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Kupferman

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[54] **WETTABLE FIRE FIGHTERS' GARMENT**

[75] Inventor: **Zelig Kupferman,** Framingham, Mass.

[73] Assignee: **The United States of America as represented by the Secretary of the Navy,** Washington, D.C.

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[52] **U.S. Cl.** ..... **2/81;** 2/2.1 A; 428/110; 428/234; 428/247; 428/255; 428/282; 428/286; 428/300; 428/920

[51] **Int. Cl.²** **A41D 31/02**

[58] **Field of Search** ..... 161/89, 154, 155, 156, 161/80, 81, 82, 153, 403; 2/81, 2.1 A; 428/234, 110, 247, 255, 282, 286, 300

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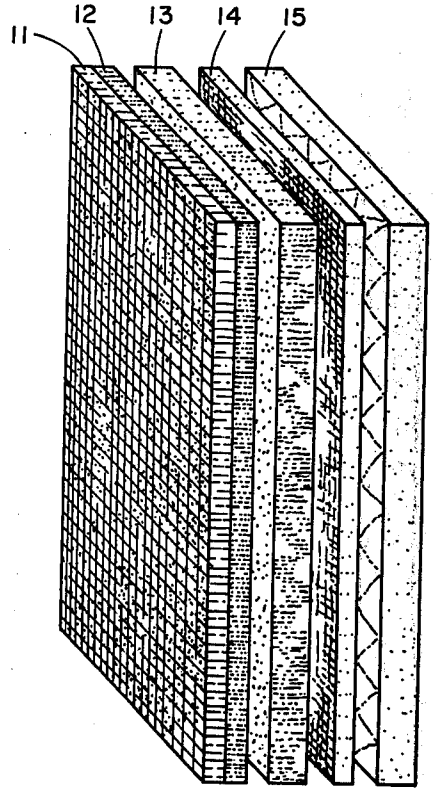
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Primary Examiner—George F. Lesmes
Assistant Examiner—James J. Bell
Attorney, Agent, or Firm—Sciascia, R. S.; C. E. Vautrain, Jr.

[57] **ABSTRACT**

A non-reflective, wettable fire fighters' suit is described which provides protection against flames and heat by wetting the suit thoroughly before entry into a fire zone and thereafter periodically spraying the suit with extinguishing agent to maintain the protection for an extended time in the fire zone.

3 Claims, 2 Drawing Figures



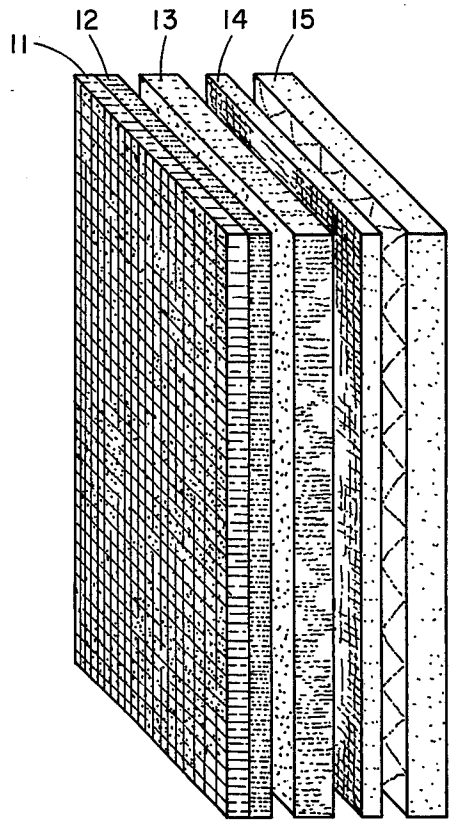


Fig. 1

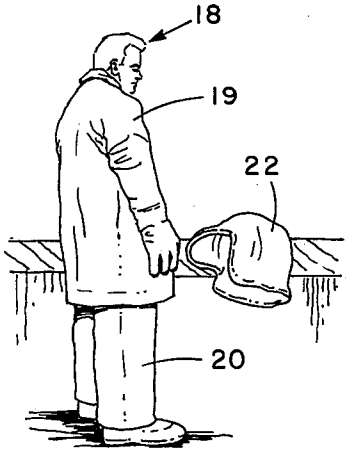


Fig. 2

WETTABLE FIRE FIGHTERS' GARMENT

This invention concerns fire fighters' clothing and, more particularly, a wettable fire fighters' suit which permits the wearer to remain in close proximity to a fire for a significant period of time.

Fire fighters' garments in use at the present time are either the structural type of garment which is generally used by city and town firemen to furnish protection from water, flying embers and a moderate amount of heat, and proximity fire fighters' clothing which provides protection through the highly reflective aluminized surface of an outer shell fabric.

