

# PATENT SPECIFICATION

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## (54) CRUSHED FOAM COATING FOR LEATHER AND LEATHER-LIKE MATERIALS

(71) We, ROHM AND HAAS COMPANY, a corporation organized under the laws of the State of Delaware, United States of America, of Independence Mall West, Philadelphia, Pennsylvania 19105, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention is concerned with crushed foam coated substrates and methods of making them.

Suitable substrate materials may include all kinds of leather by which we mean real leather, artificial leather, and materials suitable for making poromeric or other leather substrates or imitations.

Present techniques for the coating of leather and leather substitutes leave much to be desired, often involving as much as 5 to 6 coatings in order to achieve a tough abrasion resistant topcoat on leathers of poorer quality. The resulting surface may nevertheless reflect imperfections inherent in the substrate.

Thus, in the art of finishing leathers, means for upgrading low grade materials are still being sought. Also, much sought after is an attractive low cost alternative to the micro-porous urethane laminate presently used to surface the nonwoven base web of poromeric materials, such as Corfam.

Textile fabrics have been successfully coated with polymeric compositions or formable polymeric compositions which foam on the textile (U.S. Patent 3,527,654). This procedure has not been successfully adaptable to the nonwoven substrates, such as the leather finishing arts, because of the balance of properties required for leathers which is different and more difficult to achieve than with conventional textile fabrics.

The present invention in its preferred form may be used to provide a method for obtain-

ing crushed foam coated grain side leather splits whereby, in contrast to the prior art, the stiffening of the substrates coated by use of a single coating is avoided. Also, the process may be used in a continuous production line. It also makes possible the elimination of many of the operations presently being employed in standard leather finishing methods.

The invention in its preferred form can provide a more economical process for upgrading leather or leather substrates. It can also mask many of the natural defects in the leather substrate, and provide a controlled build up of the coating which results in lack of "photographing" of the underlying web.

According to the invention there is provided a process for the production of a crushed foam-coated substrate which comprises:

(A) coating the substrate with a layer of at most 60 mils thickness of a foam of a polymer latex.

(B) partially drying the foam layer.

(C) crushing, and plating and/or embossing and curing the partially dried foam in a single step or in discrete steps, the curing temperature being from 250 degrees F to 375 degrees F, the plating and/or embossing pressure being from 500 to 2000 p.s.i. in the case of a synthetic substrate and from 500 to 2000 p.s.i. in the case of a real leather substrate and plating and/or embossing, when effected separately from curing, being carried out at an elevated temperature of at most 250 degrees F, and the crushing, when carried out as a discrete step, being at an elevated pressure of up to 50 p.s.i.

Thus, in accordance with a preferred embodiment of the present invention, a leather, reconstituted leather, or a substrate suitable for making a poromeric or other leather substitutes, has a crushed foam material securely adhered thereto. The finally cured coating is

then suitable for top coating, as by spraying or knifing on, known in the art, for example, with a vinyl urethane lacquer. This in turn, is subjected to conventional drying.

- 5 The latex compositions that produce the foams used in the present invention may be prepared from a copolymer of (a) one or more of the monomers alkyl acrylates, alkyl methacrylates, acrylonitrile, vinyl halides, vinyl acetate, vinyl alkylates, olefins, styrene, vinyl  
10 toluene, and  $\alpha$ -methyl styrene, and (b) one or more vinyl monomers, which provides the cross-linker, having at least one of the following functional groups, carboxyl, hydroxyl, amide and methylol amide, alkylguanamine,  
15 aldehyde, urea, ureido and epoxy groups.

- The crushing step (C) is intended to reduce the thickness of the foam to from 8 to 12 percent of the thickness of the wet foam as applied, e.g. 60 mils reduced to 6 mils.  
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- The coating and partial drying may necessarily need to be carried out separately but, it is possible to combine the subsequent crushing, embossing or plating and curing steps  
25 by variation of the conditions normally used in these steps, according to the prevailing circumstances.

- When crushing is carried out as a discrete step, it may be effected at room temperature at up to about 50 p.s.i. This crushing is normally carried out in the cold under pressure on a large roll for example as high as 50 p.s.i. ram pressure. The pressure required merely to crush the foam can however  
30 be as low as finger pressure.

