May 25, 1971 E. M. BRINCKMAN 3,580,719

THERMOGRAPHIC RECORDING PROCESS

Original Filed June 24, 1966 2 Sheets-Sheet 1

FIG. 1

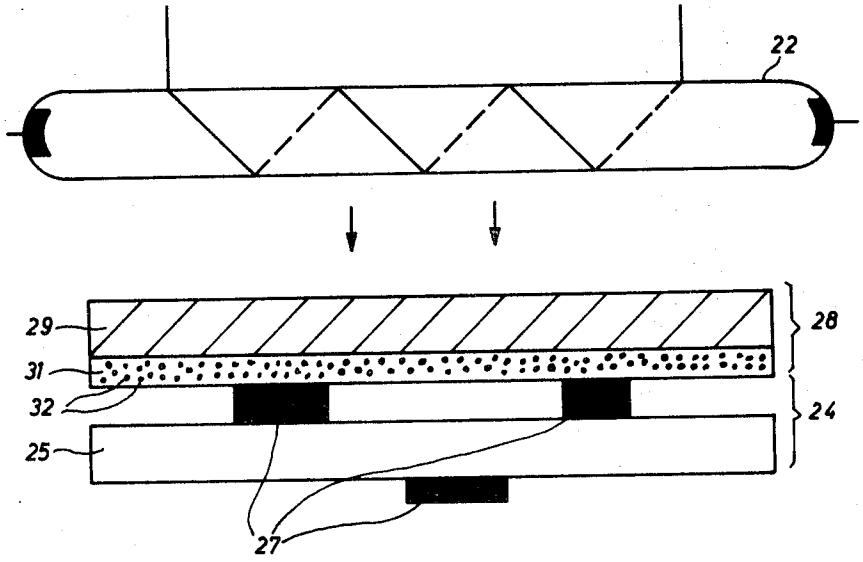
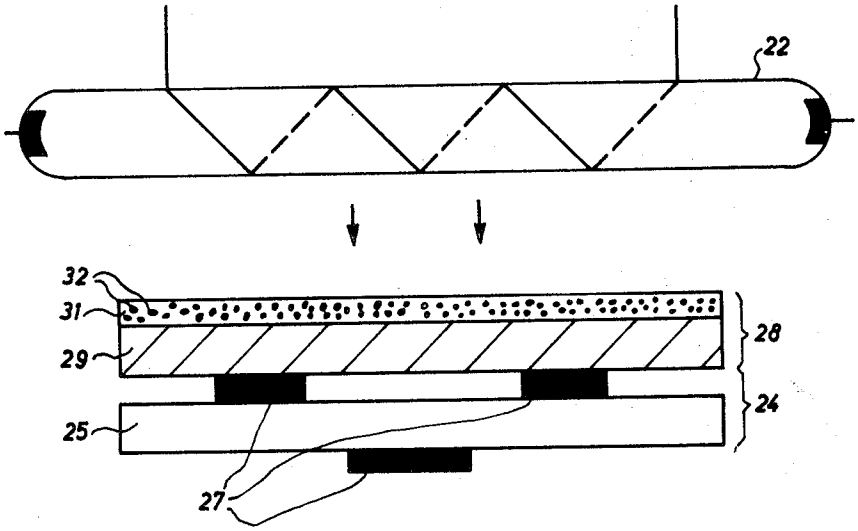


FIG. 2



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THERMOGRAPHIC RECORDING PROCESS

