Oct. 23, 1945. W. D. HEDGES ET AL 2,387,394

COATED FABRIC MATERIAL

Filed Jan. 19, 1940

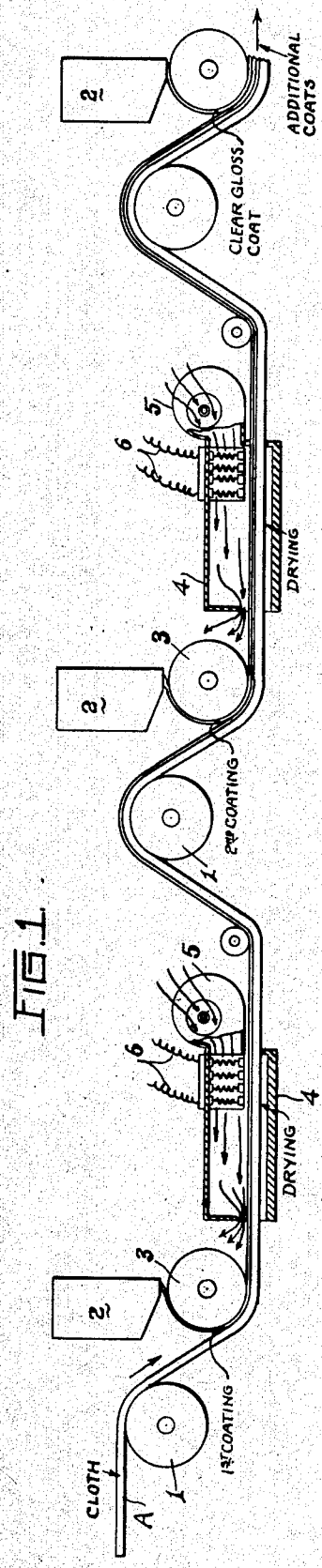


FIG. 1.

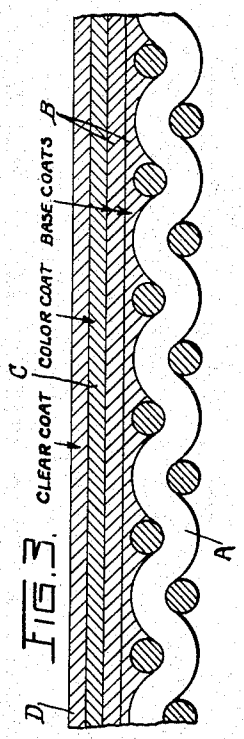


FIG. 3.

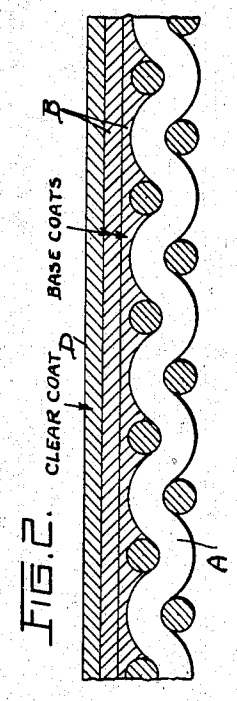


FIG. 2.

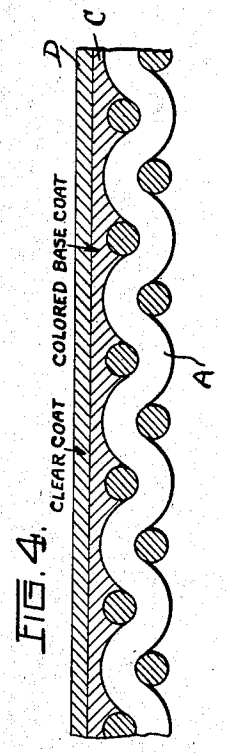


FIG. 4.

