Dec. 7, 1965 W. R. GASTON ETAL 3,222,243

THERMAL INSULATION

Filed July 11, 1962

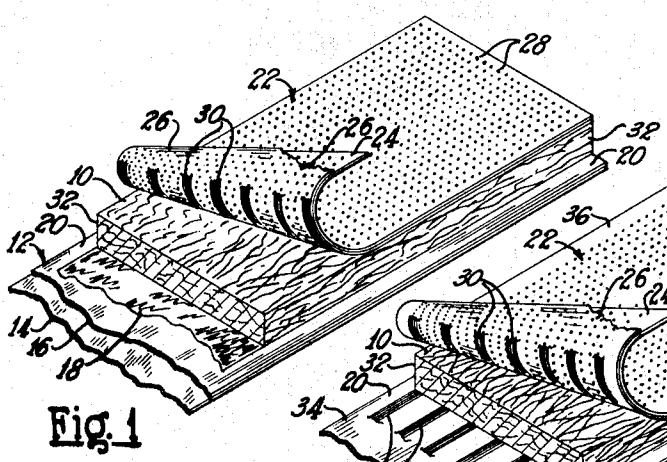


Fig. 1

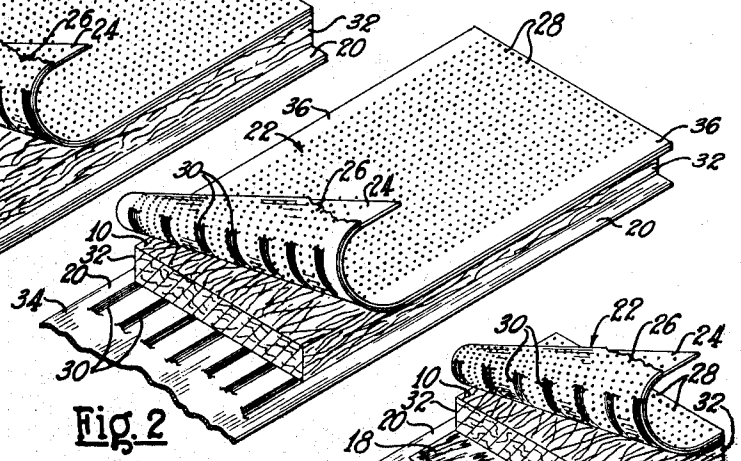


Fig. 2

Fig. 3

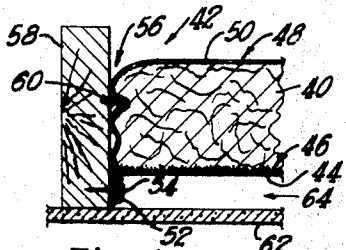


Fig. 4

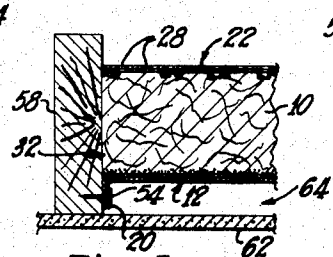


Fig. 5

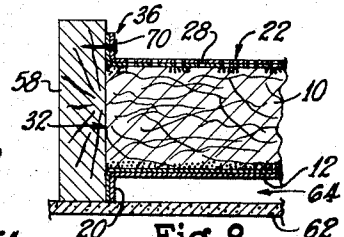


Fig. 8

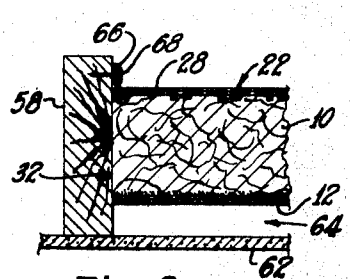


Fig. 6

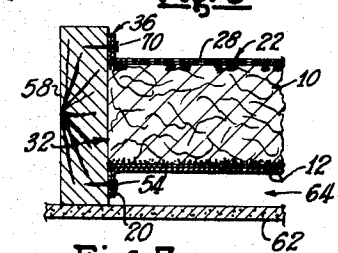


Fig. 7

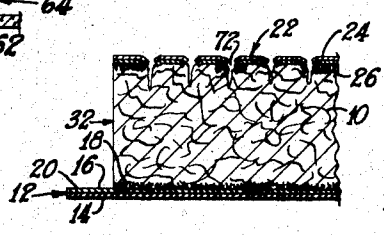


Fig. 9

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3,222,243

THERMAL INSULATION

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4 Claims. (Cl. 161—113)

This invention relates to improved thermal insulation, and more particularly to thermal insulation comprising mineral fibers in unique combination with a reflective foil and an impervious vapor barrier.

