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## (54) COMPOSITIONS FOR CLEANING SURFACES

(71) We, VICKERS LIMITED, a British Company of Vickers House, Millbank Tower, Millbank, London SW1P 4RA do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to compositions for cleaning surfaces and is particularly but not exclusively concerned with the cleansing of screens as used in the screen printing process.

In such a process, there is used a printing screen in the form of a perforated gauze which allows ink to pass through it except in those areas covered by a resist. The resist usually takes the form of poly(vinyl alcohol) and poly(vinyl acetate) material which contains a dichromate or diazo compound as sensitizer so that it becomes insoluble, and provides the required image, on exposure to light. The printing process involves the use of oleo inks containing natural or synthetic varnishes, resins, organic solvents, pigments and possibly other materials to improve or modify their colour forming or their rheological and drying characteristics. Gauze screens are expensive and it is desirable that they be cleaned so as to be reusable. Although the screens can be made from silk, it is more usual to use a synthetic fibre such as a linear polyamide (nylon) or a linear polyester such as polyethylene terephthalate.

After printing, excess ink is conventionally removed from the screen by using organic solvent liquids, for example white spirit, and the resist is then removed by, for example, rubbing the gauze with periodate solution (as described in GB Patent Specification No. 1,375,402). Alternatively, potassium permanganate may be used, although the use of the latter is messy and a further treatment with a solution of a strong acid for example dilute sulphuric acid, is necessary. Such conventional treatments leave the gauze in a greasy condition: special degreasing fluids have to be used before the gauze is sufficiently clean to enable it to be re-used.

There is thus a need to simplify the cleansing of printing screens.

According to the present invention there is provided a composition for cleaning a surface bearing a layer of light sensitised polyvinyl alcohol-containing material which has been insolubilised and which is coated with greasy ink and/or ink residue, which composition comprises:

(a) an oxidising agent that converts insolubilised light sensitised polyvinyl alcohol-containing material to soluble form and which is selected from a source of periodate ions, ceric ammonium nitrate and potassium permanganate; and

(b) an organic solvent liquid that is a solvent for greasy ink and/or ink residue, the concentration of the oxidising agent being in the range 0.1 to 10% by weight relative to the weight of the organic solvent liquid.

In one embodiment of the invention the organic solvent liquid is water miscible. The water miscible solvent may be, for example, a lactone such as  $\alpha$ -butyrolactone, a lactam such as N-methyl-2-pyrrolidone, or formdimethylamide, although other solvents such as 2-ethoxy ethanol or tetrahydrofurfuryl alcohol may be used. It is preferred that in this embodiment a surfactant (emulsifying agent) is also present in the composition. It has been found that the presence of a surfactant improves the degreasing properties of the composition.

In another embodiment of the invention the organic solvent liquid is water immiscible and the composition additionally includes a surfactant (emulsifier). As water immiscible

solvent it is preferred that a hydrocarbon such as white spirit or paraffin is used, although other solvents such as methoxy butylacetate, 2-ethoxyethylacetate and cyclohexanone may be conveniently employed.

5 The oxidising agent component of the composition according to the invention is preferably a source of periodate ions, for example a periodate such as sodium periodate, or periodic acid *per se*. Other oxidising agents which may be used in accordance with the invention are ceric ammonium nitrate or potassium permanganate. 5

10 A particularly preferred composition according to the invention includes a periodate as oxidising agent and white spirit as water immiscible solvent, together with, of course, a surfactant. The proportion of oxidising agent to solvent must be from 0.1 to 10% by weight, and is preferably 6% by weight. The supporting medium is preferably water, with the oxidising agent forming a saturated solution therein. 10

Compositions according to the invention may additionally contain acidic or alkaline materials, colourants or thickeners.

15 The compositions of the invention may be used to clean surfaces which bear a layer of light sensitised polyvinyl alcohol-containing material which has been insolubilised and which is coated with greasy ink and/or ink residue by treating the coated layer with the composition and then removing the thus treated layer from the surface. After removal of the treated layer, for example by rubbing, the surface is preferably rinsed with water or with some other suitable material such as an alcohol in order to remove all trace of the layer. The surface, for example a printing screen gauze, is left in a clean, degreased condition ready for re-use. 15

20 Whilst a gauze can be cleaned in this manner using the compositions of the invention, it may be more practicable from an economic point first to remove excess ink with a solvent such as white spirit or 'Oxitol' (registered trade mark). 20

The following Examples illustrate the invention. 25

#### Example 1

A cleansing solution was prepared comprising (by weight)

Sodium periodate	1%
$\gamma$ -Butyrolactone	25%
Surfactant	5%
Water	69%

30 The surfactant used was TEXOFOR 65 A9P. "TEXOFOR" is a registered trade mark. 30

35 A screen made of fine nylon gauze was coated with a poly(vinyl alcohol)-poly(vinyl acetate) emulsion sensitised with ammonium dichromate and was then exposed and developed in the customary manner to form a resist. The resist bearing screen was then used for printing with black pigmented oleo ink. After printing, excess ink was removed with white spirit and then the above solution was applied to the screen and agitated with a soft brush for two minutes, after which time the screen was rinsed with water. On inspection the screen was found to be undamaged and in a clean, degreased condition ready for re-use. 35

#### Example 2

45 Example 1 was repeated except that the initial treatment of the used screen with white spirit was omitted. It was found that a satisfactorily clean and degreased screen was obtained but that a greater quantity of cleansing solution was required to be used for a longer period. 45