Inventors
WILLIAM D. HEDGES,
JOHN C. LOWMAN,
THOMAS J. KERR,
By Coulson & Coulson
Attorneys

Patented Oct. 23, 1945

2,387,394

UNITED STATES PATENT OFFICE

2,387,394

COATED FABRIC MATERIAL

William D. Hedges, John C. Lowman, and Thomas J. Kerr, Columbus, Ohio, assignors to Columbus Coated Fabrics Corporation, Columbus, Ohio, a corporation of Ohio

Application January 19, 1940, Serial No. 314,683

3 Claims. (Cl. 117—161)

This invention relates to coatings and more particularly to coated fabrics and the application of flexible coating on a base material which is adapted to be folded and flexed.

It is an object of this invention to provide a coated material which is highly flexible and wherein the final product can be folded or twisted without damaging the coating film.

Another object of this invention is to provide an improved method of coating fabric or other suitable base supporting material which can be dried to produce a tack-free durable material.

Another object is to produce a coated fabric having a pyroxylin coating film which is of improved pliability and which retains its durability and flexibility for a longer period of time than similar coated materials made heretofore.

Another object is to provide a coating applicable to flexible base material to provide a wear-resistant surface which does not become dull and brittle upon aging and exposure to the elements.

Another object is to provide a method of applying multiple coating films upon a flexible base to build up a coated sheet material which will not become tacky or soften when heated for several hours at 185 to 200 degrees F.

Another object is to provide a coated flexible base material which is adapted for use in making furnishings which must withstand outdoor exposure, such as porch furniture, awnings, etc.

Another object is to make a waterproof, flexible coated fabric of improved durability and which resists checking, chalking or cracking for a longer period of time than similar coated material made prior to this invention.

A further object is to provide a multiple coated fabric base with coating compositions plasticized with a maleic acid modified castor oil plasticizer.

These and other objects will be readily apparent from the following description taken in connection with the drawing.

In the drawing:

Figure 1 is a side elevation view, partly in section, illustrating diagrammatically the method of applying one or more coatings to a cloth or fabric base material;

Figure 2 is an enlarged fragmentary cross section view showing the application of two base coats and a superposed clear coating on a fabric base material;

Figure 3 is a similar view as Figure 2, showing the intermediate application of a color coat between the base coat and the clear coat;

Figure 4 is a similar cross sectional view as in Figures 2 and 3, illustrating the application of a color base coat and a clear coat in the manufacture of a coated fabric product.

In the manufacture of coated fabric it has been conventional heretofore to plasticize the coating composition with castor oil, blown oil, dibutyl phthalate, tricresyl phosphate and the like, but coated materials prepared by the use of these coatings have been found to have either a low exudation temperature or upon aging lose their flexibility and rapidly dull and eventually crack, requiring replacement. The use of blown oils somewhat overcomes the difficulty with exudation of the softening or plasticizing agent but the product does not have the required flexibility.

It has been discovered that fabrics, felted material and the like flexible base products may be given one or multiple applications of coating films wherein the coating comprises a maleic acid-glycol reacted castor oil constituent as the softener or plasticizer to produce a highly improved coated fabric material. Further, by the application of an oleoresinous or varnish drying coat over the coated fabric, the material may be given a high gloss which is very durable on aging. Each of the under coating films is plasticized with the modified castor oil plasticizing resinous product. Where the final gloss coating film is an oleoresinous varnish it will not contain plasticizer. After applying the coating the material is thereafter dried to produce a coated fabric having a high exudation temperature which in general will show no exudation of the softener over the temperature ranges to which pyroxylin coated fabrics can be safely subjected.

