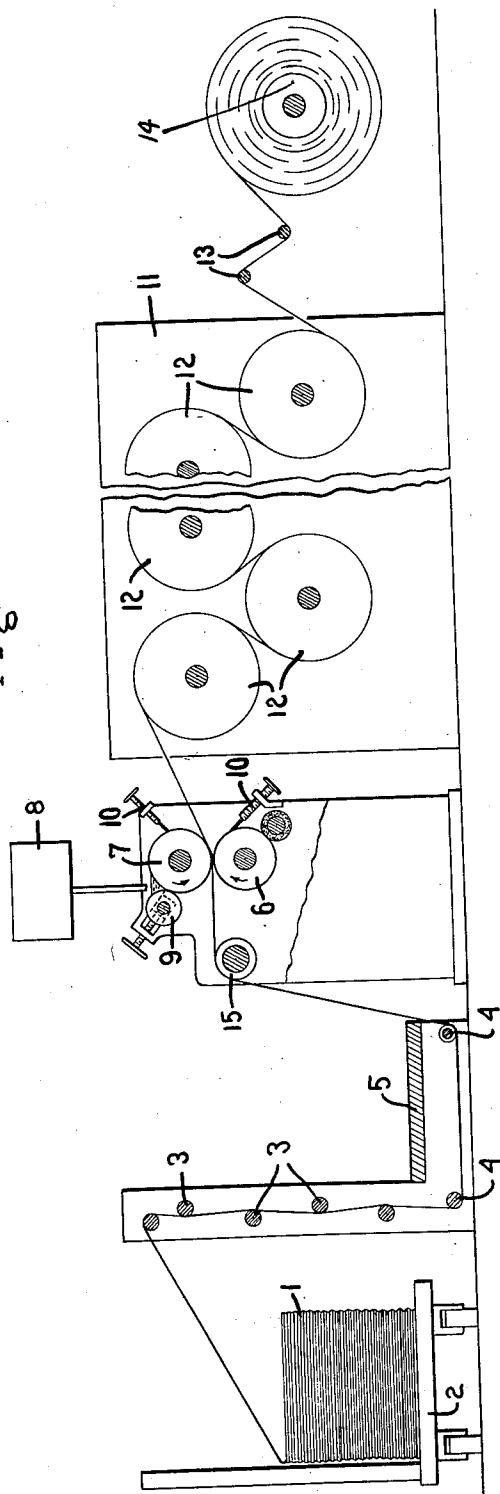


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32. J. J. CLIFFORD
LEATHER SUBSTITUTE, BASE SHEET MATERIAL THEREFOR,
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LEATHER SUBSTITUTE, BASE SHEET MATERIAL THEREFOR, AND PROCESS OF MAKING SAME

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This invention relates to a material in sheet form available as a substitute for certain kinds of leather and for other purposes.

One object of the invention is to provide
5 a novel kind of sheet material to be employed as a base which may be subsequently treated by different processes to produce different types of sheet material available as substitutes for leather of different types and having different characteristics.

10 The object of the invention is further to provide for the production of such a base material by the treatment of cotton flannel thoroughly napped on both sides and preferably by the treatment of a specially woven cotton flannel having loose twisted warps so as to insure the napping of both the warp and the filling and thus a uniformly napped surface.

20 The object of the invention is further to produce such a base material made from a textile fabric in which the weave of the fabric is concealed.

The object of the invention is further to
25 produce a leather substitute in sheet form which shall present one face resembling and having characteristics of the grain side of leather and the other face resembling and having the characteristics of the flesh side of
30 leather.

The object of the invention is further to produce such a leather substitute in sheet form characterized by sufficient porosity to breathe like leather.

35 The object of the invention is further to produce such a material including a textile fabric base and rubber compound coatings which shall be wear-resistant and with the coatings non-peelable.

40 The object of the invention is further to produce such a material having the further characteristic of leather in that it may be cut and trimmed to present a leather-like edge and without producing any ragged or frayed
45 effect, which is important when the edge is not to be folded in but is to be used in its trimmed or cut condition.

The object of the invention is further to
50 provide such a material which shall be moisture-absorbent.

