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D. J. KENNEDY

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ADHERENT PROTECTIVE COVERING FOR BLISTERS, WOUNDS AND THE LIKE

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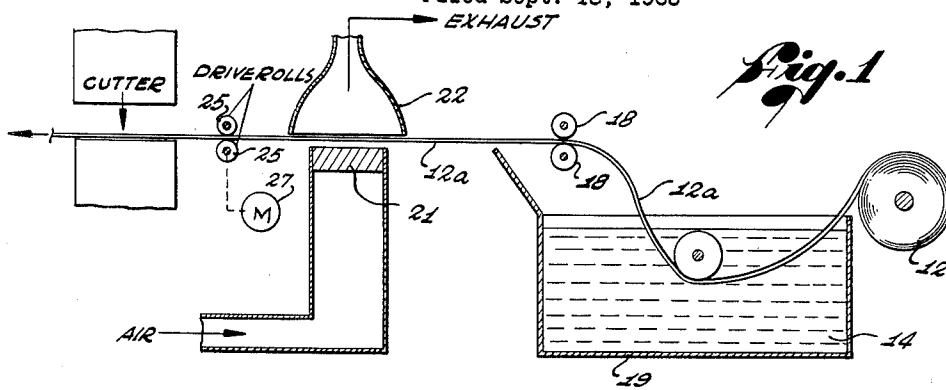


Fig. 1

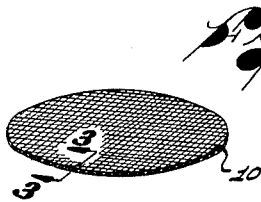


Fig. 2

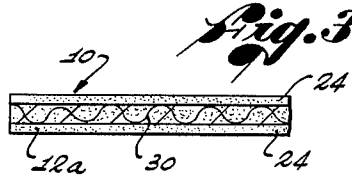


Fig. 3

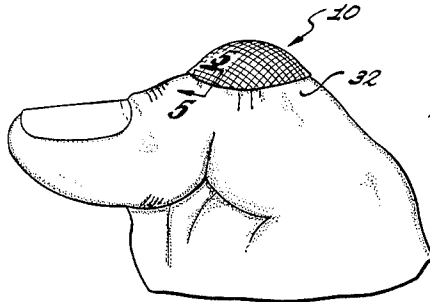


Fig. 4

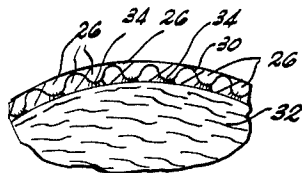


Fig. 5

INVENTOR.
DONALD J. KENNEDY
BY Fulwider, Patton, Fisher,
Lee, and Utch
ATTORNEYS

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ADHERENT PROTECTIVE COVERING FOR
BLISTERS, WOUNDS AND THE LIKE
Donald J. Kennedy, Burbank, Calif., assignor to
Jerome E. (Jerry) Horne, Burbank, Calif.
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5 Claims. (Cl. 128—156)

This invention relates generally to protective coverings for wounds, blisters and the like, and relates especially to a means for obtaining a tightly adherent, durable, protective covering for the skin.

In the past, flexible collodion has been applied directly to wounds as a protective covering and has the advantage of forming a fairly adherent and durable film over the wound. However, where good wear or abrasion resistance of the protective covering are desired, and/or where a breathable film is required, the direct application of flexible collodion cannot be employed.

Flexible collodion solution consists essentially of cellulose nitrate, a plasticizer therefor such as castor oil, and a readily evaporable solvent such as ethyl alcohol or ethyl acetate. Such a solution has been employed directly upon wounds, as a shield, and had also been applied to gauze or dressings on wounds to hold them in place. It has been found, however, that this mode of application of a solution of flexible collodion directly to gauze does not provide a tightly adherent covering especially where severe abrasion problems are to be encountered. While a film of collodion is obtained, the film prevents evaporation of the moisture of the skin and it is believed that such moisture enables the film to be quite readily removed.

