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COATING AND PROCESS FOR APPLYING SAME

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This invention relates to the art of coating, sizing and waterproofing flat sheets such as paper, cardboard, textiles, and the like, and is particularly concerned with the production of a paper or cardboard sheet on which a base coating is caused to adhere and upon which a secondary coating or finish can be applied in such a manner that base coating and finish coating form a single unitary structure, integral with one another without distinct lamination. A further product of the invention consists of an excellent decalcomania presenting marked advantages over the transfer sheets and decalcomania of the present art. The base coating is of such a nature that printing can be effected thereon and the finish coating can then be applied over the printed material, in which case the printing forms part of the unitary structure.

The invention has important advantages in the art of merchandising where it has become of increasing importance to make up an article of merchandise in a package or wrapper of attractive appearance and to advertise the article by means of printed matter prepared with a considerable amount of artistic appeal. In order to improve the appearance of such material, attempts have been made to print the desired matter upon special types of glazed paper but, inasmuch as printing upon a glossy surface is difficult, it has not been possible by this means to produce a finished article in which the printed matter satisfactorily combines with the glossy surface. Attempts to solve the problem have also been proposed by printing the desired matter upon a paper capable of taking the print and then to cover the entire printed sheet with a lamination of cellulose regenerated from the viscose such as, for instance, that known by the trade name "Cellophane." However, the cements used to bind these laminations to the paper have been found to adhere ineffectively either to the paper or to the laminated coating, with the result that the glossy sheet or coating very easily separates from the base upon which it is superimposed.

Attempts have also been made to coat such printed material with a solution of cellulose acetate, which has the advantage of considerable tensile strength and is quite waterproof and airtight. However, a cellulose acetate solution, when applied direct to a sheet, causes the surface thereof to contract. The result is that, although cellulose acetate has very many characteristics that render it highly desirable for this purpose, any paper, cardboard or textile to which it is applied will be distorted and will wrinkle and curl up to an extent that renders it useless as a flat sheet. This circumstance renders cellulose acetate by itself impracticable for the purpose despite its many desirable qualities.

The present invention has for its object the provision of a coating that may be firmly bonded to a sheet, such as paper, cardboard or textile, and that will present a smooth, glossy surface without distortion. A further object is to provide a transfer sheet or decalcomania having the design sealed in and protected against scratching or marring.

Broadly, the invention may comprise the casting directly to the sheet of a primary base coating of such a nature that it will adhere to and bond firmly with the sheet to which it is applied and then to cast upon this base coating a finish coating of a material compatible therewith and of such a nature as to form an integral bond with the base coating. The base coating may be pigmented, or printed upon, or both, and the finish coating cast thereover, the product being a sheet smooth, flat, strong and durable with the printing bright, sharp and brilliant. If it is desired, however, to produce a transfer sheet, a coating of water soluble adhesive is applied first to a sheet of water absorbent paper and the base coat, printing and finish coating are then applied over the adhesive as hereinafter described.

In a preferred form of the invention, I may use for a finishing coat cellulose acetate or the like and obtain as a product a sheet having the strength, smoothness and clarity of this material without any distortion, the color and printing of the base coat having the appearance of being lifted into the finishing coat and of being at the surface thereof.

According to the preferred form of the invention it is of advantage to apply directly to the paper sheet, whether printed or blank, a special coating which is strongly adhesive to the paper, cardboard or textile sheet to which it is applied; which is transparent to anything printed on the paper or cardboard; or, which may be pigmented so as to be opaque, or may be printed upon, or both, but in any case, whether transparent or pigmented, or printed upon, it is compatible with cellulose acetate or the like so as to form an integral, unlaminated bond therewith and with the base material. Furthermore, this base coating is of such a nature as to afford an excellent printing surface, and particularly so with an ink having a carrier or vehicle of similar components with the base coating, so that the intermediate coating may be applied to any type of sheet, printing may be effected on said coating and a transparent finishing coating of cellulose acetate or the like may be then applied over the printing. Due to the thermoplastic nature of the materials employed in the two coatings and in the preferred ink, a firm, integral, single coating is formed into which the printing is actually incorporated as an integral unitary part of the combined coating, in fact lifted up into the finish