The object of the invention is further to provide such a material having a textile fabric base and rubber compound coatings in which cotton fibres are thoroughly distributed throughout the entire material and act
55 to bind the non-fibrous components of the material to the textile body.

The object of the invention is further to provide such a leather substitute in sheet form having the general characteristics of leather
60 and which may be coated, stencilled, sprayed with leather finishes, shellac compounds and cellulose compounds employed in the finishing of real leather, and which may be embossed and in general otherwise treated as
65 leather is treated to give various finishes and effects.

These and other objects and features involved in the construction of the sheet material, the base material therefor and the process of making the same will appear more fully
70 from the accompanying description and drawing and will be particularly pointed out in the claims.

The drawing illustrates a single figure and chiefly diagrammatically a simple form of
75 apparatus which may be employed in carrying out certain steps of the process of the invention.

In the construction of this material, an
80 important feature resides in the use of cotton flannel as a textile base. The type of cotton flannel made use of is that generally known as "double nap" and should be thoroughly napped on both sides. The best results are secured by making use of a specially
85 woven cotton flannel in which the warps are loosely twisted so that when the napping operation takes place, both the warps and the filling will be napped on both sides thus to
90 give a uniformly napped surface. Because of the subsequent treatment of this material it is not necessary that the warps should have much tensile strength, but it is important that the surfaces should be thoroughly napped
95 so that the fibres may extend throughout the impregnating and coating compounds employed.

In the first step of the process, this napped cotton fabric is thoroughly impregnated with
100

a rubber compound solution or cement having a large percentage of rubber. A preferred form of impregnating compound is made up as follows:—70% pure rubber, 3% of organic resin, such as cumar resin which acts to increase the tackiness of the rubber and assists in the thorough penetration of the textile fibres by the solution, 20% of zinc oxide which acts as a filler and which also acts to toughen the rubber and to stiffen the fabric, and, as it is usually desirable to color the material, 7% of coloring pigment as required. The foregoing ingredients may be mixed in an ordinary cement churn for twenty-four hours in the proportions of about two pounds of the ingredients to one gallon of 68° to 70° naphtha. This will serve as an illustration of the type of impregnating solution desirably employed.

The impregnating solution may be applied to the fabric by any suitable means and for that purpose a form of apparatus is illustrated at the left-hand side of the drawing. In the apparatus shown, the cotton flannel 1 is piled in reverse folds on a truck 2. The truck is brought into position behind a vertical frame presenting horizontal tension bars 3 between which the flannel is passed to straighten it out. The flannel then passes beneath guide rolls or bars 4 under a platform 5 upon which the operative may stand and thence through the impregnating machine. This machine is shown as comprising two rolls 6 and 7 set in suitable bearings and positively driven. The impregnating solution is fed from a tank 8 and stands in a bank between the top roll 7 and a doctor roll 9 which covers the amount of the solution fed to the upper roll 7 and from thence forced into the fabric. Suitable scraping blades 10 maintain the rolls 7 and 6 clean. Thorough impregnation of the cotton flannel may require a second passage through the machine with the surfaces reversed.

The second step of the process consists in drying the impregnated cotton flannel. For this purpose the impregnated fabric may be run through any suitable drying apparatus. In the drawing there is illustrated a drying apparatus comprising a chamber 11 containing a number of large heated drying cans or cylinders 12 around and about which the fabric passes, thus bringing both sides of the fabric into contact with the drying elements.

The third step of the process consists in ironing the dry and impregnated fabric under tension so as gently to press the napped fibres on both sides into the impregnating substance and conceal the weave of the fabric. For this purpose highly polished steel bars 13 of small diameter may be employed and so set that the impregnated fabric has a sinuous course about these bars so that one bar irons one face of the fabric while the other bar

irons the other face of the fabric. From these bars the fabric passes to and may be wound up on a suitable core or roll 14. The desired tension on the fabric may be given in different ways, but sufficient tension will be obtained with an apparatus such as that illustrated by the drag on the fabric as it passes through the impregnating and drying apparatus. The fabric is drawn through by the roll 14, which is positively driven, and the drag is produced on the cans by the impregnating apparatus and also by the drag over a tension roll 15 which may be located at the admission end of the impregnating apparatus.

