May 15, 1962 F. ELLAM 3,034,428

COPYING PROCESSES

Filed Aug. 26, 1957

FIG. 1.

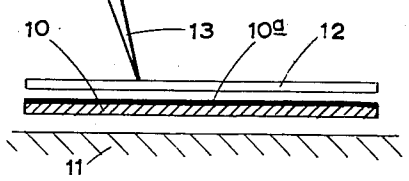


FIG. 5.

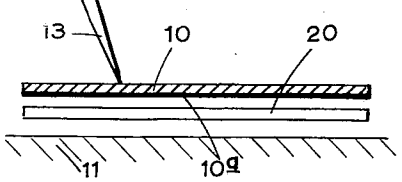


FIG. 2.

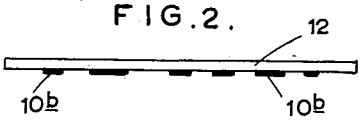


FIG. 6.

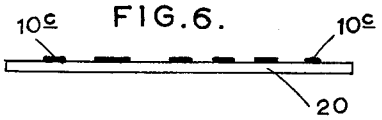


FIG. 3.

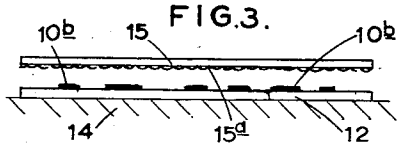


FIG. 7.

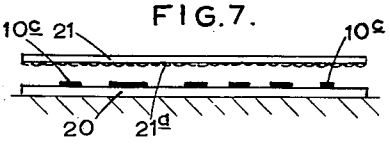


FIG. 4.

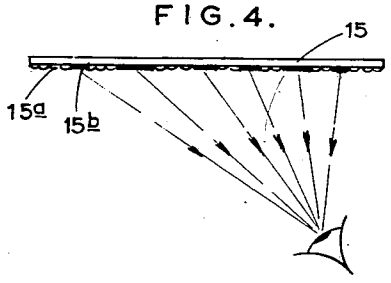
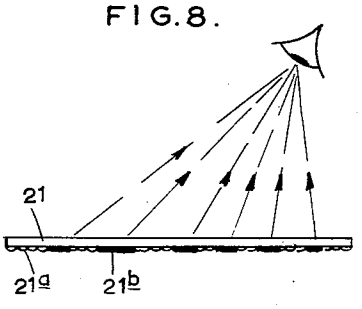


FIG. 8.



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COPYING PROCESSES

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This invention relates to methods and means for producing copies of matter to be copied, in which methods several hundreds of copies are made on copy sheets from a single master carrier sheet without recourse to more than slight local pressure, as distinct from methods for producing small numbers of copies on copy sheets without the use of a master carrier sheet, e.g. six or eight copies, with the aid of high local pressure, as for instance by means of a typewriter or a stylus. A well known method for producing copies is to prepare a mirror image of the matter to be copied by the use of a paper coated with a mixture of a soluble dyestuff, oils and waxes, the mirror image of the matter being formed by transferring the required portions of the coating from the coated paper on to another sheet of paper by superimposing the sheets and acting on the coated sheet by means of a typewriter, a printing machine, a stylus, or other means. The sheet carrying the mirror image is then brought into contact under pressure with sheets of paper which have been moistened with a solvent for the dyestuff. The method usually employed for moistening these sheets of paper consists in passing the sheets over a roller or a felt pad damped with a suitable solvent, such as industrial methylated spirits, immediately prior to their being brought into contact with the mirror image. This method suffers from the disadvantages that a uniform degree of damping is difficult to obtain, and that highly volatile solvents are usually required, which have undeniable inflammable properties.

An alternative method has been proposed whereby the paper is moistened beforehand with a mixture of water and glycerine, but this method suffers from the disadvantage that the sensitivity of the paper varies with the moisture content of the atmosphere.

It is therefore an object of the invention to provide a method of producing copies which eliminates variations in the copies due to irregularity in the degree of dampness of the sheets of paper caused either by variations in atmospheric humidity or by lack of uniformity of damping.

According to one aspect of the invention, a method of producing copies of matter to be copied comprises forming a mirror image of the matter, in a composition containing a soluble dye, on a carrier, and producing reversed impressions on copy sheets by bringing into contact with the mirror image on the carrier a succession of said copy sheets, each copy sheet having a solid surface coating containing a solvent for the dye, and wherein the method is carried out in the absence of moisture other than that present in the ambient atmosphere.

