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# FLAME AND HEAT RESISTANT ASBESTOS TEXTILE BASE MATERIAL

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This invention relates to improved flame and heat resistant fabrics and more particularly to such type fabrics which possess resilience, flexibility, smooth ness of texture and increased tensile strength and thermal insulation qualities after being subjected to high temperature heat.

Flame and heat resistant fabrics in general have been commonplace for many years. For example it has been known that many type fabrics can be rendered flame resistant by impregnating the same with a composition consisting of a fire-proofing agent and a plasticizer. Moreover fabrics treated in such a manner usually exhibit flame-proofing characteristics. However, invariably such fabrics have as a direct result of this flame-proofing treatment, likewise manifested several most undesirable qualities which were not present in the fabric before treatment. Heretofore such fabrics have, after treatment, been characterized by a loss of flexibility or resilience, and moreover a lack of ability in the fabric to slip over itself in folding or turning operations. This latter advantage may be designated for purposes of convenient description as a lack of smoothness of texture in the fabric. The importance of eliminating these difficulties in the finished fabric is readily realized when it is understood that such fabrics have widespread utility in the field of safety garments, such as flame-proof gloves, where loss of flexibility or lack of ability of the fabric to slip or slide over itself presents insurmountable hazards in the fabrication processes. Moreover fabrics of this type have in the past been characterized by a relatively large percentage weight loss upon exposure to the high temperatures incident to their normal conditions of use. This loss has been due to the rather high rate of volatilization or decomposition of the flame-proofing ingredients at red heat temperatures and is known as ignition loss. Trade requirements today demand that asbestos textiles meet a minimum ignition loss standard and hence the disadvantage of the aforedescribed inherent characteristic of presently known flame-proofing materials will be apparent.

In accordance with the present invention these and other disadvantages can be overcome by providing an asbestos base material impregnated with a flame-proofing composition resulting from a treating solution comprising a mixture of flame retardent, inert texture-imparting agent, plasticizer and water. The plasticizer is designed to retain in the fabric the softness and resiliency which ordinarily would in part be destroyed by the introduction thereto of the flame retardent. The texture-imparting agent on the other hand acts partly in the nature of a dry lubricant and serves to retain in the fabric the ability to slide over itself during folding and turning operations which normally would likewise be inhibited by the action of the flame-proofing agent. This texture-imparting agent is an indispensable element of the invention and comprises an inert material such as finely ground mica. In practical effect this ingredient serves to blend the flame retardent and plasticizer into a mixture which, when applied to an asbestos textile, not only imparts thereto the necessary flame-proofing characteristic but also maintains the fabric's original and desirable properties of flexibility and smoothness of texture.



Asbestos textile materials, such as are contemplated herein, are commonly formed primarily of asbestos fibres in combination with a lesser amount of cotton fibres which latter enhance the flexibility and softness of the fabric. A preferred embodiment of the invention hereof comprises an asbestos fabric of approximately 83% asbestos and 17% cotton by weight impregnated with a flame-proofing composition resulting from a treating solution consisting essentially of by weight about 100 parts of water, about 9.1 parts of a flame retardent, about 7 parts of a texture-imparting agent, and about 3 parts of a plasticizer. A typical example of one such preferred treating solution is as follows:

*Example 1*

| | |
|---|---|
| Water | 100.0 parts. |
| Flame retardent: | |
| Borax | 4.4 parts. |
| Ammonium chloride | 4.4 parts. |
| Deceresol P (wetting agent) | 0.3 parts. |
| Texture-imparting agent: Mica (finely ground) | 7.0 parts. |
| Plasticizer: | |
| Tricresyl phosphate (85%) | 3.0 emulsion. |
| Water (10%) | |
| Diglycol stearate (emulsifying agent) (5%) | |

The proportions of the various ingredients of the treating solution can of course be varied within certain limits while still effecting the objects of this invention. The preferred range of composition by weight of this treating solution is for 100 parts water: 8 to 24 parts flame retardent; 6 to 10 parts texture-imparting agent; and 2 to 5 parts plasticizer. Typical examples of especially useful analyses within this range are:

*Example 2*

| | |
|---|---|
| Water | 100.0 parts. |
| Flame retardent: | |
| Ammonium borate | 9.0 parts. |
| Deceresol P (wetting agent) | 0.3 parts. |
| Texture imparting agent: Mica (finely ground) | 6.5 parts. |
| Plasticizer: | |
| Tricresyl phosphate (85%) | 4.0 emulsion. |
| Water (10%) | |
| Diglycol stearate (emulsifying agent) (5%) | |

*Example 3*

| | Parts |
|---|---|
| Water | 100.0 |
| Flame retardent: | |
| Borax | 5.5 |
| Boric acid | 5.5 |
| Deceresol P (wetting agent) | 0.3 |
| Texture imparting agent: Mica (finely ground) | 7.0 |
| Plasticizer (propylene glycol) | 2.5 |


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*Example 4*

| | Parts |
|---|---|
| Water | 100.0 |
| Flame retardent: | |
| Borax | 4.4 |
| Ammonium chloride | 4.4 |
| Deceresol P (wetting agent) | 0.3 |
| Texture imparting agent: Mica (finely ground) | 7.0 |
| Plasticizer (triphenyl phosphate) | 3.0 |

