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STENCIL SHEET AND PROCESS FOR
FORMING THE SAME

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My invention relates to permeable sheets so prepared as to be impervious to ink until pressure has been applied by means of raised characters such as the type of a writing machine or by means of a stylus, such part of the sheet thereby becoming pervious and so altered that ink will pass.

My invention may be used in place of and is an improvement over those stencil papers such as wax and others which are easily ruptured in the typing process and which must be carefully handled to avoid injury to the coating. It is also an improvement over that class of stencil sheets requiring the application of moisture previous to typing, in that while possessing to a marked degree the durability and toughness of such stencil sheets and capable of reproducing a large number of copies it does not require the application of moisture.

In general my new stencil sheet possesses great chemical and mechanical stability. Also its freedom from grease and oil is advantageous in that the stencil sheet does not soil the feed rolls of the writing machine nor the backing sheets or other papers which may be packed with it in cartons. Suitably packed in cartons it will remain usable for long periods of time. In the typing process it also possesses the added improvement over other dry stencils in that it does not clog the type of the writing machine with extractive matter from the substance of the coating.

The object of my invention therefore is the production of an improved stencil sheet which shall be tough and durable, which may be typed in a writing machine, will afford a large number of reproductions and will not deteriorate from long usage. A further object is that the stencil sheet shall be proof against ink, this latter quality not being possessed by some of the stencil sheets now sold in the market. My stencil sheet may be cleansed from ink and kept for reprinting without deterioration.

I accomplish this object by making use of the great stability and other desirable properties of the anhydrides of the higher fatty acids when mixed homogeneously in a film or coating with other suitable substances such as esters of cellulose with or without a small amount of glycerin or its equivalents, a concrete example of such formula being given in the following description. When these substances are brought into solution by means of suitable solvents and applied to a sheet of open, fibrous material such as Japanese yoshino paper, on evaporation of the solvents a tough and impervious sheet results, which is ca-

pable of being typed in the ordinary manner. The acid anhydrides as made by my process and referred to, I have discovered are particularly adapted for use in the stencil sheet coatings for the reason that they are very stable and easily assimilable by the other ingredients of the film, the whole forming a tolerant mixture which deposits a film of suitable flexibility and toughness.

The most useful of these acid anhydrides I have found are those for the manufacture of which I have devised a special process, involving the use of a catalyst and relatively low temperatures, the final product being easily purified.

Anhydrides of the formula (R₂O) are obtained, the molecule of the acid or acid containing substance such as glycerides being doubled if necessary. Acetic anhydride is used in molecular proportions (although other dehydrating agents may be used) for the removal of the hydroxyl of the acid, and with an excess of about 10% where glycerides are used.

In the process of forming my new stencil sheet I first proceed to manufacture an acid anhydride by reacting on 280 pounds of oleic acid and 1.2 pounds of concentrated sulphuric acid and 60 pounds of acetic anhydride. The oleic acid (C₁₈H₃₄O₂) is entered into a closed, acid proof container and while in agitation the mixture of sulphuric acid and acetic anhydride is run in, the temperature below stated being maintained for about 30 minutes, the mixture being agitated for a few minutes at a time during this period. The reaction takes place at atmospheric pressure and the temperature of the mix is maintained at from 100 to 115 degrees F. Means for preventing any material increase of pressure or the formation of a partial vacuum are desirable.

After the reaction is completed a cold solution of 120 lbs. of water and five pounds of sodium hydrate is added, or a solution of 120 lbs. of water and ten lbs. of anhydrous sodium acetate or, a 25% brine solution of about the same volume as the mix, is added and the mix agitated for 5 to 10 minutes for the purpose of washing the oleic anhydride free of acids and impurities. Other suitable salt solutions may also be used for the purpose of washing. The reaction product may also be freed from acids by other means such as distillation, the acetic acid thus being recovered.

The mix is then left to stand at about 100°F for three or four hours or until the complete separation of the liquids has occurred. The aqueous liquid is then drawn off and the anhy-

dride is ready for use. Instead of separation of the phases of the mix by subsidence the mix may be separated by means of suitable centrifugal separation if desired.

5 I then prepare a solution of industrial nitro cellulose of medium viscosity, one part, amyl or butyl acetate 8 parts, denatured or methyl alcohol 4 parts, benzine 4 parts, oleic anhydride 6 to 7 parts, all parts being by weight. A suitable coloring material may be added if a colored sheet is desired. Basic or acid dyes or pigments may be used for the purpose. The fluidity of the solution may be increased or diminished by increasing or diminishing the solvents. The solution should be fluid enough to easily penetrate the paper.

10 Sheets of Japanese yoshino paper are then impregnated by drawing over the surface of the solution, the surplus being removed by a scraper, and suspended to dry. On evaporation of the solvents the film sets to a homogeneous compound in a few minutes, the sheets then being ready for use.

15 Sheets are typed in the well-understood manner, being superimposed on a carrier sheet and are then used in duplicating machines with inking pads or rollers, for the purpose of making impressions.

20 The proportions of materials stated in the solutions may be varied within reasonable limits for the adjustment of the coating it being understood that the proportions of anhydride and cellulose ester are fixed substances that remain in the film to compose the coating of the stencil sheet. Less anhydride for example will make a harder film and more a softer film. So that I do not bind myself to these stated proportions of solvents or other substances, it being understood that my process practically considered consists of these substances or their equivalents for the purpose of a coating of predetermined character, solvent enough being used to give necessary fluidity to the solution. A small part of glycerin equal to .5 of the cellulose ester may be used if desired, to give further flexibility.