As examples illustrating typical formulae of the plasticizing agent utilized in compounding the coating compositions for application to the flexible base material, the following are given:

Example I

A mixture of 150 parts by weight of castor oil, 31 parts by weight of glycol and 50 parts by weight of maleic anhydride is heated together in a reaction chamber, with or without stirring

or blowing with CO_2, at a temperature of approximately 230 degrees C. for 12 hours. The reaction chamber is preferably equipped with a stirrer, and provision is made for escape of the water formed during the reaction, while at the same time loss of glycol is prevented. When the product is heat treated for this length of time the produce is in the form of a gel. If it is desired to carry the resin to this state it is preferable to add a solvent such as toluol or xylol thereto while the resin is still hot. This prevents the resin from going into an insoluble state before it is used, and also provides a product which is readily dispersed in coating compositions. If CO_2 is used the alcohol compatibility of the resin is somewhat decreased and the cooking time is shortened. Carbon dioxide may be introduced by bubbling the gas through the mixture. With the use of carbon dioxide a lower acid value resin is produced.

Example II

In this example, 400 parts by weight of castor oil, 26 parts by weight of diethylene glycol and 50 parts by weight of maleic anhydride are mixed together and heated as described under Example I. Using the same temperature in cooking, the time is reduced from 12 to 8 hours. The acid number and alcohol solubility of the final resinous product are affected by the same factors as are noted under Example I. In this case the final product has an acid number of about 9 without the use of CO_2. By heat treating the resin for longer than 8 hours at a temperature between 200 and 250 degrees C. the final resinous product will be in the form of a difficultly soluble gel.

Example III

In this example, 800 parts by weight of castor oil, 50 parts by weight of maleic anhydride and 26 parts by weight of glycol, preferably diethylene glycol, are mixed together and heated, as set out above in Example I. In this instance the cooking time is about 14 hours at 230 degrees C. The resinous product produced has an acid number of about 9. A longer cooking time will produce a substantially insoluble resin. Where the resin is to be cooked to produce a product having a high viscosity it is preferable to add toluol or xylol in sufficient amount while the resin is hot so as to prevent the product from going over into an insoluble state upon cooling. The resins made as described will continue to polymerize at temperatures below 200 degrees C. and even below 100 degrees C. so that the introduction of solvent to prevent the polymerization from continuing so as to produce an insoluble solid gel is required.

Example IV

In this instance, 1000 to 1200 parts by weight of castor oil are mixed with 26 parts by weight of diethylene glycol and 50 parts by weight of maleic anhydride and the mixture heat treated as in the previous example. The time required for cooking this batch is much longer than that for the previous example. It was found impossible to produce a gel from this combination even after cooking the resinous batch for 27 hours at 275 degrees C. The product, however, results in yielding a bodied oily resin having definite advantages as a plasticizer over raw castor oil.

It will be understood that the above formulations are merely illustrative of the modified castor oil product utilized as the plasticizer and that the specific ingredients and particular proportions set out in the examples may be varied and equivalent compounds used in place of the materials mentioned.

In the application of the coating to the cloth or fabric base, referring particularly to Figure 1, the material A to be coated is moved along over guide rolls 1 and the coating composition applied from a suitable container 2 onto a spreading roller 3 which evenly coats the fabric as it is moved along. Thereafter the coating is dried by passing the coated fabric through a drying oven 4. This oven preferably comprises suitable means such as a fan 5 and electric heater means 6, for moving the heated air in contact with the coating and in a direction opposite to that of the movement of the fabric, as shown by the arrows in Figure 1. Each of the coatings is preferably dried at a temperature range of 185 to 250 degrees F. for about three minutes, depending upon the composition, and thereafter the coated fabric is moved therealong and additional coats applied if desired. Upwards of 12 to 15 coats may be applied; ordinarily, however, seven or eight coats are sufficient to provide a durable coated fabric.

As shown in Figures 2, 3 and 4, a base coat or filler B is applied to a fabric or flexible backing A and thereafter a color coat C over the base coat. Finally, if desired, a clear flexible varnish or lacquer coat D is applied thereover producing a high gloss finish.

In general the higher viscosity platicizer compositions show less tendency to exude than the lower viscosity less polymerized plasticizing product. The plasticizer formulated using 800 parts of castor oil, as illustrated in Example III, has a viscosity of approximately 450 centipoises, and in the formulation of Example IV using 1000 parts of castor oil, the viscosity of the final product is approximately 60 centipoises.

