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(54) INSULATION BATT WITH LOW FRICTION FACING

DÄMPFUNGSPLATTE MIT EINER EINE GERINGE REIBUNG AUFWEISENDEN OBERFLÄCHE
PLAQUE ISOLANTE AYANT UN REVETEMENT A FAIBLE FRICTION

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(73) Proprietor: **OWENS CORNING**
Toledo, Ohio 43659 (US)

(72) Inventors:
• **HALL, Herbert, L.**
Newark, OH 43055 (US)
• **BERDAN, Clarke, II**
Granville, OH 43023 (US)
• **SCOTT, James, W.**
Newark, OH 43055 (US)

• **WILLIAMS, Steven, H.**
Alexandria, OH 43001 (US)
• **SCHELHORN, Jean, E.**
Granville, OH 43023 (US)

(74) Representative: **West, Alan Harry et al**
R.G.C. Jenkins & Co.
26 Caxton Street
London SW1H 0RJ (GB)

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Description

This invention pertains to mineral fiber insulation products. More particularly, this invention relates to mineral fiber insulation batts having a facing adhered thereto.

In the manufacture of insulation batts from mineral fibers, it is a commonly-used practice to fiberize the mineral fibers from molten mineral material to distribute them on a collecting conveyor to form a pack. Typically the fibers are sprayed with an organic binder, and the pack is passed through a curing oven. The pack is then cut into individual pieces or batts. In some cases a facing material is added to the pack prior to the cutting step.

One of the uses for insulation batts is to reinsulate the attic spaces of residential dwellings. Typically, reinsulation batts are unfaced in order to avoid introducing a new vapor barrier within the insulation layers within the attic. Manufacturers' recommendations for reinsulation of attic spaces is to either use an unfaced batt, or to physically perforate the facing on a faced product by providing knife slits or other perforations in the material.

One of the problems with installing additional insulation batts in an attic space is that it is difficult for the insulation batts to be slid into place. The unfaced reinsulation batt has a high coefficient of kinetic friction when pushed along the existing surface i.e., the unfaced existing attic insulation. This is particularly true at the edges of the attic space where the roof slope meets the attic floor. The amount of friction between two mineral batts is considerable, and it is not easy to slide the reinsulation batt along the surface of existing batts in the attic space.

Another problem associated with reinsulating residential attic spaces is that the existing and new insulation materials generate significant quantities of dust, which are irritating to the installers. Typically, reinsulation is accomplished as a do-it-yourself project by residential homeowners. It would be beneficial if batts for reinsulating attic spaces were made to be easily slid in place over existing insulation in the attic. Further, it would be beneficial to provide some means for containing dust associated with the batts used for reinsulation.

Encapsulated insulation packages are known in the art. McLaughlin, in U.S. Patent 2,113,068 and Parker, in U.S. Patent 2,913,104, each disclose insulation packages in which mineral wool is covered by a wrapper.

Facings of different materials have been proposed for insulation batts. These include kraft paper, and polyethylene films, as disclosed in U.S. Patent 4,696,138 to Bullock. Bullock teaches a vapor-permeable polyethylene facing on four sides of a batt. The purpose of Bullock's facing is to stop convection from occurring in glass fiber insulation products.

French Patent No. 2,418,082 discloses a compressible mineral fiber insulation batt having the features of the preamble of claim 1 and teaches a mineral wool sheet onto which a polyvinylidene chloride foil has been fused. The mineral wool sheet is used to provide thermal or acoustic insulation. German Gebrauchsmuster No. 8505179 describes a mineral fiber insulation batt covered with a metallized polymeric facing adhered to the batt.

Syme in U.S. Patent 4,927,705 describes an insulation product covered with a vapor barrier of 25.4×10^{-6} to 50.8×10^{-6} meters (1 to 2 mil) polyethylene. This product is a completely encapsulated, and there is no porosity for passing moisture or for enabling compression during packaging. The ability to compress the insulation batt for packaging and have the insulation batt recover to a reasonable thickness once the package is opened for installation in the attic is a product requirement.

A very important aspect of any insulation product for retrofit situations is that the product must be nonflammable, i.e., it must pass the ASTM E84 flame spread test with a flame spread rating of 25 or less. One of the problems associated with some of the encapsulated mineral fiber insulation batts of the prior art is that the adhesive used to adhere the facing to the batt would itself contribute to a flammability problem. The adhesive prevents the product from passing the flame spread test with a flame spread rating of 25 or less. Such products invariably require expensive fire retardants to pass the test. Another problem with encapsulated insulation batts proposed to date is that the encapsulation materials prohibitively increase the cost of the insulation batt.

