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[54] **DUPLICATOR STENCIL**

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[63] Continuation-in-part of Ser. No. 51,041, June 30, 1970, abandoned.

[30] **Foreign Application Priority Data**

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[51] **Int. Cl.** **B41n 1/24,** B44d 3/30
[58] **Field of Search** 117/35.5; 101/128.2, 128.4

[56] **References Cited**

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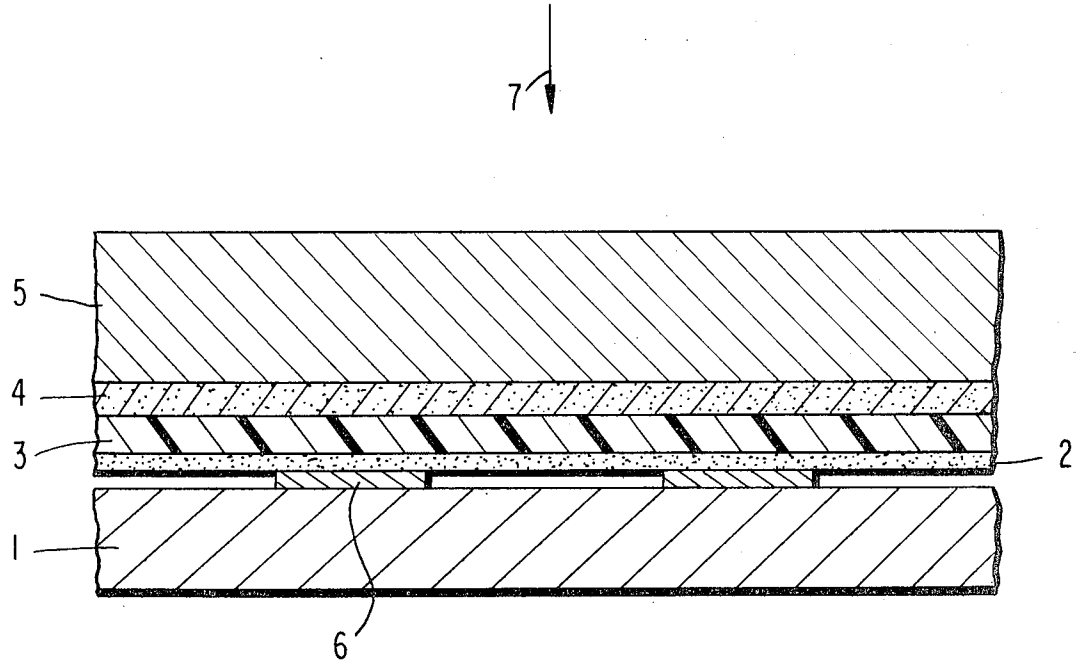
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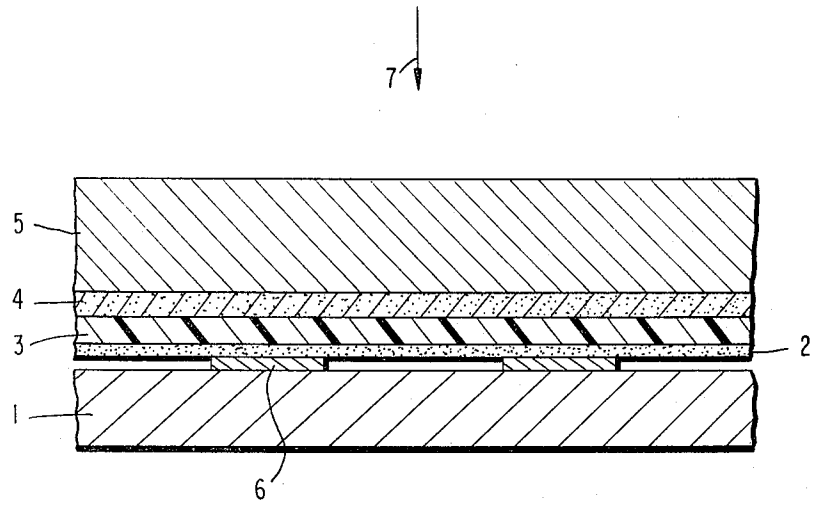
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[57] **ABSTRACT**

