Feb. 16, 1965 JIRO TACHIBANA 3,169,298

METHOD OF PRODUCING LIFE SAVING APPAREL

Filed Feb. 1, 1961

Fig. 1.

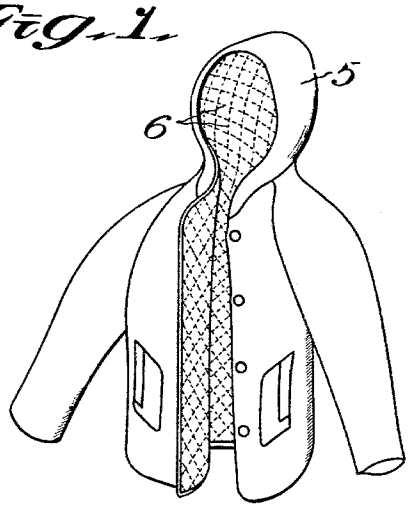


Fig. 2.

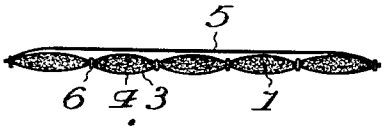
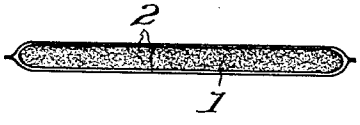


Fig. 3.



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METHOD OF PRODUCING LIFE SAVING APPAREL

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3 Claims. (Cl. 28—75)

This invention relates to life saving apparel and articles of the buoyant type for saving lives of persons in distress in water, and more particularly it relates to a new and improved method of producing such apparel and articles.

It is common knowledge in the art that such fibers as kapok (the term kapok is used herein to denoted kapok and related fibers) are characterized by hollow fiber structure which has extremely low specific gravity (0.3 to 0.5) and a buoyant force in water of from 20 to 30 times its own weight. Accordingly, such fibers have been conventionally used as filling material for life saving articles.

However, it is also known from results of experiments that raw fiber of kapok in its original state is not infallible under all conditions of marine life saving. That is, while the buoyant character of raw kapok fiber is certain for fresh water, if heavy oil, gasoline, or any animal, vegetable, or mineral oil is floating on the water, the kapok, having no impervious resistance against such substances, is impregnated by them and water instantaneously or in a short time and sinks in the water.

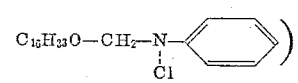
Even if the kapok layer is enveloped by a covering of oil-proof material, any damage to the said covering due to impact or abrasion will cause sinking due to absorption of oil and water as described above. Accordingly, the use of kapok and like fibres in the conventional form will be accompanied by the risk of failure in waters containing the above-mentioned oils.

It is an essential object of the present invention, therefore, to provide a method of producing life saving apparel and articles which do not have the great disadvantage mentioned above.

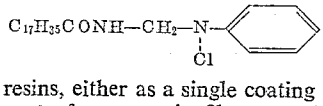
It is another object of the invention to provide a method as above-mentioned whereby comfortable and useful articles of apparel may be made effectively buoyant to save lives in times of emergency.

The details of the invention and the manner in which the foregoing as well as other objects and advantages may best be achieved will be understood more fully from a consideration of the following description and examples.

The method of the present invention in its initial and prerequisite aspect relates to the treatment of kapok fiber with the purpose of rendering it completely water-proof and oil-proof and comprises resin treatement with water-proof, oil-proof resins, for example, silicone, Velan (a trade designation of Imperial Chemical Industries described in British Patent No. 475,170 and having the formula



resins disclosed in U.S. Patent No. 2,386,631 and having the formula



and fluorine resins, either as a single coating or as several coatings, so as to form a resin film over the surface of the short fibers of kapok.

In the second aspect of the method of the invention, kapok fiber which has been resin treated as described above is used by itself or mixed with at least one kind of other fibers such as synthetic fibers and natural fibers, which have also been resin treated in the same manner

as the kapok fiber, and utilized to provide the principal buoyant body in the manufacture of various kinds of life saving apparel and articles, important examples of which are described below.

(A) Conventional life saving apparel and articles made to be filled with the above-described resin-treated kapok or mixed fiber. (Examples: life belts, light rafts.)

(B) Life saving apparel made by knitting or weaving the said resin-treated kapok or mixed fiber in spun yarn form or sliver form. (Examples: life jackets, vests, blankets.)

(C) Formed articles made of the said resin-treated kapok or mixed fiber as the principal basic material. (Examples: quilts, mattresses.)

