

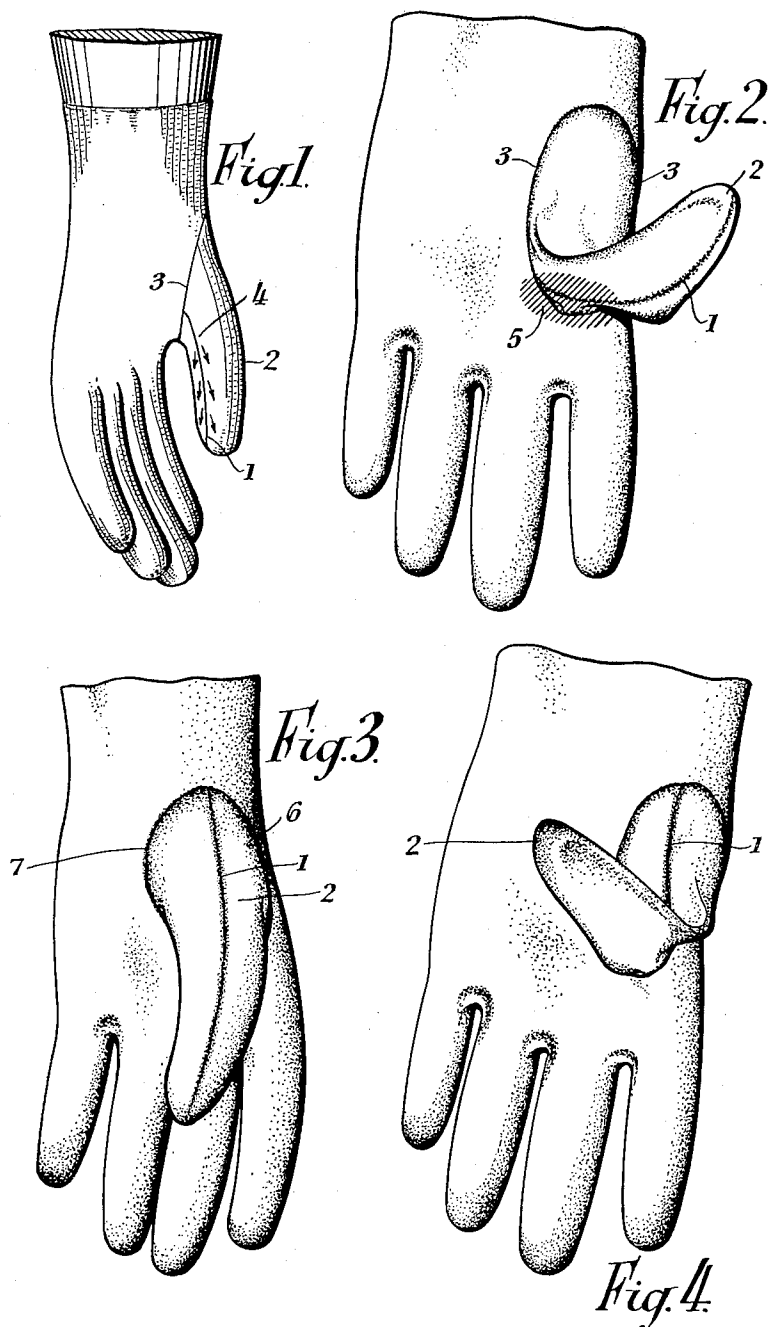
July 19, 1955

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2,713,548

METHOD OF MAKING A PROTECTIVE GLOVE

Filed Feb. 4, 1952



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1

2,713,548

METHOD OF MAKING A PROTECTIVE GLOVE

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Application February 4, 1952, Serial No. 269,876

Claims priority, application Great Britain
February 26, 1951

2 Claims. (Cl. 117—94)

This invention relates to protective clothing, namely gloves, mitts, and some types of boot or shoe, as used for example by industrial workers whose tasks involve the handling of corrosive and otherwise dangerous or deleterious materials, and/or the man-handling of heavy rough objects.

Primarily, though not exclusively, the invention relates to protective gloves for workers dealing with hydrofluoric acid, including those engaged in some forms of atomic research in which that acid is used. The invention will be described as applied to such gloves, its application to the other garments then being obvious and being within the scope of the appended claims.

With an entirely impervious glove, such as one made by dipping a former into rubber or into polyvinyl-chloride, or the like, there is no provision for the escape of skin exudations and, in consequence, the accumulated perspiration etc. within the glove may react chemically with certain components of the material of the glove, to set up dermatitis and other forms of skin irritation. To avoid these risks, such impervious gloves can be used for short periods only, which is an economic disadvantage.