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FIG. 3

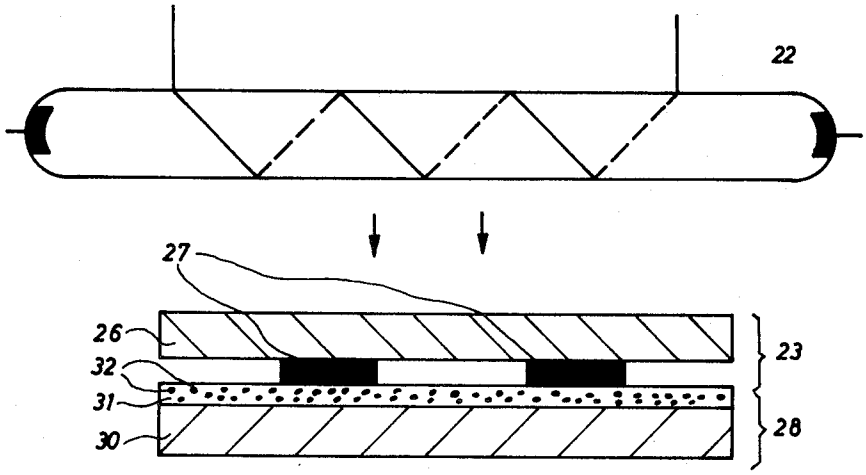
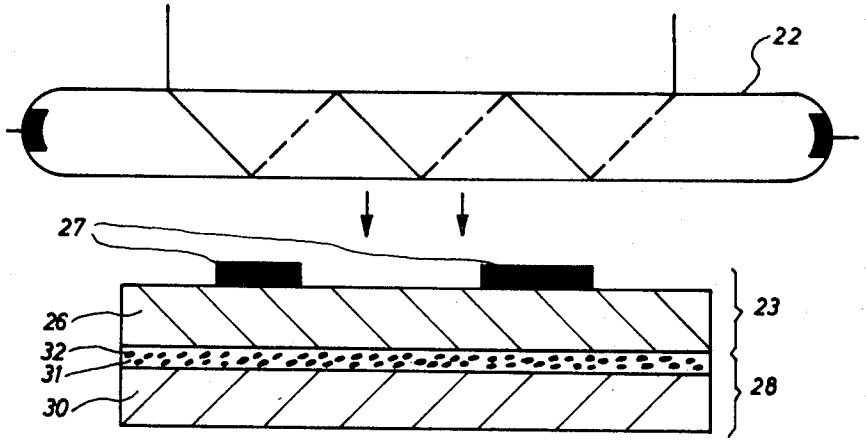


FIG. 4



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3,580,719

THERMOGRAPHIC RECORDING PROCESS

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Continuation of application Ser. No. 560,128, June 24, 1966. This application Aug. 4, 1969, Ser. No. 849,582
Int. Cl. G03c 5/04
U.S. Cl. 96—27 10 Claims

ABSTRACT OF THE DISCLOSURE

Information is reproduced by the steps of exposing to a mainly visible light image a recording layer containing at least about 80% by weight of a normally water-soluble polymer of certain selected types which is substantially insensitive to visible light but when heated undergoes a loss in its normal solubility in aqueous solvents and contacting the exposed recording layer with an aqueous solvent for the purpose of removing the unexposed soluble areas thereof thereby leaving a relief image corresponding to the original. The recording layer contains uniformly distributed therethrough a finely divided substance that absorbs and converts visible radiation into heat, the amount of such substance being sufficient to impart to the recording layer an optical density of about 0.2–1 in the event reflex exposure is practiced or of at least about 0.2 in the event the exposure is direct. The recording layer is substantially transparent except for the radiation absorbing and converting substance. The time of the exposure does not exceed 10^{-2} seconds, and the intensity of the radiation is sufficiently large as to generate within that time by virtue of the absorption and conversion effect of the substance sufficient heat to produce a loss in solubility in the polymer in the exposed area.

This is a continuation of application Ser. No. 560,128, filed June 24, 1966, now abandoned.

The present invention relates to a thermographic recording process based on insolubilisation under the influence of heat and to the production of resist images by means of recording members containing a substance or composition undergoing such insolubilisation.

It has now been found a method for recording respectively reproducing information which method comprises record-wise or information-wise exposing to electromagnetic radiation a recording material; which comprises at least one recording layer (which may be carried by a support or may be a self-supporting layer or sheet) incorporating a composition, which under the influence of heat can be insolubilized or reduced in solubility in water or an aqueous liquid mixture wherein it was previously soluble and which composition contains at least one polymer undergoing such insolubilization, and wherein said polymer stands in heat-conducting relationship with one or more substances, which absorb electromagnetic radiation in at least a part of the wavelength range of said radiation and convert at least a part of the absorbed radiation into heat, the exposure being of short duration and of such intensity that an image or record is formed in or on said layer in terms of a difference in such solubility.

