

UNITED STATES PATENT OFFICE.

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DRESSING FOR WOUNDS AND THE LIKE.

1,120,085.

Specification of Letters Patent.

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No Drawing.

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To all whom it may concern:

Be it known that I, LOUIS JOHN RILEY, a subject of the King of Great Britain and Ireland, residing at 8 Newton road, London, W., England, have invented new and useful Improvements Relating to Dressings for Wounds and the like, of which the following is a specification.

This invention relates to dressings for wounds of all kinds, of the type in which the employment of a film to cover the wound has been proposed, and the invention has for its object to provide a dressing of such a character as to allow of the healing process being effected, under perfectly aseptic conditions, and of inspecting the progress of healing of the wound without removal of the dressing.

A further object is to permit of immediate and easy access to the wound if fresh treatment is required; moreover, with this dressing, the minimum amount of labor to the attendant and discomfort to the patient are caused.

The employment of films in connection with dressings for wounds has been proposed previously. Among these a transparent film composed of cellulose acetate with an oil for softening it has been suggested, but the combination of very useful properties which are characteristic of the film or membrane according to the present invention and the method of application of the film or membrane to insure healing under perfectly aseptic conditions is not to be found in connection with any of the films, the use of which has hitherto been proposed. Up to the present time it has also been a practice to paint a wound either with collodion solution or with what is known as flexible collodion, which is a solution consisting of the same constituents as employed for making collodion, viz. pyroxylin ether and alcohol+castor oil. Both these solutions on evaporation leave an adherent skin which covers the wound. A second method is to place sterilized gauze, lint and the like which has been saturated with one of the above collodion solutions on another piece of gauze or lint which has previously been placed on the wound, so as to insure that the healing process takes place under aseptic conditions. Now both these methods have certain disadvantages, among which are the following: The wound cannot be inspected without removal of the collodion skin, gauze,

lint or the like, so that each time the wound is inspected it must be uncovered and recovered afresh. The removal of the collodion skin, should this be necessary for the purpose of treating the wound, is laborious and painful. The collodion skin is liable to break or become detached from the skin owing either to its being entirely adherent to the body or to its uneven texture. Unless great care is taken in applying the collodion solution the resulting skin may not be impervious to micro-organisms and the wound is therefore still liable to the risk of infection. Further, the application of the collodion solution to the wound causes "smarting" and is exceedingly painful to the patient. Now these disadvantages are obviated by the use of my improved dressing.

According to the invention I provide a thin film or membrane which is transparent, distensible, and colorless and which is impervious to micro-organisms and can be readily sterilized. This thin film or membrane is constituted by collodion cotton and castor oil and when in use is put over the wound and secured at its edges to the sound skin in such a manner as to remain impervious for as long a period as is necessary to insure that the healing of the wound shall take place under aseptic conditions. In order to secure the edges of the film or membrane to the sound skin so as to form an impervious cover, I further provide a fluid of a suitable degree of volatility, which possesses a not unpleasant odor, which may or may not contain sticky or adhesive material, remains homogeneous on prolonged standing and which has a softening or solvent action on the edges of the film or membrane to which it is applied so as to cause the latter to adhere to the sound skin surrounding the wound, and which further may itself yield on evaporation a film or membrane. If desired, however, I may, by omitting certain ingredients, cause the fluid to have merely a solvent or softening action and not to give a film or membrane itself on evaporation. Such a fluid may be constituted by a mixture of methylated spirits, ether and amyl acetate in suitable proportions. By adding collodion cotton and castor oil and varying the proportions as will be more clearly detailed later, I may cause the fluid to itself yield on evaporation a thin film or membrane. Further I may add gum or resin which intensify the sticky nature of the

product to the collodion cotton and castor oil, or I may add them alone and omit the latter two ingredients.

In carrying my invention into effect I prepare in the usual way from collodion cotton and castor oil, a thin film or membrane which is transparent, impervious, colorless and odorless, and which retains these properties on sterilization.

I have found that in order to obtain good results it is essential to employ the right type of collodion cotton and oil. It is also essential that a certain maximum amount of oil be employed and this quantity must not be substantially exceeded. Furthermore, excessive heating conditions to effect sterilization must be avoided.