In view of the above, it would be desirable to provide an encapsulated mineral fiber insulation batt that has a thin facing, low coefficient of sliding friction over existing insulation in the attic, means to adhere the facing to the batt for handleability without using expensive fire retardants and without failing the ASTM flame spread test. Also, the insulation product should be at least in part highly porous to enable the rapid compression of the batt for packaging, and the batt must be capable of nearly full recovery upon the opening of the package. It is to be understood that although the product of the invention is designed for retrofit insulation in a residential attic, the product can also be used in other insulation applications such as insulating wall cavities, basement ceilings, residential new construction, and insulation for commercial buildings.

In accordance with the invention there is now provided a compressible mineral fiber insulation batt having opposed major surfaces and opposed side surfaces and a polymeric facing applied to both of the major surfaces, the facing being less than or equal to 25.4×10^{-6} meters (1 mil) in thickness and being adhered to the batt to prevent relative movement between the facing and the batt and being vapor permeable, characterised in that the facing is of sufficiently low mass to exhibit a flame spread rating of 25 or less in the adhered condition, that the opposed side surfaces of the batt are covered with a highly porous membrane to enable quick air escape from the batt under conditions of rapid compression, and that the batt is capable of recovering to a predetermined thickness after release from compression

to one-fourth of the predetermined thickness.

It has been found that by using a very thin facing material, the product can pass the ASTM flame spread test, even when the facing is adhered to the mineral fiber batt with an adhesive.

The facing material preferably has a thickness of less than or equal to 15.2×10^{-6} meters (0.5 mil) and more preferably less than or equal to 10.1×10^{-6} meters (0.4 mil).

One of the valuable features of the fiber insulation batt of the invention is that the coefficient of kinetic friction of the faced batt is less than 1.0 when the faced batt is dragged across a surface of an unfaced glass fiber batt having a density of about 8.01-12.81 Kg/M³ (0.5 to about 0.8 pounds per cubic foot). This low coefficient of kinetic friction enables the do-it-yourself attic installation installer to push or slide the batt of the invention across the top of existing insulation in the attic, thereby facilitating easy installation of the retrofit batts into the farthest reaches of an attic.

The polymeric facing is adhered to both major surfaces of the batt with a fastening means. Preferably the fastening means is a small amount of adhesive material. The adhesive material is of a sufficiently small amount as to enable the insulation batt not to exceed a flame spread rating of 25 by the ASTM E84 flame spread test, while being sufficient to bond the facing to the mineral fiber batt and enable the batt to be picked up and handled by the facing.

In another particular embodiment, the polymeric facing is adhered to one or both of the opposed side surfaces of the batt.

Referring now to the accompanying drawings:

Figure 1 is a perspective view of a mineral fiber insulation batt having facing material on both the major surfaces and on the side surface; and

Figure 2 is a schematic view of apparatus used in a test to evaluate the coefficient of kinetic friction of faced insulation batts.

This invention will be described in terms of a glass fiber insulation batt. It is to be understood that the mineral fiber insulation batt can be comprised of other types of mineral fibers, including fibers made from rock, slag and basalt.

Referring to Figure 1, insulation batt 10 is generally rectangular and has major surfaces 12, side surfaces 14, and end surfaces 16. Attached to the major surfaces is an encapsulation material or polymeric facing material 18. This material can be anything suitable to contain the dust and provide a low kinetic friction surface. Preferably the material is a polymeric material, and most preferably it is a polyethylene. A specific polyethylene material found to be useful is a high density, high molecular weight polyethylene.

In other embodiments of the invention the facing is comprised of polypropylene. A preferred polypropylene facing is a biaxially oriented polypropylene.

The facing on the major surfaces is vapor permeable. A vapor impermeable membrane can be rendered vapor permeable by means of perforating the facing material.

The facing material is less than or equal to 25.4×10^{-6} meters (1.0 mil) in thickness, preferably less than or equal to 15.2×10^{-6} meters (0.6 mil) in thickness, and most preferably less than or equal to 10.1×10^{-6} meters (0.4 mil) in thickness. The facing material must be sufficiently thin to avoid high material costs and to minimize fuel contributed during fire testing.

The facing material is attached to the major surfaces of the batt by any suitable fastening means, such as adhesive 20. The fastening means could also be, for example, Velcro® attachment means, sticking or a heat sealing process. A suitable adhesive is a pressure sensitive hot melt, such as HL-2707 from H.B. Fuller Company, applied at a rate of 2.15 g/m² (0.2 grams per square foot).

