

1

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RADIATION RESISTANT FABRIC

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4 Claims. (Cl. 117—71)

This invention relates to means and methods of treating fabrics to make them resistant to radiation.

This application is a continuation-in-part of my prior application of the same title filed Sept. 29, 1953, S. N. 383,144, now abandoned.

In the present atomic age, there is a great need for a means to treat fabrics to make them resistant to radiation. By fabrics, we mean primarily clothes, draperies, curtains and the like. There has never been a need before for radiation resistant fabrics for general public use, and the closest approach to the problem heretofore has been the bulky aprons and coats worn by atomic energy technicians and X-ray technicians. However, such heavy and bulky protective covering is not suitable for the general protection of the public against electromagnetic alpha, beta and gamma radiation or radioactive particles in the air, water, or dust caused by alpha, beta and gamma rays.

A primary requirement of such radiation resistant fabrics is that they be light weight, and shall not affect the appearance of the garments. Otherwise, according to the well known rules of human nature, people will not use the material and hence, will not have any resistant protection against the initial instantaneous blast of radiation. The protection against the initial blast is the important factor since in a matter of minutes, people can run to the nearest shelter. However, they will not be protected against the initial blast unless they are provided with protective light-weight garments of a conventional appearance.

The primary problem in designing such garments is to apply a radiation resistant treatment which will leave the material malleable, that is, permitted to be twisted and turned without damaging or malforming the material or creating unsightly wrinkles or stretching of the material.

Also, the material applied must be light enough so that it will not be too heavy to wear. The treatment of the present invention adds only 1.6 ounces per yard or approximately four to six ounces for a dress or a suit of clothes.

Another requirement is that the composition applied will not be removed by dry cleaning.

This invention is a protective composition which is applied during the dyeing and finishing processes of fabrics. This protective composition resists alpha, beta and gamma radioactive particles of matter in the air, in water, fire or dust, and therefore in the treatment of fabrics with the composition a resistance to radioactive rays and particles is produced.

Radiation or radioactive particles have previously penetrated all known matter except that which is heavily coated with lead, or that substance or matter at too great a distance from the center of radiation. The present radiation resistant composition allows a comparatively light substance or material, for instance fabrics, to resist the radioactive particles of air, dust, water or fire by known and pre-determined degrees of safety.

2

Accordingly, a principal object of the invention is to provide new and improved radiation resistant material.

Another object of the invention is to provide a method and process for making fabric resistant to radiation from alpha, beta and gamma rays.

Another object is to provide a radiation resistant method and process.

Another object is to provide a radiation resistant fabric that is light weight and that does not affect the appearance of the fabric.

Another object is to provide a method and process for radiation resistance which may be applied without burning or otherwise damaging fabric.

Another object is to provide a radiation resistant fabric which is light weight and can be crinkled without causing any damage to the fabric or to its appearance.

Another object is to provide a method and process for coating fabric with at least one sub-base and then coating said treated fabric with a liquid solution of lead mixed with a material for conditioning the lead so that it may be coated at a temperature which will not damage or burn the fabric.

The treatment of the present invention preferably comprises the following primary steps:

1. The fabric is treated with a sub-base treatment which may be a conventional durable water repellent solution.

2. The fabric is treated with a durable fire resistant solution, which may be conventional as an additional sub-base.

3. The treated fabric is then coated with a liquid solution of lead mixed with a material for conditioning the lead to be coated at a temperature which will not damage or burn the fabric.

This last step is the heart of the process and solves the greatest problem. After extensive experimentation, a method has been found which will be more specifically described hereafter which will permit a solution containing lead to be coated on to the fabric in such a manner and at such a temperature that any conventional fabric may be so sprayed without burning or damaging the fabric.

The foregoing steps will now be described in greater detail as follows:

1. *Saturate with water repellent solution.*—The water repellent solution is applied by dipping the fabric for 20 to 30 seconds at a temperature 140° to 170° (all temperatures mentioned are Fahrenheit). This solution may comprise a conventional durable water repellent solution obtainable from any of the major chemical suppliers. This solution may comprise a wax such as pyromene mixed in conjunction with aluminum acetate. The fabric is then damp dried and cured for about five minutes in continuous curing oven of 300° to 320° (Fahrenheit).

2. *Saturate with flame and fire resistant solution.*—This is done by dipping the fabric for approximately 2 minutes in a flame and fire resistant solution at 110° to 120° (Fahrenheit). The fire resistant solution may be one commercially available such as Pyroset DO, Anti-Pyromene or Retarfire.