When these steps have been completed, the base material is finished and is ready for further treatment to produce a leather-like sheet material of the required type.

A further feature of the invention resides in the production from this material of novel forms of leather substitute by certain novel processes.

In the preferred process employed in the treatment of this base material, the first step consists in starching one side of the impregnated fabric. This may be done by running the material through an ordinary starching machine supplied with potato starch. The result is to enable the base material when subsequently coated on the opposite side to be wound up on itself without injury.

In the next step of the process the base material is spread on the unstarched side with a coating of rubber compound and preferably with a coating loaded with cotton flocks. This operation is carried on by passing the base material through a usual type of spreading machine and spreading the coating in a similar manner to that employed in the manufacture of rubber sheeting and similar materials.

While in the broader aspects of the invention various rubber compounds may be employed for this coating, a preferred compound is produced as follows:—pure rubber 50%, fillers and usual compounding ingredients 17%, vulcanizing agents 2%, color pigment 1%, cotton flocks 30%. The various ingredients, with the exception of the cotton flocks, may be mixed in the usual way in the ordinary mixing mill. The mixture may then be placed in a churn with the usual solvents such as naphtha and thoroughly churned to produce the spreading solution or cement. After thorough churning, the cotton flocks may be added and beaten in.

The spreading compound may also be made by mixing all the ingredients, including the cotton flocks, in a dry state in the ordinary mixing mill and then placing the mixture, together with the solvent, in the churn and agitating to form the spreading solution or cement.

In the third step, the material is then vul-

canized so as simultaneously to vulcanize the rubber compounds incorporated in the fabric both by the impregnating and by the coating operation. In the preferred form of the process, this vulcanization is carried on by a vapor cure process and involves two steps, (a) the vulcanization proper, and (b) the neutralization of any acid left in the material as the result of the vulcanization.

In step (a) the preferred method employed is to place sulphur chloride solution in a chamber in which the temperature is maintained at about 130° F. by steam or other suitable heat. The solution vaporizes in the chamber and the material is fed through the chamber. When the material is thus treated, it absorbs a large amount of sulphur chloride due to the fibrous nature of the material. The action which takes place between the sulphur chloride and the moisture in the fabric results in the formation of a substantial amount of hydrochloric acid which must be completely neutralized or the fabric will be attacked by the acid in time.

In step (b) neutralization is preferably performed in a rapid and expeditious manner by the use of anhydrous ammonia which comes commercially in the form of a gas under pressure and contains no moisture. In carrying out this step, the material is passed through a chamber and the anhydrous ammonia is sprayed from a pipe against one or both surfaces of the material and also fills the chamber. One passage of the material through the chamber under these conditions is found completely to neutralize any acid remaining in the fabric.

In the fourth step of the process, one or more additional coatings of rubber compound are successively spread, as by the use of the usual spreading machine, on the previously coated side of the material. These compounds are preferably of similar composition to that employed in the first spreading operation and preferably, therefore, are heavily loaded with cotton flocks.

In the fifth step of the process, the coated side is now starched as with corn starch applied by an ordinary starching machine. This gives a dead effect to the surface and prevents a streaky appearance. It also gives a dry surface and does away with the natural tackiness of the rubber cement solution.

In the sixth step of the process, the coatings spread in accordance with the fourth step of the process are vulcanized. The vulcanization of the impregnated material and the first spread coating separately from the vulcanization of these additional coatings prevents peeling which has heretofore been seriously objectionable. Since the uncoated side of the material has already been vulcanized in accordance with the fourth step of the process, the additional coating or coatings are vulcanized preferably by passing the

material through the usual process employed for vulcanizing surface coatings by the wet cure. For this purpose the coated side of the material is (a) passed in contact with a roller running in a solution of sulphur chloride diluted with highly volatile rubber solvents such as carbon tetrachloride and benzol and then (b) heated to vaporize the vulcanizing solution and vulcanize the last applied coating or coatings, which latter step may be carried on by passing the material over a steam-heated drum. The material is then (c) treated to neutralize any hydrochloric acid left in the fabric by any suitable method, as, for example, by passing the material through the ordinary neutralization process employed with the vapor cure. In such process 26° ammonia is placed in a heated chamber in which the ammonia vaporizes and the material is passed through the chamber.