It is of course known to wear an ordinary woollen glove within such an impervious glove, but this means extra cost, and the extra thickness involved, to some extent deprives the user both of sensitiveness of touch and of strength of grip. It has been proposed also, in the making of a rubber-coated glove to employ as a liner a fabric glove made of a material such as a knitted material or a woven material (e. g. cotton flannel) and subsequently to dip the liner into a liquid rubber mixture so that the mixture, due to its texture, would not completely penetrate the fabric. Accordingly, the finished glove had a soft inner lining surface especially if a fabric raised on one side (such as cotton flannel) were used, with the raised side innermost.

The present invention is concerned with articles (herein described as gloves) made by dipping a fabric base into polyvinyl-chloride or the like and wherein the polyvinyl-chloride or like material is first applied to the fabric body by dipping, is then permitted to drain and is subsequently cured by heat while the glove is in a vertical position, so as to be set and rendered permanent.

The present invention is based upon an appreciation of certain special conditions inherent in such method of manufacture and of a weakness which hitherto has resulted therefrom. Hitherto, it has been the practice in making up the fabric body of the glove to have a longitudinal thumb seam located on the inside of the thumb so that (in the case of a glove) it joined the base seam of the thumb in the crotch, namely between the thumb and the fingers, or (in the case of a mitt) in a similar or equivalent position. The location of such crotch is an area which is subject to maximum strain in the general use of the article and, as may be expected,

2

is the area where most frequent breakdown of the protective coating takes place. Research and careful examination of gloves produced by the aforesaid method has shown that at any raised longitudinal area, that is any area which becomes raised when the fabric is stretched on the former and which will be in the direction of possible flow of the coating during draining and curing, and one of which areas occurs at the above-mentioned longitudinal seam in the thumb, the protective coating is thinner than elsewhere. This is possibly due to the fact that a flow occurs from the higher to the lower parts of the raised seam, as well as along the seam. It has happened theretofore that the area of glove which is subject to maximum strain, has been a thinly coated area, and especially so because the junction of the several seams in the crotch gives a more pronounced raised portion than is found elsewhere. This has been found by experience to account for the frequency of breakdown at that area. On the contrary, the thumb base seam in and along the crotch, which is not in a direction of possible flow of the coating, does not in itself appear to produce a thin area in the coating.

According to this invention, the glove has an outer layer of a flexible, non-pervious material (other than rubber) of such a nature that it can be cured so as to set and be rendered permanent by the application of a high temperature, such as polyvinyl-chloride, formed on to the outer surface of a pre-fashioned inner layer of wool or other flexible absorbent material, e. g. a circular knitted cotton material, by a dipping process, in a bath of controlled viscosity, so as to be keyed on to the inner layer by an only partial impregnation of the inner layer so that, whilst the outer thickness of the inner layer serves to hold the outer layer as a continuous film, the inner thickness of the inner layer is left free from impregnation so as to be capable of taking up moisture from the user's skin, the outer layer eventually being cured by the sudden application of a temperature between 350°-450° F. to render it permanent, and the arrangement is characterised in that the (or each) longitudinal thumb seam is positioned so as to be on the outside of the thumb, that is to say away from the location of the crotch, and so located that any thinness in the coating, due to the seam being raised whilst the glove is on the former on which it is dipped, is not in the area that receives maximum strain in use.

Preferably, the invention is applied to gloves which are held vertically while being cured (with the tips uppermost or lowermost as may be desired), and more preferably to gloves which also are held vertically while draining takes place after dipping. The invention may also be applied to gloves which, though held vertically with the tips lowermost during draining and curing, are inverted after dipping and before draining and/or curing so as to have the tips uppermost.

It is essential that the garment to be cured should be placed in a stove or the like which has been raised to so high a temperature, which with polyvinyl-chloride is preferably about 420° F., that the material will upon being placed therein set sufficiently that during curing it will not to any substantial extent flow through the inner layer or run down the outside of the garment.

The viscosity, temperature and/or wetting-out properties of the preparation from which the impervious skin is to be made will, before the dipping process, be adjusted and the time period for impregnation will be chosen according to the nature of the material used for the pre-fashioned lining, and will be maintained so as to obtain a partial and preferably a uniform impregnation of the inner layer.

In a modification of the invention when the inner layer

has been in the bath for a length of time sufficient to bring about the required degree of impregnation, it is withdrawn and the outer film allowed to become partly set or tacky, as by evaporation of plasticiser, to arrest further impregnation, and is then replaced in the bath so that a thickness of the outer layer may be built up without further encroachment into the absorbent inner layer. Alternatively, curing may take place between successive dippings, by placing the article in a stove or the like which has been raised to a high temperature as aforesaid.

