

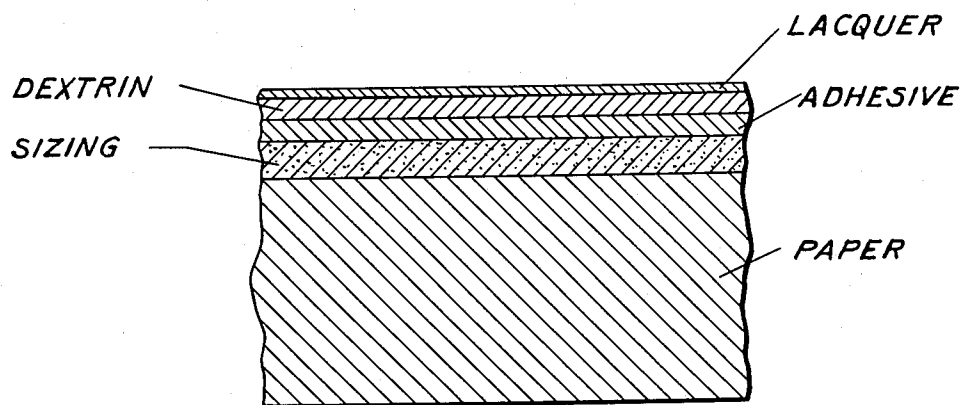
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NON-CURLING TRANSFER MATERIAL

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NON-CURLING TRANSFER MATERIAL

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5 Claims. (Cl. 117—3.5)

This invention relates to decalcomania material of the type comprising a water-permeable backing, an adhesive layer and a sizing layer intermediate the backing and adhesive. A lacquer coating may be applied over the adhesive coating or the printing may be applied directly to the adhesive coating. To transfer the print the paper is soaked in water until the adhesive coating is softened sufficiently to permit the print to be slipped off, after which the print is mounted on the article to be decorated, the part thus transferred hereinafter being called the separable layer or transfer, it being understood that at least part of the adhesive layer is transferred with the separable layer to stick the transfer to the surface to which it is to be applied.

Heretofore material of this kind has had a pronounced tendency to curl toward the coated side, especially at low relative humidities. This has been very troublesome particularly to the printer. To minimize this difficulty plants printing decalcomania paper are usually air conditioned at relative humidities of fifty per cent or more. In many cases the soaking time required to release the transfer has been excessive. Moreover difficulty has been experienced in causing the transfers to adhere satisfactorily to surfaces of many kinds.

Objects of the invention are to provide decalcomania material which is non-curling, and which at the same time quickly releases the transfer when wet, adheres to a wide variety of surfaces and is inexpensive to produce.

According to the present invention the decalcomania material comprises a water-permeable backing such as water-leaf paper, an adhesive coating of adhesive such as dextrin, and an intermediate sizing coating which comprises fine particles which are substantially non-hygroscopic and which are not readily soluble in water, the particles being bonded together with a binder, preferably an adhesive polymer, which permits the ready passage of water through the sizing layer for loosening the transfer but which is substantially insoluble in water in the time required for said loosening so that the sizing layer remains substantially intact when the transfer is released. The aforesaid particles are preferably readily wettable, particularly when the binder is quite insoluble. Preferably the binder does not completely fill the interstices between the particles so as to leave passageways for the water, particularly when the binder is quite insoluble, in which case the binder preferably does not swell substantially in the time required for said loosening so as not to close the passageways. In the preferred embodiment the particles are formed of clay or some other silicate, preferably china clay, and the ratio of particles to binder is at least approximately three to one.

In a more specific aspect the aforesaid adhesive coating comprises two layers hereinafter called top and bottom gummings. The bottom gumming may be varied widely depending on the use for which the material is intended but the top gumming preferably comprises dextrin.

For the purpose of illustration a typical embodiment of the invention is shown in the accompanying drawing

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in which the figure is a cross-sectional diagram of decalcomania material comprising a backing, a sizing coating of the kind referred to, a bottom gumming of adhesive, a top gumming of dextrin, and a lacquer coating which may be omitted, in which case the design is printed directly on the dextrin coating.