In accordance with the prior art, one popular type of thermal insulation comprised a batt of loose mineral fibers, such as glass fibers, contained in a fully enclosed reflective insulation envelope comprising a laminate of kraft paper as a base and aluminum foil as an exposed reflective coating material. As is well known, these products are light in weight and very bulky, thus requiring compression packaging for shipping.

One common method for compression packaging such thermal insulation comprises stacking layers of the insulation together at the end of the production line; then compressing the layers to about ten to fifteen percent of original thickness; and sliding the compressed mass axially or longitudinally from between the compression platens into a retaining bag of heavy kraft paper. Unfortunately, when the product is so compressed, it takes a permanent set along the crumpled edges or sides and does not recover full thickness after removal from the compression package. Further, in compression packaging and in installation between floor or ceiling joists or wall studs, the foil and kraft are often badly bent and torn open because of the weak nature and sensitivity of the previously crumped foil to abrasion. The result is improper contact between such edges and either a ceiling or floor joist or wall stud at the installation site. As will be obvious to those skilled in the art, such improper contact provides heat convection passages causing losses of thermal efficiency or lower K-factor of the insulating combination.

Further, the all-encircling envelope requires added material costs in the kraft paper-foil laminate used to cover the edges. The result is a more expensive product. Still further, the foil provided a heat transfer bridge between the hot and cold sides of the batt.

To compensate for the loss in thickness recovery, the manufacturer has been forced to produce the material oversize, entailing greater cost of materials and manufacturing energy with heavier shipping costs, thus burdening manufacturing efficiency.

To alleviate one of these difficulties, a step forward was made in the art by omitting the foil from the kraft paper backing along the edges of the fibrous batt, thus leaving only a relatively non-conductive bridge of kraft paper exposed at the edges. It has been found that this product is somewhat more successful than the prior full foil enclosed product in thermal efficiency. However, the defects of compression packaging, shipping, installation and the like are retained by the product. Thus, even the kraft-covered edge product is not fully satisfactory in that, although somewhat more abuse-resistant than the foil-laminate fully enclosed material, it is still subject to substantial edge damage in packaging, shipment and installation. Inefficiencies in installation result from the torn or crumped kraft paper edges which produce convection pockets, as mentioned above. The result is a substantial loss in insulating efficiency, counterbalancing the gain made by omitting the heat-conductive bridge.

Accordingly, an important step forward in the art would be provided by a novel insulation material which has higher thermal efficiency than prior art related products;

that uses less material for greater economy of manufacture; that overcomes convection leaks; that provides better recovery from compression packaging; and other advantages.

It is accordingly an important object of the present invention to provide a novel thermal insulation material.

A further object is to provide a novel thermal insulation material made of mineral fibers in unique combination with a reflective vapor barrier and a supporting foil.

A still further object is to provide a novel thermal insulation material of light weight having improved thickness recovery from compression packaging, that is more economical to manufacture, yet having higher thermal efficiency than comparable products.

A still further object is to provide an improved thermal insulation material combining specific mineral fibers with one or more reflective foils for improved insulation efficiency, and being vented in a unique manner for removal of condensate moisture, thus providing improved durability and longer life with a higher level of retained thermal insulation efficiency.

Another object of the present invention is to provide an improved thermal insulation comprising mineral wool fibers wherein the edges of the fibrous batt are free of enclosing material and wherein a foil-kraft laminate or reflective foils is adhesively secured in a unique manner to each major face of the batt without edge enclosing portions.

A further object is to provide an improved method of producing fibrous glass mat thermal insulation materials, unique in the manner of combining particularly laid fibers with a particularly applied strip adhesive to provide product resilience and improved breathing characteristics for vapor removal.

A further object is to provide an improved thermal insulation material made of glass fibers and having both major surfaces covered with a reflective metal foil and raw, uncovered edges whereby the edges more effectively abut building members to prevent convection heat transfer.