Collodion cotton answering the following description, substantially, when dry:—

20	Nitrogen-----	11.90%
	Solubility—in a mixture consisting of 2 parts ether (.730) and 1 part absolute alcohol-----	99.85%
	Viscosity—of a 2% solution in a mixture consisting of 2 parts ether (.730) and 1 part absolute alcohol-----	
25	at 60° F-----	$\frac{3.833}{2.49} = 1.539$
	Viscosity of water for comparison=1.	

has been found to be a suitable type of collodion cotton. If a type of collodion cotton which is completely soluble in the above mentioned solvent and of substantially lower viscosity be employed the distensibility of the film is markedly inferior.

Of the oils employed for industrial purposes castor oil has been found to be the only one which confers all the properties enumerated. The quantity employed must be substantially in the ratio of four parts of castor oil to six parts of dry collodion cotton. If this ratio of castor oil to collodion cotton be substantially exceeded oil exudes from the film or membrane on sterilization which renders it liable to become sticky, to become cloudy in appearance, especially in the presence of moisture, and to collect dust. If the ratio of castor oil to collodion cotton be substantially reduced, the distensibility of the film is materially reduced.

Excessive heating conditions to effect sterilization, even when the correct ratio of castor oil to collodion cotton, as stated above, is employed, results in the surface of the film or membrane being more or less smeared with oil. The heating conditions suitable for effecting sterilization without causing the oil to exude and besmear the surface of the film consists in maintaining the film at 220° F. during a period of twenty minutes under six pounds pressure with steam.

Good results have been obtained by employing in the making of the film, the following materials in the proportions substantially as specified hereafter. The pro-

portions given throughout the specification are all by weight.

Collodion cotton-----	6.00 parts.
Castor oil-----	4.00 parts.
Methylated spirits (64° O. P.)-----	15.00 parts.
Ether sulfuric methylated (.730)-----	109.00 parts.
	134.00 parts.

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The following method of incorporation has been found to be suitable: The collodion cotton—moistened with methylated spirits or in the dry condition—is gradually added to the previously mixed methylated spirits and ether with suitable agitation of the mixture for obtaining a homogeneous fluid after which the castor oil is completely stirred in. When collodion cotton which has been damped with methylated spirits is employed a correspondingly larger amount is taken and the amount of methylated spirits in the solvent mixture is correspondingly decreased. A fluid of the above composition when made into films in the usual way yields approximately forty five square feet of film per kilogram of fluid. The shape of the film or membrane will naturally vary with the nature of the wound to which it is to be applied. If the surface is flat, the film or membrane should be flat. If the film or membrane is intended for application after an amputation, such for example as the removal of part of a finger, it may be formed of tubular or cylindrical shape, with one end closed.

In order to secure the edges of the film or membrane to the sound skin surrounding the wound, I employ a fluid of a suitable degree of volatility, which possesses a not unpleasant odor which may or may not contain sticky or adhesive material, remains homogeneous on prolonged standing and which has a softening or solvent action on the film or membrane so as to cause it to adhere to the sound skin, and which further may itself yield on evaporation a film or membrane.

I have found that by employing the following constituents in substantially the proportions indicated hereafter the best results are obtained.

Collodion cotton-----	2.00 parts.
Castor oil-----	2.00 parts.
Resin-----	40.00 parts.
Methylated spirits-----	68.00 parts.
Ether-----	20.00 parts.
Amyl acetate-----	12.00 parts.
	144.00 parts.

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Instead of resin I may employ a gum such as gum copal and instead of castor oil I may employ another oil such as cotton seed oil both of which dissolve and yield a fluid possessing the characteristics already stated.

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The object in view in selecting the solvent or softening portion of the fluid is that besides being capable of dissolving other material which may be added to it and maintaining a homogeneous fluid on standing as

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well as exercising a solvent action on the film or membrane and possessing a not unpleasant odor, the degree of volatility of the liquid must be such as to allow of the edges of the film being secured to the skin expeditiously—it must neither be too fast nor too slow—and that the rate of evaporation from the receptacle or stock bottle in which the fluid is contained must not be so great as appreciably to alter its composition. A mixture of ether and methylated spirits and amyl acetate constitutes a mixture of solvents, which individually would answer the above requirements, except as regards the degree of volatility. The former (the ether mixed with methylated spirits) would volatilize too rapidly and the amyl acetate too slow, but by combining the two in suitable proportion the requisite degree of volatility is obtained.

The rôle of collodion cotton is that in addition to its adhesive value it forms in conjunction with the castor oil, on evaporation, a film of the same nature as that which is being attached. The resin or gum intensifies the adhesiveness.

