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DECALCOMANIA AND METHOD OF MAKING

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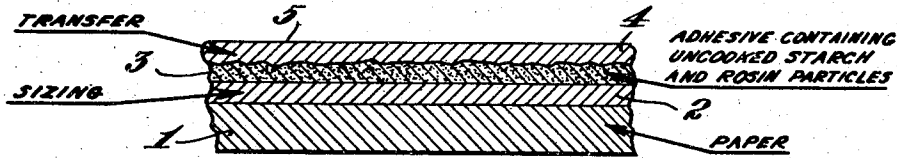


Fig. 1

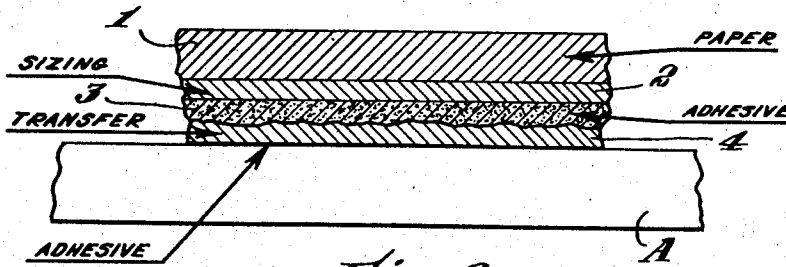


Fig. 2

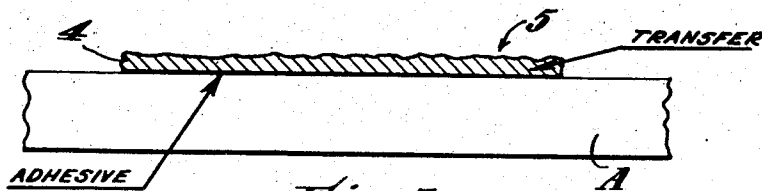


Fig. 3

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DECALCOMANIA AND METHOD OF MAKING

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As is well known a decalcomania comprises a backing of paper or other sheet material, a layer of adhesive and a so-called transfer or design. Ordinarily the backing includes a sizing coat of starch or the like on the side next to the adhesive. The transfer or design may be merely a design printed with ink directly on the adhesive layer or it may comprise a coating of lacquer applied over the adhesive with a design printed on the lacquer layer. There are two types of decalcomanias, direct and reverse, which differ primarily in mode of use and sometimes in the character of the adhesive layer. In the direct type the decalcomania is soaked in water until the adhesive layer is softened enough to permit the backing to be slipped or peeled off and the adhesive remaining on the bottom of the transfer is then utilized to stick it right side up on the surface to which it is permanently applied. In the reverse type the decalcomania is first mounted upside down by liquid adhesive applied to the face of the transfer or to the surface on which the transfer is to be permanently mounted, usually the latter, and after the adhesive has set the aforesaid adhesive layer is softened by water applied to the exposed face of the backing and the backing is peeled off. This invention relates particularly to the reverse type of decalcomania in which the front of the transfer, that is the side ultimately exposed, originally faces the backing and the back of the transfer is originally exposed.

In ordinary decalcomanias of the reverse type the front of the transfer, when ultimately exposed, is smooth and shiny, which is undesirable for many purposes where the transfer should be non-reflecting, as for example in the case of insignia applied to war planes.

Objects of the present invention are to produce a decalcomania of the reverse type which can be produced rapidly and economically, which requires no special technique in effecting the transfer, and in which the front of the transfer, after the backing is removed, is dull and relatively non-specular.

In one aspect the present invention comprises a decalcomania in which the transfer contains an ink vehicle and the adhesive coating contains a filler comprising finely divided particles which are insoluble (but not necessarily unswollen) in water (i. e., cold water) and in the ink vehicle, the particles being large enough to roughen the surface of the coating when dry, whereby the front of the transfer which is applied to said coating is not smooth and, when exposed by re-

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moving the backing as aforesaid, is not shiny. More specifically the invention is characterized by filler particles which are non-specular, that is which do not have shiny surfaces like crystalline particles and which are preferably light-transmissive, that is either transparent or translucent.

