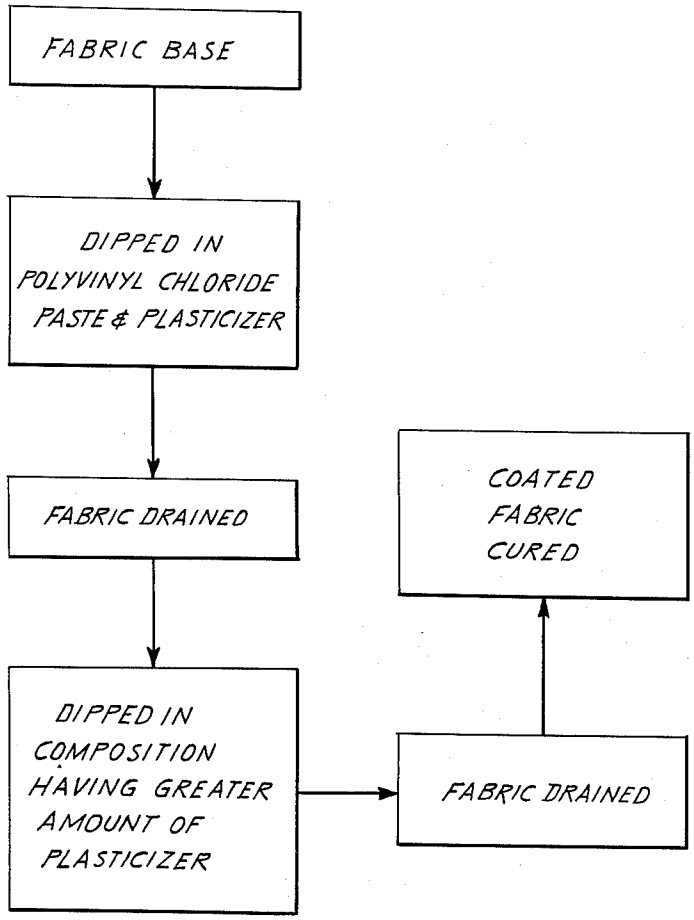
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PROTECTIVE CLOTHING AND THE LIKE

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PROTECTIVE CLOTHING AND THE LIKE

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This invention concerns protective clothing, especially gloves, of the type (hereinafter called "the type described") comprising fabric coated with a durable material. Usually such durable material is based on synthetic resin.

Protective clothing of the type described is widely used both industrially and domestically, and a large percentage of such clothing is made from a knitted cotton fabric coated with suitably plasticized and stabilized polyvinyl chloride polymer, the latter being heat treated so as to gel or "cure" and provide the fabric with an extremely hard wearing reinforcement which is also resistant to many agents which will cause traditional materials to deteriorate rapidly. It is such clothing, and especially gloves made by a dipping process, with which the present invention is particularly, though by no means exclusively, concerned.

Normally, penetration of the fabric by the reinforcing substance is undesirable. By penetration we mean (throughout the specification and claims) penetration right through onto the other surface of the fabric. For example, if the inside of a glove which is in contact with the wearer's skin has even small nodules of the reinforcing material, discomfort and irritation may be caused. To prevent such penetration special measures need to be taken if high quality clothing is to be produced, for example, as described and claimed in British Patent No. 624,795 to G. K. White. By proceeding as set out in the specification of the aforesaid patent the "paste"—that is, the suitably plasticized and stabilized polymer—does not penetrate the fabric before heat treatment and flowing of the paste through the fabric in the early stages of the heat treatment part of the process is prevented by the sudden application of a high temperature. In order to prevent penetration during the application of the paste to fabric however, the fabric construction and the rheological properties of the paste must be controlled. Thus with a given fabric, the paste must have such viscosity and other properties as to prevent penetration. The necessary viscosity and other properties of the paste, however, limit draining of the paste from the fabric after application and the thickness of the coating of paste cannot be substantially reduced beyond a certain minimum in any given case by prolonged draining

For many uses, as in the case of a glove where sensitivity is important, a thin coating is desirable. For the reasons set out above, there have been limitations to the thinness attainable by known methods. The main object of the present invention is to provide a process whereby clothing of the type described may have a very thin coating, with no penetration.