It is highly desirable, for example, that blisters on thumbs of tournament bowlers be protected during bowling—and a protective covering, for this purpose, which is not removable, has been a long-felt but unsatisfied need. The same problem exists in many other fields of sport, as well as in the field of manual labor.

It will be realized that protective coverings for movable joints of a person (such as the knuckle of a thumb) must have a very high degree of adherence as well as a very high degree of resistance to abrasion. In the sport of bowling, for example, the knuckle of the thumb is repeatedly inserted into an opening in the bowling ball, and blister formation occurs in a very short period of time. Any protective covering for such a blister, to be effective must not only be highly adherent but must be capable of complete flexibility, just as the skin itself, and have a very great degree of abrasion resistance.

Bearing in mind the foregoing, it is a major object of the present invention to provide an improved means for forming an adherent, flexible, protective covering for wounds, blisters and the like.

It is a further object of the present invention to provide a means for forming a more highly adherent protective covering for wounds, blisters and the like than has hitherto been found possible.

Still another object of the present invention is to provide a means for forming a more highly adherent porous film protective covering for wounds, blisters and the like than has hitherto been found possible without impairment of the flexibility of the covering thereby permitting complete freedom of movement of the covered area.

Yet a further object of the present invention resides in the provision of means for forming a more highly adherent protective covering for wounds, blisters and the like, yet which has extremely small pores formed therein for the purpose of allowing washing of the wound or blister without removal of the film, and allowing the wound or blister to remain in contact with air.

These and other objects of the invention will become

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more clearly understood by referring to the following detailed description and to the accompanying drawings, in which:

FIGURE 1 is a schematic view in side elevational cross-section of a means for making the protective covering of my invention;

FIGURE 2 is a perspective view of one embodiment of my protective covering;

FIGURE 3 is an enlarged fragmentary cross-sectional view taken along the line 3—3 of FIGURE 2;

FIGURE 4 is a perspective view of one embodiment of my invention shown affixed to the knuckle of a thumb; and

FIGURE 5 is an enlarged fragmentary cross-sectional view taken along the line 5—5 of FIGURE 4.

In general, my invention comprises the pre-impregnation of a fine mesh fabric or gauze made of cotton, silk, rayon, nylon or the like with a flexible collodion solution followed by a drying operation. The dried pre-impregnated gauze strip or section is then partially redissolved in situ over the wound or blister by means of an appropriate solvent, preferably having a small amount of nitrocellulose therein. It has been found that by partially redissolving the flexible collodion of the gauze in situ (i.e., while the gauze is in contact with the skin), a substantially greater adherence of the gauze is obtained than by merely allowing a liquid solution of flexible collodion to saturate an unimpregnated gauze patch or covering. The reason for this is not readily apparent, but the improvement in results has been verified by experiment. Also, in partially redissolving the collodion pre-impregnated in the gauze, the gauze is rendered somewhat porous.

Referring now specifically to FIGURES 1 and 2, the protective covering is preferably made in the form of a pre-impregnated gauze patch, section, strip or other suitable geometric configuration. A disk-like gauze patch or covering 10 is shown in FIGURE 2 by way of example, although the gauze patch could, of course, be oval, rectangular or triangular.

The gauze preferably employed is an absorbent gauze as defined in the United States Pharmacopia. Absorbent gauze consists of well-bleached cotton cloth of plain open weave. Table I gives the U.S.P. recognized commercial designations in terms of thread count and standard weight in grams per linear yard.

U.S.P. Type	Threads per inch		Weight, gm./linear yard
	Warp	Filling (the crosswise threads)	
I.....	44	36	44.5
II.....	32	28	31.3
III.....	28	24	27.0
IV.....	24	20	23.2
V.....	22	18	21.5
VI.....	20	16	18.8
VII.....	20	12	17.2

Gauze made of silk, rayon, or nylon is usable and may better achieve a flesh tone, but is non-absorbent.

