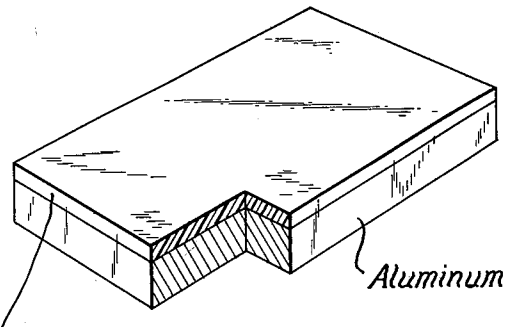
March 3, 1964 E. M. EILAND 3,123,516

COATED ALUMINUM AND PROCESS

Filed Feb. 19, 1962



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United States Patent Office 3,123,516 Patented Mar. 3, 1964

3,123,516

COATED ALUMINUM AND PROCESS

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Filed Feb. 19, 1962, Ser. No. 174,268
6 Claims. (Cl. 161—218)

This invention relates to printing on aluminum surfaces, and particularly to improving the receptivity of such surfaces to lithographic printing.

Aluminum as generally used herein, embraces both aluminum of various commercial grades and aluminum base alloys.

Gravure, lithography, letter press and flexography printing have all been used for years for printing on aluminum surfaces. Gravure, letter press and flexographic printing on aluminum surfaces offer no great difficulty in commercial application. However, it has only been in the last few years that lithography has been used commercially to print on aluminum surfaces such as foil and foil laminates. Improved aluminum surface coatings and inks have been quite instrumental in making lithography on such surfaces commercially practical. Lithography printing when compared with gravure printing costs considerably less when printing short and medium runs. Expensive gravure cylinders are not economically justified except when large volume runs are to be printed, especially where multi-color is involved since a separate cylinder is required for each color.

In lithographic printing the smooth printing plate is treated so that the image area will accept ink and repel water while the non-printing area will accept water and repel ink. The plate is first moistened with a fountain solution, containing principally water, which adheres to the non-image area. When the ink is applied to the plate it is only attracted to the image area. The ink image is then transferred onto the stock either directly, or by offsetting to a rubber blanket which prints on the stock. The offsetting blanket generally provides a more even distribution of ink onto the printing stock.

In lithographic printing on aluminum surfaces, excess water from the fountain solution accumulates on the surface. The accumulation of water on the aluminum surface is particularly noticeable when two or more colors are printed. Each color is printed by a separate press which increases the amount of water accumulated, and the aluminum surface tends to become moisture-laden. This accumulated water has been recognized as a problem for some time as it interferes with the ink being transferred onto the surface of the stock, thereby causing the image to be partially washed out and indistinct.

It is an object of this invention to provide an improved coating on aluminum surfaces and in particular to provide an improved coating for lithographic printing on aluminum surfaces where water accumulation hindering ink transfer from the plate to the aluminum surface is a problem.

In accordance with this invention, aluminum, such as aluminum foil or aluminum foil laminated with some substrate, for example, paper, polyester, cellophane, polyethylene, or the like may be used as the printing stock. The aluminum may be of any desired thickness. However, for printing label or wrapping purposes, foil in a thickness of from 0.00025 to 0.006 inch may be considered typical. The thinner gauges are usually laminated to paper or other suitable substrates.

The accompanying drawing illustrates an embodiment of the invention.

It is a common practice to coat aluminum surfaces, prior to printing, with a vinyl resin coating which, among other things, helps absorb the ink. Typical coatings are

applied from organic solvent solutions so as to deposit about one pound of vinyl resin per 3000 square feet of surface. At the present time probably the most widely used vinyl resins for surface coatings, especially aluminum foil surfaces, are the vinyl chloride-acetate copolymers. Generally, they are soluble in commonly used solvents; they are compatible with plasticizers and other film-formers; and they produce strong, tough films having good resistance to abrasion. Such vinyl chloride-acetate copolymers may also be used in the practice of this invention. Satisfactory results are most easily obtainable with vinyl chloride-acetate copolymers which have a range of acetate content of about 8% to 15%, typically those of the following approximate chemical compositions: 87% by weight of vinyl chloride and 13% by weight of vinyl acetate; 86% by weight of vinyl chloride, 13% by weight of vinyl acetate and 1% by weight of an interpolymerized dibasic acid; 90% by weight of vinyl chloride and 10% by weight of vinyl acetate; and 91% by weight of vinyl chloride and 9% by weight of vinyl acetate.