- Foam has successfully been crushed on a nonwoven web for a poromeric material using conditions similar to those conventionally used in embossing such poromerics. These would range from 5 to 500 p.s.i. The crushing pressures, here again, can be minimal; even as little as 1 p.s.i. may be sufficient. The crushing may alternatively be controlled primarily by the gap in the crushing apparatus rather than the compressive force. The gap can be set so as to crush at a given thickness, including the substrate, with minimal pressure. At the upper extreme the pressure can be the maximum that the substrate itself will tolerate. Thus there is a very broad range of suitable crushing pressures. These maximum tolerable pressures may be as high as 40 to 50 tons ram pressure (i.e. about 1000 p.s.i.) on leather splits. Such high pressures would be inappropriate on poromeric materials or other types of artificial leather substrates. In these cases it is usually more preferable to increase the temperature rather than the pressure to achieve satisfactory crushing.  
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- When crushing is performed as a step separate from curing it is of course important that the temperature should not exceed 250° F. to avoid curing.  
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- It is possible to crush and plate (or emboss) in substantially one step and in this case  
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the applied temperatures and pressures may be varied considerably from those when crushing is carried out as a separate step and will be substantially those that would be applied in plating or embossing in a discrete step.

These may vary considerably. On an artificial leather substrate the plating or embossing conditions are relatively low pressure, from 5 to 500 p.s.i. and an elevated temperature of at most 250° F., preferably 175° to 250° F., more preferably 200 to 250° F. On real leather such as leather splits or grain leathers the pressures are from 500 to 2000 p.s.i., preferably 500 to 1200 p.s.i., more preferably 800 to 1200 p.s.i. and temperatures at the upper end of the range, that is to say from 175 to 250° F.

Naturally the conditions that will be used in any commercial process will be determined by the skilled worker using his judgement in determining the best visual and textural effect for the system, as well as ensuring satisfactory adhesion of the crushed foam to the substrate.

The pressures and temperatures will vary according to the nature of the substrate, including the smoothness of its surface and upon the inherent capability of the crushed foam coating to adhere to the different types of substrates. For example, with different types of real leather the manner of tanning will influence the optimum conditions.

The curing stage will be carried out at a temperature of 250 to 375° F. Much higher temperatures are likely to induce discolouration or degradation of the substrate.

Whereas we have set out optimum conditions for each of the steps of crushing, plating or embossing, and curing it will be appreciated that these steps can be combined by adopting temperatures and pressures that, achieve a satisfactory compromise to enable two or more of the steps to be combined.

For example, when coating a web for a poromeric base all three steps could be satisfactorily combined by applying a pressure of from 5 to 500 p.s.i. at a temperature of 300° F. The pressure of 5 p.s.i. would be sufficient to crush the foam satisfactorily and in this case the higher temperature of 300 to 350° F. is very useful in helping to accomplish adequate deformation of the web, particularly if the web is bound by wholly or partially cured polymer. Of course this discussion is primarily directed towards artificial leathers. Thus in the range of 300 to 350° F. and 5 to 10 p.s.i. it may be possible to crush, plate or emboss and cure in one operation.

On real leather much higher pressures may be used, for example 1000 p.s.i. and this allows for moderation in temperature, for example 280 to 285° F., for a single-step crushing plating or embossing and curing.

It may be convenient with most of the

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substrates to crush at room temperature with minimal pressure to place the article in a readily handled condition and then to use a combined embossing/curing step as above described for crushing/plating/curing. The crushing and embossing may be combined with all of the substrates and with poromeric materials it is usual to cure in the same operation. In the case of real leathers it is possible to crush and plate or emboss at such a low temperature that a subsequent curing step is required.

For combinations of the steps of curing and plating/embossing, preferred conditions are 5 to 500 p.s.i. at 250 to 375° F. for artificial leather substrates and 800 to 1200 p.s.i. at 250 to 375° F. for real leather substrates.

In Table I is set forth a typical formulation for the foams that are useful in the coating of a non-woven web used as a base for a poromeric material, side leather, and split leather.