(D) Various life saving apparel and articles made by enveloping and sealing the packed, knitted or woven, or formed bodies of resin-treated kapok or mixed fibers, as described in A, B, and C above with water-proof, oil-proof, resin film (for example: vinyl, polyethylene).

(E) Various life saving apparel and articles made by further enveloping the articles described in D above with impact-resistant, wear-resistant, and oil-proof fabric, non-fabric sheeting, or resin leather.

Further details of the invention will be apparent from a consideration of the following specific examples.

Example 1

Raw kapok fiber is opened in an opener of the Fearnought type. Onto the opened kapok which is blown out of the outlet of the opener, a 1.2 percent aqueous solution of silicone resin is sprayed so as to result in a 100 percent depositing thereof with respect to the weight of the kapok. The sprayed kapok is then predried in a dryer at a temperature of 80° C. After sufficient drying, the said kapok is cured for 5 minutes at 120° C. in a heat-treatment chamber.

Separately, rayon staple is steeped for 30 minutes in a 3 percent aqueous solution of silicone resin. The staple is then placed in a wringer, and the solution is wrung out until the remaining solution quantity is 120 percent relative to the weight of the staple, after which the staple is subjected to the predrying and curing processes described above.

The above-described, silicone-treated kapok and staple are suitably mixed by hand with a mixture proportion by weight of 70 percent of kapok and 30 percent of staple, then the mixture is run through a machine of the Fearnought type and further mixed. After thorough mixing, the mixed fiber is processed at a rate of 4 kilograms per hour in a 50-inch-width carding machine for wool spinning, with a cylinder speed of 120 to 130 r.p.m., and the said mixed fiber is taken out as a sliver.

The sliver is fed into a knitting machine for sliver knitting as the woof yarn; cotton yarn is fed as the warp; and a sliver fabric of 7 slivers per inch is knitted.

The sliver fabric is cut to the pattern for an item of life saving apparel, and on the two sides of this fabric, sheets of vinyl film, each cut with 2.5 cm. margin for adhesive seaming beyond the peripheral contour of the said pattern, are made to adhere by means of poval resin, and the said margins for adhesive seaming are made to adhere and tightly seal by means of a high-frequency seaming machine.

The resulting material is eveloped between the outer fabric and inner lining of the said item of life saving apparel as the buoyant material.

Example 2

The same mixed material of silicone-treated kapok and staple as described in Example 1 is processed in five metallic carding machines for multi-yarn use, each of 40-inch-width and cylinder speed of 220 r.p.m., at a rate of 7.5 kg. per hour. The five webs combed by the doffer combs are

led out in laminate arrangement and led through a lap former, which produces a fiber lap of 220 grams per square meter weight

Water-proofed gauze is placed on one side of this lap and water-proofed material is placed on the other side, and the assembled material is subjected to quilting on a quilting machine.

The resulting quilted material is sewn onto the reverse side of a jacket whose outer material is made of water-proofed cotton burberry cloth, the gauze side of the said quilted material being placed in contact with the jacket outer material, and the quilted material being sewn thereto in the manner of sewing on an inner lining, thereby providing a life saving jacket.

It is a significant advantage of the method of the present invention in that it enables the production of items of life saving apparel which are extremely comfortable, which permit free bodily movements of the wearer, and which may be advantageously worn even at times when the possibility of their need as life saving apparel is remote or not anticipated.

In the case of conventional life saving articles of this type, raw kapok, cork, balsa, or some other such buoyant solid, or a gas is made to fill a fabric bag and made to assume the shape of a pillow, a cylinder, or a ring and arranged to be connected by cloth to enclose the human thorax and neck. Such articles, while they are effective as life saving means, tend to be cumbersome, lack wearing comfort, and restrict bodily movements of the wearer. Accordingly, while their disadvantages may be overlooked, and such articles used, when dangerous situations are foreseen, such articles tend to be set aside when danger is not immediately expected. Then, when danger occurs suddenly, there is often insufficient time for donning such articles, and disaster may result. Or, a person who has neglected to wear such an article may become unconscious for some reason and fall into water and drown before help can arrive.

Such tendencies to neglect wearing of life saving items of apparel can be reduced greatly by the use of such items made by the method of this invention.

In this particular aspect of the invention, the final form of the life saving item of apparel may be such a garment as a sports jacket, a windbreaker, a hunting jacket, a ski parka, a business suit coat, a half-coat, an overcoat, overalls, or a flying suit. One of the following materials is used between the outer covering material and the inner lining, in place of the outer covering material and the inner lining, in place of the outer covering material, or in place of the inner lining.