In the manufacture of the gauze patch or protective covering 10, the gauze, in the form of a roll 12 of any suitable width, e.g., 4 to 36 inches, is run through a solution 14, to be described, for preimpregnation.

The solution 14 comprises basically cellulose nitrate, a plasticizer therefor, and a solvent system. The cellulose nitrate is preferably in solution 14 in an amount of between 5–30% with the optimum percentages for the purposes of this invention being between about 10–20%.

Cellulose nitrate, if used alone as the adhesive in-

gradient in the gauze, becomes too brittle upon standing and a plasticizer is therefore required. The preferred plasticizer is castor oil; 4-8% castor oil by weight of the solution 14 is preferred. Many other non-toxic plasticizers may be employed such as those non-toxic plasticizers listed as being compatible with cellulose nitrate on pages 460-477 of the "Modern Plastics Encyclopedia for 1963," vol. 40, No. 1A, published by Charles A. Breskin, which plasticizers are incorporated herein by reference.

The solvent system for cellulose nitrate is selected from among the following solvents having a boiling point below about 175° F.: aromatic solvents such as toluene or benzene; ketones such as acetone, methyl ethyl ketone and methyl isobutyl ketone; esters such as ethyl acetate and isopropyl acetate; and glycol ethers such as ethylene glycol monomethyl ether and ethylene glycol monoethyl ether. Also, alcohols may be employed in combination with one or more of the solvents just mentioned.

The presently preferred ranges of ingredients for the impregnating solution 14 are:

	Percent by weight
Castor oil as plasticizer	4-8
Cellulose nitrate	5-30
Solvent system	62-91

A specific impregnating solution 14 is given below:

Castor oil	percent by weight	6.3
Cellulose nitrate	do	13.2
Solvent system	do	80.5
(a) Toluene	percent	38
(b) MEK	do	27.5
(c) Butyl alcohol	do	15

It will be understood that this specific solution is merely illustrative and that many variations and modifications may be employed with substantially the same results.

As mentioned, the gauze 12a in the gauze roll 12 is run through the solution 14, and is thereby saturated therewith. The gauze 12a, which has a thickness for example of 0.007", then passes through a pair of spaced parallel rolls 18 mounted above the solution container 19, and excess solution 14 is removed from the gauze and drops back into the container. By way of example, the rolls 18 are set to have a gap of between 0.019" and 0.022".

The gauze 12a is then passed to a drying stage wherein the impregnated gauze is run through preferably ambient or slightly heated air (heated by means of heater 21) to thereby rapidly remove all of the volatile solvents through the exhaust duct 22. The dried pre-impregnated gauze may then be die-stamped into the desired shape, as indicated schematically at the end of the process line in FIGURE 1, resulting in the shape 10 as shown in FIGURE 2. Of course, other methods of drying may be employed, such as drying in still air, wherein lengths of impregnated gauze are cut and merely hung in ambient still air to dry. The gauze 12a is pulled by conventional rolls 25 driven by motor 27.

The dried, pre-impregnated gauze 10 has a final thickness several mils thicker than the initial gauze thickness. Thus, for example, if the initial (unimpregnated) gauze 12a has a thickness of 0.007", the pre-impregnated gauze 10 has a final thickness preferably of .009" to 0.011", as best seen in the enlarged cross-section of FIGURE 3. The impregnated gauze 12a has a substantially continuous coating 24 on both sides thereof, the coating or impregnation consisting essentially of cellulose nitrate and a plasticizer therefor.

The ratio of cellulose nitrate to plasticizer can vary within wide limits, but is generally greater than 1. Where castor oil is employed as the plasticizer, the ratio of cellulose nitrate to castor oil lies in the range of about 1 to 5.

