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STENCIL SHEET.

No Drawing.

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This invention relates generally to type-impressible stencil sheets suitable for use on the mimeograph or other stencil duplicating machine and particularly to that type of stencil sheet in which is employed an open porous base, such as yoshino, provided with a normally impervious coating in which characters may be formed by impact or pressure, such as that of the type of a writing machine or of a stylus. In Letters Patent No. 1,526 982, granted February 17, 1925, I have disclosed and claimed broadly such a stencil sheet, the coating whereof includes a cellulose compound as, for example, a cellulose ester in a suitable solvent. The present invention concerns an embodiment of this broad idea in a form with which good results may be obtained in practice. The best known and most commonly used esters of cellulose are the nitrates and the acetates. It has been found that certain advantages inhere in the latter (in which I include other fatty esters or compound fatty esters of cellulose) as, for example, they are less inflammable and are non-explosive, for which reason they can be compounded more safely than the former with solvents of comparatively low inflammability. They may also be readily modified and softened to adapt them to the intended purpose. Stencil sheets of the so-called "dry" type, that is, not requiring moistening preliminarily to stenciling the same, coated with suitably compounded cellulose acetate, operate well under the impact of the type and produce copies of excellent quality.

Cellulose acetate as it occurs in the market or may be made in the laboratory is of several kinds and of varying solubility, but the common commercial varieties seem to fall into two distinct classes, one which is soluble in acetone and the other which is practically acetone-insoluble. Either variety is capable of yielding stencils of commercial quality. The acetone-soluble cellulose is that which scientifically is produced by the partial saponification of the directly acetylated product or so-called "triacetate", while the acetone-insoluble material consists primarily of the product directly acetylated to the triacetate. The acetone-soluble compounds are, therefore, the so-called group

of "acetyl hydro celluloses" and may so be regarded chemically, but whether the cellulose acetate be soluble or insoluble in acetone, its solutions in any volatile solvent with which I am acquainted may be modified in such a manner as to produce a satisfactory commercial stencil. Compound cellulose fatty esters, such as the nitro acetates, or esters made by the use of two or more fatty acids in union with the same cellulose molecule, would constitute fatty esters of cellulose which would no doubt yield colloidal homogeneous films capable of producing entirely satisfactory stencils.

In carrying out my invention, I employ, generally speaking, cellulose acetate in a suitable volatile solvent, such as acetone, a tempering agent or agents, one or more of which may be (wholly or in the main) a solvent of the cellulose acetate or may be characterized by substantial non-volatility, in which case it will remain as a part of the coating mass. To this coating mass there is added a tempering agent and a lubricating agent. The tempering agent may have modifying properties or a distinct modifying agent may be added in addition to a tempering agent. The tempering agent for the cellulose acetate colloid may be one of the following: the amyl and butyl tartrates and phthalates, monoacetin, triacetin and esters of glycerin or of other polyhydric alcohols.

The substances mentioned above as tempering agents exert a solvent or gelatinizing effect on the cellulose acetate, and unite with the colloid to produce a homogeneous film. Modifiers are not solvents for the colloid but cause a homogeneous film when used with a mutual volatile solvent which is evaporated.

The lubricant added to the coating is a special type of distender distinguished by the fact that it has lubricating properties. The function of a distender is to extend the homogeneous film. Some distenders possess definite lubricating properties; that is, establish inter-molecular lubrication. The non-lubricating distenders include Turkey red oil, bentonite, powdered soapstone and zinc oxide. The distenders which have definite lubricating properties include chlorinated naphthalene and other hydrocarbons,

such as anthracene, carbazol, and other hydrocarbons of the higher aromatic coal tar series and the halogen derivatives thereof. Castor oil and zinc stearate are also lubricants when used with cellulose acetate but lack this property when used with nitro-cellulose.

One distinction between tempering or modifying agents on the one hand and lubricating and distending agents on the other, is that the tempering and modifying agents are capable of forming a homogeneous, gelatinous and continuous film with the cellulose acetate, while the lubricants and the distenders do not possess this property.

To the coating containing the tempering or modifying agent and the lubricant, there may also be added coloring agents such as Prussian blue.