(*a*) A quilting made by a process comprising processing kapok which has been resin-treated, dried, and cured, as afore-described, in a rotary cutter, carding machine, webber, or some other web treating machine into a fluffy web; placing water-proofed gauze on both sides of the said web; and quilting the assembly.

(*b*) A quilting made by a process comprising producing a fluffy web as described in (*a*) above; placing water-proofed, outer covering material on one side of the said web and water-proofed gauze on the other side thereof; and quilting the assembly, said quilting to be used as the outer cover material of the wearing apparel; or, placing water-proofed, inner lining material on one side of the said web and water-proofed gauze on the other side thereof; and quilting the assembly, said quilting to be used as the inner lining material of a wearing apparel.

(*c*) A quilting as described in (*a*) above except that the fiber material which is processed is a mixture of resin-treated kapok as described in (*a*) and cotton or a synthetic fiber similarly treated with resin, dried, and cured.

(*d*) A quilting as described in (*b*) above except that the fiber material which is processed is a mixture as described in (*c*) above.

(*e*) A fully enveloped and sealed quilting fabricated by coating both sides of the quilting of (*a*) or (*c*) above with an adhesive; pressing thereon sheets of synthetic resin film (for example: vinyl film, polyethylene film); and bonding the edges of the said film sheets together to fully seal in the quilting.

(*f*) A flexible, buoyant material formed from a soft, foam-containing synthetic resin (for example: polyurethane foam, rubber foam) and enveloped and sealed by synthetic resin film or completely coated and sealed by a synthetic resin.

Two representative embodiments of the product of the invention are illustrated in the accompanying drawing, in which:

FIG. 1 is a perspective view showing the external appearance of a coat with attached hood made by the method of the invention;

FIG. 2 is a partial sectional view showing the laminate arrangement of the various materials in one embodiment; and,

FIG. 3 is a sectional view showing another embodiment.

In the construction illustrated in FIG. 2, the principal buoyant material **1**, which is resin-treated kapok or a mixture of resin-treated kapok and some other resin-treated fiber, is enveloped and sealed by resin treated fabric or synthetic resin film sheets **3** and **4** placed on the two sides thereof, and the assembly thus formed has been quilted as shown by the quilting stitch **6**. The quilting is shown with an outer cover material **5**. If the material of the sheet **3** is water-proofed, inner lining material, the material of the sheet **4** may be water-proofed gauze. In FIG. 1 is shown a coat made of the material as illustrated in FIG. 2.

Referring to FIG. 3, the principal buoyant material **1**, which is resin-treated kapok or a mixture of said kapok and some other similarly resin-treated fiber, is enveloped and sealed by a water-proof, oil-proof, synthetic resin film **2** placed on both sides of the said buoyant material **1**.

A further advantage of the life saving items of apparel produced by the method of the present invention consists in that such items of apparel afford substantial protection of the wearer also against injury due to such external actions as impact, abrasive, and lacerating blows, which often accompany dangerous situations near or in water. Moreover, such an item of apparel, because of its substantial thickness and low thermal conductivity of its constituent parts, is readily adaptable to keep its wearer warm. This is a significant advantage since, next to actual drowning, the loss of body heat is often the prime cause of incapacitation or death of a person in distress in water.

While I have described particular embodiments of my invention, it will, of course, be understood that I do not wish my invention to be limited thereto, since many modifications may be made and I, therefore, contemplate by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim is:

1. A method of producing a textile fabric suitable for use in making life saving articles comprising the steps of
depositing on raw kapok fiber an aqueous silicone resin solution in an amount about equal to the weight of the kapok;
drying said treated kapok;
curing said dried and treated kapok at a high temperature for a very short period of time;
separately depositing on rayon staple fiber a water-proof and oil-proof resin of an amount equal in weight to somewhat more than the weight of the staple fiber;
mixing said treated kapok and rayon staple in weight proportions of the order of 70% kapok to 30% staple;
forming slivers of said mixture; and,
knitting said slivers as woof yarn with non-treated warp yarn to form a knitted fabric.

2. A process as claimed in claim 1 wherein said drying

treatment is at about 80° C. and said curing treatment is at about 120° C. for about five minutes.

3. A process as claimed in claim 1 comprising providing a fully enveloping covering of durable, tear-resistant material over said fabric so as to protect the same against damage due to such external actions as impact, abrasion, and laceration.

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