According to the present invention a method of manufacturing clothing of the type described comprises the steps of applying on one side of the fabric a coating of a substance which can be subsequently converted by gelling, curing or the like into a durable solid material, the nature of said substance and the manner in which it is applied to the fabric being such that there is no penetration; thereafter one or more times applying to the coating of the first substance on the fabric a further substance of such composition and in such a manner that it modifies the composition and the rheological properties

of at least the outer layers of said coating so that more of the first substance can be drained off the fabric than would have been possible by continued draining, before the application of said further substance; thereafter draining by the desired amount, and thereafter converting the coating as aforesaid and in such manner that there is no penetration. Preferably application of at least one of the substances is effected by dipping the fabric which is preshaped and supported by a former and draining of the coating substance or substances by gravity or otherwise is allowed after each of the respective applications.

The single FIGURE is a diagrammatical representation of the nature of the present process.

We have carried out tests and experiments which have shown that by the invention gloves coated with a durable material based on polyvinyl chloride can be made in a manner suitable for use in large quantity production which have no penetration, a thinner coating than has hitherto been possible by conventional methods, and which are of high quality.

In a typical series of such tests, we used knitted cotton fabric of dry weight 5.46 ounces per square yard made from 35s yarn with 36 courses per inch, and 34 wales per inch, preshaped to glove form and supported on a thin-walled hollow aluminium former, and first dipped the fabric so supported in a mix (mix A) constituted as follows.

Ingredients:	Parts by weight
Polyvinyl chloride polymer powder sold by I.C.I. Limited, under the name "Corvic 65/50"	100
Tritolyl phosphate plasticizer	58.5
Di-octyl-phthalate plasticizer, known commercially as "DA 79 P plasticizer (Phthalate of Alphanol 79)"	47.5
Calcium stearate dispersion (stabilizer)	3.75
Suitable heat and light stabilizers, sold by Lankro Chemicals Limited under the designation "M. and P.L. Stabilizers"	0.75
Green pigment sold by Geigy Limited under the designation "D.B.N. green Dispersion"	4.0

Dipping was carried out so that there was only partial impregnation of the fabric by the mix liquid, the approximate time of introduction to the mix being 5 seconds, with slower withdrawal extending over 40 seconds following immediately.

After dipping, the fabric, still supported on the former, was gravity drained for twenty minutes, and was then again dipped, still on its former, into a second mix (mix B) which was 100 parts by weight of the mix previously described to which had been added 170 parts by weight of DA 79 P plasticizer (Phthalate of Alphanol 79). The dipping time, including withdrawal time was 45 seconds as before. Gravity draining for 20 minutes was allowed. Finally the glove was heat treated by the method according to British Patent No. 624,795. The finished glove had a very thin and even coating of polyvinyl chloride, was highly flexible, was not penetrated, and was of very good quality.

Another glove was produced in identical fashion except that the mix used for the second dipping (mix C) consisted of mix B with 85 parts by weight of Geon 202 polymer (a polyvinyl chloride polymer of a large granular size) added thereto. The resultant glove had similar properties to the glove produced by using mix B.

The use, in place of mix C, of a mix (mix D) similar to mix C save that silica sand has been substituted for Geon 202 polymer produced similar results, save that the surface was rougher.

In another test the second dipping was in DA 79 P

plasticizer (Phthalate of Alphanol 79) alone (mix E), and again a thin final coating was achieved. Other plasticizers, whether monomeric or polymeric can also be used.

Further successful tests involved the use, in or as second mix, of other substances, such as toluene (mix F) which produced a dilution of the outer layer of the coating of the first mix material.

As standards of comparison during the tests and experiments described above, we used a glove made by twice dipping in mix A with a twenty minute draining period after each dip, and a glove made by dipping in this mix once, with a greatly extended draining period of over forty minutes. Each of these gloves was a satisfactory glove but had a substantially thicker polyvinyl chloride coating than the gloves produced in accordance with the invention.

The number of additional dips may of course be more than one, and the dips may be in different mixes.