According to another aspect, the invention comprises a copy sheet for use in a method of copying in which reversed impressions of a mirror image of matter to be copied, formed in a soluble dye on the surface of a carrier, are produced on copy sheets, comprising a sheet of paper having a solid anhydrous coating on at least one side, said coating including a non-volatile solvent for the dye, and a binder for the solvent.

In addition, the coating may contain a white pigment to reduce the transparency of the paper and the solvent may be a long chain fatty alcohol. A precipitant for the dyestuff may also be incorporated in the coating on the copy sheets.

According to a further aspect, the invention includes a method of producing copies wherein the image of the matter to be copied which is formed on the carrier is a right image, and the reversed impressions produced on the copy sheet are mirror images, each copy sheet being sufficiently translucent to permit the mirror image impression produced on the coated side thereof to be legible as a right image from the other side thereof.

According to yet another aspect, the invention includes a copy sheet for use in a method of copying in which reversed impressions of a right image of matter to be copied, formed in a soluble dye on the surface of a carrier, are produced on copy sheets, comprising a sheet of translucent base paper having a solid anhydrous coating on one side only said coating including a white pigment, a non-volatile solvent for the dye, and a binder for the solvent.

Embodiments of the invention will be described with reference to the accompanying drawings, in which:

FIGURES 1 to 4 represent, in diagrammatic form, four steps in one method according to the invention, and

FIGURES 5 to 8 represent, in diagrammatic form, four corresponding steps in another method according to the invention.

Referring to the method illustrated in FIGURES 1 to 4, the copy paper is coated on a separate machine with a composition consisting of oleyl alcohol as a non-volatile solvent for the dyestuff, a binder consisting of nitrocellulose, and a white pigment consisting of titanium dioxide. The composition is prepared by dissolving the oleyl alcohol and nitrocellulose in a mixture of alcohol and ether and stirring in the titanium dioxide. The composition is then applied on a conventional paper coating machine.

The binder prevents excessive penetration of the solvent into the paper and the titanium dioxide reduces the transparency of the coated paper.

The invention will be illustrated by the following examples in which all parts are expressed as parts by weight.

Example 1

100 parts of titanium dioxide are ground into 250 parts of oleyl alcohol and added gradually to a solution of 60 parts of a mixture of 70 parts of industrial nitrocellulose (H.L. 120/170) (I.C.I. Ltd.) and 30 parts of industrial methylated spirits, in 360 parts of n-butyl acetate, the mixture being stirred during the addition.

The resulting liquor is then applied to one surface of a white paper, which has a weight of 28 gm./sq. m., by known coating procedure and the paper is heated to drive off the n-butyl acetate and methylated spirit. The thickness of the coating is such that after evaporation of the above solvents a uniform coating weighing about 5 gm./sq. m. is obtained. The coated paper is then cut up into sheets which will be referred to as copy sheets.

A mixture of 60 parts of Methyl Violet 10 B.N.S. (Imperial Chemical Industries Ltd.), 10 parts of carnauba wax and 30 parts of petroleum jelly is ground until a fine dispersion of the dye in the oil and wax mixture is obtained. The mixture is then melted and coated by known coating procedure on to a paper weighing 50 gm./sq. m. so that a uniform coating weighing 20 gm./sq. m. is obtained. This coated paper is subsequently referred to as the carbon paper.

A sheet of the carbon paper, indicated at **10** in FIGURE 1, is placed coated side upwards on a flat metal base **11** and a piece of white, smooth surfaced paper **12** weighing 85 gm./sq. m. is placed over the carbon paper **10**. This sheet of white paper **12** will subsequently be referred to as the carrier. The carrier **12** is then written

on with a stylus **13** using sufficient local pressure to transfer the coating **10***a* from the carbon paper **10** to the carrier **12** and thereby obtain a dense mirror image **10***b* of the matter to be copied on the back of the carrier **12**. This is clearly shown in FIGURE 2.

The carrier **12** is then placed on a smooth, hard, flat surface **14** with the mirror image **10***b* face upwards and a copy sheet **15** is placed over the carrier **12** with its coated surface **15***a* downwards. A rubber squeegee (not shown) is then drawn over the uppermost surface of the copy sheet **15** so that it is pressed into intimate contact with the carrier **12**. A faint image **15***b* of the matter to be copied appears on the copy sheet **15** and increases in strength until a bright purple copy results. The process may be repeated with fresh copy sheets until about 50 copies have been obtained.