The fastening means must provide a bond between the facing and the mineral fiber batt sufficient to enable the batt to be handled by the facing material. Therefore, the fastening means acts to prevent relative movement between the facing and the batt.

The fastening means, particularly if it is an adhesive, must be of sufficiently low mass so as to not unduly increase the flame spread of the batt with the facing in the adhered condition. The flame spread test is the ASTM E84 test. The measurement under the ASTM E84 flame spread test must be taken with the facing material in the adhered condition. Further, the mass of the facing material and the adhesive material is sufficiently low to pass the flame spread test with a flame spread rating of 25 or less in the absence of fire retardants. For purposes of this invention, the term "absence of fire retardants" means that the material either actually contains no fire retardants, or contains fire retardants in such an insubstantial amount that the facing, in the adhered condition, would still pass the flame spread test with a flame spread rating of 25 or less if the fire retardant were left out of the product. This provides a considerable enhancement over the art in terms of material costs since a fire retardant is not needed. The test consists of determining the extent to which flames travel along the product under specified conditions when the product is exposed to a flame at one end.

As shown in Figure 1, the side surfaces are provided with side facing material 22. The side facing material can be any material to contain the dust within the insulation product, while still being sufficiently porous to enable the rapid evacuation of air from within the batt during compression. The most expedient facing material may be the same facing

material used on the major surfaces, but being highly perforated. Alternatively, the facing material can be cut to produce flaps to enable air escape during compression, but present a rather solid-looking appearance under static conditions. Additional side facing materials useful for this invention would be any scrim or other open-weave material, woven or nonwoven, made from polymeric fibers or glass fibers. Preferably, the side facing material has openings in at least 10 percent of its surface during the compression process. In one embodiment of the invention, the side facing material 22, as well as the facing material 18, is adhered to the batt.

The addition of the facing material to what would normally be an unfaced batt, imparts a structure to the batt which enhances its handleability and installability in residential attics. Further, since the facing material covers the batt, any surface irregularities which would constitute a visual surface defect are covered up. Consequently, a certain amount of scrap or recycled glass fiber material may be added to the product without detracting from its visual appearance. Further, the mineral fiber insulation batt can be made with a lower amount of organic binder material than would otherwise be the case. Preferably, the amount of binder material is within the range of from about 1 to about 7 percent by weight of the unfaced batt. Most preferably, the binder comprises between 1 and 4.6 percent by weight of the unfaced batt. Such binders are well known to those skilled in the art.

One attribute of the facing material is that it must be sufficiently slippery to enable the batt to be pushed or slid into place on top of the existing attic insulation material. Preferably, the coefficient of kinetic friction of the faced batt is less than 1.0, when the faced batt is pulled or dragged across a surface of an unfaced glass fiber batt having a density of about 8.01-12.81 kg/m³ (0.5 to about 0.8 pounds per cubic foot).

ASTM test D 2534-88 is a standard test method for determining the coefficient of kinetic friction for wax coatings. A test dynamically similar to D 2534-88 was used to determine the coefficient of kinetic friction of various facing materials suitable for use with mineral fiber insulation. A reference batt of R-13 glass fiber insulation was constructed. The reference batt has a density of about 11.21 kg/m³ (0.7 pounds per cubic foot) and measures 3.048 meters by 3.048 meters (one foot by one foot) by about 9.2 cm (3-5/8 inches). The reference batt was faced on the top side and unfaced on the bottom. The batt was dragged at a speed of 50.8 cm (20 inches) per minute across the various surfaces to be tested in accordance with the general principles of ASTM D 2534-88, and the coefficient of kinetic friction was determined by measuring the amount of frictional resistance encountered.

The apparatus used is shown in Fig. 2 in which reference batt 24 having facing 26 is pulled across the testing surface 28. The reference batt was pulled by means of wire 30, which after being turned upwardly around roller 32, was connected to a force measuring device. Any device suitable for measuring the load on the wire, such as a force transducer or Instron load cell 34, could be used. The coefficient of kinetic friction is the measurement of the frictional force between the bottom surface of the reference batt and the top surface of the testing surface or facing material 28 to be tested.

EXAMPLE

The reference batt was dragged across five different materials according to the test procedure outlined above, with the following results.