The best filler for the purpose thus far found comprises particles of uncooked and unconverted starch. These particles may be particles which have not been cooked or converted but merely mixed in with cooked and/or converted starch or other adhesive, or they may comprise the uncooked and unconverted kernels of partially cooked and/or partially converted starch, or they may comprise both. Thus the term starch particles is used herein to apply to the aforesaid kernels as well as to particles which have not been cooked or converted at all. At least part of the starch particles preferably comprise the aforesaid kernels of partially cooked and/or partially converted starch because of the non-uniformity in the size of the particles. This non-uniformity affords a better surface and it can be obtained more readily by employing partially cooked starch. The size of the filler particles may vary from 0.005 mm. to 0.030 mm.; and the amount of filler may comprise any proportion of the adhesive layer, depending upon the degree of roughness desired, up to 60% of the layer when dry. The adhesive component of the adhesive coating may comprise any adhesive suitable for decalcomanias such as animal glue, dextrin, flour, starch, partially converted starch and partially cooked starch, the unconverted or uncooked kernels of the partially converted or partially cooked starch also affording a part or all of the aforesaid filler.

In another aspect the invention involves a method of making a decalcomania of the reverse type in which the transfer has a non-shiny front, characterized by roughening the outer surface of the adhesive layer, as by incorporating in the layer finely divided particles as aforesaid, before the transfer is applied to the adhesive layer. Contrary to usual practice the adhesive layer is not calendered.

A somewhat duller surface can be obtained by incorporating in the adhesive layer, in addition to the aforesaid particles of uncooked starch or the like, materials which, like the starch, are insoluble in water but which, unlike starch, are soluble in the aforesaid ink vehicle. These materials may be in the form of finely divided particles which are preferably much smaller than

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the starch particles. Example of this type of flattening agent are the various natural and synthetic resins.

These materials may be in the form of a water-soluble or water-dispersible salt, such as ordinary rosin size, Staybellite size (hydrogenated rosin size sold by Paper Makers Chemical Co.) or they may be in the form of emulsions in water, such as Ester Gum Emulsion No. 2607, sold by American Cyanamid Co. and Methacrol B. P. (butyl methacrylate emulsion) sold by E. I. du Pont de Nemours Co., or other dispersions of ester gum.

Alternative flattening agents may include salts of resins of medium or high acid number, with sodium, potassium, ammonium hydroxide, triethanolamine, or other basic materials. Typical examples comprise an ammoniacal solution of Petrex size A-5HT emulsion (an alcohol solution of a complex alkyd resin, sold by Hercules Powder Co.) and the triethanolamine salt of 1-methyl, 4-isopropyl, 1-4 endoethylene (tetra-hydro phthalic and hydrous).

Still other flattening agents of the solvent soluble type include water emulsion of polyacrylate and polymethacrylate esters, alkyd resins, polyvinyl acetate, or water emulsions whose dispersed phase consist of a solvent solution of any of the above resins, or of nitro-cellulose, cellulose acetate, ethyl cellulose, the natural gum, etc. The solvent component of such resin or lacquer emulsion is dissipated in the process of drying the adhesive, so that the solid component of the emulsion is left in a suitably finely divided state through the adhesive layer.

The proportion of rosin size or equivalent may comprise any proportion of the adhesive layer, depending upon the degree of dullness desired, up to 40% of the layer when dry.

By incorporating in the adhesive layer the aforesaid particles of starch or the like the surface of the adhesive layer is rough when dry, and when the transfer is applied to this rough surface in liquid form its surface assumes the same contour. Thus when the design is transferred and the adhesive is washed off, the front of the transfer has a matte finish. Furthermore some of the adhesive remains attached to the front of the transfer, thereby contributing to the matte finish because of the presence of the starch particles in the adhesive. If the particles had specular surfaces like mineral crystals they would have a lustre and this would show through the thin film of adhesive which holds them on the transfer, but this difficulty is avoided by using non-specular particles. By employing particles which are transparent or translucent, instead of being opaque, the particles which remain on the front of the transfer are not noticeable and do not interfere with the appearance of the underlying transfer. The addition of the rosin size or the like enhances the dullness of the front of the transfer, probably because of the penetration of the ink vehicle into the adhesive layer by virtue of the solubility of the particles in the vehicle.

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

Fig. 1 is a cross-section of a decalcomania;

Fig. 2 is a similar view showing the decalcomania applied to the surface of an article in the aforesaid reverse manner; and

Fig. 3 is a similar view showing the transfer on the article after the backing has been removed.

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In the particular embodiment chosen for the purpose of illustration the backing comprises a sheet of paper 1 and a coating 2 of sizing as usual. The aforesaid adhesive layer, containing particles of uncooked starch or the like and in some cases also containing rosin size or the like, is indicated at 3. The transfer or design is indicated at 4. After the back of the transfer has been secured to the surface of article A by liquid adhesive as aforesaid the adhesive layer 3 is softened by water applied to the backing and the backing is then peeled off, leaving the transfer 4 with its rough front face 5 exposed as shown in Fig. 3. Substantially all of the adhesive layer may be washed off leaving little if any of the starch particles on the front of the transfer, or a substantial thickness of adhesive, including the aforesaid particles, may be left adhering to the transfer. In either case the front of the transfer has a matte surface and is non-specular.