We now set out hereunder the results achieved. In all tests fabric liners of substantially identical nature were used and the depth of dip was controlled in each to the same amount. After curing the gloves were cut to a standard length of ten and a half inches. The weight of the cured cut glove in each case was, as set out hereunder, the weight being given in grams.

Glove 1: Mix A (one dip, drained for forty minutes)	70.0
Glove 2: Mix A (two dips, drained each time for twenty minutes)	75.5
Glove 3: Mix A, then Mix B (drained twenty minutes after each dip)	54
Glove 4: Mix A, then Mix C (drained twenty minutes after each dip)	60.7
Glove 5: Mix A, then Mix D (drained twenty minutes after each dip)	57.0
Glove 6: Mix A, then Mix E (drained twenty minutes after each dip)	56.3
Glove 7: Mix A, then Mix F (drained twenty twenty minutes after each dip)	57.0

From the above it will be seen that a glove, single dipped, and drained completely (as for forty minutes) or double dipped in the same conventional mix and drained for a substantial period after each dip, has a materially thicker coating than a glove produced according to the invention.

Further tests were carried out to show similar results in gloves coated with a durable material based on polyvinyl acetate.

Two mixes were used, namely mix A consisting of polyvinyl acetate emulsion 100 parts by weight and glycerine 10 parts by weight, and mix B, consisting of hot water.

Three gloves were produced. In each case a cotton double interlock knitted fabric liner of substantially identical nature was used and dipping and curing carried out in generally similar manner as in the previous tests set out hereinbefore.

Glove 1 was dipped once in mix A, drained for twenty minutes, cured, and cut to standard size. Glove 2 was dipped in mix A, drained for 10 minutes, dipping in Mix A again, drained for 10 minutes, cured, and cut to standard size. Glove 3 was dipped in mix A, drained for ten minutes, dipped in mix B for ten minutes, drained for ten minutes, cured, and cut to standard size.

The weights of the finished gloves were as follows:

	Grams
Glove 1	60
Glove 2	67
Glove 3	40

The same conclusions can be drawn as in the case of the polyvinyl chloride gloves.

Further tests were carried out to show similar results in gloves coated with a durable material based on polyvinyl alcohol.

Two mixes were used, namely mix A consisting of polyvinyl alcohol 100 parts by weight, water 400 parts by weight, and glycerine 25 parts by weight, and mix B consisting of hot water.

Three gloves were produced. In each case a cotton double interlock knitted fabric liner of substantially identical nature was used and dipping and curing carried out in generally similar manner as in the previous tests set out hereinbefore.

Glove 1 was dipped once in mix A, drained for ten minutes, and cut to standard size. Glove 2 was dipped in mix A, drained for five minutes, dipped in mix A again, drained for five minutes, cured, and cut to standard size. Glove 3 was dipped in mix A, drained for five minutes, dipped in mix B for five minutes, drained for five minutes, cured, and cut to standard size.

The weights of the finished gloves were as follows:

	Grams
Glove 1	33
Glove 2	38
Glove 3	26

The same conclusions can again be drawn.

We claim:

1. A method of making a relatively thin impervious coating of a synthetic resinous material on the surface only of a fabric article of clothing without penetration of said material through said fabric which comprises

(1) dipping said article into a first uncured composition taken from the class consisting of polyvinyl chloride paste, polyvinyl acetate latex, and polyvinyl alcohol latex, the viscosity of said composition being such as to prevent penetration thereof through the fabric and forming a relatively thick coating on said article;

(2) said first composition containing a substantial amount of a plasticizer for the respective resins;

(3) removing the dipped article from said first composition and draining off excess of said first composition;

(4) then dipping said dipped article into a second composition comprising an amount of a plasticizer greater than that present in said first composition to cause solution of the surface of said coating, removing from said surface a portion of said coating in said solution;

(5) removing the re-dipped article from said second composition and draining excess thereof together with said solution of the surface of said coating; and

(6) thereafter curing said article to convert said first composition into a solid material.

2. A method according to claim 1 characterized in that said resinous material is polyvinyl acetate and said plasticizer is hot water.

3. A method according to claim 1 characterized in that said resinous material is polyvinyl alcohol and said plasticizer is water and glycerine.

4. A method according to claim 3 characterized in that said second composition comprises hot water.

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