coating so that it seems to be on the surface of the combined coating. This combined coating applied in two steps is, in fact, including the printed matter, a single coating adhering strongly to the paper or cardboard, or sheet of whatever nature, and permeating the pores of the same, and of such tensile strength and texture and of such a waterproof nature that it cannot be removed from the sheet except by wetting and abrading the same, in which case the coating with its printed matter will still remain intact with all its brilliancy of color.

For a base coating I prefer to use a polymerized vinyl compound, for example, a polymerized vinyl acetate if the application is to be made to paper or cardboard sheet. In some instances, polymerized vinyl halides may be used as a base coating depending on the nature of the material of the sheet to which it is to be applied. In any case, the base coating and the finish coating, which may be cellulose acetate or equivalent, integrally united, is not to be considered as a support, since the support of the structure is derived from the paper, cardboard, textile or other material to which the integrated coating is to be applied. However, in the form of the invention now discussed, the base coating is such as to make a firm adhesion to the material to which it is applied and to unite and bond with the finish coating, which may be of cellulose acetate. Moreover, the base coating is capable of being printed upon, preferably with an ink of like composition to itself, and when the finish coating is applied upon the printed base coating, the finish coating forms a unitary structure with the base coating and the printed matter is apparently lifted into the finish coating so that it seems to be on the surface.

This structure has hereinabove been described as an unlaminated structure. It is, of course, true that the base coating and the finish coating are of different composition; but, nevertheless, the base coating and the finish coating are so compatible in nature and each of them is so compatible with the print that they combine and merge into an integral unitary bond and no separation can be made by stripping one from the others. It is in this sense that the term "unlaminated" is here used.

For example, I may employ for a transparent base coating directly applied to a paper or cardboard or textile sheet, the following:

	Per cent
Polymerized vinyl acetate.....	40
Acetone.....	50
Dibutyl phthalate.....	10

The vinyl acetate may be first added slowly to the acetone with vigorous agitation and when a clear solution is obtained the dibutyl phthalate is slowly added with continued agitation. This coating is applied by any known methods in a thin film at about 110° F., at which temperature it immediately dries sufficiently to be printed upon if printing is desired.

A second transparent finish coating may then be applied of which the following is an example:

	Per cent
Cellulose acetate.....	25
Acetone.....	70
Dibutyl phthalate.....	5

The cellulose acetate is first added slowly to the acetone with vigorous agitation and when a clear solution is obtained the dibutyl phthalate is slowly added with continued agitation. This coating is then similarly applied in a thin film

under a temperature of about 110° F. The second coating immediately dries and shows a strong, transparent, glossy coating without any distortion of the material underlying the base coat to which it is applied and with which it has merged and united in an integral bond.

The coatings above illustrated are, as has been said, transparent and the color of the background is, therefore, the color of the sheet to which the coating is applied. However, (and this is particularly true where cheap grades of paper are employed), it may be desirable to furnish a good color to the base coating to mask the poor color of the paper. In such case the desired color may be introduced into the base coating, the finish coating being still applied in transparent form over the colored base coating printed or otherwise at such temperatures as to form a single integral coating bonded to the paper.

It must be understood that when pigments are added to the base coating, an exemplary formula of which is given above, various other additions must also be made in order to hold the color in proper dispersion and the solvents and plasticizers must be accordingly of different proportions and of such nature that the colors added should not be deleteriously affected.

I give the following practical formulae for base coatings of the invention with colors as indicated added:

Red

Toluidine red.....	pints.....	1½
Dissolved cotton.....	oz.....	8
Polymerized vinyl acetate, viscosity about 15.....	pint.....	1
Ester gum.....	pint.....	1
Acetone.....	do.....	2
Benzol.....	do.....	1½
Dibutyl phthalate.....	oz.....	8

The whole should be ground from 24 to 30 hours in a ball mill.

