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(54) **Fiberglass fire barrier for mattresses**

(57) Provided is a mattress with a fire resistant layer, said layer being strategically placed in the mattress, preferably protecting its core materials, and comprises glass microfibers having an average diameter of less than 6 microns.

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The invention relates to open flame resistant mattresses and mattress foundations protected by a fire barrier comprised of microfiber fiberglass.

Description of the Related Art

[0002] The importance of preventing mattress fires in institutional settings has been recognized for many years, and a number of standards for flame retardance of these mattresses have been promulgated. A federal performance standard applicable to mattresses on a nationwide basis is codified in 16 CFR Part 1632 (Standard for Flammability of Mattresses and Mattress Pads), customarily referred to as the Cigarette Ignition Standard, the entire contents of which are incorporated herein by reference. However, even when mattresses meet the requirements of the Cigarette Ignition Standard, these can react with volatile and potentially deadly results when exposed to open-flame and smoldering ignition sources. The result can be a fire with sufficient energy to cause an average size room to reach a state of total instantaneous combustion or flashover. The California Bureau of Home Furnishings and Thermal Insulation has addressed the hazards associated with the ignition of mattresses in public institutions with California Technical Bulletin #129 (hereinafter 'TB 129'), published as a draft standard in 1992. It has since been adopted as a voluntary consensus standard by the American Society of Testing and Materials as ASTM E-1590 and the National Fire Protection Association (NFPA) as NFPA 267. (ASTM E-1590 and NFPA 267 use essentially the same test protocol as TB 129 but contain no failure criteria.) The standard has also been embodied in NFPA's Life Safety Code 2000, section 10.3.4, and in Underwriter's Laboratories' UL 1895.

[0003] Although hazards in public institutions have been addressed with standards based on TB 129, the number of injuries and fatalities associated with residential fires in which a mattress was the first item ignited or the mattress exacerbated the fire event has led to efforts to reduce flammability of mattresses used in homes. One notable event is the passage of Assembly Bill 603 in the California Legislature of Assembly. The bill calls for virtually all mattresses and sleep surfaces sold in the State of California, as of Jan. 1, 2004 to meet an open flame resistance standard. In addition, the Consumer Products Safety Commission is currently developing new regulations for further reducing mattress flammability beyond the level required by the Cigarette Ignition Standards. This was announced recently in the Federal Register (Advance Notice of Public Rule Making (ANPR) published Oct. 11, 2001)).

[0004] New standards for flammability of residential mattresses will require new materials and methods of manufacturing these, as mattresses targeted for residential markets differ significantly from those typically used in institutions. Institutional bedding installations typically require only a mattress and no foundation; mattress may be simply a solid core of polyurethane foam, which may be combustion modified to some degree as well. Many of the components used in institutional mattresses and sleep support surfaces, including fill materials and covering fabrics are subject to performance testing according to test criteria such as NFPA 701 and California Technical Bulletin No. 117.

[0005] In contrast to institutional bedding, residential sleep surfaces are typically covered and filled with a number of potentially volatile components, including polyurethane foam, highly combustible ticking fabrics, insulator padding, and pockets or cavities of air that can serve to feed an ignition source such as a candle, match, lighter, faulty electric socket, tipped over lamp or smoldering cigarette. For instance, pillow-top constructions feature additional layers of filling materials contained in layers on the panel surfaces, and set off aesthetically from the basic mattress design by gussets or seam lines in the case of the box-top approach. Gussets create thin lines of highly volatile fill materials and add more gaps and crevasses that can trap and concentrate heat and flame. A crowned/convex shape for the sleep surface or mattress panel also creates crevasses or voids between a mattress and foundation, again providing areas that can trap heat and flames and concentrates these on small areas. Also, the presence of a foundation does not provide an easy escape path for dissipation of heat across and beyond the bottom of the mattress. Super heating in the air cavity within the mattress and/or foundation can lead to what has been referred to as a flashover event.

[0006] One approach to reducing flammability of mattresses used in residential settings has been to treat fabrics used in their construction with chemical flame retardants. However, these chemical treatments may be objectionable because of distasteful odors which are noticeable when in close contact with the materials, offgassing obnoxious elements, stiffness of the fabric caused by such treatments, which may compromise the comfort of the finished mattress or mattress foundation, and the potential temporary durability of such treatments, which may compromise the long term protection from open-flame, smoldering ignition and radiant/thermal heat flux sources. Other attempts to reducing flammability of fabrics have been only partly successful, and there are no materials commercially available for use in mattress that can reduce flammability of a sleep set including a mattress and foundation to a level where the requirements of TB 129 can be met.

