edges thereof, at least two relatively stiff edge strips of different widths, the respective flanges of the front sheet extending forwardly and being connected, to one face of the forward



side of an edge strip, the insulating sheet next adjacent the front sheet overlying the front sheet and extending over the rear sides of the edge strips to which the flanges of the front sheet are connected and having its respective flanges connected to the opposite sides of the edge strips to which the flanges of the front sheet are attached, whereby when the edge strips are held apart and parallel to each other the insulating sheets are held spaced apart and parallel to each other.

6. An improved insulation according to claim 5 in which at least two of the sheets are of aluminum foil held about ¾ inch apart.

7. An improved insulation according to claim 5 in which another edge strip approximately ¾ inch wider than the aforementioned edge strips are adhesively bonded over each of the longitudinal edges of the other insulating sheet, and a third insulating sheet is placed in position overlying the other insulating sheet and the longitudinal edge portions thereof are adhesively bonded to the last-mentioned edge strips.

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