TABLE I

| Formulation                               | Nonwoven Web and Side Leather (parts by wt./.) | Split Leather (parts by wt.) |
|-------------------------------------------|------------------------------------------------|------------------------------|
| Latexes A or B                            | 100.0                                          | 100.0                        |
| China Clay                                | 15.0                                           | 15.0                         |
| Ammonium Stearate 33% (Foam Stabilizer)   | 7.0                                            | 7.0                          |
| Aerotex MW, Melamine (Amer. Cyanamid Co.) | 2.3                                            | 2.3                          |
| Ammonium Hydroxide, 28%                   | 2.0                                            | 2.0                          |
| Colorants:                                |                                                |                              |
| PRIMAL (R) Black 110                      |                                                | 15.0                         |
| PRIMAL (R) White 85                       | 15.0                                           |                              |
| PRIMAL (R) Ochre 10                       |                                                |                              |
| PRIMAL (R) D.Brwn. 5                      |                                                |                              |
|                                           | Beige                                          |                              |
| Totals                                    | 141.3                                          | 141.3                        |

(R) is defined as a registered trademark of the Rohm and Haas Company for their series of various standard pigments in a vehicle of a water soluble polymer binder, a sulfonated tallow, an auxiliary dispersant, and water.  
 "Aerotex" is a Registered Trade Mark.

Runs were made on foam coating of the following substrates:  
 —Nonwoven web from Fleming-Joffe Company

PRIMAL® 571—Impregnated Greiss-Pflegger Combatan leather

—Chrome tanned work shoe splits from Lannon Mfg. Co.

—Vegetable tanned splits.

—Hartland's chrome tanned splits

Acrylic foam coatings made with the following two resins were used: (Parts by weight are indicated)

Latex A (86 ethyl acrylate/10 acrylonitrile/2.7 methylol acrylamide/1.3 acrylamide)

Latex B (96 ethyl acrylate/3.5 acrylamide/0.5 acrylic acid)

These were then partially cured and

—Nip-rolled (crushed) smooth, then

—Nip-rolled (crushed) over Warren's morocco-grained release paper to achieve a texture.

After final curing, one set was:

—Topcoated with a vinyl urethane laquer

—While another set was left without a topcoat.

The following physical tests were run on these various crushed foam-coated substrates: Taber abrasion, Multech wet soak resistance, Satra Dome, Bally Flex, and Cold Crack (–20° F.) flexibility (see Table II).

## RESULTS.

CORFAM WEB—The Latex B crushed

foam-coated nonwoven web, nip-rolled smooth, and topcoated with a vinyl urethane lacquer

had a good balance of properties and meets commercial requirements:

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#### Typical Commercial Requirements.

#### Crushed Foam Coating Results

Good Wet Bally Flex adhesion  
Good Wet Bally Flex flexibility  
Cold Crack Resistance at  $-20^{\circ}\text{C}$ .  
Embossibility  
Receptivity to Topcoats

>40,000 Wet Bally Flexes  
>40,000 Wet Bally Flexes  
No Cracking at  $-28.9^{\circ}\text{C}$ .  
Good  
Good

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In addition, this system was passed over 1000 cycles on the Taber Abraser without wear. It passed 750 cycles on the Multech, and passed the Satra Dome Test. "Corfam" is a Registered Trade Mark.

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**CORRECTED GRAIN SIDE LEATHER**—The Latex B foam coating, nip-rolled smooth

(crushed) on Griess-Pfleger's corrected grain side leather with PRIMAL® 571 impregnated and topped with a vinyl urethane lacquer resulted in a good balance of properties. It is better than is usually obtained with a conventional coating system:

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Mul-Tech Wet Soak Resistance  
Taber Abrasion Resistance  
Cold Crack Flexibility  
Appearance  
Coverage

#### Crushed Foam Coating Results

430 Cycles  
>1000 Cycles  
Slight Cracking  
Smooth and Well-filled  
Excellent

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**RESULTS ON SPLIT LEATHER**—The Latex A foam coating nip-rolled smooth (crushed) on a reverse side of a vegetable

split also had a good balance of properties. It is better than that usually obtained with a conventional coating system:

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Appearance  
Coverage  
Taber Abrasion Resistance  
Mul-Tech Wet Soak Resistance  
Bally Flex Flexibility (Wet)

#### Crushed Foam Coating Results

Smooth and well filled  
Excellent  
600 Cycles  
270 Cycles  
Slight cracking

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Table II presents the physical measurements made on a number of typical substrates which had been crushed foam-coated, according to the present invention, and demonstrates the

significant results obtained. It should be noted that products having different substrates may have different commercial requirements, depending on particular commercial usages.