It is a further important object to provide a thermal insulation material which effectively reflects radiant heat and which further effectively reduces the transmission of convection heat.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

FIGURE 1 is a perspective view of one embodiment of the novel composite thermal insulation of the present invention, utilizing an imperforate foil-kraft-asphalt laminate on the hot side and a perforate foil-kraft laminate on the cold side with strip asphalt adhesive, and nailing tabs on the hot side;

FIGURE 2 is a perspective view of another embodiment of the invention utilizing a foil vapor barrier bonded with strips of adhesive on the hot side and a perforated foil-kraft laminate on the cold side, with fastening tabs extending from the edges of both major surfaces;

FIGURE 3 is a perspective view of still another embodiment of the invention utilizing an imperforate kraft-asphalt laminate vapor barrier on the hot side and employing a perforated kraft-reflective foil laminate on the cold side with fastening tabs on the hot side only;

FIGURE 4 is a fragmentary section view illustrating an installed condition of the prior art all-enclosing envelope product, for comparison with the installed views of FIGURES 5–9 of the present invention;

FIGURE 5 is a fragmentary section view similar to FIGURE 4, but showing the improved installation of one embodiment of the present invention, installation having been made from the inside as in new building construction;

FIGURE 6 is a fragmentary section view similar to FIGURE 5 illustrating installation of one embodiment of the present invention from the outside as in old building construction or optionally in new building construction;

FIGURE 7 is a fragmentary section view illustrating the improved installation provided by a product similar to that of FIGURE 2, having fastening tabs along both major surfaces with both sets of tabs secured, as in highest quality new building construction.

FIGURE 8 is a fragmentary section view similar to FIGURE 7 illustrating the improved installation provided by a product typified by FIGURE 2, having fastening tabs on both major surfaces, but with only the tabs on the cold side secured, illustrating highest quality old building installation; and

FIGURE 9 is a fragmentary section view in enlarged detail illustrating the manner in which the perforations are formed in the cold side kraft-foil laminate by splayed piercing.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

PERSPECTIVE VIEW

Briefly the present invention relates to an improved thermal insulation material comprising high-grade long staple mineral fibers in unique combination with reflective foils, and held together in a particular manner to permit free exposure of the raw edges, thus providing improved thermal insulation efficiency, reduced convection of heat, improved flexibility of installation, greater economy of production and improved thickness recovery from compression packaging.

Accordingly, the present invention provides a unique product and method for its manufacture based on the use of a particular manner of laying up the fibrous batt itself and combining it with a vapor barrier and reflective material in a unique strip adhesive application technique for a resilient, substantially abuse-resistant product.

THE INVENTION

The embodiment of FIGURE 1

The embodiment of FIGURE 1 comprises a fibrous mat **10** or batt of long staple fibers, preferably of mineral wool, and more particularly of fine glass fibers produced as by disc spinning or by flame attenuation and with the fibers bonded to one another at the point of intersection as by a thermosetting resin, applied by spraying an aqueous dispersion of the resin into a collecting chamber in which the fibers are directed during formation of the batt, and subesquently cured in a heated oven with provision being made for controlling the thickness of the batt during the curing operation.

Also, in the embodiment of FIGURE 1, a foil-kraft laminate **12** is provided on the hot side, that is on the side of the insulation that is installed toward the interior of the building. The foil-kraft laminate **12** comprises a thin foil **14** of reflective character, such as aluminum foil, or equivalent, bonded as by sodium silicate or other suitable agent to a sulphite kraft paper **16**.

In this embodiment of the invention, the foil-kraft laminate is bonded to one major surface of the fibrous batt **10** by means of a continuous layer of asphalt **18**. It will be noted that the foil-kraft laminate is wider than the batt **10** to provide nailing or fastening tabs **20** along each edge.

In this embodiment of the present invention, the foil **14** provides a first vapor barrier and the asphalt a second vapor barrier, so that in the event of shipping or handling if any holes are accidentally made in the foil, the continuous asphalt coating **18**, being attached to the other side of the tough kraft layer **16** will provide a secondary safeguard for a hot side vapor seal.

To the other side of the batt **10**, there is secured a perforate foil-kraft laminate **22**, comprised of outer foil **24** and inner kraft **26**, bonded together as by sodium silicate or other suitable and economical water-resistant bonding agent.