Light blue (egg shell)

Lithopone.....	lb.....	½
Blue ultramarine.....	lb.....	½
Dissolved cotton 40 seconds.....	oz.....	6
Dissolved cotton ½ second.....	oz.....	10
Polymerized vinyl acetate, viscosity about 15.....	pint.....	1
Acetone.....	do.....	2
Toluol.....	do.....	1
Tricresyl phosphate.....	oz.....	8

If dark blue is desired, two ounces of a suitable black, such as carbon black or lamp black, may be substituted for an equal amount of lithopone.

Egg shell white

Zinc oxide.....	lbs.....	1¼
Titanium oxide.....	lb.....	¾
Dissolved cotton about 40 seconds.....	oz.....	4
Dissolved cotton about ½ second.....	oz.....	20
Polymerized vinyl acetate, viscosity about 15.....	pints.....	2
Acetone.....	do.....	2
Dammar solution.....	do.....	2
Butanol.....	do.....	1
Tricresyl phosphate.....	oz.....	8

In the case of a flat black coating solution, a pigment stock may first be made of about the following composition:

Eight ounces medium viscosity dissolved cotton per gallon of a solvent consisting of ethyl acetate 1½ pints, butyl acetate 1½ pints, butanol ½ pint, alcohol ½ pint, benzol 2 pints, and toluol 2 pints. To this may be added about 8 ounces of carbon

black and 2 ounces of lamp black to each gallon of solution. The whole should be ground about 36 hours in a ball mill.

The formula for the flat black coating follows:

Foregoing pigment stock.....	Pints	5
Ester gum solution.....	1 3/4	
16 oz. cotton dissolved in same solvents as the pigment stock to 1/2 second.....	1/2	
Butyl acetate.....	4	
Acetone.....	1 1/2	10
Polymerized vinyl acetate viscosity about 15	1 1/2	

All mixtures above described should be centrifuged to obtain a homogeneous particle size.

It will be observed from the composition of the ink used for printing on the base coat as shown by the formulae above given, that the ink is substantially the same as the base coat—in fact, is the same as the pigmented base coat—and that it is compatible with the finish coat of cellulose acetate or the like. It is also the case that when the finish coat is applied, the base coat and printing is taken up and merged integrally with the finish coating.

This property of the base coat and the ink makes it possible to use the invention herein set forth for the production of an excellent decalcomania which is shielded and protected. For this purpose a suitable water absorbent paper is first coated with an adhesive that is soluble in water, the design or other matter is then printed in the ink above described directly upon the adhesive and the finish coat of cellulose acetate is then applied over the printed matter. The printed matter thus becomes an integral part of the finish

coat—is, in fact, taken up by the finish coat, but owing to the presence of the water soluble adhesive the base coat or printed matter does not adhere to the paper. When, therefore, the paper support is wetted with water, the adhesive dissolves and releases the finish coat embodying the printed matter so that it will slide off the paper support and may be affixed to the desired object. This transfer sheet has a marked advantage over the ordinary decalcomania in that the printed matter is sealed and protected from injury or marring by the acetate coating.

The coating of the invention may be applied by any suitable apparatus having means for holding and casting the coating materials and means for printing. One such apparatus particularly devised for the practice of the invention is disclosed and claimed in my copending application Serial No. 271,923 filed May 5, 1939.

Having thus described my invention, what I claim is:

1. A flat sheet of fibrous material, a base coating of polymerized vinyl acetate thereon, a printing upon said base coating, and a finish coating of cellulose acetate over said base coating and said printing, said sheet, base coating, printing and finish coating being so bonded one with another as to form a single, integral, unitary, un laminated and inseparable structure.

2. The process of coating a flat sheet of fibrous material which comprises casting a film of polymerized vinyl acetate solution on said sheet, drying said film, printing on said film and then casting a film of cellulose acetate solution on said film of polymerized vinyl acetate and said printing.

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