By the wording "an aqueous liquid mixture" we understand a mixture of water with an organic solvent which is miscible with water, e.g., ethanol, or an aqueous solution of an ionic water-soluble compound, e.g. a base, a salt or an acid.

By record-wise or information-wise exposing to electromagnetic radiation is meant that the exospure may be progressive (in the sense that the exposure of a recording tape to spoken information is progressive) or simultaneous, e.g. as is the case in reflectographic or transmission exposure respectively to or through an original,

e.g. a printed text or silver image transparency. When assuming for example, that the information to be recorded is in the form of written or printed matter, the record is in terms of a differentiation in solubility in water or a mixture of water with water-soluble solvents.

The high intensity, short duration exposure is preferably carried out by means of electromagnetic radiation mainly in the wavelength range above 390 mμ.

In contrast to commonly used photo-insolubilization systems is the fact that a recording composition or insolubilizable polymer for use according to the present invention is not photo-sensitive and that said composition need not contain a chemically sensitizing agent and/or photo-initiator for promoting and/or inducing a polymerization reaction.

The exposure energy and the concentration of said substances in the recording member are chosen so that the degree of differentiation in insolubilization produced is sufficiently great to be useful.

Having stated in general the concept of this invention, reference will now be made in more detail to the composition and structure of preferred heat-sensitive materials, and to suitable methods of carrying out image-wise or record-wise exposure.

Preferably, the heat-sensitive material used in the performance of the invention comprises at least one recording layer (which may be carried by a support or may be a self-suporting layer or sheet) preferably consisting for at least 80% by weight of a composition or compound undergoing insolubilization when heated between 50 to 250° C. The applied electromagnetic radiation is preferably mainly visible light (at least 70%) and the exposure preferably is carried out for a time preferably no longer than 10^{-1} second, more preferably for a time not exceeding 10^{-2} second, e.g. with a flash tube.

Polymer systems suited for thermo-insolubilization according to the present invention are e.g. non-light-sensitive water-soluble thermosetting resins, that undergo a rapid chemical change to a highly cross-linked form when heated above their reaction temperature. Representatives of that type are polyacrylamide and copolymers thereof, e.g. a copolymer of acrylamide and sodium acrylate, poly(N-methylol-acrylamide), poly(1,2-dihydro-2,2,4-trimethylquinoline) and water-soluble precondensates such as melamine-aldehyde and urea-aldehyde resins, e.g. an urea-formaldehyde resin.

Further are mentioned polymers, which on heating become insoluble in water or an aqueous liquid mixture, by splitting off water or ammonia or undergo another chemical or physical change, which lies on the basis of their insolubilization, such as starch, e.g. manioc starch, starch phosphate, esters of alginic acid, water-soluble salts of alginic acid, e.g. amine alginate and sodium alginate, hydroxypropylstarch, carboxymethylethers of amylose and amylopectine, sucrose stearate, cellulose sulphate, ethylhydroxyethylcellulose, the sodium salt of carboxymethylcellulose, the sodium salt of carboxymethylstarch, the sodium salt of ethylcellulose phthalate, polyvinylpyrrolidone, copolymers of vinyl methyl ether and maleic anhydride and copolymers of vinyl methyl ether and maleic acid half-amide.

If a catalyst or monomeric cross-linking agent is used for the insolubilization reaction it is preferably formed in the recording member itself during recording by the action of image-wise applied light and/or heat.

For example, use can be made of compounds which split off a cross-linking agent, e.g. formaldehyde, by heating.

According to a special embodiment of recording of the present invention it is possible to use a recording material wherein the cross-linking agent, catalyst or catalyst-producing compound and the cross-linkable polymer or com-

position are applied in separate layers. This composition has the advantage of being more stable under storage conditions, more particularly in the case both layers are separated by an interlayer, which, however, can not prevent mixing by diffusion of the cross-linking agent and/or catalyst with the cross-linkable polymer on heating.