The following are typical examples of formulae suitable for use in making the adhesive layer 3.

(1)

25	Dextrin	-----	lbs.	25
	Uncooked starch	-----	lbs.	60
	Water	-----	gals.	30

(2)

			Parts
30	Partially cooked wheat starch	-----	40
	Water	-----	160

(3)

	Dextrin	-----	lbs.	21
35	Uncooked starch	-----	lbs.	60
	Rosin size	-----	lbs.	10
	Water	-----	gals.	30

(4)

40	Dextrin	-----	lbs.	60
	Uncooked starch	-----	lbs.	10
	Staybellite size	-----	lbs.	30
	Water	-----	gals.	30

(5)

45	Partially converted starch	-----	lbs.	50
	Uncooked starch	-----	lbs.	30
	Rosin size	-----	lbs.	20
50	Water	-----	gals.	30

(6)

			Parts
	Partially converted starch	-----	100
55	Staybellite size	-----	30
	Water	-----	300

(7)

			Parts
	Partially converted starch	-----	50.5
60	Uncooked starch	-----	33.8
	Staybellite size	-----	10.7
	Water	-----	300

(8)

65			Parts
	Partially converted starch	-----	79
	Staybellite size	-----	16
	Water	-----	300

(9)

			Parts
70	Partially converted starch	-----	40
	Uncooked starch	-----	35
	Methacrol B P (25% solids)	-----	15
75	Water	-----	125

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(10)

	Parts
Partially converted starch.....	40
Uncooked starch.....	35
Petrex A-5HT emulsion (25% solids).....	20
Water.....	125

(11)

	Pounds
Partially converted and partially cooked starch.....	35
Water.....	65

(12)

	Pounds
Partially converted starch.....	40
Partially cooked starch.....	20
Water.....	100

The Petrex emulsion was made by mixing equal volumes of the aforesaid Petrex A-5HT and 5% aqueous ammonia.

In those formulae which employ wholly uncooked starch or the like and/or rosin size or the like, the starch and/or rosin are first mixed with cold water and then added to the liquid adhesive. Thus in Formula 5, for example, the slightly converted starch may be mixed with 16 gallons of cold water, heated to a temperature of 162° F. and then immediately allowed to cool to room temperature; the uncooked starch may be mixed with 8 gallons of cold water and added to the first mixture; and the rosin size may be dispersed in the remaining 6 gallons of water, cooled and added to the mixture.

Formulae 1, 2 and 12 include uncooked starch but no rosin size or the like. Formulae 1, 3 and 4 illustrate the use of wholly uncooked starch without partially converted starch, whereas in each of the other formulae at least a part of the uncooked starch is in the form of uncooked kernels of partially converted starch. Formulae 3 to 10 illustrate the use of various fillers of the type which are soluble in the ink vehicle, Formulae 3 and 5 comprising rosin size and the others comprising other soluble fillers. Formula 9 illustrates the use of a material like ester gum No. 2607 which resembles rosin size in that it is soluble in the ink or lacquer vehicle of the subsequently added transfer layer, but is insoluble in water and, therefore, must be added to the adhesive as an emulsion.

While the degree of conversion of the partially converted starch may vary through wide limits, so long as the proportion of the starch particles does not exceed approximately 80% of the adhesive layer when dry, in the aforesaid formulae the degree of conversion is preferably such that the starch has a solubility of 5% to 10% in water at room temperature. The partially cooked starch referred to in Formulae 2 and 12 may be formed by dispersing starch particles in cold water, heating the mixture to 142° F., at which point the solution will begin to thicken noticeably, and then cooling.

All of the above formulae relate to the liquid compositions for forming the adhesive layer. After the adhesive coating is dried of course the proportions are different, as indicated by the following which correspond to the above Formulae 7 and 8 respectively.

(7a)

	Per cent
Partially converted starch.....	50.5
Uncooked starch.....	33.8
Staybellite size.....	10.7
Water.....	5

6
(8a)

	Per cent
Partially converted starch.....	79
Staybellite size.....	16
Water.....	5

A typical ink for use in forming the design or transfer may comprise:

	Parts
Pigment.....	60
Nitro-cellulose.....	34
Plasticizer (for example dibutyl phthalate).....	10
Ethynol.....	25
Ethyl-acetate.....	50
Butyl-acetate.....	10

By omitting the pigment this formula may also be used to form the aforesaid lacquer layer of the transfer. Thus when the transfer includes a lacquer layer this layer should include some of the ink vehicle or an equivalent solvent.