The following method of incorporation has been found suitable. The collodion cotton—moistened with methylated spirits or in the dry condition, is gradually added to the previously mixed methylated spirits, ether and amyl acetate with suitable agitation of the mixture for obtaining a homogeneous fluid. The castor oil is then added with suitable stirring and finally the resin is incorporated with suitable agitation of the mass. When collodion cotton which has been damped with methylated spirits is employed a correspondingly larger amount is taken and the amount of methylated spirits employed in the solvent mixture is correspondingly decreased. The type of collodion cotton to be employed is one which substantially answers to the following specification, the nitrogen content being, for example, 11.71%.

Solubility—In a mixture of 2 parts ether (.730) and 1 part absolute alcohol

100.00%

Viscosity—of a 2% solution in a mixture consisting of 2 parts ether (.730) and 1 part absolute alcohol at 60° F. (Viscosity of water for comparison=1).....

$$= \frac{2.47}{2} = 1.23$$

If collodion cotton of greater viscosity be employed one runs the risk of the fluid setting especially in cold weather and not possessing the requisite degree of fluidity and volatility. If desired, however, I may by omitting the collodion cotton, which gives adhesive value and which with castor oil gives a film or membrane of the nature of that which is being fixed, and the resin or gum which intensify the sticky nature of the product, cause the fluid only to have a solvent or softening action upon the film or

membrane stretched or placed over the wound. An example of the approximate relative proportions of the constituents in a fluid of the kind is as follows:—

Methylated spirits (64° O. P.)	53.00 parts.	70
Ether sulfuric meth. (.730)	14.00 parts.	
Amyl acetate	33.00 parts.	
	100.00 parts.	

or I may omit the resin or gum alone. An example of the approximate relative portion of the constituents in a fluid of the kind is as follows:—

Methylated spirits (64° O. P.)	56.48 parts.	
Ether sulfuric meth. (.730)	20.12 parts.	
Amyl acetate	19.40 parts.	
Collodion cotton	2.00 parts.	80
Castor oil	2.00 parts.	
	100.00 parts.	

In the above example I may if desired leave out the castor oil, the proportions of the other constituents remaining unchanged. Again, I may omit the castor oil, but retain the collodion cotton and resin or gum, the proportions of the mixture being then substantially as follows:—

Methylated spirits (64° O. P.)	68.00 parts.	90
Ether sulf. meth. (.730)	20.00 parts.	
Amyl acetate	12.00 parts.	
Collodion cotton	2.00 parts.	
Resin (or gum)	40.00 parts.	

I may further omit the collodion cotton and castor oil and retain the resin or gum. An example of the approximate relative proportions of the constituents in a fluid of the kind is as follows:—

Methylated spirits (64° O. P.)	37.86 parts.	100
Ether sulfuric meth. (.730)	10.00 parts.	
Amyl acetate	23.57 parts.	
Resin	28.57 parts.	
	100.00 parts.	

The readjustment of the ratio of the constituents being necessary mainly for the purpose of securing a suitable degree of volatility.

A receptacle for the volatile fixing fluid and means for applying same which have been found satisfactory in practice will now be described, although not forming part of the present invention. A convenient type of receptacle for the fixing fluid is a wide mouthed or cylindrical vessel fitted with a cork, because, when this is suitably filled—not beyond one and a quarter inches or thereabout of the top of the vessel—any excess of fluid which may be taken up by the brush fitted to the cork, which is subsequently described, may be readily removed against the side of the vessel without smearing the outlet into which the cork is inserted for closing the receptacle. Furthermore such a wide mouthed or cylindrical vessel allows drops from the tube or rod attached to the cork, as described hereafter, to fall into it with ordinary skill.

The cork of the receptacle may have fastened to it a brush, which dips into the fixing fluid, for painting the fluid on the skin

and film of such size as to produce the requisite thin layer of fluid. This has been found to be quite suitable in ordinary practice. If it be desired, substitutes for the brush attached to the cork may be employed which insure the application of the fixing fluid under ideal conditions, since no part of the contents of the receptacle which come in contact with the skin is ever returned to it as is the case when the brush is employed. These substitutes may consist of a glass tube pointed at one end, to which is attached, at the blunt or cork end, a compressible rubber adjustment for expelling the contained fluid in drops or, preferably, a pointed glass rod for the ready delivery of drops of fluid when and where desired in virtue of the pointed end without the tube or rod coming into contact directly with the skin or with an object which has been in contact with the skin. The glass rod is preferable on account of its simplicity and adaptability to easier control. The dimensions of the glass rod which have been found to answer well are as follows:—length about $2\frac{3}{4}$ inches; circumference— $\frac{3}{4}$ of an inch.