[0007] The use of fiberglass as a fire barrier material has been suggested. For example, U.S. Pat. No. 4,504,991, to Klancnik, relates to a fire-resistant mattress that includes a flame-retardant composite. The compos-

ite is a two-layered material, made up of a flame-retardant material that forms a char when exposed to fire and a layer of high tensile strength material. The flammable materials of the mattress are enclosed by the composite. In the single embodiment disclosed, the composite is made up of a neoprene foam bonded to a fiberglass fabric.

[0008] U.S. Pat. No. 4,092,752, to Dougan, relates to a mattress enclosed with a flame-retardant polyurethane foam having an optional layer of polyimide foam. The foam core is enclosed in a flame retardant cloth or retardant ticking, e.g., fiberglass cloth.

[0009] U.S. Pat. No. 4,801,493 to Ferziger et al., describes coated fiberglass fabrics which are fire retardant. The chemically coated fabric comprises a woven or nonwoven fiberglass fabric base to which one or more thin layers of a polymeric coating have been applied. The fiberglass fabric base is inherently fire retardant.

[0010] See also U.S. Pat. Nos. 4,866,799 and 6,823,548. Both of these patents relate to the use of a fire resistant barrier or shield in a mattress. The barrier or shield can comprise fiberglass.

[0011] However, none of these solutions is capable of imparting sufficient and consistent flame-retardant characteristics to the full breadth of styles and constructions of bedding typically used in the home, that is, a comfortable mattress placed atop a foundation, both containing a significant amount of flammable material. As a result, there is a need for new materials to protect residential mattress sets from fire, and especially for material in use in manufacturing mattress than can meet the more stringent flammability standards expected to be imposed on the residential market, such as TB 129. Also there is a need for providing comfortable bedding which is fire resistant. This is particularly true when using fiberglass, which can often result in itch.

SUMMARY OF THE INVENTION

[0012] The present invention provides a fire resistant layer for use in mattresses, and other furniture, which layer is comprised of glass microfibers. The glass microfibers are generally employed in a fire resistant layer strategically placed within the mattress or other item. In mattresses, the layer will generally be placed as a shield against an open flame reaching the core contents of the mattress, which are generally comprised of highly flammable materials.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] The fire resistant layer can be a single layer of primarily microfiber fiberglass, or a single layer of primarily microfiber fiberglass with a nonwoven or woven facer on one side, or a "sandwich" of woven or nonwoven fabric, e.g. such as a needlepunched or spunbond nonwoven, around a core of primarily microfiber fiberglass.

[0014] In a preferred embodiment, the fiberglass fire barrier layer of the invention will be comprised primarily of microfibers of fiberglass having an average fiber diameter between 0.2 microns and 6 microns, and more preferably less than 3 microns, and most preferably less than 1.0 micron. The most preferred diameter is between 0.5 and 1.0 micron average fiber diameter. The smaller microfibers are preferred for reasons of comfort. Biosoluble glass microfiber is also preferred.

[0015] The microfiber fiberglass nonwoven layer can be formed using a variety of conventional nonwoven processes. These include, but are not limited to air-laid, dry-laid or wet-laid processes. The processes form a fire-resistant nonwoven fabric. This fire-resistant fabric can also contain between 0% and 60% by weight of polymer, natural and/or glass fibers that are larger than 8 microns in diameter. It is preferred, however, that the fabric be an all glass product, and not preferably an all micro-fiberglass product.

[0016] The fire-resistant nonwoven can be either bonded or unbonded. For bonding, an organic binder, such as, but not limited to, urea formaldehyde, melamine or acrylic binders can be used. Also, an inorganic binder, such as, but not limited to, the bonding action of acid drying on glass fibers is an option. Unbonded fibers that are held together by the tangling of the fibers either with or without one or two facers for added strength or handleability can also be employed in another embodiment.

[0017] The fire resistant layer comprising the glass microfibers can further comprise a woven or non-woven substrate. The substrate can be a needlepunched or spunbond nonwoven fabric bonded on one or both sides of the fire resistant layer. These substrates can add comfort, tensile and tear strength to the fire resistant layer. The substrate can be of any suitable fiber, e.g., polyester.

[0018] The functionality of the fire-resistant nonwoven is to act as a barrier to inhibit fire and heat from an open flame such as a candle, match, cigarette lighter or the same from reaching the inside of the mattress. Typically the inside of a mattress is made of highly flammable material such as foam that will burn quickly and at high temperatures if exposed to an open flame and may spontaneously combust if enough heat is added. As noted above, the functionality of the outside woven or nonwoven substrates is to provide tensile and tear strength to allow the fire resistant layer fabric to be more easily stitched into a mattress in a standard construction and as a comfort layer to prohibit any potential skin irritation from operators during the manufacture of a bedding mattress.