The exposure of the heat-sensitive member containing said light-absorbing substances converting that light into heat is preferably carried out with a light source producing to a major extent visible light of a high intensity during a very short exposure time, i.e. in a time not longer than 10^{-1} seconds, e.g. with a so-called flash-lamp. Such lamps produce also infra-red radiation and U.V.-radiation but only to a minor extent i.e. normally less than 30% of the total irradiation energy.

According to the present invention good results can be obtained with a xenon gas discharge lamp, which can supply an energy of 200–2000 w.-sec. in a period of 10^{-4} to 10^{-2} seconds.

According to a preferred arrangement the discharge lamp is in the form of a thin tube fitted in a hollow glass cylinder in order to make possible a uniform exposure of the recording material applied according to the periphery of the cylinder. More details about such a gas discharge lamp can be found in Belgian patent specification 664,868, filed June 3, 1965 by Agfa-Gevaert A. G. and our United Kingdom patent application 20,818/65 filed May 17, 1965. The intensity of the light emitted by such a gas discharge lamp is particularly high in the region of the visible spectrum.

It is possible to employ a number of flash tubes operating simultaneously, or to obtain a suitable image differentiation by flashing a single tube at suitable intervals. Reflectors and other optical components may be included to provide irradiation of maximum uniformity.

Evidently radiation sources with a much lower energy than those mentioned can be used if the light energy is focused onto a relatively small heat-sensitive area e.g. by using a laser beam or by carrying out the exposure progressively and/or intermittently. In other words, the heat-sensitive material containing the light-absorbing substances, which convert that light into heat, may be scanning-wise exposed, e.g. by means of an image-wise modulated high-intensity light spot, or may be progressively exposed through a slot wherein light, e.g. of a tube-like radiation source, is focused.

It is evident that the heat-sensitive material, before or during the image-wise heating, can be integrally heated to a certain temperature below the temperature at which the heat-sensitive recording element is substantially insolubilized.

Finely divided substances suited for use in the recording member and which convert visible light and infra-red light into heat are, e.g. carbon black, graphite, oxides or sulphides of heavy metals, particularly of those heavy metals themselves in finely divided state, such as silver, bismuth, lead, iron, cobalt, or nickel. Preference is given to carbon black as light-absorbing material in heat-conductive relationship with the insolubilizable composition.

The heat-sensitive layer may comprise from 0.01 to 1, preferably from 0.1 to 0.5% by weight of such finely divided substances or pigments calculated on the weight of the recording layer. Black or deep-black coloured pigments are preferred. Particularly in the case of reflex exposure, the optical density of the light-absorbing recording layer should preferably be between 0.20 and 1.00 and may be above 1 for direct exposure.

The heat-sensitive layer may further comprise plasticizers for the applied polymers such as glycerol, sorbitol, polyglycols, polyethylene glycols and esters thereof, such as glyceryl monolaurate, polyethyleneglycol distearate and others.

The thickness of the recording layer depends on the use for which the recording material is intended. If a relief image is to be produced the thickness depends on the particular kind of master to be manufactured, e.g. a printing master, such as a planographic, intaglio or letterpress printing master. In general, the thickness of the layer will vary from about 0.001 mm. to about 7 mm. Layers ranging from about 0.001 mm. to about 0.70 mm. thickness will be used for half-tone plates (screen images). Layers ranging from about 0.25 to 1.50 mm. thickness will be used for the majority of letterpress printing plates.

If the surface of the recording layer is somewhat sticky, e.g. in the case the recording layer is formed by means of a cross-linkable high-viscous composition, the exposed recording layer can be developed by means of a powder adhering to the areas of the recording layer that have not been exposed to heat. If a sticky character of the recording layer is not desired the latter may contain an amount of pigment, e.g. zinc oxide, which reduces the adhesive character.