A duplicator stencil of the type adapted to be perforated through heat action in selected areas comprises a film of a thermoplastic resin carrying on the surface thereof which is to be exposed to heat action, a coating containing a softener for the resin which is a solid and which melts or is decomposed at a lower temperature than the perforation temperature of the film material so as to promote the rapidity and to lower the temperature of perforation of the film material, a substance influencing the surface property of the film material to make it more supple so as to allow complete contact with the original to be stenciled, and to insure easy separation of the original and stencil after heat perforation of the latter, and an inorganic finely divided powder which eliminates residual tackiness of the film material and to impart sharp contours to the perforations, all in amounts effective to facilitate penetration and rapid perforation of the film at places where it is exposed to a source of heat.

4 Claims, 1 Drawing Figure




7
5
4
3
2
1
6

DUPLICATOR STENCIL

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of application Ser. No. 51,041, filed June 30, 1970 now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to duplicator stencils of the type adapted to be perforated and make ink-permeable through thermal action, such stencil comprising a film of plastic material and, if desired, a porous backing material united therewith.

It is common knowlege that black characters absorb infra-red radiation so as to accumulate thermal energy which may be used to produce a thermal replica of the characters in a heat-senstive stencil placed in contact with an original. This fact is already utilized for producing copies on heat-sensitive paper and for perforating duplicator stencils.

One known type of heat-sensitive stencil comprises a sheet of thin, porous, inherently ink-permeable paper which is made non-permeable through impregnation with suitable wax compostion. When such stencil is placed in contact with an original having characters in black ink, or other ink capable of absorbing infra-red radiation, and the original and the stencil are subjected to infra-red radiation in a suitable apparatus, the wax is melted at the places opposite the dark characters so that, after absorption of the molten wax in a sheet of paper, a stencil is produced in which the places corresponding to the characters of the orginal are ink-permeable.

Another known type of heat-sensitive stencil comprises a film of plastic material, such as polyethylene, polyvinyl-polymerisates or other substances which become porous and, accordingly, ink-permeable under heat action. The perforation, or ink-permeability, is caused by melting or, in the case of orientated films a combination of melting and shrinking. Likewise, the use of plastic films united with a porous backing material is known.

Orientated plastic films may also be subjected to an additional mechanical treatment.

Plastic films intended for the manufacture of stencils must present certain well-defined characteristics. Apart from the fact that few plastics give satisfactory results, their suitability for the purpose also depends of their specific heat, their degree of crystallization, of their mechanical pretreatment, if any, and, besides, of the thickness of the film.

Accordingly, the production of well perforated stencils by means of conventional thermo-copying machines requires great care and an exact maintenance of well-defined conditions. In addition, it has to be considered that most plastic films become tacky under the action of heat and, consequently, are difficult to separate from the original without the stencil and the original being impaired.

SUMMARY OF THE INVENTION

The present invention remedies the foregoing inconveniences inherent in the known duplicator stencils and improves the properties of a plurality of plastic materials so as to make them suited for the manufacture of perfect stencils in a simple manner.

In accordance with the present invention, there is provided a novel duplicator stencil adapted to be perforated through heat action in selected areas, comprising a film of a thermoplastic resin carrying on the surface thereof which is to be exposed to heat action, a coating including the following ingredients: (a) a softener for the thermoplastic resin which promotes the rapidity and lowers the temperature of perforation of said film material; (b) a substance influencing the surface property of said film material to make it more supple so as to allow a complete contact with the original to be stenciled, and to insure an easy separation of the original and stencil after heat perforation of the latter; and (c) an inorganic finely divided powder which serves to eliminate any residual tackiness of the film material and to impart sharp contours to the perforations. These ingredients are present in amounts effective to facilitate penetration and rapid perforation of the film at places where the film is exposed to a source of heat.

The softener ingredient is advantageously a primary plasticizer in solid state which melts or is decomposed at a lower temperature than the perforation temperature of the film material.

Reference will now be had to accompanying drawings which schematically represent an enlarged section of a duplicator stencil according to the invention.

First, the general structure of the stencil illustrated will be described, and afterwards the composition and other properties of its components will be exemplified.