There is some adhesion difficulty when employing vinyl chloride-acetate copolymers as a coating on smooth surfaces, such aluminum foil. To overcome this difficulty it has been customary to incorporate a modifier into the molecular structure of the copolymer. Usually a small amount of a reactive dibasic acid, such as maleic, is interpolymerized with the copolymer. For better adhesion of the coating to the surface the coating solution should contain some amount of a copolymer having a dibasic acid incorporated in the structure. The vinyl chloride-acetate copolymer mentioned above which has a composition of 86% by weight of vinyl chloride, 13% by weight of vinyl acetate and 1% by weight of an interpolymerized dibasic acid is a commonly used copolymer for obtaining improved adhesion qualities.

I have found that when the vinyl resin coating contains sorbitan monolaurate, which is a fatty acid monoester of hexitan inner esters derived from hexahydric alcohol, the water accumulation problem is reduced if not eliminated. The coating should, in accordance with the invention, consist essentially of vinyl chloride-acetate copolymer and sorbitan monolaurate, the latter being present in an amount of between 5 and 40% on a solvent-free basis. For best results I prefer the sorbitan monolaurate to be present in an amount of between 10 and 25% on a solvent-free basis.

A typical coating of the type just described was applied to an aluminum product by the following procedure: A commercial solution of copolymer resins consisting of 50% of a mixture of 87% by weight of vinyl chloride and 13% by weight of vinyl acetate, and 50% of a mixture of 86% by weight of vinyl chloride, 13% by weight of vinyl acetate, and 1% by weight of an interpolymerized dibasic acid, dissolved in a mixture of methyl ethyl ketone and toluene, was diluted with additional methyl ethyl ketone to produce a solution having a resin solids content of about 22 grams per 150 grams of solution. To this solution was added about 3.9 grams (per 150 grams of solution) of sorbitan monolaurate. The resultant solution was then applied to the aluminum surface by the use of a gravure cylinder and dried at an oven temperature of about 350° F. for 18 seconds which heated the foil to about 250° F. This resulted in an aluminum product with a coating having about 85% vinyl resin and 15% sorbitan monolaurate on a solvent-free basis.

Conveniently the vinyl resin may consist of a mixture of 40 to 95 parts by weight of a copolymer having a vinyl chloride content of 87% by weight and a vinyl acetate content of 13% by weight and 5 to 60 parts by weight of a copolymer having a vinyl chloride content of 86% by weight, a vinyl acetate content of 13% by weight, and

1% by weight of an interpolymerized dibasic acid. Alternates for the copolymer having 87% by weight vinyl chloride and 13% by weight vinyl acetate may be: (1) a copolymer containing 90% by weight of vinyl chloride and 10% by weight of vinyl acetate, and (2) a copolymer containing 91% by weight of vinyl chloride and 9% by weight of vinyl acetate. The above-described resins are usually dissolved in a volatile organic solvent such as a ketone, particularly methyl ethyl ketone, to which may also be added, if desired, a diluent, such as toluene.

Coating the surface of an aluminum product with the organic solvent solution, including the vinyl copolymer resins and the sorbitan monolaurate, may be accomplished by any well known method for applying such coatings. Satisfactory results, and probably the simplest means of transferring the coating solution to the aluminum surface, is by the use of a gravure cylinder. The above-described coating solution should be applied at such a rate that after the solvent is driven off by heating as hereinbelow described at least a half pound of solvent-free material is distributed over 3000 square feet of the coated surface. When less than a unit weight of a half pound of solvent-free material is applied per 3000 square feet of coated surface, the surface becomes iridescent which condition is generally undesirable from an appearance standpoint. While the maximum amount of solvent-free material is not critical more than 1½ pounds per 3000 square feet does not give any added advantage.

After the coating solution is applied to the aluminum surface, the coated surface should be heated at elevated temperatures to dry the coating. This may be accomplished by subjecting the coated surface to an oven temperature of between 275° F. and 500° F. and holding within this range for a sufficient period of time to dry the coating. Generally, the period of heating within the foregoing temperature range would be from 10 to 30 seconds. In general, the higher the temperature employed, the shorter the period of time required to achieve the proper dryness. Heating at a higher temperature or for a longer period of time than described above is not necessary and it may adversely affect the substrate by causing excessive loss of water content, especially where the substrate is lightweight paper. On the other hand, insufficient drying of the coated surface does not provide for good adhesion of the coating.

If desired, the aluminum surface may be coated with a prime coat of vinyl chloride-acetate copolymers prior to applying the vinyl resin coating containing sorbitan monolaurate. When this procedure is followed each coating application should be dried separately, usually at a lower temperature and for a shorter period of time than employed when only a single vinyl resin coating is applied to the aluminum surface.