The perforate foil-kraft laminate **22** has small breather holes **28** uniformly distributed over the entire surface, as by punching or piercing, to be subsequently described. Where punching is utilized, actual bits of the laminate are removed; however, where piercing is utilized the material is retained in place for the full reflective effect of the retained foil.

In this embodiment of the invention, it will be noted that the cold side perforate foil-kraft laminate **22** covers only the cold-side major surface of the batt **10**, and thus does not extend beyond the edges, as does the hot-side foil-kraft laminate **12**.

An important aspect of the FIGURE 1 embodiment, as well as the other embodiments to be later described, is the manner in which the cold side laminate **22** is secured to the fibrous batt **10**. Reference numeral **30** illustrates spaced longitudinally extending strips of asphalt placed on the underside of the kraft paper **26** to bond the laminate **22** and the cold-side major surface of the batt **10** together. By so operating, the major portion of the breather holes **28** will be left open so that the cold side of the structure can breath for removal of moisture, such as formed by condensation.

Summary of FIGURE 1

From the foregoing, it will be understood that a highly effective thermal barrier is provided in accordance with the present invention by utilizing a double vapor barrier in the form of foil and continuous asphalt layer, and a double reflector in the form of exposed reflective foils on each surface of the fibrous glass batt. Note also that free breathing characteristics are provided. Still further, a highly effective convection heat reducer is provided by the fibrous batt **10**, containing a multitude of tiny air pockets or pores, a known effective insulator; with the batt integrity being preserved by long staple mineral fibers retained in position by a bonding agent at the intersections of the fibers, thus insuring an open structure to the air pockets over a long product life.

The manner in which improved installation is provided in accordance with the present embodiment will be subsequently described.

From the foregoing it will also be observed that the lateral edges **32** of the fibrous batt **10** are exposed, providing full thickness recovery from compression packaging.

The embodiment of FIGURE 2

A modification of the present invention resides in the use of a substantial foil **34** on the hot-side of the fibrous batt **10**, as an equivalent to the foil-kraft laminate **12** of FIGURE 1; the stronger foil replaces the strength and support of the kraft for a lighter foil.

In this embodiment of the invention, it is also possible to use strips of asphalt **30** on the hot-side, because of the highly effective vapor barrier characteristics of the heavier foil **34**. By operating in this manner, the resilient characteristic of the batt **10** is utilized to provide conformance to the flexing of the foil **34**, thereby substantially decreasing the possibility of rupturing the foil during manufacturing, packaging, shipping or installation.

By operating in this manner, the heavier foil **34** may be found to be approximately of the same cost as the lighter foil **14** and kraft backing support **16** and bonding material and processing technique steps as required in producing the laminate **12** of FIGURE 1.

In this second embodiment of the invention, the cold-side is covered with the same type of perforate foil-kraft laminate **22** as used in FIGURE 1, comprising an outer foil **24**, inner kraft **26**, perforated as at **28**, and bonded as by strips of asphalt adhesive **30**. However, it will be noted that the cold-side laminate **22** can be approximately of the same width as the foil **34**, thus extending beyond the lateral edges **32** of the batt **10** to provide cold-side nailing tabs **36**, in addition to the hot-side nailing tabs **20**, provided by the foil **34**.

The advantages inherent in this type of structure, as regards the effective utilization of the nail tabs **36**, will be brought out hereinafter.

The thermal characteristic of this product is the same as that of the embodiment of FIGURE 1, by virtue of the use of exposed reflective foil on each of the major surfaces of the batt **10** to provide effective reflection of radiant energy, in combination with the fibrous batt **10**, which provides effective reduction of convection heat.

The embodiment of FIGURE 3

A more economical embodiment of the novel insulation of the present invention resides in the use of kraft paper **38** in combination with a continuous layer **18** of asphalt for bonding to the hot-side of the batt **10**, providing the extended attachment tabs **20**. It will be noted that in this embodiment of the invention, the asphalt layer **18** provides the vapor barrier on the hot-side.

On the cold-side, the foil-kraft laminate **22** is also used with strip asphalt bonding **30** to provide proper breathing through the holes **28**. It will be noted in this embodiment, as in the previously described embodiments, that the lateral edges **32** of the batt **10** are exposed for improved thickness recovery after compression packaging.