The base or support material for the insolubilizable layer can be of any natural or synthetic product capable to be worked up in fabrics, film or sheet form. It can be flexible or rigid, reflective or non-reflective for the copying light. For the manufacture of printing materials metals are normally preferred as the base materials. However, e.g. where weight is critical, synthetic resin or polymer sheets are desirable base materials. Rotary pressplates can be prepared by using cylindrically shaped base plates carrying the curable composition and by exposing them e.g. to infra-red radiation generating heat in the recording element directly through a concentrically disposed image-bearing transparency. The support can also be a screening material, which is coated with a heat-sensitive cross-linkable composition. As screening material Japan paper (Yoshino paper), nylon fabrics with a size of mesh of 0.2 to 0.08 mm. and woven bronze wire are particularly suited. The screening material impregnated or coated with the cross-linkable composition forms a screen- or stencil printing master blank. By washing away the portions of the coated composition, which were not cross-linked, a printing master ready for screen-printing is obtained.

The recording member containing the cross-linkable substance or substances used in the present invention can be applied to a support or base from a solution or dispersion by coating techniques known in the art. A liquid cross-linkable composition can also be applied in liquid state without a liquid carrier or solvent, e.g. by extrusion.

If the composition is sufficiently film-forming, it can also be cast or extruded on a casting wheel or belt in the form of a self-supporting sheet. Later on the sheet can be affixed to the surface of a permanent support if necessary.

Exposure can be a direct exposure or a reflectographic exposure. During reflectographic exposure the recording material is placed between the radiation source and the original. The original may be a transparency or an opaque element, having an image differentiation in terms of areas absorbing visible light and other areas reflecting visible light.

In order to obtain very sharp images preference is given to that type of exposure wherein the heat-sensitive recording member stands in contact with the image areas or portions of the original. The light absorbed in the image areas or portions of the original will not affect the recording member since the very short exposure, preferably lower than 10^{-2} second, prevents an accumulation of heat in these portions to such an extent that by conduction a substantial insolubilisation of the recording member in the areas corresponding with these portions would result. Only due to the intimate contact of the insolubilizable substances in the interior of the recording layer with the finely divided light-absorbing substances, which convert that light into heat, a very local and intense heating produces the desired insolubilization.

The effectiveness of the recording with electromagnetic radiation depends also on the intensity of the radiant

energy. The distance between the radiation source and the recording element may be increased as the energy increases.

According to another embodiment the recording material can be placed during the exposure with its back side (support) in contact with an original. If the radiation has to penetrate through the support of the recording material, it is important that said support be sufficiently transparent.

The recording material containing after the exposure an image-wise differentiation in solubility can be used in all kind of techniques wherein relief or resist-images have to be produced. In these techniques the soluble portions of the image-wise exposed recording element are dissolved in water or an appropriate aqueous liquid mixture, which will be selected with care, since it should have good solvent action on the unexposed areas and also on the base material whereto the thermo-insolubilizable composition has been applied. In view of the use aimed at, the liquid-treated material may serve as a resist image for the etching of a relief printing plate or for the formation of a printing plate carrying hydrophilic and hydrophobic portions and which is suitable for lithographic printing. More particularly are mentioned applications directed to the production of ornamental plaques, patterns for automatic engraving machines, cutting and stamping dies, relief maps for braille and as resists in the preparation of printed or etched circuits.

After washing away the portions that have not been exposed to heat, the polymer parts made insoluble by the image-wise heating may be supplementarily more thoroughly hardened by any known hardening technique applicable thereto. The purpose of this additional hardening is to strengthen the insolubilized polymer parts as much as possible. If, e.g., the remaining insolubilized polymer surface is to be used as a printing plate, such subsequent hardening is often desirable.

A differentiation in cohesion power of the recording element, more particularly in wet state, can be used in a transfer process wherein the soft and still water-swellable or soluble parts of the recording layer are transferred to a receiving material forming thereon a print or relief image in correspondence with the areas which have not been exposed to heat.

A differentiation in liquid permeability, which is practically always the result of the created difference in solubility, can be used in techniques wherein substances, e.g. substances which can colour or bleach the recording material, are selectively absorbed into the recording material. For such techniques reference is made, e.g., to our Belgian patent specification 656,713.

FIGS. 1 and 2 represent two possible methods of reflectographic exposure.