The inner layer is usually of a cotton fabric heavily raised on one side, and in the made-up glove the raised surface is the inner surface. However, since some of the outstanding fibres become pushed through to the unraised (outer) surface, the resultant glove has a rather roughened surface since the polyvinyl-chloride coagulates and eventually sets around such fibres. This roughening is beneficial for many industrial processes, especially where a good gripping surface is required.

According to another feature of the invention, where a thinner, more flexible outer layer is required having more of a "Patent leather" finish, and where the maximum degree of imperviousness is wanted, the inner layer is singed all over its outer surface, whilst on the former and immediately before dipping, for the removal of fuzz. The singeing should preferably be carried out only just before dipping to ensure that no re-raising of surface fibres is allowed.

The invention will now be described in more detail with reference to the accompanying drawing, wherein:

Fig. 1 is a rear view of a fabric body of a lefthand glove on a former ready for dipping, the glove body being of the old style with the longitudinal thumb seam on the inside of the thumb;

Fig. 2 is a perspective view of the finished glove, again with the longitudinal seam on the inside of the thumb;

Fig. 3 is a front view of a left-hand glove made in accordance with this invention and showing the preferred form of the invention; and

Fig. 4 is a perspective view of the glove shown in Fig. 3, with the thumb turned back to show the crotch.

In Figs. 1 and 2, the longitudinal thumb seam 1 is on the inside or front of the thumb 2, and joins the base seam 3 of the thumb in the crotch. The terms "inside" and "outside," as applied to the thumb, both relate to the external surface of the glove but different parts thereof relatively to the grasp of the hand, inside meaning in the grasp, towards the palm and/or fingers. When the fabric body is on the former, the edges of the seam 1, which are in the interior of the thumb, cause the seam to stand up as a longitudinal ridge. It has been observed that this ridge causes the coating material to flow down the thumb and away from the higher part of the ridge, as indicated by the arrows 4 in Fig. 1, during curing, with the result that the coating in the crotch, indicated by the shading at 5 in Fig. 2 is thin and, as this is the area of maximum strain when the glove is in use, the coating often breaks down there.

In the glove shown in Figs. 3 and 4, the seam 1 is on the outside of the thumb, on the back of the thumb, so that any thin areas resulting from the flow of coating material away from the seam are not in the area of maximum wear, i. e. the parts thereof contacted by the grasp of the hand but is on the outside and back of the thumb. Whilst the position chosen for the seam 1 in Figs. 3 and 4 is the preferred position, it is not the only position which gives the improved results. Any position where the seam 1 terminates between the points 6 and 7 in Fig. 3 is useful, in all which positions the outer thumb wall (i. e. the back of the thumb) make an obtuse angle with the glove proper, as distinct from the acute angle which obtains between the inner or front wall of the glove (where the seam is located in Fig. 2) and the palm of the glove.

In the result, the effect of a thin coating can still be seen at the raised or outstanding area of the longitudinal

seam, as if due to flow into the adjacent depressed area of the seam, but as such thinner area is away from the crotch area it is subject to less stress and the resultant removal of such weak area of the glove from the relatively highly-stressed area of the thumb crotch, considerably increases the useful life of the glove.

The fabric body of the glove is first made from an unbleached 54" circular-knitted, cotton fabric, raised on one side and weighing approximately 10.8 ozs. per yard. The glove is made to the exact pattern, to fit a porcelain former, accurate cutting and machining being essential to ensure an exact fit. The raised side of the fabric is inside. Other materials are suitable, the raised cotton being cited as an example having commercial advantages. Such glove is first placed on the former, which is of the curved-finger-and-thumb type, so that the completed glove will conform more nearly to the natural position of the hand, after which it is dipped into a bath containing a polyvinyl-chloride paste.

It is important that the former be placed into the bath quickly and that it be drawn out slowly. In a convenient mode of operation there are two racks, each fitted with 30 formers (15 left hands and 15 right hands under normal conditions) set in 5 rows of 6, which racks when loaded, are fitted into the slides of a dipping machine, fingers downwards. The dipping machine consists of a slide which holds the two racks and is capable of being moved vertically towards and away from the bath with the aid of worm gears, manual power being sufficient for the descent, but electric power being provided for the ascent.

The said racks are lowered into a tank holding the polyvinyl-chloride mixture, until gloves are immersed to the required depth, the depth of dip being limited to the length of the shortest glove in the set. The gloves are lowered into the bath quickly, so as to obtain, as nearly as possible, simultaneous impregnation all over them, but the raising of the racks is done slowly, the ideal speed being the rate at which the polyvinyl-chloride flows down the gloves as it drains back towards the bath.

The two racks of formers should contain the same size of former, though not necessarily of the same type. For instance, one rack of mitts and one of gloves may be used together, but they must both be 8½ or 7½ etc.