In this embodiment of the invention, advantage is taken of the reflective nature of the foil **24** of the laminate **22** to cut down solar heat radiation inwardly from the exterior of a building during summer. This insulation is particularly adapted for warmer climates, such as the southern portion of the United States, where solar radiation is a greater factor than internal heat-loss.

In this embodiment of the invention, effective use is also made of the batt **10** in reducing convection heat. Thus, a highly effective insulation for more moderate climates is provided, having the improved thickness recovery characteristic by virtue of the omission of any restriction from the raw edges **32**.

Installation advantages of the present invention

Illustration of the disadvantages of the prior art.— FIGURE 4 illustrates a typical prior art installation, wherein the insulation material comprised a loose and unbonded batt of mineral fibers **40**, contained within an all-enclosing envelope **42**. It will be noted that the hot side layer **44** of the envelope was made of kraft paper with a coating of asphalt **46** thereon comprising the vapor barrier. The cold side covering **48** is shown as it completely encased the sides or lateral edges of the batt **40** and was provided with breather holes **50** on the cold-side or surface. Note also that the edge of the cold-side covering **48** and the edge of the kraft paper hot-side layer **44** are interleaved to form the conventional nailing tab **52**, through which a nail **54** is passed for installation.

Note that the portion of the cold-side covering **48** covering the lateral edge of the batt **40**, namely designated by the reference numeral **56**, is severely wrinkled and not in perfect abutting contact with the adjacent building member, typified by a ceiling joist **58**. Thus, convection currents are readily set up for heat transfer between the hot-side **44** and the cold-side **48** in the void spaces **60** provided between the joist **58** and the wrapping portion **56**. Thus heat penetrating the plaster layer **62** into the air space **64** will travel by convection along the ceiling joist **58** and be lost in accordance with this typical prior art installation, brought about by crushing of the edge-covering portion **56** during compression packaging and handling.

Improved installation of FIGURE 5

In contrast to the deficiencies inherent in the prior art as shown in FIGURE 4, FIGURE 5 illustrates an improved installation in accordance with the present invention, namely the embodiment of FIGURE 1. Note that perfect abutting relation is provided between the exposed lateral edge **32** and the building joist **58**, thus eliminating convection transfer at this vital point of installation.

The installation of FIGURE 6

FIGURE 6 illustrates the installation of an embodiment of the invention wherein the nailing tab **66** is on the cold-side foil-kraft laminate **22**, in contrast to the prior descriptions of FIGURES 1 and 3, where the nailing tabs **20** are on the hot-side batt support.

The advantage of the FIGURE 6 embodiment is that "after-building" installation is provided in accordance with the present invention; thus an old, uninsulated structure can be insulated. As is well-known, the attic space in many houses is accessible, and particularly in some areas contractors are known to leave the attic uninsulated. Noting the lost heat after living in the dwelling for a time, the occupant is often desirous of reducing the heat loss in cooler seasons for greater fuel economy, as well as heat entry during the hot seasons from the attic for greater comfort. Thus he desires to insulate the attic after the dwelling is built. In accordance with FIGURE 6, this is readily done and it will be noted that nailing at **68** provides for installation from the attic space, the nail tab **66** serving as a gage for preservation of the air space **64**, which of course the workman cannot see.

An advantage of this type of installation is that the hot-side laminate **22** is stretched or placed under slight tension to form a supporting bridge for the batt **10**, and thus sustains the lower foil-kraft laminate **12** against in situ sagging, and thereby preserves the air space **64** over long life. As is well-known, the air space **64** is an important factor in overall thermal insulation efficiency and its preservation is thereby enhanced in accordance with the present invention.

The installation of FIGURE 7

The installation of FIGURE 7 utilizes the type of double tab nailing structure, described for the embodiment of FIGURE 2, and, as shown, results in a very high quality installation when both sets of nailing tabs **20** and **36** are secured to the building joists **58** in new construction where both sides are accessible.

The cold-side set of tabs **36**, when nailed as at **70**, serve to stretch or tension and support the cold-side foil-kraft laminate **22** as discussed for the FIGURE 6 embodiment, and prevent sagging and compaction of the batt **10**, thus preserving full thickness with high heat insulation properties over extended periods of in situ use.

Also, the nailing as at **54** also converts the foil-kraft laminate **12** into a supporting bridge for the batt **10**, cooperating with the upper laminate **22** to preserve the air space **64**.

Thus, by the present invention the highest efficiency life of the product is preserved.