My invention may be practiced by the use of the following formula, the proportions stated being approximate:

20 grams of cellulose acetate of the acetone-soluble grade are dissolved in

400 grams of good commercial grade acetone. To this, there is now added a mixture consisting of

75 grams of monoacetin (the monoacetic acid ester of glycerin) in which has been dissolved

5 grams of chlorinated naphthalene and 8 grams of castor oil.

There is now added a mixture consisting of

2 grams of Prussian blue in 5 grams of castor oil.

Then there should be stirred in 10 grams of stearate of zinc and

10 grams of Turkey red oil (sulfonated castor oil).

The mixture so produced will be found to be of about the proper consistency for application to sheets of yoshino paper by the "drawing" process commonly in use. If too stiff, however, this may be readily remedied by the addition of more solvent or oil or both. After the coating operation the sheets may be hung for a short time to permit the evaporation of the volatile solvent, after which they will be ready for stencilizing in the usual manner.

As representative of a second working formula in which are used esters of the higher alcohols which may be regarded as more powerful modifying and softening agents of the cellulose acetate, the following formula may be employed:

80 grams of a 10% solution of cellulose acetate in acetone. To this may be added

50 cc. of a 16% solution of starch acetate in acetone

10 gm. castor oil

10 gm. chlorinated naphthalene

45 cc. dibutyl tartrate.

At ordinary temperatures this makes a

homogeneous mass from which stencil sheets may be produced in the manner above described.

Another compound suitable for addition to this mass is diamyl phthalate, and it may wholly or in part replace the dibutyl tartrate in the formula given. The acetate of starch, while not an absolutely essential constituent, nevertheless improves the quality of the stencil sheet for practical purposes. Other higher alcohols than amyl and butyl are no doubt suitable for the preparation of esters of the character of dibutyl tartrate and diamyl phthalate, and other polybasic acids than phthalic and tartaric will yield compounds which are applicable for the purpose.

The foregoing statements of preferred methods of practicing the invention are not to be regarded as limitations with respect to scope, for it is obvious that other substances may be substituted or added and that this may necessitate variations of the proportions stated. Thus, with suitable grades of cellulose acetate, other volatile substances than acetone may be employed. Monoacetin, may be replaced wholly or in part by diacetin or triacetin or mixtures thereof, or similar esters of glycerin and other polyhydric alcohols, such as the glycols. The chlorinated naphthalene may also be replaced by other halogenated hydrocarbons and possibly by certain hydrocarbons themselves. Castor oil, while the best product of its kind for the purpose which has been found, need not be regarded as, and may not be, a necessity, as other oils of similar properties such as rapeseed, olive, almond or peanut oil, may be used, in whole or in part, for the same purpose. The coloring ingredient may, of course, be varied widely; for example, the Prussian blue may be replaced by lake colors or by dyestuffs soluble in the mixture. Chlorinated naphthalene is also a lubricant in the compositions referred to. Turkey red oil (sulfonated castor oil) may be replaced by sulfonated corn oil or by sulfonated oils derived from other saturated or partially unsaturated oils.

If desired, the coating compound as hereinbefore set forth, or the essentials thereof, may be combined with other ingredients to vary the character of the resultant mass for the production of desired effects. Thus there may be employed, in conjunction with the cellulose acetate in proper solution and with other softening or tempering agent or agents, salol (phenyl salicylate), acetanilid, triphenyl or tricresyl phosphate or other substances which will modify the character of the coating mass either by coagulation or upon the evaporation of the volatile solvent. As in the case of the formulae above specifically stated, the result will be a

homogeneous, type-impressible, colloidal, coating substance capable of use throughout an extended period of time without moistening preliminarily to stencilizing.

5 It should also be pointed out that certain of the higher esters of cellulose may be soluble in a non-volatile solvent. Where these are used, such solvent becomes a more or less permanent constituent of the coating
10 compound which should be applied to the yoshino while at a somewhat elevated temperature or, at least, a temperature sufficiently high to hold the cellulose ester in solution. After the coating operation the
15 sheet may be hung for a sufficient time to attain a moisture balance, particularly where a constituent having more or less hygroscopicity (monoacetin, for example) is employed. Such a comparatively non-
20 volatile solvent for cellulose acetate is represented by ortho-nitro-toluol, although because of its toxic properties, preference would naturally be given to another substance or other substances having the capacity of acting as a solvent of cellulose acetate. The higher alcohol esters of phthalic and tartaric acid, either alone or when
25 mixed with other substances and used in connection with a suitable cellulose ester, may form coating masses which can be
30 handled in this manner.