[0019] A typical design approach for residential mattresses is to localize comfort elements, such as polyurethane foams and battings, in the sleep surface areas (panels), with a minimum of fabric in the borders or sides. Accordingly, the fire barrier fabric comprising the glass microfibers according to the present invention at least partially encloses the core of the mattress, and the core may be fully enclosed, if desired, as flame retardant per-

formance may be achieved without loft or thickness being so high as to hinder the ability of the mattress manufacturer to completely encapsulate the fuel load with the fire barrier fabric. In addition, the weight of the fire barrier layer and the composition of any outside substrate may be varied in order to address the burning and combustion challenges presented by a variety of mattress and mattress foundation designs. The fire barrier fabric having different compositions and weight may be used to cover different areas of the mattress or mattress foundation. For example, lighter weight and lower cost versions may be used as barriers for the horizontal surface area that is the panel or mattress top, while heavier weight and higher cost versions may be used to protect vertical surfaces, that is the borders or sides of the mattress for foundation. In general, design and financial resources for raw materials and assembly costs may be targeted to areas of the mattress and foundation that require a greater investment for fire protection. Also, the fire barrier fabric for the panel and/or border may be joined at the tape edge of the mattress with sewing thread specifically designed to withstand ignition, typically para-aramid or fiberglass sewing thread.

[0020] The fire barrier fabric may be placed under or disposed beneath a mattress ticking, but is generally never placed as the outermost layer. The fire barrier fabric may be simply placed adjacent to or in contact with the ticking using flame-retardant thread, or it may be bonded or attached to it. In particular, the fire barrier fabric may be conveniently quilted to the ticking, as mattresses for the residential market typically have decorative patterns stitched in the cover fabric or filling materials. This can be of benefit to mattress manufacturers, and only one feed position on quilting equipment may be required to add the fire barrier fabric during the quilting operation. Fire-retardant thread composed of the resistant fibers such as fiberglass or para-aramid may be used in the quilting operation.

[0021] The fire barrier fabric may also be designed to address variable flammability of any exterior cover by including fibers in that exterior woven or nonwoven substrates that provide structure to the char formed therefrom. This includes the stitching which may result in a point of weakness. Therefore, fibers that yield a char having structural integrity may be used to promote survival of the flame barrier.

[0022] Having thus described the invention in detail, it will be understood that such detail need not be strictly adhered to, but that additional changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

Claims

1. A mattress comprising a fire resistant layer of glass microfiber having an average diameter of less than 6 microns.

2. The mattress of claim 1, wherein the glass microfiber has an average diameter of less than 3 microns.

3. The mattress of claim 1, wherein the glass microfiber has an average diameter no greater than 1.0 micron.

4. The mattress of claim 1, wherein the fire resistant layer further comprises a woven or non-woven fabric on one or both sides of the layer.

5. The mattress of claim 4, wherein the fire resistant layer comprises a spunbond polyester fabric on at least one side.

6. The mattress of claim 4, wherein the fire resistant layer comprises a sandwich of woven or nonwoven fabric around a core comprised of glass microfiber.

7. The mattress of claim 5, wherein the polymer fabric is comprised of a polyester or polypropylene material.

8. The mattress of claim 5, wherein the polymer fabric is comprised of a spunbond polyester material.

9. Furniture comprising a fire resistant layer of glass microfiber having an average diameter of less than 6 microns.

10. The furniture of claim 9, wherein the glass microfiber has an average diameter no greater than 1.0 micron.

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EUROPEAN SEARCH REPORT

Application Number
EP 07 00 0295

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 5 840 413 A (KAJANDER RICHARD EMIL [US]) 24 November 1998 (1998-11-24) * abstract * * column 2, line 64 - column 3, line 42 * -----	1,4-9	INV. A47C27/00
Y	EP 1 602 304 A (HILL ROM SERVICES INC [US]) 7 December 2005 (2005-12-07) * abstract * * column 4, line 20 - column 4, line 30 * * figure 7 * -----	1,4-9	
Y	US 3 512 192 A (SIMON GEORGE) 19 May 1970 (1970-05-19) * column 3, line 40 - line 46 * -----	1,4	
Y	US 5 972 434 A (KAJANDER RICHARD EMIL [US]) 26 October 1999 (1999-10-26) * abstract * * column 7, line 14 - column 7, line 35 * -----	1	
Y	US 2003/054717 A1 (AHLUWALIA YOUNGER [US]) 20 March 2003 (2003-03-20) * abstract * * column 3, paragraph 21 * -----	1	TECHNICAL FIELDS SEARCHED (IPC) A47C C03C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 April 2007	MacCormick, Duncan

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 00 0295

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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