As a further step preferably employed, the material is then starched in an ordinary starching machine with talc which gives a smooth, leather-like feel, although with certain of the chloride materials employed, this talc starching process cannot be used satisfactorily.

The completed sheet material presents a highly satisfactory substitute for various kinds of leather. It is characterized by having the feel and appearance of leather, particularly in that one side has the feel and appearance of the flesh side of leather and the other side those of the grain side of leather. The best quality of leather selected for hard service is that which has the natural grain side at one surface and the flesh side at the other. The flesh side is composed of a mass of long, loose fibres held together by a natural agglutinant, while the grain side is composed of a mass of fine, closely knit fibres thoroughly bound together by a natural agglutinant and capable of withstanding substantial abrasion and wear and presenting a non-peeling surface. The material of this invention closely resembles leather in these characteristics. The base material is a soft, suede-like, substance, very flexible and resembling the flesh side of leather. It is made up of the loosely woven textile material which presents particularly in the nap a mass of long, loose fibres held together by the rubber compound agglutinant. The finished material of this invention presents, however, at one side a composition similar to the grain side of leather, presenting a mass of finely divided, closely knit fibres bonded together with the rubber compound. This is particularly true when, as is preferred, the rubber compound is heavily loaded with cotton flocks. The material therefore presents one side having the characteristics of the flesh side of leather and the other side having the characteristics of the grain side and capable of similar treatment to that given leather and

presenting a highly satisfactory substitute for leather.

The rubber coatings will not peel or skin off. The napped fibres extend well through the rubber compounds with which the fabric is impregnated and coated and, particularly when the cotton flocks is employed, the fibres are very thoroughly distributed throughout the entire material, binding the non-fibrous components to the body of the fabric. The difficulty heretofore with the use of rubber compound coatings has been that the coating is present in the material as a surface film which, while giving waterproof qualities, is likely to peel when subjected to abrasion. With the present invention, the fibres of the napped surface and, in the preferred form, the cotton flocks with which the coatings are heavily loaded destroy this film-like characteristic so that an intimate bond and union takes place between the fibre content of the material and the rubber compound. The rubber compound becomes chiefly a binder holding the cotton fibres together and combining with them to make an integral, non-peelable material.

The material of this invention also, by reason of the thorough intermixture throughout of the fibrous base and the rubber compound may be cut and trimmed to present a clean leather-like edge which will not be ragged, fray or ravel. This is particularly important where, as frequently, the edge is not to be folded but to be left in its natural state.

The material is moisture-absorbent, which is particularly desirable where it is used as a substitute for leather and is subject to contact with perspiration. The material has sufficient porosity to cause it to breathe like leather, which is a desirable characteristic. Furthermore, it is highly wear-resistant, making it particularly useful for shoe parts subject to friction and abrasion, as in the case of quarter linings. The material is of light weight and is capable of receiving the various leather finishes usually employed as heretofore pointed out and of being embossed to increase its resemblance to leather and to present any desired pattern or effect.

When the grain or coated side of the material of this invention is vulcanized, the rubber compound becomes firm and hard, much like the result of the tanning operation with leather. When leather finishes or pyroxylin finishing compounds are applied to ordinary rubber surface coatings, difficulty is experienced in the adhesion and such finishes are likely to be worn or rubbed off. The present material takes and holds such finishes largely because of two of its inherent characteristics, first, the high percentage of fibres which permeate the material to the surface and, second, the porosity of the material. The fibres absorb the finishes and the porosity of the

material permits the finishes to penetrate well into the body of the material.

It is believed that the material presents the closest approximation to real leather in all characteristics ever produced and therefore a highly desirable substitute for leather.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is:

1. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising producing a base by, (1) thoroughly impregnating cotton flannel, having loosely twisted warps in which the filling and warps are napped on both sides, with a solution of rubber, organic resin and a filler, (2) drying the impregnated fabric and (3) ironing the impregnated fabric under tension on both sides gently to press the napped fibres at both sides into the impregnating substance and conceal the weave, and thereafter vulcanizing said base.

2. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising producing a color transfused base by, (1) thoroughly impregnating cotton flannel, having loosely twisted warps in which the filling and warps are napped on both sides, with a solution of rubber, organic resin, a filler and coloring pigment, (2) drying the impregnated fabric and (3) ironing the impregnated fabric under tension on both sides gently to press the napped fibres at both sides into the impregnating substance and conceal the weave, and thereafter vulcanizing said base.

3. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising producing a color transfused base by, (1) thoroughly impregnating cotton flannel, having loosely twisted warps in which the filling and warps are napped on both sides, with a solution of approximately 70% pure rubber, 3% organic resin, 20% of a suitable filler acting to toughen the rubber and stiffen the fabric and 7% of coloring pigment, (2) drying the impregnated fabric and (3) ironing the impregnated fabric under tension on both sides gently to press the napped fibres at both sides into the impregnating substance and conceal the weave, and thereafter vulcanizing said base.

4. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising producing a base by, (1) impregnating thoroughly cotton flannel, in which both sides are thoroughly napped, with a solution of rubber, organic resin and a filler, (2) drying the impregnated fabric and (3) ironing the impregnated fabric under tension on both sides gently to press the napped fibres at both sides into the impregnating substance and

conceal the weave, and thereafter vulcanizing said base.

5 The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising
 10 producing a color transfused base by, (1) impregnating thoroughly cotton flannel, in which both sides are thoroughly napped, with a solution of rubber, organic resin, a filler and coloring pigment, (2) drying the impregnated fabric and (3) ironing the impregnated fabric under tension on both sides gently to
 15 press the napped fibres at both sides into the impregnating substance and conceal the weave, and thereafter vulcanizing said base.

6. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising
 20 producing a color transfused base by, (1) impregnating thoroughly cotton flannel, in which both sides are thoroughly napped, with a solution of approximately 70% pure rubber, 3% organic resin, 20% of a suitable filler acting to toughen the rubber and stiffen the fabric and 7% of coloring pigment, (2)
 25 drying the impregnated fabric and (3) ironing the impregnated fabric under tension on both sides gently to press the napped fibres at both sides into the impregnating substance and conceal the weave, and thereafter vul-
 30 canizing said base.

7. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the im-
 35 pregnated base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) vulcanizing simultaneously the rubber compounds incor-
 40 porated in the fabric by the impregnating and coating operations, (4) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (5) starching the face of the last applied coating, (6) vulcanizing the aforesaid additional coating or coatings.

8. The process of producing a sheet material available as a substitute for certain kinds
 50 of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 6 to render it non-adhesive, (2) spreading a coating of rubber compound on the
 55 other side of the impregnated fabric, (3) vulcanizing simultaneously the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) spreading one or more additional coatings of
 60 rubber compound on the previously coated side of the fabric, (5) starching the face of the last applied coating, (6) vulcanizing the aforesaid additional coating or coatings.

9. The process of producing a sheet material available as a substitute for certain kinds

of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a
 70 coating of rubber compound on the other side of the impregnated fabric, (3) vulcanizing simultaneously the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) spreading one or
 75 more additional coatings of rubber compound on the previously coated side of the fabric, (5) starching the face of the last applied coating, (6) vulcanizing the aforesaid additional coating or coatings, (7) starching the coated side of the fabric.

10. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the im-
 85 pregnated unvulcanized base fabric described in claim 6 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) vulcanizing simultaneously the rubber compounds incorporated in the fabric by the im-
 90 pregnating and coating operations, (4) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (5) starching the face of the last applied coating, (6) vulcanizing the
 95 aforesaid additional coating or coatings, (7) starching the coated side of the fabric.

11. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the im-
 100 pregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) passing the fabric through a chamber filled with sulphur chloride vapor main-
 105 tained at a temperature of substantially 130° F. simultaneously to vulcanize the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) neutralizing any hydrochloric acid left in the fabric as a result of the previous step, (5)
 110 spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (6) starching the face of the last applied coating, (7) vulcanizing the aforesaid additional coating or coatings.