Coated fabrics and similar flexible backing material are made in accordance with this invention by applying one or more coatings comprising the plasticizer formulated according to that illustrated in Figures 1 to 4 so as to provide a durable flexible coated base product. Nitrocellulose or pyroxylin coated fabrics made in this way exhibit greater flexibility and are more durable upon aging than coated fabrics made heretofore utilizing castor oil as the plasticizer.

As typical examples of the formulae suitable for application to flexible backing material, the following are given:

Example V

	Parts by weight
Nitrocellulose (20–30 sec. viscosity)	10.0
Plasticizer (Example III)	16.0
Plasticizer (Example IV)	7.5
Pigment	7.5
Solvent	40.0

The solvent is that conventionally used in compounding nitrocellulose compositions and in this instance comprises by volume ethyl acetate 45 per cent, alcohol 32½ per cent, hydrocarbon (toluol or xylol) 22½ per cent. Different pigments may be used which are preferably ground in the nitrocellulose and plasticizer composition, such as is commonly done in a ball mill. If desired suitable driers may be incorporated to speed up the film formation, particularly where slow drying pigments are used. The addition of zinc preferably in the form of naphthanate will retard the drying action of the fast drying pigments so that mixtures of zinc naphthanate with

other pigments which accelerate the drying of the coating may be made to control the final product.

The above ingredients are compounded in the conventional manner. The cloth is then coated with the coating composition and dried. Coated fabric made with this formulation does not exude or soften at 190 degrees F. and its flexing properties are maintained after aging.

As another typical formula for compounding coating suitable for exceedingly soft pieces of coated fabric, the following formulation is illustrative:

Example VI

	Parts by weight
Nitrocellulose (½ sec. or 20–30 sec. viscosity)	10.0
Plasticizer (Example III)	11.3
Plasticizer (Example IV)	10.0
Pigment	10.0
Superfloss (diatomaceous earth)	3.0
Butyl acetyl ricinoleate	2.5

The above coating composition is compounded as the pigment formulation of Example V and is adapted for use in making garments, typewriter covers and similar coated fabrics where the material is required to be very soft and of non-spewing character.

Another typical example of a nitrocellulose composition containing the improved softener or plasticizer in making coated fabrics of this invention is as follows:

Example VII

	Parts by weight
Nitrocellulose (½ sec. or 20–30 sec. viscosity)	12.0
Plasticizer (Example IV)	20.0
Pigment	10.0
Solvent	45.0

The coating is compounded as in Example V and is similarly applied to the fabric or flexible backing and dried to provide a soft flexible coated material.

As a typical formula for a base coating, the following may be used:

Example VIII

	Parts by weight
Nitrocellulose (½ sec. or 20–30 sec. viscosity)	10.0
Plasticizer (Example III)	22.5
Pigment	7.5
Solvent	40.0

The solvent used is a mixture of ethyl acetate, alcohol and hydrocarbon solvent as given above in Example V. Other suitable solvent mixtures commonly utilized in compounding cellulose nitrate compositions may be used.

Where it is desired to apply varnish or oil drying coating over a pyroxylin coated fabric to give it a higher gloss and pleasing appearance, it is essential that the plasticizer used in formulating the base coat does not exude at the temperature at which the varnish coating is applied and dried thereon. The coating compositions formulated as disclosed when employing the maleic anhydride-polyhydric modified castor oil as a plasticizer for the base coating provide an ideal base over which oil varnish, oleoresinous, alkyd resin or similar clear varnish or lacquer compositions may be applied and dried. This is readily accomplished because the plasticizer does not exude during drying of the varnish at 185 to 200 degrees F.