Instead of using oleyl alcohol for the solvent, decyl alcohol, n-hexyl alcohol or benzyl alcohol may be used.

Example 2

The copying process is improved if a precipitant for the dyestuff is added to the coating on the copy sheets. The addition of a precipitant prevents the tendency for the matter on the copies to spread during storage.

A suitable precipitant must be soluble in the coating composition applied to the copy sheets and must be capable of re-acting with the dyestuff transferred to the copy paper to produce a coloured product which is insoluble in the coating of the copy paper. It is probable that a very rapid reaction between the precipitant and the dyestuff is undesirable as this would prevent the copies developing to a satisfactory strength during the first few minutes after copying. It has been found that a suitable precipitant, when using the carbon paper described in Example 1, is phosphomolybdic acid.

A composition for coating the copy paper may be made up as in Example 1 except that before the liquor is applied to the paper a solution of 3.85 parts of phosphomolybdic acid in 385 parts of industrial methylated spirit (740 o.p.) is added.

After coating, the paper is heated to drive off the solvents and then used as in Example 1.

I have found that the benefits of the invention may be extended to a modification of the method in which is right image is produced on the carrier instead of the mirror image, as produced in the aforesaid method.

Example 3

A liquor is made up in accordance with Example 1 and is applied by known coating procedure to a base paper as described in that example. The base paper, however, instead of being the white paper previously specified, is a translucent paper known as Imitation Parchment having a weight of 45 gm./sq. m.

The carbon paper may be made up as in Example 1 hereinbefore mentioned.

Referring to FIGURES 5 to 8, a sheet **20** of smooth surfaced paper weighing 85 gm./sq. m. is placed on a flat metal base plate **11** and a sheet of carbon paper **10** is placed on top of this with the coated side **10***a* in contact with the white paper **20**. The upper surface of the carbon paper **10** is then written on with a stylus **13** or other suitable writing instrument, using sufficient local pressure to transfer the coating **10***a* from the carbon paper **10** to the carrier **20** and thereby obtain a dense "true" or "right" image **10***c* of the matter to be copied on the top side of the carrier **20**, as shown in FIGURE 6.

The copies are produced as follows: After discarding the carbon paper **10** a copy sheet **21** is placed over the carrier **20**, coated side **21***a* downwards, as shown in FIGURE 7. A squeegee (not shown) is then drawn over the uppermost surface of the copy paper **21** so that it is pressed into intimate contact with the carrier **20**. A faint mirror image **21***b* of the matter to be copied appears on the coated side **21***a* of the copy sheet **21** and increases in strength until a bright purple copy results. On the uncoated side of the copy paper **21** a "true" image is visible through the translucent base paper, as shown in FIGURE 8. The process may be repeated with fresh copy sheets until about 50 copies have been obtained.

The presence of the pigment in the copy paper **21** is important as it conceals the translucent nature of the paper during normal use, but the image **21***b* is enabled to be read through the paper **21** after the copy has been made.

Instead of using carbon paper the carrier may be prepared by typing on to it using a typewriter ribbon which is impregnated with a mixture of soluble dyestuffs such as Methyl Violet 10 B.N.S. and mineral oil.

I claim:

1. A dry method for producing copies of matter to be copied, which method comprises the steps of forming an image of the matter in a composition containing a non-volatile soluble dye, on a carrier sheet, thereafter producing impressions on copy sheets by bringing into contact with the image on the carrier sheet a succession of said copy sheets without previous moistening, each copy sheet having a solid surface coating containing a non-volatile solvent for the dye, said solvent being selected from the group consisting of oleyl, decyl, n-hexyl and benzyl alcohols, and a nitrocellulose binder for said non-volatile solvent, whereby an impression is produced on said coating without said sheets having to be moistened prior to use.

2. A dry method for producing copies of matter to be copied, which method comprises the steps of forming an image of the matter, in a composition containing a non-volatile soluble dye, on a carrier sheet, thereafter producing impressions on copy sheets by bringing into contact with the image on the carrier sheet a succession of said copy sheets without previous moistening, each copy sheet having a solid surface coating containing a long-chain fatty alcohol non-volatile solvent, and a nitrocellulose binder for said non-volatile solvent, whereby an impression is produced on said coating without said sheets having to be moistened prior to use.

3. The product produced in accordance with the process of claim 2.

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