When instead of a brush, a pointed glass tube or rod, as described above, is employed, a brush, or, preferably, on account of the greater readiness with which it can be cleaned and sterilized, a glass rod with a bent end which has been flattened out is used to spread the drop or drops which have been delivered by the glass tube or rod for fixing the film or membrane. The length of the bent and flattened portion should be approximately $\frac{1}{4}$ of an inch so as to coincide with the width of the layer of fluid for causing the film to adhere to the skin. A suitable glass rod for the purpose is one whose circumference is $\frac{3}{4}$ of an inch and the angle at which it is bent 135° approximately.

A suitable method of fixing the film or membrane to the sound flesh surrounding the wound by means of the fixing fluid so as to form an impervious cover over the wound is as follows: After absorption of any fluid on and subsequent drying of the sound skin surrounding the wound by wetting with a little ether which instantly evaporates and removes any residual moisture, the sterilized film or membrane which is of such size that its edges are substantially away from the wound over which it is to be placed is applied over the wound. If the cork of the receptacle containing the fixing fluid has attached to it a brush, as previously described, an edge of the film or membrane is then raised and the skin immediately subjacent is thinly painted with the fluid in a layer of about $\frac{1}{4}$ of an inch in width. The edge is then placed on this painted surface and fixed into position with the moist brush, thus not merely fixing the

margin of the film to the skin by means of the adhesive fluid applied between it and the skin, but, also, by means of a prolongation of the edges of the film or membrane on the skin. The edges of the film are progressively fixed to the skin in this manner until the whole circuit is complete. A second application of the fluid is advisable and should be applied as follows: The edges of the film or membrane for about $\frac{1}{4}$ of an inch in width and the adjacent skin for a similar distance are painted with the fluid.

When the type of receptacle which has a pointed glass tube or rod, as previously described, is employed the drop or drops from the tube or rod are allowed to drop on a small sterilized brush or, preferably, on the underside of the flattened end of the sterilized glass rod previously described and the fixing of the film or membrane to the skin carried out with the latter in the manner just described. The brush or rod is cleaned and sterilized for subsequent use.

Satisfactory conditions for working with a fixing fluid receptacle fitted with a pointed glass rod are as follows: Wet the rod for about $\frac{3}{4}$ of its length in the fixing fluid. Remove it and hold it in a more or less horizontal position allowing the rapidly falling drops to drop into the receptacle. Then place the pointed end above the spot where it is desired to place the fluid. On altering the position of the rod to the vertical position a drop or two will fall readily where desired in virtue of the pointed end of the rod. As a rule there need be no delay between the first application and the second because the edge of the film which had been first stuck to the skin is dry when re-application commences. Thus a dressing is produced for wounds and the like, which is transparent, distensible, impervious, and which is readily capable of sterilization. The dressing remains impervious, transparent and distensible for a longer period than obtained with the methods hitherto employed and thus secures protection against the risk of infection from the air or other sources of disease. The film or membrane can be readily punctured or torn with a sharp-pointed instrument, if access to the wound is desired.

It will be understood that the composition and proportions given with regard to the constituents of the thin film or membrane and the volatile fluids employed for causing it to adhere to the sound skin surrounding the wound are given by way of example only.

What I claim is:—

1. A method of dressing wounds of the human body, said method comprising the application over the injured portions of skin of a substantially transparent, distensible, imperforate, aseptic film, impervious to

micro-organisms, by applying between the skin and the edge portions only of said film an aseptic adhesive capable of hardening, said adhesive containing at least some of the constituents of said film together with a volatile solvent, and thereafter allowing said adhesive to harden and thereby retain said film as applied.

2. A method of dressing wounds of the human body, said method comprising the application over the injured portions of skin of a film comprising cellulose nitrate

and castor oil, by applying between the skin and the edge portions only of said film an aseptic adhesive capable of hardening, said adhesive containing cellulose nitrate, castor oil and a volatile solvent, and thereafter allowing said adhesive to harden and thereby retain said film as applied.

LOUIS JOHN RILEY.

Witnesses:

JOHN P. BLACK,
GEORGE HORR.