As schematically illustrated in FIG. 1, the element **22** represents a xenon gas discharge lamp, while **24** represents a line original carrying light-absorbing characters **27** on the two sides of a light-reflecting support **25**. The heat-sensitive material **28** consists of a transparent support **29** and of a heat-sensitive layer **31** containing light-absorbing particles **32**.

FIG. 2 represents another method of reflectographic exposure. Here the support **29** of the heat-sensitive material **28** is in direct contact with the characters **27** of the original **24**.

Direct exposure through the original is illustrated in FIGS. 3 and 4. In FIG. 3 the light from the gas discharge lamp **22** passes first through the transparent support **26** of the original **23**, before it strikes the heat-sensitive layer **31** of the heat-sensitive material **28**. In this case the support **30** of this material can be opaque or transparent. The light cannot pass through the parts of the original **23**, which bear the light-absorbing characters **27**.

In FIG. 4, the original **23** has its side bearing the light-absorbing characters **27** turned towards the gas discharge lamp **22**.

In addition to the exposure methods illustrated by these figures, several other exposure methods are possible. For a man skilled in the art, these methods are not difficult to find out.

The following examples illustrate the following invention.

EXAMPLE 1

A baryta paper is coated with the following suspension pro rata of 1 litre per 10 sq.m.:

2.5% aqueous solution of poly(N-methylol-acrylamide—400 ccs.

Aqueous carbon black dispersion comprising 53 g. of carbon black, 23 g. of water, 18 g. of glycol, and 6 g. of nonylphenylpolyethyleneoxide per 100 g. of dispersion—1.5 g.

11% aqueous solution of saponine—10 ccs.

The resulting material is dried and then exposed as illustrated in FIG. 3 for 8/1000 sec. through a negative by means of an electronic flash lamp with an energy output of 1.03 watt-sec. per sq. m. Subsequently the exposed material is washed for approximately 10 seconds in cold water.

A black positive image is obtained.

EXAMPLE 2

Example 1 is repeated, but after exposure of the material and washing away of the unexposed parts with water, said material can be used as an offset master. Only the parts that have been washed out accept the ink.

EXAMPLE 3

A cellulose triacetate film is provided with a gelatin subbing layer coated with a suspension consisting of:

2.4% aqueous solution of a copolymer of acrylamide and sodium acrylate (percent by weight 31.2/68.2)—100 ccs.

Carbon black dispersion as described in Example 1—0.1 g.

Upon drying the material has a density of 0.70 measured by transmitted light.

This material is exposed reflectographically as illustrated in FIG. 1 while in contact with an original by means of an electronic flash tube with an energy output of 0.96 watt-sec. per sq. m. It is then moistened with water at 40° C. and pressed against a sheet of common writing paper. Upon separation a positive print is obtained from the original.

EXAMPLE 4

A mixture of the following products is ground in a ball mill for 6 h.:

50% solution of a methylpolysiloxane resin in a mixture of toluene and methyl ethyl ketone (1:1)—25 g.

Benzoyl peroxide—1 g.

Carbon black—0.2 g.

Methyl ethyl ketones—25 ccs.

This dispersion is applied to a subbed support of polyethylene terephthalate in such a way that the coating possesses a density of 1.78 measured by transmitted light. The material obtained is exposed as illustrated in FIG. 3 and subsequently treated with a mixture of methyl ethyl ketone and water (1:3 by volume). A black positive image is obtained.

EXAMPLE 5

Onto a subbed support of cellulose triacetate a suspension is coated from the following composition:

Sodium salt of ethylcellulose phthalate—1 g.

Ethanol—80 ccs.

Water—20 ccs.

Aqueous carbon black dispersion of Example 1—0.2 g.

Coating is carried out in such a way that the applied layer possesses a density of 0.66 measured by transmitted light.

As illustrated in FIG. 1 the heat-sensitive side of the recording material is laid on a text to be copied, and the whole is irradiated reflectographically with a high intensity electronic flash lamp having an energy output of 1.0 watt-sec./sq. m.

The exposed layer is then rubbed with water so that the areas corresponding to the characters of the original are removed. A black negative copy is obtained.