#### Example 3

50 Examples 1 and 2 were repeated using four cleansing solutions in which the  $\alpha$ -butyrolactone was replaced respectively with a similar quantity of N-methyl-2-pyrrolidone, formdimethylamide, 2-ethoxyethanol and tetrahydrofurfuryl alcohol. Similar results were obtained as regards the cleaning and degreasing of the screen, but it was found that the solution containing tetrahydro alcohol deteriorated rapidly during storage. By virtue of its toxicity the use of the formdimethylamide solution was undesirable. 50

#### Example 4

60 A cleansing solution was prepared comprising (by weight) 60

Potassium permanganate	2.5%
$\gamma$ -Butyrolactone	40%
Surfactant (TEXOFOR FP85)	11%
Water	46.5%

65 65

An image bearing screen which had been used for printing, as in Example 1, was cleaned with white spirit. Thereafter the above cleansing solution was applied and agitated for 3 minutes. The screen was then rinsed with water, treated with a dilute acidic solution of sodium metabisulphite containing approximately 10% of the above surfactant, and finally rinsed again with water. Whilst a re-usable degreased screen was produced, this cleansing solution did not work as well as those of the previous Examples.

#### Example 5

A cleansing solution was prepared comprising

Potassium permanganate	2.5%
$\gamma$ -Butyrolactone	40%
Surfactant	11%
Water	46.5%

The surfactant used was ANTAROX C0530. "ANTAROX" is a registered trade mark. The procedure of Example 1 was repeated and similar results were obtained.

#### Example 6

A cleansing liquid comprising:

32 parts by volume of white spirit

64 parts by volume of 3% aqueous ceric ammonium nitrate and 4 parts by volume of surfactant was well shaken to form a coarse emulsion. The surfactant used was NANSAS 94. "NANSAS" is a registered trade mark.

After leaving for several days, the above emulsion was re-shaken and used to clean an inky screen in the manner of Example 1. The screen was fine gauze linear polyester screen (Terylene) and the resist was formed from a dichromate-sensitised poly(vinyl alcohol) - poly(vinyl acetate) emulsion. The screen was left free of residual greasy and light hardened materials and was ready for re-use.

#### Example 7

An emulsion screen cleanser was produced by mixing the following:

58 parts by volume of 2% aqueous periodic acid

3 parts by volume of surfactant (NANSAS 94)

27 parts by volume of white spirit

12 parts by volume of dimethyl formamide.

After nine months' storage at 20°C, the above emulsion was found to have separated into two layers which readily re-mixed during gentle shaking. The emulsion was used to treat a screen in the manner of Example 1. After such treatment the screen gauze was found to be clean and ready for re-use.

It was found that the cleansing properties of all the preceding compositions could be enhanced if they were made suitably alkaline.

Our copending British patent application 1471/80 (Serial No. 1586472) which is divided out of this application describes and claims a method of cleaning a surface bearing a layer of light sensitised polyvinyl alcohol-containing material which has been insolubilised and which is coated with greasy ink and/or ink residue, which method comprises treating the coated layer with a composition comprising

(a) an oxidising agent that converts insolubilised light sensitised polyvinyl alcohol-containing material to a soluble form, and

(b) an organic solvent liquid that is a solvent for greasy ink and/or ink residue, and removing the thus treated layer from the surface.

#### WHAT WE CLAIM IS:-

1. A composition for cleaning a surface bearing a layer of light sensitised polyvinyl alcohol-containing material which has been insolubilised and which is coated with greasy ink and/or ink residue, which composition comprises:

(a) an oxidising agent that converts insolubilised light sensitised polyvinyl alcohol-containing material to soluble form and which is selected from a source of periodate ions, ceric ammonium nitrate and potassium permanganate; and

(b) an organic solvent liquid that is a solvent for greasy ink and/or ink residue, the concentration of the oxidising agent being in the range 0.1 to 10% by weight relative to the weight of the organic solvent liquid.

2. A composition according to claim 1 wherein the organic solvent liquid is water miscible.

3. A composition according to claim 2 which additionally includes a surfactant.

4. A composition according to claim 2 or 3 wherein the water miscible solvent is a

lactone.

5. A composition according to claim 4 wherein the lactone is  $\gamma$ -butyrolactone.
6. A composition according to claim 2 or 3 wherein the water miscible solvent is a lactam.
- 5 7. A composition according to claim 6 wherein the lactam is N-methyl-2-pyrrolidone.
8. A composition according to claim 2 or 3 wherein the water miscible solvent is formdimethylamide.
9. A composition according to claim 2 or 3 wherein the water miscible solvent is 2-ethoxy ethanol or tetrahydrofurfuryl alcohol.
- 10 10. A composition according to claim 1 wherein the organic solvent liquid is water immiscible and wherein the composition includes a surfactant.
11. A composition according to claim 10 wherein the water immiscible solvent is a hydrocarbon.
12. A composition according to claim 11 wherein the hydrocarbon is white spirit.
- 15 13. A composition according to claim 11 wherein the hydrocarbon is paraffin.
14. A composition according to claim 10 wherein the water immiscible solvent is methoxybutyl acetate or 2-ethoxyethyl acetate.
15. A composition according to claim 10 wherein the water immiscible solvent is cyclohexanone.
- 20 16. A composition according to any one of the preceding claims which additionally includes water.
17. A composition according to any one of the preceding claims wherein the oxidising agent is a periodate.
18. A composition according to claim 17 wherein the periodate is sodium periodate.
- 25 19. A composition according to any one of claims 1 to 16 wherein the oxidising agent is periodic acid.
20. A composition according to any one of the preceding claims which contains 6% by weight of the oxidising agent relative to the weight of the organic solvent liquid.
21. A composition according to claim 1 substantially as described in Example 1, 2, 3 or
- 30 4.
22. A composition according to claim 1 substantially as described in Example 5, 6 or 7.
23. A composition according to claim 1 substantially as herein described.

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