TABLE II

## Physicals of Representative Acrylic Crushed Foam-Coated Substrates

| Substrate                             | Latex Used in Foam | Topcoat | Surface Texture | Taber Abrasion <sup>1</sup> |                       | Mul-Tech Wet Soak Resistance <sup>2</sup> |                       |                          |
|---------------------------------------|--------------------|---------|-----------------|-----------------------------|-----------------------|-------------------------------------------|-----------------------|--------------------------|
|                                       |                    |         |                 | Initial Failure Cycles      | % Wear at 1000 Cycles | Initial Failure Cycles                    | Cycles at 10% Failure | % Damage at Cycles       |
| Non-Woven Web                         | L-A                | None    | Smooth          | 215                         | 70                    | 30                                        | 40                    | 100/100                  |
| "                                     | L-A                | Lacquer | Smooth          |                             | None                  | >10,000 <sup>6</sup>                      | >10,000 <sup>6</sup>  | None/10,000 <sup>6</sup> |
| "                                     | L-A                | None    | Embossed        | 185                         | 20                    | 110                                       | 200                   | 10/200                   |
| "                                     | L-A                | Lacquer | Embossed        |                             | None                  | 300                                       | >1,000                | >10/1000                 |
| "                                     | L-B                | None    | Smooth          | 165                         | 100 at 550 cycles     | 20                                        | 23                    | 100/50                   |
| "                                     | L-B                | Lacquer | Smooth          |                             | None                  | 750                                       | 800                   | 100/1000                 |
| "                                     | L-B                | None    | Embossed        | 120                         | 100 at 350 cycles     | 15                                        | 20                    | 100/50                   |
| "                                     | L-B                | Lacquer | Embossed        |                             | None                  | 65                                        | 80                    | 15/100                   |
| Impregnated Side Leather              | L-A                | None    | Smooth          |                             | None                  | 170                                       | 200                   | 10/200                   |
| "                                     | L-A                | Lacquer | Smooth          |                             | None                  | >1,000                                    | >1,000                | None/1,000               |
| "                                     | L-B                | None    | Smooth          |                             | None                  | 35                                        | 40                    | 90/100                   |
| Impregnated Side Leather Reverse Side | L-B                | Lacquer | Smooth          |                             | None                  | 430                                       | 450                   | 90/500                   |
| Vegetable Split                       | L-A                | None    | Smooth          | 300                         | 40                    | 40                                        | 60                    | 50/100                   |
| Vegetable Split                       | L-A                | Lacquer | Smooth          | 600                         | 15                    | 270                                       | 285                   | 40/300                   |

### Physicals of Representative Acrylic Crushed Foam-Coated Substrates

| Substrate                             | Latex used in Foam | Topcoat | Surface Texture | Wet Bally Flex <sup>3</sup><br>Amount of Failure | Cold Crack <sup>5</sup><br>Amount of Cracking |
|---------------------------------------|--------------------|---------|-----------------|--------------------------------------------------|-----------------------------------------------|
| Non-Woven Web                         | L-A                | None    | Smooth          | Moderate                                         | Moderate                                      |
| " "                                   | L-A                | Lacquer | Smooth          | Moderate                                         | Consid.                                       |
| " "                                   | L-A                | None    | Embossed        | Moderate                                         | Consid.                                       |
| " "                                   | L-A                | Lacquer | Embossed        | Moderate                                         | Consid.                                       |
| " "                                   | L-B                | None    | Smooth          | Slight                                           | Very Slight                                   |
| " "                                   | L-B                | Lacquer | Smooth          | Very Slight                                      | None                                          |
| " "                                   | L-B                | None    | Embossed        | Slight                                           | Very Slight                                   |
| " "                                   | L-B                | Lacquer | Embossed        | Very Slight                                      | None                                          |
| Impregnated Side Leather              | L-A                | None    | Smooth          | None                                             | Consid.                                       |
| " "                                   | L-A                | Lacquer | Smooth          | None                                             | Consid.                                       |
| " "                                   | L-B                | None    | Smooth          | None                                             | None                                          |
| Impregnated Side Leather Reverse Side | L-B                | Lacquer | Smooth          | Blister <sup>4</sup>                             | Slight                                        |
| Vegetable Split                       | L-A                | None    | Smooth          | Consid.                                          | Consid.                                       |
| Vegetable Split                       | L-A                | Lacquer | Smooth          | Slight                                           | Consid.                                       |