EXAMPLE 6

A coating composition consisting of:

Poly(1,2-dihydro-2,2,4-trimethylquinoline)—5 g.
Ethanol—94.6 ccs.
Aqueous carbon black dispersion of Example 1—0.4 g.

is applied to a subbed support of cellulose triacetate in such a way, that the dried layer possesses a density of 1.00 measured by transmitted light. Exposure and subsequent treatment are carried out as described in Example 5, with the difference, however, that the electronic flash exposure amounts to 12/10,000 sec. and possesses an energy output of 0.23 watt-sec./sq. m.

A black negative copy of the original is obtained.

EXAMPLE 7

5 g. of colophony are dissolved in 102 ccs. 0.5% aqueous solution of ammonium hydroxide. To the solution obtained 0.5 g. of the aqueous carbon black dispersion of Example 1 is added whilst stirring. Thereupon the fine suspension obtained is applied to a subbed support of cellulose triacetate in such a way that after drying, the formed layer possesses a density of 0.85 measured by transmitted light.

After exposure such as in Example 1, the material is dipped for some 20 seconds in a mixture of ethanol and water (2:1). A black positive image is obtained.

EXAMPLE 8

A subbed cellulose triacetate support is coated with a layer from a suspension of the following composition:

Water—100 ccs.
Mixed carboxymethylether of amylose and amylopectine—0.2 g.
Aqueous carbon black dispersion of Example 1—0.2 g.

After drying, this layer possesses a density of 0.26 measured by transmitted light. The heat-sensitive material is now exposed as illustrated in FIG. 3. After rinsing with water, a black positive image is obtained.

EXAMPLE 9

Example 8 is repeated but the carboxymethylether of amylose and amylopectine is replaced by 4 g. of sucrose monostearate. After drying, the heat-sensitive layer has a density of 0.83 measured by transmitted light.

Exposure and subsequent treatment occur as described in Example 8. A black positive image of the original is obtained.

EXAMPLE 10

Example 8 is repeated but the carboxymethylether of amylose and amylopectine is replaced by 2 g. of ethylhydroxyethylcellulose. After drying, the heat-sensitive layer has a density of 0.54 measured by transmitted light.

Exposure and subsequent treatment occur as described in Example 8. A black positive image of the original is obtained.

EXAMPLE 11

Example 8 is repeated but the carboxymethylether of amylose and amylopectine is replaced by 1.5 g. of cellulose sulphate. After drying, the heat-sensitive material has a density of 0.62 measured by transmitted light.

Exposure and subsequent treatment occur as described in Example 8. A black positive image of the original is obtained.

EXAMPLE 12

Example 8 is repeated but the carboxymethylether of amylose and amylopectine is replaced by 1 g. of starch phosphate. After drying the heat-sensitive layer has a density of 0.25 measured by transmitted light.

Exposure and subsequent treatment occur as described in Example 8. A black positive image of the original is obtained.

EXAMPLE 13

To a subbed polyethylene terephthalate support a heat-sensitive layer is applied from a suspension consisting of a solution of 1.5 g. ammonium alginate in 150 ccs. of ethanol, and 0.15 g. of carbon black dispersion, prepared as described in Example 1. Coating is carried out in such a way that after drying, the layer possesses a density of 0.42 measured by transmitted light.

The obtained heat-sensitive material is exposed through a negative transparency as illustrated by FIG. 3 and the unexposed parts are washed away with water. A black positive image is obtained.

EXAMPLE 14

20 g. of melamine-formaldehyde resin are dissolved in a mixture of 120 ccs. of water and 80 ccs. of ethanol. Thereupon 1 g. of carbon black dispersion of Example 1 is added whilst stirring and the new mixture is then coated onto a subbed cellulose triacetate film. After drying, the heat-sensitive material obtained possesses a density of 0.30 measured by transmitted light.

The material is exposed as in Example 1 and rinsed for a short while in water. A black positive image is obtained.

EXAMPLE 15

A mixture of 170 ccs. of water, 5 g. of manioc starch and 0.1 g. of carbon black dispersion as described in Example 1 is boiled for a short while and after being cooled applied to a subbed film of cellulose triacetate. After drying, the material possess a density of 0.65 measured by transmitted light.

