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DUAL-TONED METALLIC-COATED WEB

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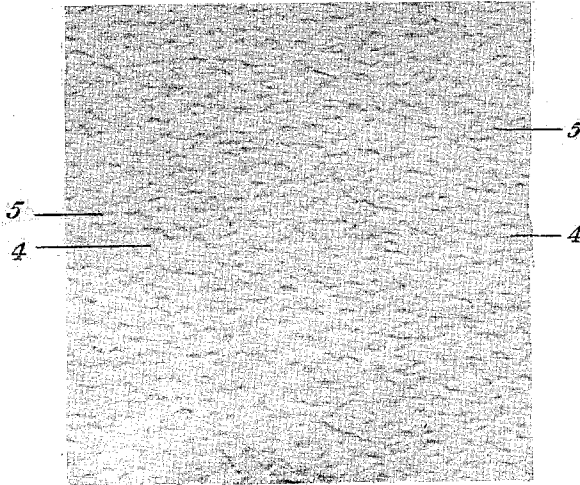


Fig. 1.

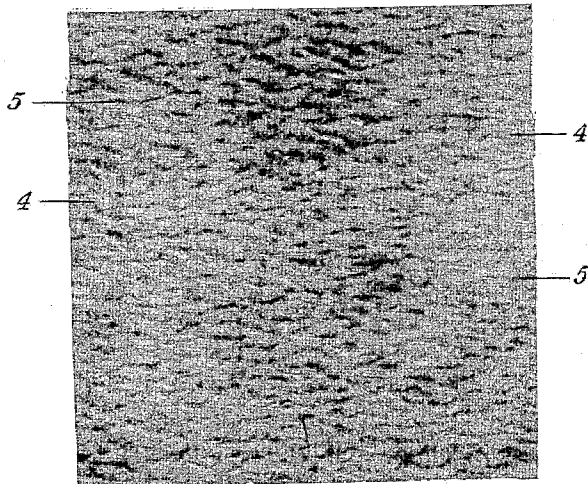


Fig. 2.

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DUAL-TONED METALLIC-COATED WEB

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This invention relates to dual-toned metallic-coated flexible webs and to methods for their production.

Briefly, the process of making the new products comprises applying a metallic-coating to a suitable flexible base by any desired or conventional means; the so-coated web is then acted upon, by mechanical means, at divers spots or areas whereby the areas acted upon are changed in respect to brilliance, gloss, metallic appearance or the like from their original condition and from other areas of the sheet which are unacted upon or acted upon to a lesser degree.

Specifically a preferred embodiment of the invention comprises preparing a metallic-coated surface the metal component of which is unpolished or actually bears a superficial adherent film of metallic compound, e. g., metallic sulfide, oxide, or the like, or may be an allotropic form of the metal itself: the metallic-coated surface is then mechanically treated at divers spots to burnish, rub off, or decrease the superficial film of metallic compound and to tend to lay bare the underlying metal whereby a contrasting pattern is produced of burnished metallic areas in juxtaposition to less brilliant areas in which the metal still bears a film of metallic compound. If desired, coloring material may be included in the superficial film overlying the metal component of the coating to alter the color of the metallic compound thereon. Subsequent treatment according to the invention acts, in part at least, to remove the coloring matter along with the superficial films of the metallic compound in the spots or areas treated.

Advantageously the web, either simultaneously with or in addition to the aforesaid burnishing treatment, may likewise be treated to produce thereon rugosities or irregularities of surface, and preferably the pattern of such surface irregularities may coincide with the aforementioned pattern of contrast between burnished and unburnished areas. For example, depressions may be dull areas and elevations polished areas, or the reverse may be true with depressions polished and elevations dull. The combination of contrast in both brilliance and surface irregularity yields a novel dual-toned metallic-coated product of attractive and striking appearance.

The surface to be acted on according to the invention may be a sheet of metal foil, e. g., aluminum foil, having an oxidized surface; said foil may be heavy enough to support itself, or it may be considerably lighter in weight and be supported by a paper or other flexible base to

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which it may be adhesively fastened. Or, preferably, the surface may be prepared by applying to paper or other suitable flexible base a fluid coating composition comprising an adhesive and finely divided or powdered metal the surfaces of the particles of which are superficially oxidized or sulfidized.

Coating compositions mentioned above may be applied by any desired means, the Terry air-doctor or "air-brush" (Patent No. 2,139,628) being an eminently satisfactory apparatus for the purpose. The coating compositions may take the form of a metallic lacquer or varnish in which cellulosic or resinous adhesives are used. Ordinarily, however, I prefer to use aqueous dispersions of superficially filmed metal powder with any convenient water-dispersible adhesive. Satisfactory adhesives include glue, starch, soy protein, polyvinyl alcohol, dispersed elastic resins, and the like. Casein is in general a very satisfactory adhesive for my purpose.