In the structural garment, the outer shell is made of materials that repel water and resist flames, while the inner lining fabrics provide additional protection from heat transmission. The outer shell materials conventionally are a tightly woven fabric or a rubber neoprene or hypalon coated base fabric. When a porous woven fabric is used for the outer shell, a vapor barrier material, usually a thin light-weight coated fabric, is placed directly behind it. In addition, behind these material systems is usually found an additional removable woolen liner. These garments, made to protect the fireman against structural fires, would be badly charred if worn in close proximity to gasoline, jet fuel, or oil fires of 1 to 2 cal/cm^2-sec.

The aluminized proximity fire fighters' garment is generally used where very high heat fluxes are encountered. The aluminized surface thereof is most often laminated to flame-proof fabrics such as asbestos or glass. In addition, a coated vapor barrier fabric, to protect against steam penetration, and about a ¼ inch thick wool fabric insulator are disposed behind the outer shell. The heat protection afforded by a new reflective aluminized surface is significantly reduced by soiling, extinguishing agent, and normal wear abrasion without the wearer realizing it. Even though soiled aluminized garments might not show any outward signs of degradation when exposed to heat fluxes as high as 2.0 cal/cm^2-sec, the fire fighter would be forced to retreat from the fire before he completes his mission. Otherwise he will suffer severe burns.

The present invention provides a water wettable, fibrous fabric, fire fighters' heat protective garment for use in close proximity to and for short period emergency entry into gasoline, jet fuel, etc. fires which avoids the disadvantages and deficiencies of the conventional structural and aluminized proximity fire fighters' garment.

Protection is afforded by the present fire fighters' heat protective garment by providing a non-reflective, wettable suit which comprises an outer lining of fire-resistant fabric needle-punched together with an adjacent layer of water absorbtive batt to allow capillary action, a next layer of water absorbtive batt, needle-punched, or felt material to retain the water carried to it, a next layer of a hydrostatic resistant coated fabric to form a vapor barrier, and a heat insulating inner layer which could be a woven or non-woven fabric or quilted batt made from any fiber so desired. The suit is thoroughly wetted before entry into the fire zone and, thereafter, periodical spraying of the suit with extinguishing agent maintains protection. The suit is reusable substantially indefinitely.

Accordingly, it is an object of the present invention to provide a fire fighters' protective garment which will

afford protection from the intense heat of gasoline, jet fuel, and oil fires while fighting these fires or performing rescue missions.

Another object of the inventions is to provide a fire fighters' protective garment which may be used in close proximity to and for short period emergency entry into gasoline, jet fuel and similar fires.

A further object of the invention is to provide a garment for fire fighters which is reusable substantially indefinitely.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description thereof when considered in conjunction with the accompanying drawing in which like numerals represent like parts throughout and wherein:

FIG. 1 is an exploded perspective view of the elements comprising the present fire fighters' protection garment; and

FIG. 2 is a perspective view showing a fire fighter wearing a garment made according to the present invention.

Referring to FIG. 1, an enlarged sectional view of the fabric components comprising the invention is presented which include an outer shield 11 of open weave, flame-resistant type fabric, an adjacent water transfer non-woven fabric 12 which preferably is joined separately to fabric 11 before being formed in the assembly of fabrics, a next adjacent water absorbent non-woven reservoir layer 13, a vapor barrier 14, and an inner insulation lining 15.

Outer shield 11 and capillary transfer fabric 12 provide a flame-resistant couple which transmits or conveys by capillary action externally applied water to the interior fabrics of the assembly. Fabric 11 preferably is an open weave, fire retardant fabric which is strong enough to resist abrasion and tearing. It can be made from commercially available flame-resistant material such as naturally water absorbent wool and asbestos fibers. The fabric used characteristically should have a fairly open and porous structure to promote rapid wicking of the water or other liquid through it to the additional wettable layers in the interior of the assembly. The rapid transfer of liquid is an important feature of the invention and affords the wearer protection from heat exposures of approximately 0.8 cal/cm^2-sec for a period of at least 3 minutes without additional wetting. Fabric 12 preferably is made of a water absorbent fibrous material such as a 7 oz rayon batt which is needle-punched to fabric 11 to such an extent that the two fabrics are permanently interlocked, with the rayon fibers of fabric 12 protruding through and lying on the surface of outer shell fabric 11. Combining fabric 11 and 12 in the manner described provides a capillary water or other liquid transfer system so that a 2-second spray of water or extinguishing agent from a fire hose, on both the front and back of the garment, will completely and thoroughly wet-out the garment, creating an effective thermal shield.

The next adjacent inner layer of the garment, fabric 13, is a controlled water absorbent, needle-punched flame resistant fibrous felt which serves as a water reservoir for the system. Fabric layer 13 preferably is an intimate blend of 50/50 wool-rayon needle-punched felt whose weight and thickness is determined by the additional amount of heat absorbing water considered essential to protect the wearer of the garment. Fabric 13 rapidly absorbs the excess water from the outer fabric and acts as a water reservoir, returning the water

to the surface of fabric **11** when called for.