The dried, pre-impregnated or coated gauze 10 is now ready for use as a protective covering and a piece, strip or

patch thereof is placed over the wound or blister (for example, see FIGURE 4) and saturated with a non-toxic solvent preferably containing as much as 3 (three) percent cellulose nitrate. The solvent should have a boiling point of less than about 175° F. so that evaporation occurs readily. Thus, for example, the solvent may comprise substantially all ethyl acetate or other suitable ester, or may contain ethyl acetate together with up to 3% cellulose nitrate. As a specific example, the solvent presently preferred has the following composition:

	Percent
Ethyl acetate	91.5
Methyl ethyl ketone	1.8
Butyl alcohol	1.3
Toluene	2.5
Cellulose nitrate	2.9
	100.0

By saturating the pre-impregnated gauze 10 with the solvent, the collodion 24 in the gauze 10 is partially redissolved and is softened. The strands 30 of the gauze are very adherently affixed or bonded to the skin 32 by this partial redissolution or softening action followed by a short drying period of the order of a minute or so. The points of such adherent contact with the skin are indicated by the numeral 34 in FIGURE 5. The collodion is partially redissolved from within the mesh of the gauze, the gauze becoming somewhat, i.e., partially, porous, but the gauze remains adherent in the manner just described. The pores are indicated by the numeral 26.

Thus, by adding the solvent to the pre-impregnated gauze after the pre-impregnated gauze has been placed in contact with the skin, an exceptionally adherent covering is produced which, contemporaneously, repels moisture while permitting the covered wound to breathe. It has been found that due to the numerous tiny openings created by the additional solvent, the protective coverings of this invention can be worn on areas such as the face for sixty days without causing discoloration of the covered areas of the skin.

To insure that the user will not completely dissolve all the cellulose nitrate impregnating the gauze 10 by means of the solvent, up to 3% of cellulose nitrate is preferably incorporated into the solvent itself.

One of the important applications of my pre-impregnated gauze is its successful use by medical doctors as a substitute for sutures. In such cases, gauze strips, formed of silk or rayon and impregnated, as described herein, are employed. The wound is clamped temporarily in a conventional manner, and the gauze strips are then placed across the wound and rendered adhesive by means of my solvent, as previously described. The resulting covering is breathable, allows visual inspection of the wound without removal of the covering, and allows the wound to be washed, e.g., with alcohol.

It will thus be seen that a highly adherent, breathable, protective mesh or gauze network for wounds and blisters is provided by the method and means described herein. Modifications will occur to those skilled in the art which lie within the scope of my invention. Hence, I intend to be bound only by the claims which follow:

I claim:

1. A process for making an adherent protective covering for skin, which comprises the steps of: covering a desired portion of the skin with a fabric of open weave, said fabric having substantially continuously coated thereover an adhesive composition consisting essentially of cellulose nitrate and a plasticizer therefor; and saturating said fabric with a solvent selected from the group consisting of benzene, toluene, acetone, ethyl acetate and ethylene glycol monomethyl ether, said solvent having a boiling point of below about 175° F., whereby to soften and partially dissolve said adhesive composition in said fabric while in contact with the skin whereby a highly

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adherent bond between said fabric and said skin upon evaporation of said solvent and a partially porous covering are obtained.

2. The process of claim 1 wherein said adhesive composition contains castor oil as a plasticizer, the ratio of cellulose nitrate to castor oil being in the range of 1 to 5.

3. The process of claim 1 wherein said solvent contains up to about 3% cellulose nitrate.

4. An article of manufacture for making an adherent protective covering for skin, which comprises, in combination: a porous fabric having substantially continuously coated thereon an adhesive composition consisting essentially of cellulose nitrate and a plasticizer therefor; and a solvent selected from the group consisting of ketones, esters and alcohols having a boiling point of be-

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low about 175° F., said solvent, when applied to said porous fabric, partially dissolving said adhesive composition on said porous fabric to thereby cause formation of a highly adherent bond between said fabric and said skin upon evaporation of said solvent, the resulting fabric being air-pervious.

5. The article of manufacture of claim 4 wherein said solvent contains up to about three percent cellulose nitrate.

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ADELE M. EAGER, *Primary Examiner.*