In the particular machine now being described, the tank is 5' 9" x 3' 2" and is filled to a depth of 19", at which depth it has an approximate capacity of 176 gallons, and is suitable for the dipping of gloves up to and including a 15" finished glove. If longer lengths of glove are required the depth of mixture in the tank must be increased proportionately. The tank should be stirred at least once a day to prevent sedimentation, produced chiefly by black dye, when used. The use of mechanical agitators in the mixture, when the plant is at rest, gives more satisfactory results, than when such agitators are not used.

The temperature of the polyvinyl-chloride mixture should remain constant, say at 62° F. (55°-65° F. has been found to be the useful range), so that the viscosity is not varied and a uniform penetration and coating is ensured.

After withdrawal of the formers from the bath, the mixture is allowed to drain from the gloves, either back into the bath or in a suitable drainer, for a period of say 24 minutes, this period running from the moment when the withdrawal from the mixture commences, to the moment when the gloves are placed in the oven.

The drainer, if employed, should catch the surplus polyvinyl-chloride draining from the gloves, since a considerable quantity is recoverable. This should be recovered from the drainer daily to obviate the creation of sediment.

Upon the completion of the draining process, the racks are turned through 180° so that the fingers now point upwards, and are left in such position for 15 seconds, to allow the odd drops of polyvinyl-chloride on the finger tips to run back, after which the two racks are put in the

oven at an oven temperature of 420° F. The oven referred to is for the curing of the polyvinyl-chloride, and is an electrically-heated, insulated oven in which air is circulated by a rapidly rotating, electrically-driven fan. A cure is effected in 20 minutes time, but this time period will vary according to the temperature of the stove and according to the nature of the materials in the bath and the degree of hardness required in the final product.

After the 20 minutes, the racks are removed from the oven, and the completed gloves are pulled off the formers and allowed to cool naturally, care being taken that they are kept in shape. The formers themselves are cooled by means of a created draught, cleaned of any spots of polyvinyl-chloride, dirt, etc. and reloaded with the fabric linings.

When cool, the gloves are finished off by trimming off the cuff edge down to the depth of dipping, and hemming or binding in the usual way.

It is possible to obtain good results using a normal commercial polyvinyl-chloride compound (such as that sold by I. C. I. Ltd. under the Registered Trademark "Welvic") without further addition, but for satisfactory production it needs to be diluted, and furthermore it is better that it be coloured so that the finished gloves do not look unnecessarily dirty during use.

In a convenient mode of operation therefore, the polyvinyl-chloride paste is diluted with either tricresylphosphate, tri-xenyl phosphate, or a mixture of the two in any proportion, and is dyed to a reddish brown shade with the aid of 3 I. C. I. dyes, sold under the following registered trademarks:

"Monolite" Fast Black BS (2 measures)
 "Vulcafor" Fast Orange GS (2 measures)
 "Vulcafor" Fast Red MS (1 measure)

mixed with 1 pint of T. C. P. As the dye does not mix very freely with the T. C. P. it is essential that the mixture is passed through a fine sieve into the polyvinyl-chloride paste, any lumps being pushed through the mesh. The volumes of dye used are equal to the following approximate weights:

	Ozs.
Black	2½
Orange	1½
Red	1¼

in 4½ gallons of polyvinyl-chloride paste.

The paste, dye and T. C. P. are mixed together for a minimum of one hour, but preferably for a longer period. The mixing may in fact be safely continued overnight.

Gloves made according to this example have been found to have a very high resistance to wear, in addition to their adaptability for long periods of use without injury to the user's skin.

What we claim is:

1. A method of making a protective glove or the like which comprises forming a glove body of absorptive fabric and having a longitudinal seam only on the side opposite the palm, quickly dipping the entire body into a solution of a polyvinyl chloride resin so as to wet the entire body practically simultaneously, holding said body in said solution only for the time necessary to impregnate the outer surface, withdrawing said body and holding it in a vertical position for a number of minutes to drain off excess solution with the thumb down, then inverting said body for less than one minute to allow solution on the finger tips to run back, and immediately thereafter subjecting said body to the sudden application of a temperature of 350°-450° F. to cure said body.

2. A method of making a protective glove or the like which comprises forming a glove body of absorptive fabric and having a thumb having a longitudinal seam only on the side opposite the palm and an encircling base seam, quickly dipping the entire body into a solution of a polyvinyl chloride resin so as to wet the entire body practically simultaneously, holding said body in said solution only for the time necessary to impregnate the outer surface, withdrawing said body and holding it in a vertical position for a number of minutes to drain off excess solution, and immediately thereafter subjecting said body to the sudden application of a temperature of 350°-450° F. to cure said body, whereby the coating on said base seam is thicker than on said longitudinal seam.

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