The improvement in lithographic printing on moisture laden aluminum surfaces resulting from employment of the invention is illustrated in the following comparison. Two aluminum foil-paper laminate rolls of printing stock consisting of a lubricant-free aluminum foil 0.00035 inch thick laminated to 8 point paper board were used in the test. The exposed aluminum surface of the first roll was coated, by the use of a gravure cylinder with the coating solution wherein the coating solution contained a mixture of equal proportions of two copolymer resins, one copolymer consisting of 87% by weight of vinyl chloride and 13% by weight of vinyl acetate and the other consisting of 86% by weight of vinyl chloride, 13% by weight of vinyl acetate and 1% by weight of an interpolymerized dibasic acid, dissolved in a mixture of methyl ethyl ketone and toluene and further diluted with methyl ethyl ketone. Said coating solution contained about 22 grams of solids content per 150 grams of solution. The exposed aluminum surface in the second roll was also coated with the same solution and in the same manner as the first roll except that 3.9 grams of sorbitan monolaurate per 150 grams of solution was added to the coating solution prior to applying the solution to the aluminum foil surface. Sufficient coating solution was applied so that after drying there was approximately one pound of solvent-free material (of which 85% was vinyl resin and 15% was sorbitan monolaurate) per 3000 square feet deposited on the surface. The coatings were dried in an oven maintained at a temperature of 350° F. for 18 seconds. 13 by 20 inch sheets cut from the first roll were designated as lot #1. Sheets of the same size were cut from the second roll and these were designated as lot #2. Sheets from lot #1 were run through a 14½ by 20½ inch Harris offset lithographic press with the water content on the plate being adjusted until portions of the image area became washed out or indistinct. When this condition occurred and without stopping the press, sheets from lot #2 were run through the press. The image on the lot #2 sheets did not have any washed out areas and the entire image had excellent clarity.

Adhesion of the ink to the coated surface was checked by two common testing procedures. In the first, strips of pressure-sensitive cellophane tape were applied to the printed area and then pulled away to determine whether or not the printing would strip. In the second, the printed area was abraded with a finger nail to determine if any of the printing could be removed. In both tests, no ink was removed showing excellent adhesion of the ink to the coated surface.

I claim:

1. An aluminum product adapted to receive lithographic printing comprising aluminum having a coating consisting essentially of vinyl chloride-acetate copolymer and 5 to 40% by weight of sorbitan monolauraet.

2. An aluminum foil product adapted to receive lithographic printing comprising aluminum foil having a coating consisting essentially of vinyl chloride-acetate copolymer having a vinyl acetate range of 8 to 15% by weight, and 10 to 25% by weight of sorbitan monolaurate.

3. An aluminum foil product adapted to receive lithographic printing comprising an aluminum foil-paper laminate, the aluminum foil of said laminate having a coat consisting essentially of

(*a*) a copolymer having a vinyl chloride content of about 87% by weight and a vinyl acetate content of about 13% by weight,

(*b*) a second copolymer having a vinyl chloride content of about 86% by weight, a vinyl acetate content of about 13% by weight, and an interpolymerized dibasic acid content of about 1% by weight, and

(*c*) 10 to 25% by weight of sorbitan monolaurate, said coating having a unit weight of at least 0.5 pound per 3000 square feet of surface.

4, A process for improving the receptivity of an aluminum product to lithographic printing which comprises

(*a*) coating said product with an organic solvent solution of vinyl chloride-acetate copolymer and 5 to 40% by weight on a solvent-free basis of sorbitan monolaurate, and

(*b*) heating to dry the coating.

5. A process for improving the receptivity of an aluminum foil surface to lithographic printing which comprises

(*a*) coating said surface with an organic solvent solution of vinyl chloride-acetate copolymer having a vinyl acetate range of 8 to 15% by weight, and 10 to 25% by weight on a solvent-free basis of sorbitan monolaurate, and

(*b*) heating to dry the coating at an oven temperature between 275 and 500° F. for 10 to 30 seconds.

6. A process for improving the receptivity of the exposed aluminum surface of an aluminum foil-paper laminate to lithographic printing which comprises

(*a*) coating said surface with an organic solvent solution of (1) a copolymer having a vinyl chloride content of about 87% by weight and a vinyl acetate content of about 13% by weight, (2) a second copolymer having a vinyl chloride content of about 86% by weight, a vinyl acetate content of about 13% by weight, and an interpolymerized dibasic acid content of about 1% by weight, and (3) 10 to 25% by weight on a solvent-free basis of sorbitan monolaurate,

(*b*) the solution being applied in an amount sufficient to provide upon drying a coating having a unit weight on a solvent-free basis of at least 0.5 pound per 3000 square feet of surface, and

(*c*) heating to dry the coating at an oven temperature between 300 and 375° F. for 10 to 20 seconds.

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