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PRINTING INK

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This invention relates to printing inks containing nitro-cellulose as a base and more particularly to inks which are designed to be utilized for printing upon textile materials.

An object of the present invention is to formulate a printing composition of the above described type which is relatively non-inflammable. A second object of the invention is to provide a printing ink which is not stringy and which does not exhibit any undue tendency to dry upon the inking and printing rollers. A further object of my invention is to eliminate the necessity of high pigmentation of the ink. Other objects and advantages will become more readily apparent from the following detail description of the invention.

Designs, decorative lines and figures have heretofore been applied to all manners of textile materials, generally through the use of printing inks having a base of oleoresinous varnish and similar compositions. The printing process usually consists of the transfer of the ink from a stencil, or through a screen, or through the recently developed direct printing, in which the ink is picked up by the depressions of the design engraved upon a metallic roll or plate and then transferred to the cloth. The oleoresinous inks are slow drying and therefore objectionable for many purposes. It has also been proposed to employ inks containing nitro-cellulose as a base in a highly volatile solvent. These inks have the advantage of a very quick dry and in most instances a clearness of tone not obtainable with oleoresinous or oil base inks. However, because of their speed of drying and setting, they tend to dry upon and build up in the design carried by the printing rolls and thus necessitate cleaning of the latter after short runs of cloth have been made. Obviously, this is uneconomical and impractical when it is desired to print thousands of yards of cloth in one continuous operation. A second difficulty which has been encountered in the use of nitro-cellulose inks is the excessive fire hazard created by the low flash point of the low boiling solvents used therein.

Various attempts have been made to obviate these disadvantages and in most cases the development work has been directed to the substitution of high boiling solvents, such as the ethers of ethylene glycol, butyl lactate, etc., for the low boiling solvents. Such solvents minimized the fire hazard, but retarded the drying of the ink, introduced stringiness and caused the ink to run. In addition the ink was marked by excessive penetration into the cloth. Manifestly, therefore, the physical characteristics of such inks prevented a clean-cut transfer of the design from the printing roll to the cloth. It became necessary to use very high pigmentation to reduce the tendency of the ink to flow. This improved ink was, however, only partially satisfactory and was expensive to manufacture.

The present invention is designed to eliminate many difficulties encountered in the prior art. It involves the discovery that by proper combination of a relatively high boiling solvent and a non-solvent diluent with a nitro-cellulose base, an ink is obtained which is substantially free of the objectionable features of coventional inks. For example, the lacquer composition exhibits a plastic flow in distinction to the fluid flow or mobility of other printing compositions. This plastic flow or high yield value is given to my printing compositions by the solvents themselves. Accordingly, it becomes unnecessary to employ additional quantities of pigments or fillers to gain this high yield value.

Such compositions, when the various constituents are in proper proportions, are of a gel consistency. Under a sudden impact, such as may be given by striking them with a spatula, or similar instrument, they exhibit a pronounced degree of the rubbery elasticity of a gel. However, upon a continuous application of a very slight force they exhibit plastic flow and a mass of the material will slowly flatten out under its own weight.

The components of the ink are susceptible of considerable variation in character without loss of the desired properties thereof. For example, the nitro-cellulose used as the base for the inks may be of any viscosity normally used in the lacquer industry, that is it may vary from 1/15 of a second to 80 seconds in viscosity. Any of the plasticizers commercially availabe, such as tri-cresyl phosphate, tri-phenyl phosphate, dibutyl phthalate, or triacetine may be used. The softeners may be castor oil, either raw or blown, or any of the oxidizing oils sometimes used in lacquer compositions. Resins, including any of the natural resins, such as dammar, or the synthetic resins, as for example the glyptals, vinyl resins, the phenol formaldehyde resins, or other synthetic resins, commercially available, may be added.

The solvents have a flash point in an open cup of 90° F. or higher, and preferably have a boiling point of 200° F., or above. Solvents having a flash point lower than 90° F. may be used only in such proportions with other solvents that the flash point of the final mixture will not be below 90° F. Examples of the high flash point solvents

which may be used include the ethers of ethylene and diethylene glycol, ethyl, butyl and amyl lactate, octyl acetate, octyl alcohol, hexanol, diacetone alcohol, amyl alcohol, butyl alcohol, amyl and butyl acetates, dichlorethyl ether, and cyclohexanone derivatives.

The non-solvents or diluents may consist of ordinary petroleum naphtha, or mineral spirits, hydrogenated naphtha and the coal tar hydrocarbons, such as toluol, xylol, etc. Butyl stearate in the composition acts partly as a plasticizer and also provides a certain amount of lubricating action.

It is obvious that the pigments incorporated in the ink will vary according to the particular color which it is desired to obtain. The proportions of pigment will also vary with the requirements of color, hiding power, and in the event that it becomes necessary to increase or decrease the percentage of pigment in any given composition, the amount of nitro-cellulose contained therein will be decreased, or increased, to maintain the desired physical properties of the composition.