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. In the art of decalcomanias of the type in which the transfer contains an ink vehicle and the outer face of the transfer is applied to a surface and the backing is then removed to expose the inner face of the transfer by dissolving the intermediate coating of adhesive with water absorbed through the backing, the method of rendering said inner face relatively non-specular which comprises incorporating in said coating finely divided particles which are insoluble in water and in the ink vehicle of the transfer and which are large enough to roughen the outer surface of the coating, drying the coating to solidify it in this roughened condition, applying the transfer to said roughened surface in fluid form so as to conform in contour therewith, and drying the transfer to solidify it in this contour, whereby when the transfer is applied as aforesaid its exposed surface is not shiny.

2. In the art of decalcomanias of the type in which the outer face of the transfer is applied to a surface and the backing is then removed to expose the inner face of the transfer by dissolving the intermediate coating of adhesive with water absorbed through the backing, the method of rendering said inner face relatively non-specular which comprises incorporating in said coating finely divided starch particles which are large enough to roughen the outer surface of the coating, drying the coating to solidify it in this roughened condition, applying the transfer to said roughened surface in fluid form so as to conform in contour therewith, and drying the transfer to solidify it in this contour, whereby when the transfer is applied as aforesaid its exposed surface is not shiny.

3. A decalcomania comprising a backing, a coating of adhesive on one side of the backing, and a transfer applied to said coating, the backing being water-permeable so that the adhesive coating may be wet through the backing and the adhesive coating being readily soluble in water so that the backing is quickly loosened from the transfer when thus wet and the transfer containing an ink vehicle characterized in that the adhesive coating contains finely divided particles which are insoluble in water and in said vehicle, said particles being large enough to roughen the

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surface of the coating when dry, whereby the surface of the transfer which is applied to said coating is not smooth and, when exposed by removing the backing as aforesaid, is not shiny.

4. A decalcomania comprising a backing, a coating of adhesive on one side of the backing, and a transfer applied to said coating, the backing being water-permeable so that the adhesive coating may be wet through the backing and the adhesive coating being readily soluble in water so that the backing is quickly loosened from the transfer when thus wet and the transfer containing an ink vehicle characterized in that the adhesive coating contains finely divided particles which are insoluble in water and in said vehicle, said particles being non-specular and large enough to roughen the surface of the coating when dry, whereby the surface of the transfer which is applied to said coating is not smooth and, when exposed by removing the backing as aforesaid, is not shiny.

5. A decalcomania comprising a backing, a coating of adhesive on one side of the backing, and a transfer applied to said coating, the backing being water-permeable so that the adhesive coating may be wet through the backing and the adhesive coating being readily soluble in water so that the backing is quickly loosened from the transfer when thus wet and the transfer containing an ink vehicle characterized in that the adhesive coating contains finely divided particles which are insoluble in water and in said vehicle, said particles being non-specular and light-transmissive and large enough to roughen the surface of the coating when dry, whereby the surface of the transfer which is applied to said coating is not smooth and, when exposed by removing the backing as aforesaid, is not shiny.

6. A decalcomania comprising a backing, a coating of adhesive on one side of the backing, and a transfer applied to said coating, the backing being water-permeable so that the adhesive coating may be wet through the backing and the adhesive coating being readily soluble in water so that the backing is quickly loosened from the transfer when thus wet, characterized in that the adhesive coating contains finely divided starch particles which are large enough to roughen the surface of the coating when dry, whereby the surface of the transfer which is applied to said coating is not smooth and, when exposed by removing the backing as aforesaid, is not shiny.

7. A decalcomania according to claim 3 further characterized in that said adhesive coating also contains a finely divided filler which is soluble in said vehicle.

8. A decalcomania according to claim 3 further characterized in that said adhesive coating also contains a finely divided filler which is insoluble in water but soluble in said vehicle.

9. A decalcomania according to claim 3 further characterized in that said adhesive coating also contains rosin size.

10. A decalcomania according to claim 3 further characterized in that said adhesive coating also contains hydrogenated rosin size.

11. A decalcomania according to claim 3 further characterized in that said adhesive coating also contains a dispersion of ester gum.

12. A decalcomania according to claim 4 further characterized in that said adhesive coating also contains a finely divided filler which is soluble in said vehicle.