Fabric **14** preferably is a light weight, flame resistant, vapor impermeable barrier fabric which may be neoprene coated if desired. The function of this fabric is to stop hot vapors such as steam from penetrating to the wearer of the garment. Fabric **13** may be a commercially available 2-ounce nylon taffeta fabric which is coated with fire resistant neoprene on its outer surface.

Against the wearer is an additional inner lining, fabric **15**, whose weight and thickness also are determined by the protection desired. One such inner lining may be composed of ¼ inch thick fiber batt or needle-punched felt quilted to rayon or to other types of lining fabrics.

FIG. **2** shows a fire fighter **18** wearing a jacket **19** and trousers **20** of a garment made of the foregoing composite materials for display purposes. A hood **22** also is shown. In use, a fire fighter wearing a suit made of the foregoing materials first exposes himself to a spray of water or extinguishing agent from a fire hose, both in the front and back, until the garment is thoroughly wetted out. Normally a 2-second spray is sufficient to completely wet-out the garment front and back. The fire fighter may now approach a fire and will be protected from the heat of the fire as long as the suit remains wetted out. Periodically, additional spraying of water or foam on the suit will assure a continuance of this protection.

The heat protective action of the wettable fire fighters' garment is achieved according to the ablation principle. That is, heat energy from the fire changes the water into steam which is in turn vaporized off from the outer fabric surface. As long as water remains close to the surface of the outer shell fabric and continues to absorb heat energy, the fabric assembly of the invention will not char or flame and will effectively block the heat from being conducted through the assembly to and burning the wearer.

Fire fighters' garments made from the fabric assembly of the present invention thus provide a substantially unchanging high level of heat protection notwithstanding the number of times the garment is reused. There is no requirement that an external mirror surface be constantly maintained unsoiled and substantially without abrasion. Experimental use of the present garment has demonstrated no noticeable effect on its heat protective properties because of soiling, which constitutes a considerable improvement over reflective type garments which can lose up to two-thirds of their original heat protection time due to soiling and/or abrasion. A fire fighters' suit made according to the present invention has been found to be more comfortable than existing suits intended for the same purpose. The present suit is of moderate weight; it is not bulky, and it is easy to maneuver in.

The approximate weight of a typical suit before being thoroughly wetted is 13 pounds, while the approximate weight after being wetted is 31 pounds. The latter figure is that obtained at the completion of a test in a simulated fire environment. The material used in the suit has been found to have excellent heat resistant properties, however, it has been noted that the suit must be thoroughly wetted down before being subjected to severe heat since charring may occur in portions of the suit where there has been only slight wetting.

Accordingly, the present invention permits a fire fighter to remain close to and in the fire area for much longer periods of time than was possible with existing garments. It provides confidence in the wearer since he can feel or sense the addition of protective water or extinguishing agent during his tenure in the fire area, and it provides a suit which may be reused substantially indefinitely, thereby reducing the expenditures of public funds for garments for the use intended.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings; for example, the materials may be substantially altered to take into account the individual needs of different fire fighting services and changes can be made in weight, thickness, and percentage water pick-up. Also, the materials can be so handled that many kinds of design changes in the garment can be made to satisfy the individual needs of the fire services.

What is claimed:

1. A non-reflective wettable fire fighters' suit for use in close proximity to and for brief emergency entry into fires where high heat fluxes are encountered comprising:

a plurality of layers of material assembled in suit form,

said layers including an outer heat shield made of an open weave flame resistant fabric;

a next adjacent inner layer made of a fibrous batt having a capability of substantially instantaneously passing water therethrough,

said batt being needled-punched to the open weave fabric so that the two fabrics are permanently interlocked;

a next adjacent inner layer made of a water absorbent fibrous felt material to act as a water reservoir and provide for the capillary transfer of water received through said outer heat shield and said fibrous batt;

a next adjacent inner layer made of a coated flame resistant nylon fabric to provide a barrier substantially impermeable to gas and liquids; and

a next adjacent inner quilted fabric lining made of insulating material to protect the wearer from the conductive heat of a fire after first having said garment saturated with water and thereafter periodically wetted while in close proximity to the fire, whereby a person wearing the garment may closely approach a fire and remain in close proximity thereto for brief periods of time.

2. The garment as defined in claim **1** wherein the next adjacent water absorbent layer is varied in thickness to absorb the desired amount of water and to provide a time control for the escape thereof in the form of vapor,

said layer not bound to the fabric on either side of it.

3. The garment as defined in claim **2** wherein said outermost layer is made of wool,

said next adjacent layer is made of rayon,

said next adjacent layer is made of an intimate 50/50 blend of rayon and wool,

said next adjacent layer is made of nylon taffeta and is coated with neoprene on its outer surface, and

said next adjacent layer is made of quilted rayon-wool.

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