DESCRIPTION OF THE DRAWING

The single FIGURE is an enlarged fragmentary cross-sectional view of a stencil according to the invention; juxtaposed with an original to be reproduced.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawing in detail, a stencil according to the invention comprises a porous backing sheet **5**, e.g. of paper, and a film **3** of plastic material which is united with the backing sheet by means of a suitable adhesive **4**. The face of the stencil film **3** is coated with a layer **2** intended to improve the properties of the stencil. In use, the stencil is placed with its coated face in contact with an original **1** having heat-absorbing characters **6**, and is subjected to infra-red radiation in the direction of the arrow **7**, which heats the characters **6** to perforate the contacting portions of the stencil film **3**.

The production of the duplicator stencils of the invention is accomplished by treating the plastic films to be used as stencil sheets with substances which, on the one hand, influence their surface activity, and, on the other hand, increase their rapidity of perforation.

It has been found that such surface treatment with certain substances has a favorable influence on the surface properties and that certain substances promote the destruction of the plastic material through heat.

The use of these substances imparts to the resulting duplicator stencil of the invention several important advantages. These include (a) high mechanical strength of the stencil sheet; (b) sharp contours of the characters and lines produced by perforation of the stencil in accordance with an original; (c) a supple stencil film insuring good contact between the master and the original; and (d) an easy separation of the original and the stencil after the heat perforation of the latter.

Substances which are employed to influence surface properties in accordance with the invention include substances which influence surface tension (tensides), examples thereof being isobutylene-naphthalene sulfuric acid sodium salt, derivatives of fatty acid dibutylamide and the like, polydimethyl-siloxane, methyl silicone polymers, polymeric tetra-alkysilanes and like substances covered by the terms. "silicones," polyethylene glycols, and their derivatives such as ethanolized alkylguanidine-amine complexes.

Substances serving to promote the rapidity of perforation or to lower the temperature of perforation may be primary plasticizers preferably in solid state which melt or are decomposed at a lower temperature than the perforation temperature of the film material. These or other substances should be miscible with the plastic material, provided that such miscibility is present at temperatures immediately below the temperature of perforation and does not, or only to a small extent, exist at room temperature. Examples of suitable softening agents include dioctyl phthalate, tricresyl phosphate, in liquid form, and polyphenyl chlorides or dicyclohexyl phthalate in solid form.

The preparations according to the invention may be applied to the face of the stencil to be in contact with the original, as well as to the back side of the stencil. Likewise, different substances may be applied to the front side and the back side, respectively, of the film. Some of the substances exemplified hereinbefore will act both as a primary softening agent and as a surface-active agent for the plastic film, and may thus serve both purposes of the invention.

The treatment of the films in accordance with the invention allows for a greater choice of materials for the film. Thus, for example, polyvinylchloride and other polyvinyl derivatives, polystyrene, co-polymers of styrene and methyl-metacrylate and/or butadiene, futher polyethylene, polypropylene, and many others, may be used.

The substances according to the invention, preferably those applied to the face of the film to be contacted with the original, may suitably contain unmeltable, finely dispersed powders, such as talc or colloidal silicic acid. Such additions result in a kind of screening action which, in the case of copies of great area, insures a proper dosage of the ink and, besides, eliminates any residual tackiness of the film and gives sharp contours to the prints. The best results of the addition of solids to the active substances are obtained if the amount of powder is from **10** to **50** per cent of the mixture and the powder has a particle size of 0.5 -10 μ.

The substance or substances intended exclusively to promote the rapidity of perforation may be added to an adhesive serving to unite the stencil film with a backing sheet, whereas the substances influencing the surface activity are suitably, though not necessarily, applied to the free face of the stencil film.

EXAMPLE 1

A suitable stencil of this structure comprises a backing sheet **5** of conventional stencil tissue having a weight of 11.0 grams per square meter, to which is glued a film **3** of polypropylene having a thickness of 6 μ by means of an adhesive layer **4** of polyvinylacetate in an amount of 2 grams per square meter and having a molecular weight of about 250,000. The coating **2** is made of poly-dimethyl-siloxane and is applied in an amount of 0.5 grams per square meter. This coating acts both as a surface active agent and as a primary softening agent for the polypropylene film **3.** However, different agents for these two purposes may also be used, as illustrated by the following example.