- 1 Taber Abrasion: Wheel No. CS-17; Suction 60; 1000 g. Load.
- 2 Mul-Tech:  $\frac{1}{2}$  hour soak; 4 lb. Load.
- 3 Bally Flex:  $\frac{1}{2}$  hour soak; rated at 40,000 cycles.
- 4 Blister: There was one large blister on this sample.
- 5 Cold Crack:  $-20^{\circ}\text{F.}$ ; samples conditioned  $\frac{3}{4}$  hour.
- 6 This was the only sample tested for this many cycles.

Note: All the above foam-coated substrates passed the Satra Dome Test.

Based on the data in Table II, certain meaningful comments are possible. The Latex A foam coating resulted in good wet soak resistance and abrasion resistance, but poor Bally Flex and Cold Crack flexibility. The opposite is true with the Latex B foam coatings. On the nonwoven web and side leather substrates, the best balance of properties is obtained with the Latex B coating, nip-rolled smooth, and topcoated with lacquer. This system results in good Taber abrasion resistance, the best Bally Flex and Cold Crack flexibility. The Mul-Tech wet soak resistance is not as good as its Latex A counterpart, but is the best of the Latex B foam coatings.

*Topcoat:* The Latex B-vinyl urethane lacquer topcoat considerably upgraded the wet soak resistance, Taber abrasion, and in some cases, flexibility.

*Surface Texture:* Some of the physical parameters appear to have been affected by the surface texture (smooth or embossed). With Latex A smooth-coated, untopped Corfam web shows less cold cracking than its embossed counterpart. The Mul-Tech wet soak resistance of the embossed and untopped Latex A was better than its smooth coated counterpart; however, the reverse was true when it was topcoated.

With the Latex B coating, both the smooth and embossed untopped nonwoven web had equally poor Mul-Tech wet soak resistance, while the smooth topcoated nonwoven web had much better wet soak resistance than its embossed counterpart. The other substrates were all nip-rolled smooth.

*Substrates:* The nonwoven web is the easiest to foam coat as it is available in a continuous roll of uniform thickness. The impregnated side leathers give some mechanical handling problems because of low spots in the leather. Certain splits are more difficult to foam-coat, because the coating does not adhere to the loose "fuzz" on a heavily sueded surface. However, a vegetable tanned split which was foam coated with the Latex A coating on a smoother surface and then topcoated, resulted in good abrasion resistance, respectable wet soak resistance, and wet Bally Flex flexi-

bility, but to be foam coated, splits will have to be free of dust or "fuzz" to obtain adequate adhesion.

#### EXAMPLE I.

Split leather was foam coated with a composition containing Latex A, the coating was partially dried, and crushed at less than 5 psi and at room temperature. One piece was embossed at a pressure of 550 psi and a temperature of  $200^{\circ}\text{F.}$ , and was subsequently cured at a temperature of  $325^{\circ}\text{F.}$  Another piece was embossed at a pressure of 1000 psi and a temperature of  $200^{\circ}\text{F.}$ , and subsequently cured at a temperature of  $325^{\circ}\text{F.}$  Both sections were then topcoated with conventional side leather finishing materials.

The adhesion of the foam coating to the substrate for the low pressure embossed piece was inadequate, while the adhesion of the foam coating embossed at the higher pressure was adequate.

A third section was first cured at  $325^{\circ}\text{F.}$ , and then embossed at a pressure of 1000 psi and a temperature of  $200^{\circ}\text{F.}$  The adhesion of the foam coating to the substrate for this process was also inadequate. The trial demonstrates that the sequence of operation described and the conditions of pressure and temperature set forth are necessary to achieve the desired end result.