The installation of FIGURE 8

The double tab structure of FIGURE 7 is also highly effective in "after installation" as in older buildings, as shown in FIGURE 8. In this type of installation, of course, the installer works from the attic side, using the tabs **36** as a gage for establishing the concealed air space **64**. As discussed above, nailing at **70** tensions the laminate **22** to form a supporting bridge for the batt **10** and also supports through the batt the hot-side laminate-vapor barrier **12**. In making this installation the installer holds back the tabs **20** before placing the batt between the joist **58**. The tabs **20** will tend to resume

their former position and swing in an arcuate manner to a generally perpendicular bridge-like wall with the terminal edge abutting the plaster layer **62** and providing support adjacent the joist **58** for more perfect and intimate contact between the exposed lateral edges **32** of the batt **10** and the building member **58**. Thus, the full width of the air space **64** is carefully preserved and long life thermal efficiency is enhanced in accordance with this "after installation."

The pierced barrier of FIGURE 9

FIGURE 9 illustrates a method embodiment of the invention where the cold side laminate **22** may be pierced as by blades or needles to both preserve the full surface of the foil **24** for its reflective characteristics and also provide small open pockets **72** down into the fibrous mat for improved breathing efficiency.

In accordance with this embodiment, the perforating operation is effected suitably by a needled roller just as the product leaves the assembly line. Thus, the laminate **22** is perforated in situ.

Extended scope of invention

An important feature of the products of the present invention resides in the use of a coherent fibrous batt containing long staple fibers, and more preferably of glass fibers having appreciable length. These fibers are preferably oriented in generally parallel planes and laid in transverse directions upon one another with the intersections between the fibers being bonded by a suitable material such as a thermosetting phenolic resin and thus presenting substantial batt integrity.

More particularly, glass fibers having diameters in the range of up to about fifty microns and lengths in the range up to about three inches, made either by a spinning disc process or by flame attenuation are preferred, and have been found to give unexpected performance. The long nature of the glass fibers utilized in accordance with the present invention render the product unique in that the fibers are maintained within the mat without need for complete enclosure as contrasted to the loose prior art structures. The binder is highly effective in preserving fiber-to-fiber spacing relationship and in preserving the air cells in uniform distribution throughout the batt.

It is this combination of factors that makes it possible to omit either the paper or paper-foil bridges that have heretofore characterized the products of the prior art, with their inherent difficulties of installation because of the crumbling along the lateral edges as indicated in FIGURE 4.

Other long staple fibers, essentially equivalent in body dimension to those of the glass fibers described above can be employed. However, since other mineral fibers such as mineral wool fibers or the slag fibers, do not generally encompass these characteristics because of their extremely short fiber length and brashy, brittle nature, the invention will therefore be generally limited to the longer staple glass fibers. Where fire resistance is not an important factor, it may be possible within the scope of the invention to produce insulation materials from longer wood fibers and similar cellulosic fibers such as cotton fibers.

While asphalt has been mentioned as a desirable bonding agent, it will be understood that other equivalent, generally pliable materials having high adhesive retention over extended periods of time, can also be used. Such materials would include rubber based adhesives and the like having volatile solvents as vehicle. However, it has been found that care should be exercised in the complete removal of the solvents of a flammable nature.

Kraft paper particularly desired for use in the present invention is a sulphate kraft of natural brown color of about thirty pounds ream weight. Aluminum foil for the foil-kraft laminate is preferably about 0.00025 inch thick, preferably laminated to the paper with sodium silicate. Of course, the invention is not to be limited to sodium silicate as the only laminating material. Where cost is not a limiting factor, heavier foils and papers can be used.

While the foregoing disclosure has related to strips of adhesive, characterizing economical and effective commercial production, it is to be understood that spaced spots of adhesive also can be used within the broadened scope of invention.

Vent hole size on the cold-side are preferably as small as possible for optimum reflectivity and good vapor transmission. While hole size is not necesarily critical, they are preferably formed by lancing to avoid removing material.

Advantages of the present invention

Advantages of the present invention are believed to be self-evident from the foregoing description; however, they are briefly enumerated as follows:

(1) Higher thermal efficiency.

(2) The use of double foil for increased reflectivity yet preserving economies of production by omitting bridging foil-paper laminates or papers along the lateral edges of the fibrous batt.