Metal powders satisfactory for use include: finely divided lead or silver having a superficial coating of sulfide; zinc powder superficially coating of sulfide; zinc powder superficially sulfidized, or oxidized; tin powder superficially oxidized; superficially oxidized aluminum powder; or the like. The grades of powdered aluminum variously referred to in the trade as "disintegrated aluminum powder," "atomized aluminum," and "aluminum dust" all exist with a natural film or superficial coating of aluminum oxide and such powders appear grayish rather than bright or metallic. These aluminum powders are very satisfactory for use in the carrying out of the present invention and constitute a preferred species of the invention. Such powder in unpolished form usually possesses considerable softness, malleability and ductility, which properties are advantageous in that they make easy the subsequent burnishing of selected areas of surfaces coated with the powder.

Metal powder useful according to the invention may vary over a considerable range of particle sizes. Powder passing a 325 mesh screen but which is retained on a 400 mesh screen is useable, although not giving quite such a satisfactory coated product as powder of somewhat finer particle size. Any size of powder finer than 400 mesh down to the very finest dust obtainable (i. e., less than one micron) gives good results. On the other hand, powder coarser than about 44 microns (325 mesh) is usually less desirable, unless special effects are desired, because

coatings made therefrom tend to look rough and grainy.

Other things being equal, the particle size of the particular metal powder being used exerts a considerable effect upon the quantity of adhesive required to bind the coating to the underlying flexible base. For instance, one part by weight of casein was found to bind securely 100 parts of 325 mesh atomized aluminum, whereas about 20 times as much of the adhesive was required to bind a much finer powder approximately 1 micron in diameter. Fortunately, provided sufficient adhesive is used to bind the metallic powder securely to the paper or other base, the exact quantity used does not appear to be critical for my purpose. That is to say, a considerable excess of adhesive over the minimum actually required to prevent dusting does not appear to have serious detrimental effect, though naturally too great an excess should be avoided.

The weight of coating required to give good coverage will vary with the particle size of the metal powder used. For the very finest grades of powder obtainable (e. g., "aluminum dust," having a mean particle size of 1 micron or less), a coating of about one pound per ream (24" x 38"=500 sheets) will in some cases suffice; on the other hand, with very coarse powder as much as 25 pounds per ream may be desirable. Hence the advantage is obvious for using powder of fine particle size.

As a base to which the metallic coating composition is applied any flexible sheet will serve which is wettable by said coating composition. Filled or/and sized textile fabric or felt; cellulosic, resinous, or protein films; and paper, either coated or uncoated, may be used with good results. Paper makes a very satisfactory base, and especially fine results are obtained if the paper is coated with a conventional mineral-coating before the metallic-coating is applied. Good results are obtained, however, when the metallic-coating is applied directly to plain paper without any base-coat. The paper, either base-coated or uncoated, may be calendered if desired before application of the metallic coating, but such calendering is not necessary since excellent results have been obtained on uncalendered base-stock. Likewise the metallic-coated paper may be calendered or not, as desired, before being subjected to the differential polishing or burnishing treatment which is the final step in producing my new product.

The preferred process used by me in producing the two-toned metallic coated paper consists essentially in the following combination of steps. A suitable paper base is coated with a dull metallic coating, and the coating is dried; thereupon the coated paper is embossed in conventional fashion, and may or may not receive finally a further polishing treatment applicable to isolated areas of the surface. The resulting two-toned effect is novel, striking and attractive; the paper product is quite different in appearance from any other paper known to me.

The embossing apparatus may be a conventional embosser consisting of a metal roll (which usually is the driven roll) having a raised pattern or die thereon which runs against a soft roll into which the die sinks. The two substantially coextensive rolls are arranged parallel to each other and are adapted to be pressed together under variable pressure. When paper is passed between the rolls the pattern on the metal roll is impressed in the paper; that is, depressions corre-

sponding to the pattern are made in the paper. When my paper coated with surface-oxidized powder is passed through the embosser with the metallic-coated side facing the metal embossing roll, the areas impressed with the pattern (that is, the depressions) are left bright and metallic, probably because the coated surface slips slightly as it stretches over the die, while the rest of the surface is affected little or not at all. The contrast is greater if the metallic-coated paper is not calendered prior to being embossed.

It should be mentioned that embossing nearly any coated sheet of paper, i. e., mineral-coated paper, causes some polishing action in the depressions, but such polishing, as far as I know, invariably makes the area acted upon look darker. Contrary to this, the product coated with the oxidized aluminum powder (or with one of the equivalent materials hereinbefore recited) looks lighter, brighter and more nearly "metallic" in the polished areas.