In the following description all proportions are by weight and a ream comprises five hundred sheets twenty by twenty-five inches.

The backing may comprise any material through which water may penetrate readily but it preferably consists of water-leaf paper. While the thickness of the paper is not critical, for most purposes it is preferably about five thousandths of an inch.

Typical particles for use in the sizing coating are china clay, magnesium aluminum silicate and the like which are commonly called talc, barium sulphate which is commonly called barytes, calcium carbonate, calcium sulphate, mixtures of aluminum hydroxide and calcium sulphate sometimes called satin white and, where a high degree of whiteness is desired, titanium dioxide. However, china clay is preferable, particularly when using a binder which is highly insoluble. While all these particles are relatively insoluble in water and non-hygroscopic and, when applied to paper as herein described, afford a high degree of flatness or non-curling quality, they vary considerably in the rate of release of the transfer, china clay being the most rapid of the three and barytes being the slowest. This is believed to be due to their different degrees of wettability or adsorptivity, china clay being exceptionally readily wettable, talc having a lesser degree of wettability and barytes being still less readily wettable. Even though the surfaces of the particles are at least partly covered with a thin film of the binder which holds the particles together, nevertheless the wettability accelerates the transfer release, particularly where the binder is so insoluble that the water passes through interstices without substantially swelling the binder. The particle size may vary widely but best results have been obtained with particles less than five microns.

The binder of the sizing coating should not be substantially soluble in the time required for release of the transfer because some of the solid particles would then slide off with the transfer and for best results the binder is highly insoluble. While good non-curling material can be produced with a binder which swells considerably during the soaking operation, the rate of release of the transfer is much slower than in the case of a highly insoluble binder which does not swell appreciably during the soaking operation. Typical binders are:

- (1) Animal glue such as sold by Peter Cooper under the number 1½ hide glue
- (2) Wheat starch
- (3) Casein or alpha protein dissolved in a blend of borax and ammonia
- (4) Polyvinyl acetate copolymer emulsion such as 15K31 sold by National Adhesive Company
- (5) Vinylidene chloride copolymer emulsion such as Geon 652 sold by B. F. Goodrich Chemical Co.
- (6) Copolymer of butadiene and styrene such as 512K sold by Dow Chemical Co.
- (7) Polyacrylic resin emulsion such as Rhoplex AC-33 sold by Rohm & Haas
- (8) High molecular weight polyvinyl acetate such as Ayat sold by Carbide and Carbon Company dissolved in methanol
- (9) Nitrocellulose solution
- (10) Alcohol soluble protein derived from corn protein such as Zein sold by Corn Products Co., dissolved in alcohol or a mixture of alcohol and water.

Some of these binders are more or less swellable, some

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are more insoluble and some are quite insoluble. Some of the binders are in continuous phase and some are in discontinuous phase. For example the above binders 1, 2, 3, 8, 9 and 10 are in continuous phase, and binders 4, 5, 6 and 7 are in discontinuous phase. The discontinuous binders permit faster passage of water and therefore quicker release.

By using wetting agents in the manufacture of the binders the rate of release is increased. Thus the above binders 4, 5, 6 and 7 are more rapid than 8, 9 and 10.

While the ratio of binder to particles varies widely with different materials, best results have been obtained with ratios between 1 to 3 and 1 to 10 in the case of the materials herein referred to.

The thickness of the sizing coating may also vary widely and in general the thicker the coating the flatter the resulting product, but for most purposes five pounds per ream is sufficient.

Typical formulas for the sizing coat are the following:

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English china clay	6
Alpha protein (17% solids)	6
Water	6

The alpha protein is preferably dissolved as follows:

Alpha protein	pounds	450
Water	gallons	250
Ammonia	do	5
Borax	pounds	37½

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English china clay	30
Polyvinyl acetate emulsion in water containing 5 lbs. solids	10
Water	30

Where the transfers are to be applied to surfaces of different kinds, including baked enamels of the urea formaldehyde or phenolic or alkyd resin type, where it is difficult to obtain good adhesion, the adhesive coating should comprise wide-range gumming of which the following is a typical example:

Animal glue	30
Rosin size	30
Polyvinyl acetate emulsion (55% solids)	37
Methoxy polyethylene glycol 350	2
Water	150

The formula is preferably prepared by dissolving the glue and rosin size in water, adding the methoxy polyethylene glycol to the polyvinyl acetate emulsion, making sure that the polyvinyl acetate emulsion is compatible with the other ingredients, and then adding the latter to the glue-rosin size mixture cooled to 110° F.