(3) Improved insulation by more intimate contact between the exposed lateral edges of the batt and building structural members.

(4) Improved thickness recovery after compression packaging.

(5) A lighter weight product, reducing manufacturing and shipping costs with resultant advantages to both manufacturer and consumer.

(6) Improved thickness retention in use with retained high thermal efficiency.

(7) Optional nailing tabs at both surfaces for improved retention of insulating air spaces over the life of the product.

(8) Production advantage over the prior art that the problems inherent in envelope formation are obviated.

(9) Improved packaging efficiency with no edge losses or defects as previously encountered—there is no edge crumpling to damage the product while forcing compressed batts into a packaging tube.

(10) Also, an unexpected result is provided by removal of the lateral edge bridge. Thus improved processing and thickness recovery after compression packaging are provided—with lesser material weight—and higher thermal efficiency.

I claim:

1. In a thermal insulating material,

a coherent batt of long staple glass wool fibers positioned in random oriented interlay and joined to one another at point contact by cured thermosetting phenolic resin,

said batt having opposed major surfaces of rectangular shape and lateral edges of rectangular shape,

said edges being free of covering,

an imperforate kraft-roll laminate secured to one of said major surfaces by adhesive between said surface and laminate and with the foil exposed,

said laminate comprising about 30 lbs./ream natural brown sulphite paper and aluminum foil of a thickness of 0.00025 inch bonded with sodium silicate,

a kraft-foil laminate as defined above, and also perforated, secured to the other major surface by adhesive between said surface and laminate and with the foil exposed,

said perforated laminate having about 9025 punctures per square foot,

a major portion of said punctures being open to permit said batt to breath to the ambient atmosphere,

and said imperforate laminate extending beyond said edges to form fastening tabs.

2. In a thermal insulating material,
a coherent, self-sustaining flexible, porous batt of glass wool fibers positioned at random oriented interlay and joined to one another at point contact by cured thermosetting phenolic resin and containing a multiplicity of air spaces,
said batt having opposed major surfaces of rectangular shape and opposed lateral edges of rectangular shape,
said edges being free of covering,
a sheet of kraft paper secured to one of said major surfaces by a substantially continuous layer of asphalt,
said paper extending beyond said edges to provide fastening tabs,
a kraft-foil laminate secured to the other major surface by parallel strips of asphalt and with the foil exposed,
said laminate comprising about 30 lb./ream natural brown sulphite paper and aluminum foil of a thickness of 0.00025 inch bonded with sodium silicate.
and said laminate having about 9025 punctures per square foot and with a major portion of said punctures open to permit moisture vapor to pass at ambient temperatures.

3. In a thermal insulating material,
a coherent batt of long staple glass wool fibers positioned in random oriented interlay and joined to one another at point contact by cured thermosetting phenolic resin,
said batt having opposed major surfaces of rectangular shape and opposed lateral edges of rectangular shape,
said edges being free of covering,
an imperforate kraft-foil laminate secured to one of said major surfaces by a substantially continuous layer of asphalt and with the foil exposed,
said laminate comprising about 30 lbs. per ream natural brown sulphite paper and aluminum foil of 0.00025 inch bonded with sodium silicate,
a perforated kraft-foil laminate as defined above, secured to the other major surface by parallel strips of asphalt with the foil exposed,

said perforated laminate extending beyond said edges to provide fastening tabs,
and said perforated laminate having about 9025 punctures per square foot, with a major portion of said punctures open to permit moisture vapor to pass freely at ambient temperatures.

4. In a thermal insulating material,
a coherent batt of long staple glass wool fibers positioned in random oriented interlay and joined to one another at point contact by cured thermosetting phenolic resin,
said batt having opposed major surfaces of rectangular shape and opposed edges of rectangular shape,
said edges being free of covering,
an imperforate kraft-foil laminate secured to one of said major surfaces by a substantially continuous layer of asphalt with the foil exposed,
said laminate comprising about 30 lbs. per ream natural brown sulphite paper and aluminum foil of about 0.00025 inch thickness bonded with sodium silicate,
a perforated kraft-foil laminate as defined above, secured to the other major surface by parallel strips of asphalt with the foil exposed,
each of said laminates extending beyond said edges to provide fastening tabs,
and said perforated laminate having about 9025 punctures per square foot.

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