EXAMPLE 2

To a backing sheet **5** made of conventional stencil tissue having a weight of **10** grams per square meter is glued a film of polystyrene **3** having a thickness of 3 μ, by means of an adhesive **4** made of cumaron indene resin to which is added 5 percent of stearyl-amine, the mixture being applied in an amount of 1 gram per square meter. The coating **2** consists of a mixture of 70 percent trixylyl-phosphate and 30 percent talc. The coating is applied in an amount of 2 grams per square meter. In this example, the stearyl-amine is the surface-active agent, and the tri-xylyl-phosphate is the softening agent, whereas the talc serves as a screening agent for the duplicator ink, as hereinbefore described.

In use, the stencil is placed with its coated face in contact with an original **1** having heat-absorbing characters **6,** and is subjected to infra-red radiation in the direction of the arrow **7,** the radiation having a wave length of 8,000 – 40,000 Ang. This causes the characters **6** to be heated to about 80 – 200°C, whereby the stencil film **3** is perforated at the places in contact with the characters.

EXAMPLE 3

To a backing sheet **5** made of conventional stencil tissue having a weight of 11 grams per square meter is glued a film of polystyrene **3** having a thickness of 6 μ, by means of an adhesive layer **4** of poly-vinyl-acetate in an amount of 2 grams per square meter and having a molecular weight of about 250.000. The coating **2** consists of a mixture of 70 percent stearic acid ester of poly-oxy-ethylene-glycol having a molecular weight of about 1,000 and 30 percent finely dispersed colloidal silicic acid powder. In this example the stearic acid ester acts both as a surface active agent and as a softening agent for the polystyrene film, whereas the colloidal silicic acid serves as a screening agent for the duplicator ink, as hereinbefore described.

EXAMPLE 4

It will be understood that the invention is not limited to the examples described. Thus, a backing sheet for the stencil film **3** may, if desired, be dispensed with. For perforating the stencil, the character in question may alternatively be printed directly on the stencil which is then alone subjected to infra-red radiation.

A duplicator stencil as in example **3** wherein the coating **2** consists of a mixture of 40 percent di-cyclo-hexyl-phthalate in solid form, 30 percent stearic acid ester of poly-oxy-ethylene-glycol and 30 percent finely dispersed talc. In this example the di-cyclo-hexyl-phthalate is a solid softening agent and the stearic acid ester is a solid surface active agent, whereas the talc serves as a screening agent for the duplicator ink, as hereinbefore described.

We claim:

1. A duplicator stencil adapted to be perforated through heat action in selected areas, comprising a film of a thermoplastic resin carrying on the surface thereof, which is to be exposed to heat action, coating consisting essentially of the following ingredients:

a. a softener for said synthetic resin selected from the group consisting of dioctyl phthalate, tricresyl phosphate, trixylyl phosphate, polyphenyl chlorides and di-cyclohexyl phthalate in an amount which promotes the rapidity and lowers the temperature of perforation of said film material when the film material is exposed to heat action;

b. a substance influencing the surface property of said film material and selected from the group consisting of isobutylene-naphthalene-sulfuric acid sodium, derivatives of fatty-acid-dibutyl-amide, polydimethyl-siloxane,

methyl-silicone-polymers, polymer tetra-alkylsilanes, polyethylene glycols and ethanolized alkyl-guanidine-amine-complexes in an amount to make it more supple under the influence of heat action so as to allow a complete contact with the original to be stenciled, and to insure an easy separation of the original and stencil after heat perforation of the latter;

said components (a) and (b) not being the same; and

c. an inorganic finely divided powder in an amount effective to eliminate any residual tackiness of the film material and to impart sharp contours to the perforations, said ingredients (a), (b) and (c) having the capability and being present in amounts effective to facilitate penetration and rapid perforation of the film at places where the film is exposed to a source of heat.

2. A duplicator stencil according to claim **1** wherein said softener is a primary plasticizer in solid state and melts or is decomposed at a lower temperature than the perforation temperature of the film material.

3. A duplicator stencil according to claim **1,** wherein said coating contains 10–50 per cent of said finely dispersed inorganic absorbing substance.

4. A duplicator stencil according to claim **1,** wherein the particle size of said finely dispersed inorganic powder is between about 0.5 and about 10 μ.

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