The following examples illustrate satisfactory proportions of the various ingredients:

Example 1

	Per cent
Nitro-cellulose	10
Pigment	15
Plasticizer	6½
Softeners	6½
Butyl stearate	1
Ethylene glycol monobutyl ether	15
Diethylene glycol monoethyl ether	17
Petroleum naphtha	29

Example 2

	Per cent
Nitro-cellulose	10
Pigment	15
Plasticizer	5
Softeners	5
Butyl stearate	1
Synthetic resin	5
High boiling active solvents	32
Petroleum naphtha	27

Example 3

	Pounds
Nitro-cellulose viscosity, 20 seconds	100
Pigment	150
Dibutyl phthalate	65
Castor oil	65
Butyl stearate	10
Diethylene glycol monoethyl ether	170
Ethylene glycol monobutyl ether	150
Petroleum naphtha	290
	1000

Example 4

	Pounds
Nitro-cellulose viscosity, 25 seconds	50
Pigment (colored)	75
Triacetine	25
Blown castor oil	25
Butyl stearate	5
Glycerol phthalate resin	25
Dichlorethyl ether	75
Ethyl lactate	85
Petroleum naphtha	135
	500

It will be noted that in each of the examples, and it is an important feature of my invention, that a definite relationship exists between the quantities of solvents and diluents, or non-solvents. This relationship has been established as the result of careful experimentation and is so selected as to make the resultant ink exhibit plastic flow rather than fluidity. The compositions are of such body that they closely resemble a gel. In the instant examples, the ratio of true solvents to non-solvents is 32 to 29 and 32 to 27. This relationship holds generally, but is subject to modification with variations in the particular solvents included in any given formulation. Manifestly, the inclusion of a solvent of higher solvent power will permit an increased amount of diluent to be added to the mixture without causing actual precipitation of the nitro-cellulose from solution. The physical characteristics imparted to a printing ink by this mixture of solvent and diluent compounds combine to produce a printing composition which has never before been available to the art.

The inks prepared in accordance with the provisions of the present invention are suitable for use in various processes of printing, but are of particular value in the so-called stencil printing, where the ink is forced through a stencil design onto the cloth, and also in processes involving application of ink to a roll carrying the desired design, and then directly imprinting the design upon the fabric to be decorated. For example, the design may be engraved in the surface of a roller which runs in a bath of ink, or contacts with inking rollers that carry ink thereto. Any excessive ink may be wiped off by suitable means, leaving only the ink carried by the depressions in the design. Upon contact of the latter with the fabric to be decorated the ink is transferred without any tendency to smear or string. At the same time the rollers are operable over long periods of time without accumulation of partially, or completely, dried ink in the depressions of the design. Therefore, stoppage of the rollers for purposes of cleaning is required only at relatively long intervals of time. While the ink may be regarded as slow drying when it is considered in relation to the printing platens, or rollers, it is at the same time sufficiently quick in drying that the fabric decorated therewith will not be smeared or blurred.

It will be obvious that many modifications may be made in the above disclosed compositions and the modes of applying the principles of my invention may be altered without departing from the spirit or scope thereof as set forth in the following claims.

What I claim is:

1. A composition for printing textile materials, said composition comprising 10 parts of nitrocellulose, 15 parts of a pigment, 6½ parts of dibutyl phthalate, 6½ parts of castor oil, 1 part of butyl stearate, 17 parts of diethylene glycol monoethyl ether, 15 parts of ethylene glycol monobutyl ether, and 29 parts of petroleum naphtha, the composition being plastic in flow, but gel-like under sudden impact and being non-stringy when applied to printing rollers.

2. An ink for printing on textile materials which ink approximately comprises 10 parts nitrocellulose of less than about 80 seconds viscosity, 15 parts pigment, and 32 parts of a mixture of mono-alkyl ethers of ethylene and diethylene glycol as a solvent and about 27–29 parts of petroleum naphtha as a diluent, the ratio of solvent and diluent being such the ink is of gel-like consistency under sharp impact, but

is capable of plastic flow under continued pressure and is of a non-stringy character upon a printing press.

3. An ink for printing upon textile materials which ink comprises nitrocellulose, a pigment to color the ink, 32 parts of mono-alkyl ether of an ethylene glycol and 27–29 parts of a petroleum naphtha as a non-solvent diluent, the ratio of solvent and petroleum naphtha being such that the ink is of gel-like consistency under sudden impact, but being capable of plastic flow under prolonged pressure and being non-stringy upon a printing press.

4. An ink for printing upon textile materials which ink comprises nitrocellulose, a pigment to color the ink, 32 parts of a high boiling solvent for the nitrocellulose, said solvent being one of the group consisting of ethers of ethylene and diethylene glycol, ethyl, butyl and amyl lactate, octyl acetate, octyl alcohol, hexanol, diacetone alcohol, amyl alcohol, butyl alcohol, amyl and butyl acetates, dichlorethyl ether and cyclohexanol, the high boiling solvent being admixed with about 27 to 29 parts of petroleum naphtha as a non-solvent diluent, the ratio of solvent and petroleum naphtha being such that the ink is of gel-like consistency under sudden impact, but is capable of plastic flow under prolonged pressure and being non-stringy and non-drying upon a printing press.

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