As was intimated above, when the paper coated with surface-oxidized (or surface-sulfidized) metal powder is passed through the embosser with the metallic-coated side facing the soft roll, the resulting elevations are brighter and more nearly "metallic" in appearance, whereas the depressions (i. e., the non-impressed areas) are contrastingly dull. In either case (that is to say, whether the metallic-coated side is faced toward the embossing die or away from it), the degree of pressure exerted on the paper should be correlated to (1) the configuration of the particular die used and to (2) the relative amount of "brightening" desired in the final product; the smaller the area of the die, the lighter the pressure required; also, the heavier the pressure the more general is the "brightening."

It is to be noted that selection of the particular "pattern" of the juxtaposed bright and dull areas is altogether a matter of individual artistic preference, as is selection of the particular pattern provided by the embosser. Thus, it may be an all-over pattern of larger or smaller bright and dull areas of more or less regularity; or, it may comprise a design of bright lines on a dull background or of dull lines on a bright background.

The following specific examples illustrate the invention:

1. Superficially oxidized atomized aluminum powder of 400 mesh together with a casein solution in amount sufficient to provide 1% of casein, dry weight, based on the weight of the aluminum powder, was dispersed in water, coated onto a sheet of mineral-coated paper, and dried. This coated sheet, which at this stage was uniformly gray and dull (i. e., having the appearance of a gray-tinted dull-finished mineral coated paper), was then run between a pair of embossing rolls, the metallic-coated surface being in contact with the embossing or die roll. The depressions made in the coated surface were polished to a light "metallic" appearance while the rest of the surface remained dull and gray.

2. The above experiment was repeated with a coating composition containing 8 parts of casein to 100 parts of superficially oxidized aluminum powder much finer than that used in Example 1, the sheet carrying 5 pounds per ream of the metallic coating. The appearance of the finished sheet was even more attractive than that of the product of the preceding example; the contrast between the "brightened" and dull areas was more pronounced.

3. An aqueous coating composition contain-

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ing 14 parts of polyvinyl alcohol to 100 parts of fine aluminum dust, superficially oxidized, was applied to an uncoated paper base and dried. The coated sheet was then embossed, thereby developing contrasting polished and dull areas.

4. Zinc dust bearing a superficial film of oxide was incorporated into an aqueous coating with 4% of casein. This was applied to a mineral-coated paper and dried. When embossed this sheet also developed polished "metallic" areas which contrasted with the dull gray unaffected areas in the rest of the coated surface.

5. Powdered tin of dull appearance was made into an aqueous coating with 7% of casein based on the weight of the tin. This composition was applied over a conventional clay-casein base coated paper web and dried. The sheet, without calendering, was embossed. The tin particles were polished to a bright "metallic" appearance in the depressions but remained dull in the other areas. While the grade of powdered tin called "Argentine" was used in this example, and is satisfactory for the present purpose, it is to be noted that other commercially available unpolished tin powders also are operable.

6. In a repetition of Example 2, the metallic-coated and dried sheet was calendered before embossing. The calendering treatment developed considerable gloss on what had been a dull finished coating, and darkened the coating somewhat. More particularly, the calendering imparted to the coated surface a slight degree of "metallic appearance." The ensuing embossing treatment developed somewhat more brilliant and polished areas in the indentations, only, with the result that there was secured a dual-toned effect wherein there obtained a slight but perceptible contrast.

7. It was found that this slight contrast (Example 6) was heightened, and that the general effect was changed, by a subsequent buffing operation wherein the burnishing treatment was substantially confined to the elevated areas. The general visual effect secured was that of an embossed polished metal foil wherein the depressed areas had been slightly dulled as if by oxidation.

In the accompanying drawing:

Fig. 1 is a reproduction of a photomicrograph, 2 diameters magnification, of a portion of the product of Example 2, and

Fig. 2 is a reproduction, of similar nature, of a portion of the product of Example 7.

In the figures, the numerals 4, 4 call attention to elevated areas, and the numerals 5, 5 call attention to depressions, in the metallic-coated surfaces. In Fig. 1, the depressed areas appear in reproduction somewhat darker than the elevated areas; actually, the depressed areas in this instance were lighter and brighter than the elevations and had a contrasting glossiness or brilliance which was not photographed and reproduced. In Fig. 2, the elevated areas, by reason of their more highly polished surfaces, appear in reproduction somewhat darker than the depressed areas. By contrast, the surfaces of the depressed areas appear somewhat grayer and duller, and less "metallic," than the elevations.

The particular embosser pattern used in producing the products illustrated in Figs. 1 and 2 was one adapted to produce a "grained leather" surface.

I claim:

1. Process of making a decorative dual-toned metallic-coated web, which comprises applying to a supporting flexible web a continuous layer

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of coating composed of an adhesive component and a powdered metal component the surfaces of the particles of which latter have been chemically reacted and are dull and deficient in metallic appearance and drying the coating whereby there is provided an intermediate product having the uniform appearance of a tinted relatively dull-finished mineral-coated web, and mechanically acting upon the so-coated web surface at divers areas thereover by burnishing certain areas only, so as to change the visual appearance of such areas as regards their brilliance, gloss, metallic appearance and the like, in contrast to the juxtaposed relatively unacted upon areas whereby to develop alternate contrasting bright and dull areas thereover.