13. A decalcomania according to claim 4 further characterized in that said adhesive coating

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also contains a finely divided filler which is insoluble in water but soluble in said vehicle.

14. A decalcomania according to claim 6 further characterized in that said transfer contains an ink vehicle and said adhesive coating also contains a finely divided filler which is soluble in said vehicle.

15. A decalcomania according to claim 6 further characterized in that said transfer contains an ink vehicle and said adhesive coating also contains a finely divided filler which is insoluble in water but soluble in said vehicle.

16. A decalcomania according to claim 6 further characterized in that said adhesive coating also contains rosin size.

17. In the art of decalcomanias of the type in which the outer face of the transfer is applied to a surface and the backing is then removed to expose the inner face of the transfer, the method of rendering said inner face relatively non-specular which comprises applying to the backing a coating containing finely divided particles, and adhesively joining the transfer to said coating so that, when the transfer is detached from the backing, some of said particles remain joined to said inner face of the transfer, whereby the transfer has a matte finish.

18. In the art of decalcomanias of the type in which the outer face of the transfer is applied to a surface and the backing is then removed to expose the inner face of the transfer, the method of rendering said inner face relatively non-specular which comprises applying to the backing a coating containing finely divided non-specular particles, and adhesively joining the transfer to said coating so that, when the transfer is detached from the backing, some of said particles remain joined to said inner face of the transfer, whereby the transfer has a matte finish.

19. In the art of decalcomanias of the type in which the outer face of the transfer is applied to a surface and the backing is then removed to expose the inner face of the transfer, the method of rendering said inner face relatively non-specular which comprises applying to the backing a coating containing finely divided non-specular light-transmissive particles, and adhesively joining the transfer to said coating so that, when the transfer is detached from the backing, some of said particles remain joined to said inner face of the transfer, whereby the transfer has a matte finish.

20. In the art of decalcomanias of the type in which the outer face of the transfer is applied to a surface and the backing is then removed to expose the inner face of the transfer, the method of rendering said inner face relatively non-specular which comprises applying to the backing a water-soluble adhesive coating containing finely divided particles, and adhesively joining the transfer to said coating so that, when the transfer is detached from the backing by moistening said coating, some of said particles remain joined to said inner face of the transfer, whereby the transfer has a matte finish.

21. In the art of decalcomanias of the type in which the outer face of the transfer is applied to a surface and the backing is then removed to expose the inner face of the transfer, the method of rendering said inner face relatively non-specular which comprises applying to the backing a coating containing finely divided particles, adhesively joining the transfer to said coating, and softening said coating sufficiently to detach the transfer from the backing while leaving some of

said particles adhering to the transfer, whereby the transfer has a matte finish.

22. In the art of decalcomanias of the type in which the outer face of the transfer is applied to a surface and the backing is then removed to expose the inner face of the transfer, the method of rendering said inner face relatively non-specular which comprises applying to the backing a water-soluble adhesive coating containing finely divided particles, adhesively joining the transfer to said coating, and moistening said coating sufficiently to detach the transfer from the backing while leaving some of said particles adhering to the transfer, whereby the transfer has a matte finish.

23. In the art of decalcomanias of the type in which the transfer contains an ink vehicle and the outer face of the transfer is applied to a surface and the backing is then removed to expose the inner face of the transfer by dissolving the intermediate coating of adhesive with water absorbed through the backing, the method of rendering said inner face relatively non-specular which comprises incorporating in said coating finely divided particles which are insoluble in water and in the ink vehicle of the transfer and which are large enough to roughen the outer surface of the coating, drying the coating to solidify it in this roughened condition, applying the transfer to said roughened surface in fluid form so as to conform in contour therewith, drying the transfer to solidify it in this contour, and softening said coating sufficiently to detach the transfer from the backing while leaving some of said particles adhering to the transfer, whereby the transfer has a matte finish.

24. In the art of decalcomanias of the type in which the transfer contains an ink vehicle

and the outer face of the transfer is applied to a surface and the backing is then removed to expose the inner face of the transfer by dissolving the intermediate coating of adhesive with water absorbed through the backing, the method of rendering said inner face relatively non-specular which comprises incorporating in said coating finely divided particles which are insoluble in water and in the ink vehicle of the transfer and which are large enough to roughen the outer surface of the coating, drying the coating to solidify it in this roughened condition, applying the transfer to said roughened surface in fluid form so as to conform in contour therewith, and drying the transfer to solidify it in this contour, the transfer being adhesively joined to said surface so that, when the transfer is detached from the backing, some of said particles remain joined to the transfer, whereby the transfer has a matte finish.

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