Sample	Coefficient of Friction
Unperforated 10.1 x 10 ⁻⁶ meters (0.4 mil) high density, high molecular weight polyethylene	0.826
Perforated 10.1 x 10 ⁻⁶ meters (0.4 mil) high density, high molecular weight polyethylene	0.735
Kraft paper	0.186
AC plywood	2.5
Unfaced glass fiber batt	7.73

The above data show that the faced batt has a small fraction of the friction exhibited by the action of sliding one unfaced batt across the other. Preferably, the coefficient of kinetic friction is within the range of from about 0.7 to about 0.9, and most preferably it is anything less than or equal to 1.0.

The fact that the side surfaces of the batt are highly porous not only enables rapid compression by allowing the escape of air during compression, but also facilitates the recovery of the product after the product is unpackaged in its place of intended use. Thus, the batt is capable of recovering to a predetermined thickness after release from compression to one-fourth of that predetermined thickness. For example, if the desired nominal thickness of an R-19 glass fiber insulation batt is 15.24 cm (6 inches), the batt can be compressed to a thickness of 3.8 cm (1.5 inches), and upon release from the packaging material, the batt will self-recover to the thickness of 15.24 cm (6 inches). Most preferably, the batt is capable of recovering to a predetermined thickness after release from compression to one-sixth of that predetermined thickness.

The mineral fiber insulation batt of the invention can be used for additional insulation in the attic space of a residential dwelling which has already been insulated.

Claims

1. A compressible mineral fiber insulation batt (10) having opposed major surfaces (12) and opposed side surfaces (14) and a polymeric facing (18) applied to both of the major surfaces (12), the facing (18) being less than or equal to 25.4×10^{-6} meters (1 mil) in thickness and being adhered to the batt (10) to prevent relative movement between the facing and the batt and being vapor permeable, characterised in that the facing (18) is of sufficiently low mass to exhibit a flame spread rating of 25 or less in the adhered condition, that the opposed side surfaces (14) of the batt are covered with a highly porous membrane (22) to enable quick air escape from the batt under conditions of rapid compression, and that the batt is capable of recovering to a predetermined thickness after release from compression to one-fourth of the predetermined thickness.
2. An insulation batt as claimed in claim 1, in which the mineral fiber is glass.
3. An insulation batt as claimed in claim 1 or claim 2, in which the facing is adhered to the batt using a hot melt adhesive applied at a rate of 2.15 g/m^2 .
4. An insulation batt as claimed in claim 3, in which the facing is adhered to the batt using a series of strips of adhesive (20) spaced along one or more of the major surfaces of the insulation batt.
5. An insulation batt as claimed in any one of claims 1 to 4, in which the facing (18) is comprised of high density, high molecular weight polyethylene
6. An insulation batt as claimed in any one of claims 1 to 5, in which the highly porous membrane (22) is adhered to at least one of the side surfaces (14) of the batt.
7. An insulation batt as claimed in any one of claims 1 to 6, in which the coefficient of kinetic friction of the faced batt is less than 1.0 when the faced batt is dragged across a surface of an unfaced glass fiber batt having a density of $8.01\text{-}12.81 \text{ Kg/m}^3$ (0.5 to 0.8 pounds per cubic foot).
8. An insulation batt as claimed in any one of claims 1 to 7, in which the facing has a thickness of less than or equal to 15.2×10^{-6} meters (0.6 mil).
9. An insulation batt as claimed in claim 8, in which the facing has a thickness of less than or equal to 10.1×10^{-6} meters (0.4 mil).

Patentansprüche

1. Komprimierbare Mineralfaser-Isolierplatte (10) mit gegenüberliegenden Hauptflächen (12), gegenüberliegenden Seitenflächen (14) und einer auf beiden Hauptflächen (12) aufgetragenen Polymerbeschichtung (18), die eine Dicke von höchstens $25,4 \times 10^{-6} \text{ m}$ (1 Mil) aufweist, zur Vermeidung von Verschiebungen relativ zu der Platte (10) an dieser haftet und dampfdurchlässig ist, dadurch **gekennzeichnet**, daß die Beschichtung (18) ausreichend geringe Masse hat, so daß sie im anhaftenden Zustand eine Flammenausbreitungsrate von höchstens 25 aufweist, daß die gegenüberliegenden Seitenflächen (14) der Platte mit einer hoch-porösen Membran (22) bedeckt sind, so daß bei schneller Kompression Luft rasch aus der Platte entweichen kann, und daß die Platte in der Lage ist, eine vorgegebene Dicke nach Freigabe aus einer Kompression auf ein Viertel der vorgegebenen Dicke wieder anzunehmen.
2. Isolierplatte nach Anspruch 1, wobei die Mineralfaser aus Glas besteht.
3. Isolierplatte nach Anspruch 1 oder 2, wobei die Beschichtung mittels eines in einer Stärke von $2,15 \text{ g/m}^2$ aufgetragenen heiß-schmelzenden Klebstoffs an der Platte haftet.
4. Isolierplatte nach Anspruch 3, wobei die Beschichtung mittels einer Reihe von Klebstreifen (20), die längs einer

oder mehrerer der Hauptflächen der Isolierplatte verteilt sind, an der Platte haftet.