A clear lacquer or resinous coating containing the improved plasticizer and suitable as a coating to be applied over the case is as follows:

Example IX

	Parts by weight
Nitrocellulose (½ sec. or 20–30 sec. viscosity)	12.0
Drying oil modified alkyd resin	4.0
Plasticizer (Example III)	20.0
Solvent	45.0

In the above examples it will be understood that different viscosity nitrocellulose, such as the 5 second, 10 second or higher viscosity cellulose, may be used in place of the half-second variety and the proportionate amount of ingredients varied to produce the desired coating consistency.

The application of coatings for sizing threads or fibers such as silk, cotton or artificial filaments may be utilized by substituting the castor oil modified plasticizer disclosed herein for the softener or plasticizer utilized in compounding the sizing or coating composition. In this way an improved coated fabric or filament is provided which will exhibit a high degree of flexibility and freedom from exudation of softener when the coated fabric is subjected to relatively high temperatures such as 185 to 200 degrees F.

When the resinous plasticizers herein disclosed are used to replace raw castor oil on a part-by-weight basis the plasticized film is somewhat less pliable. If the plasticizing resin is used to replace only a portion of the castor oil a softer film results than when the resinous plasticizer alone is employed, and the flexibility of the coating is greatly increased and the exudation point of the plasticizer is raised materially. It has been found unexpectedly that when upholstering material or the like coated fabric made according to this invention is aged, it retains its original properties better after it has aged several months than a similar material made utilizing raw castor oil as a plasticizer before it has aged. It is believed that this results from the influence of the pigment on the drying action of the resinous plasticizer which forms a gel and continues to plasticize the filament without weakening it, while in the case of raw castor oil no such results are produced. Further, more of the resinous plasticizer disclosed herein may be incorporated in the coating film without encountering exudation difficulties than is possible using raw castor oil. In this way artificial leather may be produced using the modified castor oil plasticizer which exhibits outstanding improvement in flexibility and also does not exude the plasticizer at temperatures upwards of 185 degrees F.

It is understood that this invention is not limited to the specific examples given and that widely different embodiments of this invention may be made without departing from the spirit and scope thereof.

Having thus fully described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A coated product comprising a flexible base and a coating thereon, said coating comprising a nitrocellulose film forming constituent and a plasticizer comprising the reaction product of substantially 800 parts by weight of castor oil, substantially 50 parts by weight of maleic anhydride and substantially 26 parts by weight of di-

ethylene glycol for a period of about 14 hours at a temperature of substantially 230° C., said reaction product being characterized by the fact that its acid number is about 9, and said coated product being characterized by the fact that it will retain its pliability and flexibility at extremely low temperatures, that the coating thereon will not soften or exude at temperatures of from 185 to 200° F. and will not crack or spew when subjected to weathering.

2. A coated product comprising a flexible base and a coating thereon, said coating comprising a nitrocellulose film forming constituent and a plasticizer comprising the reaction product of substantially 150 parts by weight of castor oil, substantially 50 parts by weight of maleic anhydride and substantially 31 parts by weight of glycol for a period of about 12 hours at a temperature of substantially 230° C., said reaction product being characterized by the fact that its acid number is about 9, and said coated product being characterized by the fact that it will retain its pliability and flexibility at extremely low temperatures, that the coating thereon will not soften or exude at temperatures of from 185 to 200° F. and will not crack or spew when subjected to weathering.

3. A coated product comprising a flexible base and a coating thereon, said coating comprising a nitrocellulose film forming constituent and a plasticizer comprising the reaction product of substantially 800 parts by weight of castor oil, substantially 50 parts by weight of maleic anhydride and substantially 26 parts by weight of glycol for a period of approximately 14 hours at a temperature of substantially 230° C., said reaction product being characterized by the fact that its acid number is about 9, and said coated product being characterized by the fact that it will retain its pliability and flexibility at extremely low temperatures, that the coating thereon will not soften or exude at temperatures of from 185 to 200° F. and will not crack or spew when subjected to weathering.

WILLIAM D. HEDGES.
JOHN C. LOWMAN.
THOMAS J. KERR.