What I claim is:—

1. A type-impressible stencil sheet comprising a porous base having a coating including a fatty acid ester of cellulose, a
35 lubricant and a tempering agent.

2. A type-impressible stencil sheet comprising a porous base having a coating including a fatty acid ester of cellulose and a
40 halogenated hydrocarbon.

3. A type-impressible stencil sheet comprising a porous base having a coating including a fatty acid ester of cellulose, a halogenated hydrocarbon and a tempering
45 agent.

4. A type-impressible stencil sheet comprising a porous base having a coating including a fatty acid ester of cellulose, a halogenated hydrocarbon and castor oil.

50 5. A type-impressible stencil sheet comprising a porous base having a coating including an acetone-soluble fatty acid ester of cellulose.

6. A type-impressible stencil sheet comprising a porous base having a coating including an acetone-soluble fatty acid ester of cellulose and a lubricant.

7. A type-impressible stencil sheet comprising a porous base having a coating including an acetone-soluble fatty acid ester of cellulose and a tempering agent.

8. A type-impressible stencil sheet comprising a porous base having a coating including an acetone-soluble fatty acid ester

of cellulose, a lubricant and a tempering agent. 65

9. A type-impressible stencil sheet comprising a porous base having a coating including a fatty acid ester of cellulose and a higher alcohol ester of a polybasic acid. 70

10. A type-impressible stencil sheet comprising a porous base having a coating including cellulose acetate and a higher alcohol ester of a polybasic acid.

11. A type-impressible stencil sheet comprising a porous base having a coating including cellulose acetate and dibutyl tartrate. 75

12. A type-impressible stencil sheet comprising a porous base having a coating including cellulose acetate and diamyl phthalate. 80

13. A type-impressible stencil sheet comprising a porous base having a coating including cellulose acetate, starch acetate and a higher alcohol ester of a polybasic acid. 85

14. A type-impressible stencil sheet comprising a porous base having a coating including cellulose acetate, starch acetate and dibutyl tartrate. 90

15. A type-impressible stencil sheet comprising a porous base having a coating including cellulose acetate, starch acetate and diamyl phthalate. 95

16. A type-impressible stencil sheet comprising a porous base having a coating including cellulose acetate, a higher alcohol ester of a polybasic acid and a lubricant.

17. A type-impressible stencil sheet comprising a porous base having a coating including cellulose acetate, an acetate of starch, dibutyl tartrate and castor oil.

18. A type-impressible stencil sheet comprising a porous base having a coating including cellulose acetate, an acetate of starch, diamyl phthalate and castor oil. 105

19. A type-impressible stencil sheet comprising a loose fibred base provided with a coating of glycerol fatty acid ester, phthalic acid ester, and a binding agent. 110

20. A type-impressible stencil sheet comprising a porous base having a coating including cellulose acetate dissolved in acetone, phthalic acid ester, butyl tartrate, and a lubricant. 115

21. A stencil sheet comprising a porous base having a coating including cellulose acetate dissolved in acetone, butyl tartrate, diamyl phthalate, and a lubricant. 120

22. A stencil sheet comprising a porous base having a coating including cellulose acetate dissolved in acetone, butyl tartrate, diamyl phthalate, and chlorinated naphthalene. 125

23. A stencil-sheet of open tissue coated with a solution of cellulose acetate whose toughness is sufficiently reduced by non-

oleaginous plastifying, stabilizing and softening agents to form therewith a homogeneous ink-proof body which may be readily stenciled by the types of a typewriter.

5 24. A stencil-sheet of open tissue coated with a solution of cellulose acetate whose toughness is sufficiently reduced by non-oleaginous plastifying, stabilizing and softening agents to form therewith a homogeneous ink-proof body which may be readily stenciled by the types of a typewriter. the homogeneous body also including a lubricating agent.

10 This specification signed this 30th day of March, 1925.

EDWARD W. HILL.