25 In the manufacture of the acid anhydrides other substances may be used such as the glycerides of the fatty acids or other fatty acids such as stearic or palmitic or mixtures of these. I may also manufacture the acid anhydrides by a different process such as heating under pressure, my invention of the stencil sheet contemplating such acid anhydride as a necessary ingredient without regard to the process of manufacture. In the process described I may use other catalysts such as an acid, metallic salt, an oxide or finely divided metal or a catalyst of any kind capable of maintaining the reaction. I may also use other esters of cellulose as the acetate or xanthate with suitable solvents.

30 It has been proposed to manufacture stencil sheets with esters of cellulose such as the nitrate mixed with fats, oils and fatty acids but I distinguish between those stencil sheets and my invention in that I do not use any fatty material and thus provide a coating of much more stability, the anhydrides referred to being much more stable than the fats and oils and produce a different and superior coating of much more flexibility and toughness and free of greasy and oily qualities.

35 It will be understood that the invention of the stencil sheet is not limited to the details as above described but that it comprehends broadly a stencil sheet adapted to be converted into a stencil

oil by pressure as by impact or stylus thereon, it being essentially a fibrous base provided with a coating which includes suitable anhydrides of the higher fatty acids or their equivalents, this being so modified as to make it substantially stable for the purpose designed and responsive to pressure for the purpose stated such being the production of stencil openings of character suitable for the passage of ink.

40 The invention of the process described herein is not limited to the precise details set forth but comprehends broadly the preparation of the acid anhydrides described and compounding with the remaining ingredients and impregnating open, fibrous material with the completed solution and drying by suitable, equivalent means.

What I claim is:

1. A stencil blank convertible into a stencil by impact of type and the like thereon, comprising open, fibrous material impregnated with an ester of cellulose and a higher fatty acid anhydride.

2. A stencil blank convertible into a stencil by impact of type and the like thereon, comprising open, fibrous material impregnated with an ester of cellulose, a higher fatty acid anhydride and a suitable polyhydric alcohol.

3. A stencil blank convertible into a stencil by impact of type and the like thereon, comprising open, fibrous material impregnated with an ester of cellulose and oleic anhydride.

4. A stencil blank convertible into a stencil by the impact of type and the like thereon, comprising open, fibrous material impregnated with an ester of cellulose, oleic anhydride and a suitable polyhydric alcohol.

5. A stencil blank convertible into a stencil by impact of type and the like thereon, comprising open, fibrous material impregnated with nitro-cellulose and a higher fatty acid anhydride.

6. A stencil blank convertible into a stencil by impact of type and the like thereon, comprising open, fibrous material impregnated with nitro-cellulose and oleic anhydride.

7. A stencil blank convertible into a stencil by impact of type and the like thereon, comprising open, fibrous material impregnated with nitro-cellulose, oleic anhydride and a suitable polyhydric alcohol.

8. A stencil blank convertible into a stencil by impact of type and the like thereon, comprising open, fibrous material impregnated with an ester of cellulose and anhydrides of the higher fatty acids.

9. A stencil blank convertible into a stencil by impact of type and the like thereon, comprising open, fibrous material impregnated with nitro-cellulose and anhydrides of the higher fatty acids.

10. The process of forming a stencil sheet, consisting of heating and agitating a higher fatty acid or a higher fatty acid containing substance with a dehydrating agent and a catalyst until dehydration of the acid occurs, removing the acids from the resulting acid anhydride, adding thereto an ester of cellulose and suitable solvents, impregnating an open, fibrous material with the said solution and drying.

11. The process of forming a stencil sheet, consisting of heating and agitating oleic acid with acetic anhydride and concentrated sulphuric acid as a catalyst until dehydration of the oleic acid occurs, removing the acids from the resulting acid anhydride, adding thereto nitro-cellulose and suitable solvents, impregnating an open, fibrous material with the said solution and drying.

12. The process of forming a stencil sheet consisting of heating and agitating oleic acid with acetic anhydride and a catalyst such as concentrated sulphuric acid until dehydration of the oleic acid occurs; washing the resulting oleic anhydride with a suitable alkaline or salt solution, adding nitro-cellulose and suitable solvents, impregnating an open, fibrous material with the compound and drying.
13. The process of forming a stencil sheet involving the production and purification of a higher fatty acid anhydride, adding to a solution containing an ester of cellulose, impregnating a sheet of open, fibrous material with the solution and drying the sheet.
14. The process of forming a stencil sheet involving the production of a higher fatty acid an-

hydride, washing the same free of acids, adding nitro-cellulose and suitable solvents, impregnating an open, fibrous material with the solution and drying.

15. The process of forming a stencil sheet involving the production of a higher fatty acid anhydride, dissolving the acid anhydride in a solution containing nitro-cellulose and suitable solvents, impregnating an open fibrous material with the said solution and drying.

16. The process of forming a stencil sheet, involving the production of a higher fatty acid anhydride, dissolving the same with an ester of cellulose and suitable solvents, coating the solution on fibrous material and drying.

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