12. The process of producing a sheet material available as a substitute for certain kinds
 120 of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 6 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side
 125 of the impregnated fabric, (3) passing the fabric through a chamber filled with sulphur chloride vapor maintained at a temperature of substantially 130° F. simultaneously to vulcanize the rubber compounds incorporated

in the fabric by the impregnating and coating operations, (4) neutralizing any hydrochloric acid left in the fabric as a result of the previous step, (5) spreading one or more additional coatings or rubber compound on the previously coated side of the fabric, (6) starching the face of the last applied coating, (7) vulcanizing the aforesaid additional coating or coatings.

13. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) passing the fabric through a chamber filled with sulphur chloride vapor maintained at a temperature of substantially 130° F. simultaneously to vulcanize the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) passing the vulcanized fabric through a chamber containing gaseous, anhydrous ammonia to neutralize any hydrochloric acid left in the fabric as a result of the previous step, (5) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (6) starching the face of the last applied coating, (7) vulcanizing the aforesaid additional coating or coatings.

14. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 6 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) passing the fabric through a chamber filled with sulphur chloride vapor maintained at a temperature of substantially 130° F. simultaneously to vulcanize the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) passing the vulcanized fabric through a chamber containing gaseous, anhydrous ammonia to neutralize any hydrochloric acid left in the fabric as a result of the previous step, (5) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (6) starching the face of the last applied coating, (7) vulcanizing the aforesaid additional coating or coatings.

15. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) passing the fabric through a chamber filled with sulphur chloride vapor maintained at a

temperature of substantially 130° F. simultaneously to vulcanize the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) neutralizing any hydrochloric acid left in the fabric as a result of the previous step, (5) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (6) starching the face of the last applied coating, (7) applying a vulcanizing solution of sulphur chloride diluted with highly volatile rubber solvents to the coated side of the fabric, (8) heating the fabric to vaporize the vulcanizing solution and vulcanize the last applied coating or coatings, (9) neutralizing any hydrochloric acid left in the fabric.

16. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) passing the fabric through a chamber filled with sulphur chloride vapor maintained at a temperature of substantially 130° F. simultaneously to vulcanize the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) neutralizing any hydrochloric acid left in the fabric as a result of the previous step, (5) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (6) starching the face of the last applied coating, (7) applying a vulcanizing solution of sulphur chloride, carbon tetrachloride and benzol to the coated side of the fabric, (8) heating the fabric to vaporize the vulcanizing solution and vulcanize the last applied coating or coatings, (9) neutralizing any hydrochloric acid left in the fabric.

17. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 6 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) passing the fabric through a chamber filled with sulphur chloride vapor maintained at a temperature of substantially 130° F. simultaneously to vulcanize the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) neutralizing any hydrochloric acid left in the fabric as a result of the previous step, (5) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (6) starching the face of the last applied coating, (7) applying a vulcanizing solution of sulphur chloride, carbon tetrachloride and benzol to the coated side of the

fabric, (8) heating the fabric to vaporize the vulcanizing solution and vulcanize the last applied coating or coatings, (9) neutralizing any hydrochloric acid left in the fabric.

18. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) vulcanizing simultaneously the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (5) starching the face of the last applied coating, (6) applying a vulcanizing solution of sulphur chloride diluted with highly volatile rubber solvents to the coated side of the fabric, (7) heating the fabric to vaporize the vulcanizing solution and vulcanize the last applied coating or coatings, (8) neutralizing any hydrochloric acid left in the fabric.

19. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) vulcanizing simultaneously the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (5) starching the face of the last applied coating, (6) applying a vulcanizing solution of sulphur chloride, carbon tetrachloride and benzol to the coated side of the fabric, (7) heating the fabric to vaporize the vulcanizing solution and vulcanize the last applied coating or coatings, (8) neutralizing any hydrochloric acid left in the fabric.

20. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 6 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) vulcanizing simultaneously the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (5) starching the face of the last applied coating, (6) applying a vulcanizing solution of sulphur chloride, carbon tetrachloride and benzol to the coated side of the fabric, (7) heating the fabric to vaporize the

vulcanizing solution and vulcanize the last applied coating or coatings, (8) neutralizing any hydrochloric acid left in the fabric.

21. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) passing the fabric through a chamber filled with sulphur chloride vapor maintained at a temperature of substantially 130° F. simultaneously to vulcanize the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) passing the vulcanized fabric through a chamber containing gaseous, anhydrous ammonia to neutralize any hydrochloric acid left in the fabric as a result of the previous step, (5) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (6) starching the face of the last applied coating, (7) applying a vulcanizing solution of sulphur chloride diluted with highly volatile rubber solvents to the coated side of the fabric, (8) heating a fabric to vaporize the vulcanizing solution and vulcanize the last applied coating or coatings, (9) neutralizing any hydrochloric acid left in the fabric.

22. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound heavily loaded with cotton flocks on the other side of the impregnated fabric, (3) vulcanizing simultaneously the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) spreading one or more additional coatings of rubber compound on the previously coated side of the fabric, (5) starching the face of the last applied coating, (6) vulcanizing the aforesaid additional coating or coatings.

23. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound on the other side of the impregnated fabric, (3) vulcanizing simultaneously the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) spreading one or more additional coatings of rubber compound heavily loaded with cotton flocks on the previously coated side of the fabric, (5) starching the face of the last

applied coating, (6) vulcanizing the aforesaid additional coating or coatings.

24. The process of producing a sheet material available as a substitute for certain kinds of leather and for other purposes comprising, (1) starching one side of the impregnated unvulcanized base fabric described in claim 4 to render it non-adhesive, (2) spreading a coating of rubber compound heavily loaded with cotton flocks on the other side of the impregnated fabric, (3) vulcanizing simultaneously the rubber compounds incorporated in the fabric by the impregnating and coating operations, (4) spreading one or more additional coatings of rubber compound heavily loaded with cotton flocks on the previously coated side of the fabric, (5) starching the face of the last applied coating, (6) vulcanizing the aforesaid additional coating or coatings.

25. A sheet material available as a substitute for certain kinds of leather and for other purposes comprising cotton flannel thoroughly napped on both sides, thoroughly impregnated with a vulcanized compound of rubber, organic resin and a filler, having the napped fibres at both sides lying embedded in the incorporated impregnating compound and concealing the weave, starched on one side and coated on the other side with a vulcanized rubber compound starched on the exposed face of the coating.

26. A sheet material available as a substitute for certain kinds of leather and for other purposes comprising cotton flannel thoroughly napped on both sides, thoroughly impregnated with a vulcanized compound of rubber, organic resin and a filler, having the napped fibres at both sides lying embedded in the incorporated impregnating compound and concealing the weave, starched on one side and coated on the other side with a vulcanized rubber compound heavily loaded with cotton flocks and starched on the exposed face of the coating.

27. A base material for use in the production of sheet material available as a substitute for certain kinds of leather and for other purposes comprising cotton flannel thoroughly napped on both sides, thoroughly impregnated with a vulcanized compound of rubber, organic resin and a filler, having the napped fibres at both sides lying embedded in the incorporated impregnating compound and concealing the weave.

28. A sheet material available as a substitute for certain kinds of leather and for other purposes comprising cotton flannel thoroughly napped on both sides, thoroughly impregnated with a vulcanized compound of rubber, organic resin and a filler, having the napped fibres at both sides lying embedded in the incorporated impregnating compound and concealing the weave, starched on one side, coated on the other side with a vulcanized

rubber compound, starched on the exposed face of the coating and characterized in that the two sides of the material have the feel and appearance of the flesh and grain sides, respectively, of leather, in that the material due to the embedded napped fibres has sufficient porosity to breathe like leather, and in that it is capable of receiving the usual leather finishes.

29. A sheet material available as a substitute for certain kinds of leather and for other purposes comprising cotton flannel thoroughly napped on both sides, thoroughly impregnated with a vulcanized compound of rubber, organic resin and a filler, having the napped fibres at both sides lying embedded in the incorporated impregnating compound and concealing the weave, starched on one side, coated on the other side with a vulcanized rubber compound heavily loaded with cotton flocks, starched on the exposed face of the coating and characterized in that the cotton fibres are thoroughly distributed throughout the material binding the non-fibrous components to the flannel, and in that the two sides of the materials have the feel and appearance of the flesh and grain sides, respectively, of leather, in that the material due to the embedded napped fibres and cotton flocks has sufficient porosity to breathe like leather, and in that it is capable of receiving the usual leather finishes.

In testimony whereof, I have signed my name to this specification.

JAMES J. CLIFFORD.