*Example 5*

| | |
|---|---|
| Water | 100.0 parts. |
| Flame retardent: | |
| Antimony oxide (finely ground) | 13.5 parts. |
| Zinc borate (finely ground) | 6.5 parts. |
| Deceresol P (wetting agent) | 0.3 part. |
| Texture imparting agent: Mica (finely ground) | 7.0 parts. |
| Plasticizer: | |
| Tricresyl phosphate (85%) / Water (10%) / Diglycol stearate (emulsifying agent) (5%) | 3.0 emulsion. |

In all of the above examples deceresol P has been included as the wetting agent for the particular flame retardent used for illustrative purposes only and it should be noted that many other well known wetting agents in approximately the same amount, are interchangeable in these formulas. Among such wetting agents are those sold under the names of "Aerosol," "Sulfatale," "Wetonal," "Duponol," "Tergitol" and many others. Similarly it should be noted that while diglycol stearate is given as the emulsifying agent for tricresyl phosphate, other well known emulsifying agents in approximately the same amount may be used to equal advantage. Among these are those sold under the names of "Tergitol NPX," "Emulgar A" and others.

The method of treating the fabric comprises the steps of first placing the proper weights as above set forth, of flame retardent, texture-imparting agent and plasticizer in a diptank and then adding hot water thereto while maintaining a vigorous stirring action. When approximately one-third of the proper water content has been added, the ingredients will be dissolved with exception of the mica which remains in suspension. The remaining water content which may be cold water, is then added and the fabric is run through the tank in such manner as to accomplish total immersion thereof. During this period the treating solution is maintained in constant agitation by means of any well known type of recirculating pump. Following immersion the asbestos fabric is then run through a pair of squeeze rolls, preferably formed of neoprene or rubber. This last step removes the excess of treatment solution and leaves the fabric impregnated with the flame-proofing composition. Such a process results in the fine particles of the texture-imparting agent, in this specific example mica, along with the flame retardent and plasticizer, becoming impregnated in the voids between the fibres of the fabric, where they remain after treatment due to the cementing action of the plasticizer and flame retardent. This impregnation of the mica occurs even though the same is only in suspension in the treating solution because of the minute size of the particles thereof and the inherent fibre structure of asbestos fabrics.

In the resulting fabric the flame retardent of course renders the same flame-proof while the plasticizer maintains flexibility and resiliency without increasing its flammability. The mica imparts smoothness to the finished fabric, as described above and renders body to that fabric. In this regard mica in finely ground form is especially satisfactory since it is inherently slick and its tiny particles slide easily over one another much in the same manner as does graphite. Moreover, when used in the combination herein set forth, it increases the tensile strength of the finished fabric after the same has been subjected to heat at relatively high temperatures. Furthermore it increases the heat resistance of the fabric and also its thermal insulating properties. Being of an inert nature, this texture-imparting agent will not readily volatilize when subjected to flame heat and hence has an extremely low ignition loss. On the other hand the constituent elements of the flame retardent and plasticizer, such as borax, ammonium chloride, tricresyl phosphate etc., have a relatively high ignition loss. Therefore if these latter ingredients were to be used without the inert texture-imparting agent the overall ignition loss of the fabric would be quite high but when the mica is added in the proportions specified that overall ignition loss is reduced by as much as 60–70%. Thus in an asbestos textile fabric treated according to the invention their weight reduction due to ignition loss is only about 2.5 to 3.8% whereas a similar asbestos fabric treated solely by a flame retardent and plasticizer will show a reduction of from 5 to 9%.



While I have described my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications, without departing from the spirit thereof, and therefore, only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What is claimed and desired to be secured by Letters Patent, is:

1. A flame and heat resistant fabric characterized by smoothness of texture and by low overall ignition loss after being subjected to high temperatures and being flexible and resilient, comprising an asbestos textile base material impregnated with a flame proofing composition comprising an inorganic flame retardant, a plasticizer and mica in finely divided form.

2. A flame and heat resistant fabric comprising an asbestos textile base material impregnated with a flame-proofing composition comprising an inorganic flame retardent, a plasticizer and mica in finely ground form, the ratio of flame retardent to mica content being about 1.3:1 by weight, and the ratio of plasticizer to mica content being about 0.43:1, said fabric being characterized by a smoothness of texture and by a low over-all ignition loss after being subjected to high temperatures and being flexible and resilient.

3. A flame and heat resistant fabric comprising an asbestos textile base material impregnated with a flame-proofing composition comprising an inorganic flame retardent, a plasticizer, and mica in finely ground form, the ratio of flame retardent to mica content being from about 0.8:1 to 4:1 by weight, the ratio of plasticizer to mica content being from about 0.2:1 to 0.83:1, said fabric being characterized by a smoothness of texture and by a low over-all ignition loss after being subjected to high temperatures and being flexible and resilient.

4. A flame and heat resistant fabric as set forth in claim 3 wherein the flame retardant comprises substantially equal weights of borax and ammonium chloride.

5. A flame and heat resistant fabric as set forth in claim 3 wherein the flame retardant comprises ammonium borate.

6. A flame and heat resistant fabric as set forth in claim 3 wherein the flame retardant comprises borax and boric acid.

7. A flame and heat resistant fabric as set forth in claim 3 wherein the flame retardant comprises antimony oxide and zinc borate.

8. A flame and heat resistant fabric comprising an asbestos textile base material impregnated with a flame proofing composition comprising about 35–75% of an inorganic flame retardant, about 5.5–26% of a plasticizer and about 17–50% of finely ground mica, said fabric being characterized by a smoothness of texture and by a

low overall ignition loss after being subjected to high temperatures and being flexible and resilient.


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