The fabric is then cured in continuous running oven of approximately 320° for about 3½ minutes. Where the material is being run on an assembly line basis in large quantities, the ovens mentioned in the present discussion may be those conventionally used in the industry for drying and curing a moving ribbon of material.

3. *Coat with leaded solution.*—A preferable solution and one which has been successfully used is lead sulphur dioxide with a bonding agent of glucovinyl resinate.

The bonding agent of glucovinyl resinate is a resin type of polyamide or carbamide (synthetic urea). There are

many binders that can be used and the use of them is dependent on the type of fibre the fabric is composed of.

The bonding agents used such as the resin type or the vinyl co-polymer may vary in their solid contents from 15% to 55% depending on the fabric used. For example on viscose or acetate the solid content is 45%.

In one coating application, the material is run past a coating knife at a moderate speed which is not critical. The important problem in this portion of the process is to condition the lead so that it will be conveniently coated and still not be at such a high temperature that it will burn up or damage the fabric. In the solution used and preferably recommended, namely one containing lead, sulphur dioxide and aluminum, it has been found that the coating operation may be performed at a temperature of 70° to 90°, which is considerably below the melting point of lead.

The leaded solution is coated by means of stationary knife coating the solution on the fabric. The fabric is then cured passing over a series of drums or cans each with a different temperature starting about 100 degrees Fahrenheit and building up to approximately 320 degrees Fahrenheit. The cans or drums then gradually cool the fabric to the low of 10 to 20 degrees Fahrenheit. This curing and setting operation is done at different speeds depending upon the weight of the fabric being coated and the number of coatings being applied.

The time for this step is approximately 30 seconds to 3 minutes, depending on the particular application.

Should very heavy fabrics be coated an additional predrying step is necessary and this is the arranging of a gas or electric range directly after the coating operation before going over the set of cans or drums.

The leaded solution is prepared by melting the lead and adding sulphur dioxide in the proportions of substantially 80% lead and 12% sulphur dioxide, 8% aluminum by weight. It has been found that the solution will remain sufficiently liquid for a coating operation after it cools to a temperature of 60° to 80° (Fahrenheit).

Several coats or laminations of the leaded solution may be applied and the radiation resistance is proportional to the number of coats or laminations.

In another solution of lead sulphur dioxide with the bonding agent of glucovinyl resinate a quantity of very small glass particles in the form of spheres are added in suspension. This coating adds bulk to the fabric and can be successfully used in industrial cases where protection is necessary from the radiation caused by atom releases. This insures the reflectivity to radiation.

The limitations to the number of coats is first the weight, and second, the stiffness. It has been found that each coat will weigh about 1.6 ounces per yard so that from the weight standpoint, it is not practical to add more than 2 or 3 coats. The leaded solution is applied

to the inside of the material and so does not affect the outside appearance.

The flexibility is also proportional to the number of coats. For instance, after 5 coats the material would attain the stiffness of cardboard and would not be used for clothing without adding joints at the movable parts such as the shoulders and elbows. Therefore, it is not too practical to add more than 2 or 3 coats from the flexible requirement.

In a particular embodiment of the invention, the following alpha, beta and gamma radiation resistance have been measured:

Distance	No. of Coats	Radiation Rejection, Percent
1 mile.....	1 coat.....	45
1/4 mile.....	1 coat.....	20
1 mile.....	2 coats.....	60
1/4 mile.....	2 coats.....	30

where distance is that from the center of the radiation. The measurements were performed in a laboratory under simulated conditions.

I claim:

1. A method of producing radiation resistant fabric comprising the steps of: water proofing and fire proofing said fabric for protecting said fabric against the subsequent process step, and spraying said treated fabric with a solution of lead sulphur dioxide containing approximately 80% lead and 12% sulphur dioxide and 8% aluminum by weight.

2. A method of producing radiation resistant fabric comprising the steps of: water proofing said fabric for protecting said fabric against the subsequent process step, and spraying said treated fabric with a solution of lead sulphur dioxide containing approximately 80% lead and 12% sulphur dioxide and 8% aluminum by weight.

3. A method of producing radiation resistant fabric comprising the steps of: fire proofing said fabric for protecting said fabric against the subsequent process step, and spraying said treated fabric with a solution of lead sulphur dioxide containing approximately 80% lead and 12% sulphur dioxide and 8% aluminum by weight.

4. A method of producing radiation resistant fabric comprising the steps of: water proofing said fabric for protecting said fabric against the subsequent process step, and spraying said treated fabric with a solution of lead sulphur dioxide containing approximately 80% lead and 12% sulphur dioxide and 8% aluminum by weight, and a bonding agent of glucovinyl resinate.

No references cited.