For most purposes this wide-range coating should be applied approximately four to six pounds (dry) per ream.

The top gumming preferably comprises dextrin or other low viscosity water soluble gumming, with which may be mixed an animal glue, resin dispersions, wetting agent and a plasticizer such as glycerine and sorbitol. A good example for such a top coat is as follows:

Dextrin	75
Animal glue	25
Nekal BX con.	2
Glycerine	2
Water	150

This coating should be relatively thin, usually about two to four pounds (dry) per ream.

A thin film of lacquer may be applied over this top gumming or the printing may be applied directly to the top gumming.

Notwithstanding the solubility of dextrin is much greater than that of the bottom gumming, the slide-off

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split occurs in the bottom gumming, so that the adhesive surface of the transfer is composed largely of bottom gumming. This is due at least in part to the fact that any water reaching the dextrin coating must pass through the bottom gumming; and it may also be partly due to a reduction of the solubility of the dextrin coating by penetration of ink and/or lacquer. While the dextrin has little if any effect on the adhesiveness of the surface of the transfer, it accelerates the release of the transfer so that the soaking time may be substantially reduced. While the reason for this acceleration is not clear, it may be due at least in part to the dextrin layer keeping the ink and/or lacquer from reducing the solubility of the bottom gumming, by obstructing its absorption thereinto.

When wide-range adhesion is not required the bottom gumming may be omitted but it is preferably replaced by a high-viscosity water-soluble film-former slide-off gumming which swells and becomes slippery when wet and therefore serves as a lubricant in sliding-off the transfer, the other layers of the material remaining the same as before. In this case the surface of the transfer is composed largely of dextrin or other top gumming, very little of the slide-off gumming sliding off with the transfer. The preferred slide-off gumming is as follows:

Cellulose gum of low viscosity such as Hercules	
CT grade	8.0
Glycerine	1.5
Water	192.0

This slide-off coat is preferably quite thin, say one pound or less per ream.

Other typical slide-off gummings are starch, sodium salt of polyacrylic acid, sold by Rohm & Haas, as Acrysol G. S. and alpha protein.

When using slide-off gumming, it may be mixed with the adhesive gumming. This has the advantage of eliminating one coating operation, although it tends to increase the release time. A good example for such mixture is as follows:

Acrysol G. S—dry	lb	½
Dextrin—dry	lbs	4½
Water		18

In making the aforesaid decalcomania material each coating should be dried under tension before the next coating is applied and after the last coating has been dried the exposed surface of the paper should be lightly moistened and again dried under tension. The gumming may also be "broken" in the usual way, either with or without the moistening treatment referred to in the preceding sentence.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. Transfer material comprising a backing of porous water-leaf paper, a transfer layer of remoistenable adhesive of the quick-release decalcomania type and a curl-resistant layer interposed between and adhesively joined to said backing and transfer layer which resists the tendency of the transfer material to curl when subjected to ambient humidity changes, said curl-resistant layer comprising fine solid particles which are substantially non-hygroscopic and are bonded together with a binder in amount to leave interstices between the particles so as to leave passageways for water through said curl resistant layer to loosen said transfer layer, the particles being rapidly wettable to speed up the time required to loosen the transfer layer and the binder being substantially insoluble in water in said time so that the curl-resistant layer remains substantially intact when the transfer layer is released.

2. Transfer material according to claim 1 further char-

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acterized in that the binder is substantially non-swellable in the time required for said loosening.

3. Transfer material according to claim 1 further characterized in that said particles are silicates.

4. Transfer material according to claim 1 further characterized in that said particles are clay. 5

5. Transfer material according to claim 1 further characterized in that said particles are china clay.

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