#### EXAMPLE II.

A piece of a non-woven web coated with a foam coating composition containing Latex B, was partially dried at  $225^{\circ}\text{F.}$ , crushed with minimal pressure, subsequently topcoated with a urethane lacquer, and cured at  $300^{\circ}\text{F.}$  Another section was smooth embossed at a pressure of 10 psi and a temperature of  $350^{\circ}\text{F.}$ , prior to topcoating.

The foam coating of the former section showed inadequate adhesion to the web, while the foam coating embossed according to the second sequence, showed adequate adhesion.

This trial further demonstrates the need for adequate pressure, combined with a temperature during embossing, to achieve the desired end result, including the critical good

adhesion of the crushed foam coat.

# WHAT WE CLAIM IS:—

1. A process for the production of a crushed foam-coated substrate which comprises:

5 (A) coating the substrate with a layer of at most 60 mils thickness of a foam of a polymer latex.

(B) partially drying the foam layer.

10 (C) crushing, and plating and/or embossing and curing the partially dried foam in a single step or in discrete steps, the curing temperature being from 250° F. to 375° F., the plating and/or embossing pressure being from 5 to 500 p.s.i., in the case of a synthetic  
15 substrate and from 500 to 2000 p.s.i. in the case of a real leather substrate and plating and/or embossing, when effected separately from curing, being carried out at an elevated temperature of at most 250° F., and the  
20 crushing, when carried out as a discrete step, being at an elevated pressure of up to 50 p.s.i.

2. A method as claimed in Claim 1 wherein the substrate is grain upper leather, a split, reconstituted leather, or a web suitable for  
25 the manufacture of poromeric and other artificial leather.

3. A method as claimed in Claim 1 or 2 wherein the latex composition comprises a copolymer of (a) one or more of monomers:  
30 alkyl acrylates, alkyl methacrylates, acrylonitrile, vinyl halides, vinyl acetate, vinyl alkylates, olefins, styrene, vinyl toluene, and  $\alpha$ -methyl styrene, and (b) one or more vinyl monomers, which provide the cross-linker,  
35 having at least one carboxyl, hydroxyl, amide and/or methylol amide, alkyl-guanimine, aldehyde, urea, ureido and/or epoxy functional groups.

4. A method as claimed in any one of  
40 Claims 1 to 3 wherein the crushing is carried out at a pressure of from one to five pounds per square inch and a temperature above the minimum film-forming temperature of the particular copolymer employed, but below its  
45 curing temperature.

5. A method as claimed in any one of  
50 Claims 1 to 4 wherein the substrate is a synthetic substrate and the plating and/or embossing is carried out at a pressure of from 5 to 500 p.s.i. at a temperature of from 175 to 250° F.

6. A method as claimed in any one of Claims 1 to 4 wherein the substrate is a real

leather substrate and the plating and/or embossing is carried out at a pressure of 500 to 1200 p.s.i. and a temperature of 175 to 250° F. 55

7. A method as claimed in any one of Claims 1 to 3 wherein the substrate is an artificial leather substrate and crushing and plating and/or embossing are carried out together at a pressure of from 5 to 500 p.s.i. and a temperature of from 200 to 250° F. 60

8. A method as claimed in any one of Claims 1 to 3 wherein the substrate is real leather and crushing and plating and/or embossing are carried out together at a pressure of from 800 to 1200 p.s.i. and a temperature of from 175 to 250° F. 65

9. A method as claimed in any one of Claims 1 to 3 wherein the substrate is an artificial leather substrate and curing and plating and/or embossing are carried out together at a pressure of from 5 to 500 p.s.i. and a temperature of from 250 to 375° F. 70

10. A method as claimed in any one of Claims 1 to 3 wherein the substrate is real leather and curing and plating and/or embossing are carried out together at a pressure of from 800 to 1200 p.s.i. and a temperature of from 250 to 375° F. 75

11. A method as claimed in any one of Claims 1 to 3 wherein the substrate is an artificial leather substrate and curing and plating and/or embossing are carried out together at a pressure of from 5 to 500 p.s.i. and a temperature of from 250 to 375° F. 80

12. A method as claimed in any one of Claims 1 to 3 wherein crushing, plating and/or embossing and curing are carried out together upon an artificial leather substrate at a pressure of from 500 to 1200 p.s.i. and a temperature of from 250 to 375° F. 85

13. A method as claimed in Claim 1 substantially as described in any of the foregoing Examples. 90

14. A crushed foam coated substrate produced by a method as claimed in any one of the preceding Claims. 95

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adhesion of the crushed foam coat.