According to FIG. 1, this material with its heat-sensitive layer is laid onto a text original to be copied and the whole is exposed reflectographically by means of an electronic flash lamp with an intensity of 0.96 watt-sec./sq. cm. Then the exposed material is dipped for some 30 seconds in water of 30° C. so that the areas of the layer corresponding with the text areas of the original are washed away. A negative copy of the original is obtained.

EXAMPLE 16

0.4 g. of carbon black is added to a solution of 6 g. of abietic acid in 50 ccs. of acetone. The obtained suspension is ground in a ball-mill for 12 h. Then a solution of 2 g. of butane-1,4-dicarboxylic acid in 50 ccs. of acetone is added. This new mixture is applied to a support of polyethylene terephthalate in such a way that the material obtained possesses a density of 0.25 measured by transmitted light. After being exposed as described in Example 15, the material is dipped in a 0.5% aqueous sodium hydroxide solution for some seconds, whereby a black negative copy of the original is obtained.

I claim:

1. A method for reproducing information, which method comprises exposing to an electromagnetic radiation image of said information to be reproduced composed of at least about 70% visible light a recording material comprising at least one recording layer containing at least about 80% by weight of a normally water-soluble polymer which is substantially insensitive to actinic light but upon being subjected to heat undergoes a reduction in solubility in aqueous liquid solvents and having uniformly distributed therethrough at least one

substance which absorbs at least a part of the visible radiation to which said material is exposed and converts at least a part of the absorbed radiation into heat, the amount of said radiation absorbing and converting substance in said recording layer being such that said recording layer has an optical density for reflex exposure of about 0.20–1.00 and for direct exposure of at least about 0.20, said recording layer being substantially transparent in the absence therefrom of said radiation absorbing and converting substance, the exposure being for a time of not more than 10^{-2} sec. and such radiation being of such an intensity as to form in said layer an image having relatively reduced solubility, said polymer being selected from the group consisting of polyacrylamide and copolymers thereof, poly(N-methylolacrylamide), poly(1,2-dihydro-2,2,4-trimethylquinoline), a urea-formaldehyde resin, a melamine-formaldehyde resin, starch, starch phosphate, hydroxypropyl starch, esters of alginic acid, water-soluble salts of alginic acid, ethyl hydroxyethylcellulose, carboxymethylethers of amylose and amylopectine, sucrose stearate, cellulose sulphate, the sodium salt of carboxymethylcellulose, the sodium salt of carboxymethyl starch, the sodium salt of ethylcellulose phthalate, polyvinylpyrrolidone, copolymers of vinyl methyl ether and maleic anhydride, copolymers of vinyl methyl ether and maleic acid half-amide and polysiloxane, contacting said exposed recording layer with an aqueous liquid solvent and removing the unexposed soluble areas of said layer to leave a relief image of polymer of reduced solubility.

2. A method for reproducing information according to claim 1, wherein the exposure is carried out by means of electromagnetic radiation mainly within a wavelength range above 390 mμ.

3. The method of claim 1, wherein the content of said radiation absorbing and converting substance in said recording layer is sufficient that said layer has an optical density of at least about 1.00.

4. A method for reproducing information according to claim 1, wherein the said substances absorbing visible light are finely divided black or dark colored substances.

5. A method for reproducing information according to claim 4, wherein the said substances are carbon black particles.

6. A method for reproducing information according to claim 1, wherein the said layer is exposed with a flash lamp.

7. A method for reproducing information according to claim 1, wherein the said layer is exposed reflectographically.

8. A method for reproducing information according to claim 1, wherein the said layer after the exposure is treated with an aqueous liquid solvent.

9. A method for reproducing information according to claim 8, wherein the said layer after the exposure is wetted with water and pressed against a receiving material, in order to transfer to the receiving material a stratum of said layer in the unexposed regions thereof.

10. A method for reproducing information according to claim 8, wherein the unexposed areas of the recording layer are washed away with an aqueous liquid solvent.

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MURRAY KATZ, Primary Examiner

U.S. Cl. X.R.

101—470, 471; 117—35.5