2. Process of making a decorative dual-toned metallic-coated paper, which comprises applying to a suitable paper web a continuous layer of coating composed of an adhesive component and a powdered metal component the surfaces of the particles of which latter have been chemically reacted and are dull and deficient in metallic appearance and drying the coating whereby there is provided an intermediate product having the uniform appearance of a tinted relative dull-finished mineral-coated paper, and mechanically acting upon the so-coated paper surface at divers areas thereover by burnishing certain areas only, so as to change the visual appearance of such areas as regards their brilliance, gloss, metallic appearance and the like, in contrast to the juxtaposed relatively unacted upon areas whereby to develop alternate contrasting bright and dull areas thereover.

3. Process of making a decorative dual-toned metallic-coated paper, which comprises applying to a suitable paper web a continuous layer of coating composed of an adhesive component and a powdered metal component the surfaces of the particles of which carry superficial films of an inorganic compound of the metal of the group consisting of oxides and sulfides of the metal said compound having a dull appearance and drying the coating whereby there is provided an intermediate product having the uniform appearance of a tinted relatively dull-finished mineral-coated paper, and mechanically acting upon the so-coated paper surface at divers areas thereover by burnishing certain areas only, so as to remove exposed superficial films from the exposed powdered metal particles in such areas and hence to change the visual appearance of such areas as regards their brilliance, gloss, metallic appearance and the like, in contrast to the juxtaposed relatively unacted upon areas whereby to develop alternate contrasting bright and dull areas thereover.

4. Process of making a decorative dual-toned metallic-coated paper, which comprises applying to a suitable paper web a continuous layer of coating composed of an adhesive component and a powdered aluminum product the surfaces of the particles of which carry superficial films of aluminum oxide and drying the coating whereby there is provided an intermediate product having the uniform appearance of a gray, dull-finished mineral-coated paper, and mechanically acting upon the so-coated paper surface at divers areas thereover to remove the aluminum oxide from the exposed surfaces of the aluminum particles in such areas and thereby to change the visual appearance of such areas as regards their brilliance, gloss, metallic appearance and the like, in contrast to the juxtaposed relatively un-

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acted upon areas whereby to develop alternate contrasting bright and dull areas thereover.

5. The process defined in claim 1, wherein the pattern of alternate contrasting bright and dull areas is developed simultaneously with the production of a corresponding pattern of alternate rugosities and depressed areas in the coated surface by an embossing operation.

6. Process of making a decorative dual-toned metallic-coated paper, which comprises applying to a suitable paper web a continuous layer of coating composed of an adhesive component and a powdered aluminum product the surfaces of the particles of which carry superficial films of aluminum oxide and drying the coating whereby there is provided an intermediate product having the uniform appearance of a gray, dull-finished mineral-coated paper, and thereafter embossing the so-coated paper to develop over the coated surface a pattern of alternate rugosities and depressed areas and simultaneously to develop brilliance, gloss and a metallic appearance in the areas directly affected by the embossing treatment.

7. The process defined in claim 6, in the embossing step of which the coated side of the paper is faced to the die of the embosser so as to effect rubbing off of oxide films from surfaces of aluminum particles in the depressions created by the die.

8. The process defined in claim 6, characterized in that after the embossing step elevated areas on the coated side of the paper are subjected to a burnishing treatment wherein oxide films are removed from surfaces of exposed aluminum particles in said elevated areas and said elevated areas are given a more brilliant, glossy and metallic appearance than the depressed areas.

9. The process defined in claim 1, in which the coated side of the web is calendered before being mechanically acted upon at divers areas thereover.

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10. As a new product, an embossed dual-toned metallic-coated flexible web, comprising a flexible paper web carrying on a surface thereof a continuous layer of a coating composition comprising finely divided metallic particles having chemically reacted surfaces giving a dull appearance and an adhesive therefor, exhibiting a pattern of alternate juxtaposed contrasting bright and dull areas the bright areas in the depressions having polished surfaces exhibiting a metallic appearance and the elevations having a relatively dull and non-metallic appearance.

11. The product defined in claim 10, in which the finely divided metallic particles are powdered aluminum, surfaces of which particles are superficially filmed with aluminum oxide.

12. The product defined in claim 10, in which the finely divided metallic particles are powdered zinc surfaces of which particles are superficially filmed with an inorganic compound of zinc of the group consisting of oxides and sulphides of zinc.

13. The product defined in claim 10, in which the finely divided metallic particles are powdered tin surfaces of which particles are superficially filmed with tin oxide.

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