- 5 5. Isolierplatte nach einem der Ansprüche 1 bis 4, wobei die Beschichtung (18) aus hochmolekularem Polyethylen hoher Dichte besteht.
6. Isolierplatte nach einem der Ansprüche 1 bis 5, wobei die hoch-poröse Membran (22) an mindestens einer der Seitenflächen (14) der Platte haftet.
- 10 7. Isolierplatte nach einem der Ansprüche 1 bis 6, wobei der kinetische Reibungskoeffizient der beschichteten Platte kleiner ist als 1,0, wenn diese über eine Fläche einer unbeschichteten Glasfaserplatte mit einer Dichte von 8,01 bis 12,81 kg/m³ (0,5 bis 0,8 Pounds pro Kubik-Foot) gezogen wird.
- 15 8. Isolierplatte nach einem der Ansprüche 1 bis 7, wobei die Beschichtung eine Dicke von höchstens $15,2 \times 10^{-6}$ m (0,6 Mil) aufweist.
9. Isolierplatte nach Anspruch 8, wobei die Beschichtung eine Dicke von höchstens $10,1 \times 10^{-6}$ m (0,4 Mil) aufweist.

Revendications

- 20 1. Plaque isolante en fibres minérales compressible (10) comportant des surfaces principales opposées (12) et des surfaces latérales opposées (14) ainsi qu'un revêtement en polymère (18) appliqué aux deux surfaces principales (12), revêtement (18) qui a une épaisseur inférieure ou égale à $25,4 \times 10^{-6}$ mètre (1 millième de pouce), qui est collé à la plaque (10) pour empêcher un mouvement relatif entre lui et la plaque, et qui est perméable à la vapeur, caractérisée en ce que le revêtement (18) a une masse suffisamment faible pour présenter un indice de propagation des flammes égal ou inférieur à 25 à l'état collé, en ce que les surfaces latérales opposées (14) de la plaque sont recouvertes par une membrane très poreuse (22) pour permettre à l'air de s'échapper rapidement hors de la plaque dans des conditions de compression rapide, et en ce que la plaque est capable de retrouver une épaisseur prédéterminée après relâchement d'une compression à un quart de l'épaisseur prédéterminée.
- 25 2. Plaque isolante telle que définie dans la revendication 1, dans laquelle la fibre minérale est du verre.
3. Plaque isolante telle que définie dans la revendication 1 ou dans la revendication 2, dans laquelle le revêtement est collé à la plaque à l'aide d'un adhésif thermofusible appliqué à raison de 2,15 g/m².
- 35 4. Plaque isolante telle que définie dans la revendication 3, dans laquelle le revêtement est collé à la plaque à l'aide d'une série de bandes d'adhésif (20) espacées le long de l'une au moins des surfaces principales de la plaque isolante.
- 40 5. Plaque isolante telle que définie dans l'une quelconque des revendications 1 à 4, dans laquelle le revêtement (18) est constitué de polyéthylène haute densité de poids moléculaire élevé.
- 45 6. Plaque isolante telle que définie dans l'une quelconque des revendications 1 à 5, dans laquelle la membrane très poreuse (22) est collée à l'une au moins des surfaces latérales (14) de la plaque.
7. Plaque isolante telle que définie dans l'une quelconque des revendications 1 à 6, dans laquelle le coefficient de friction cinétique de la plaque revêtue est inférieur à 1,0 lorsque la plaque revêtue est trainée sur une surface d'une plaque en fibres de verre non revêtue ayant une densité de 8,01 à 12,81 kg/m³ (0,5 à 0,8 livre par pied cube).
- 50 8. Plaque isolante telle que définie dans l'une quelconque des revendications 1 à 7, dans laquelle le revêtement a une épaisseur inférieure ou égale à $15,2 \times 10^{-6}$ mètre (0,6 millième de pouce).
- 55 9. Plaque isolante telle que définie dans la revendication 8, dans laquelle le revêtement a une épaisseur inférieure ou égale à $10,1 \times 10^{-6}$ mètre (0,4 millième de pouce).