**WHAT WE CLAIM IS:—**

1. A process for the production of a crushed foam-coated substrate which comprises:
  - 5 (A) coating the substrate with a layer of at most 60 mils thickness of a foam of a polymer latex.
  - (B) partially drying the foam layer.
  - (C) crushing, and plating and/or embossing and curing the partially dried foam in a single step or in discrete steps, the curing temperature being from 250° F. to 375° F., the plating and/or embossing pressure being from 5 to 500 p.s.i., in the case of a synthetic substrate and from 500 to 2000 p.s.i. in the case of a real leather substrate and plating and/or embossing, when effected separately from curing, being carried out at an elevated temperature of at most 250° F. and the crushing, when carried out as a discrete step, being at an elevated pressure of up to 50 p.s.i.
  2. A method as claimed in Claim 1 wherein the substrate is grain upper leather, a split, reconstituted leather, or a web suitable for the manufacture of poromeric and other artificial leather.
  3. A method as claimed in Claim 1 or 2 wherein the latex composition comprises a copolymer of (a) one or more of monomers:
    - 30 alkyl acrylates, alkyl methacrylates, acrylonitrile, vinyl halides, vinyl acetate, vinyl alkylates, olefins, styrene, vinyl toluene, and  $\alpha$ -methyl styrene, and (b) one or more vinyl monomers, which provide the cross-linker, having at least one carboxyl, hydroxyl, amide and/or methylol amide, alkyl-guanimine, aldehyde, urea, ureido and/or epoxy functional groups.
    4. A method as claimed in any one of Claims 1 to 3 wherein the crushing is carried out at a pressure of from one to five pounds per square inch and a temperature above the minimum film-forming temperature of the particular copolymer employed, but below its curing temperature.
    5. A method as claimed in any one of Claims 1 to 4 wherein the substrate is a synthetic substrate and the plating and/or embossing is carried out at a pressure of from 5 to 500 p.s.i. at a temperature of from 175 to 250° F.
    6. A method as claimed in any one of Claims 1 to 4 wherein the substrate is a real

leather substrate and the plating and/or embossing is carried out at a pressure of 500 to 1200 p.s.i. and a temperature of 175 to 250° F. 55

7. A method as claimed in any one of Claims 1 to 3 wherein the substrate is an artificial leather substrate and crushing and plating and/or embossing are carried out together at a pressure of from 5 to 500 p.s.i. and a temperature of from 200 to 250° F. 60

8. A method as claimed in any one of Claims 1 to 3 wherein the substrate is real leather and crushing and plating and/or embossing are carried out together at a pressure of from 800 to 1200 p.s.i. and a temperature of from 175 to 250° F. 65

9. A method as claimed in any one of Claims 1 to 3 wherein the substrate is an artificial leather substrate and curing and plating and/or embossing are carried out together at a pressure of from 5 to 500 p.s.i. and a temperature of from 250 to 375° F. 70

10. A method as claimed in any one of Claims 1 to 3 wherein the substrate is real leather and curing and plating and/or embossing are carried out together at a pressure of from 800 to 1200 p.s.i. and a temperature of from 250 to 375° F. 75

11. A method as claimed in any one of Claims 1 to 3 wherein the substrate is an artificial leather substrate and curing and plating and/or embossing are carried out together at a pressure of from 5 to 500 p.s.i. and a temperature of from 250 to 375° F. 85

12. A method as claimed in any one of Claims 1 to 3 wherein crushing, plating and/or embossing and curing are carried out together upon an artificial leather substrate at a pressure of from 500 to 1200 p.s.i. and a temperature of from 250 to 375° F. 90

13. A method as claimed in Claim 1 substantially as described in any of the foregoing Examples. 95

14. A crushed foam coated substrate produced by a method as claimed in any one of the preceding Claims.

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