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SILICONE RELEASE COATING TRANSFER PAPER

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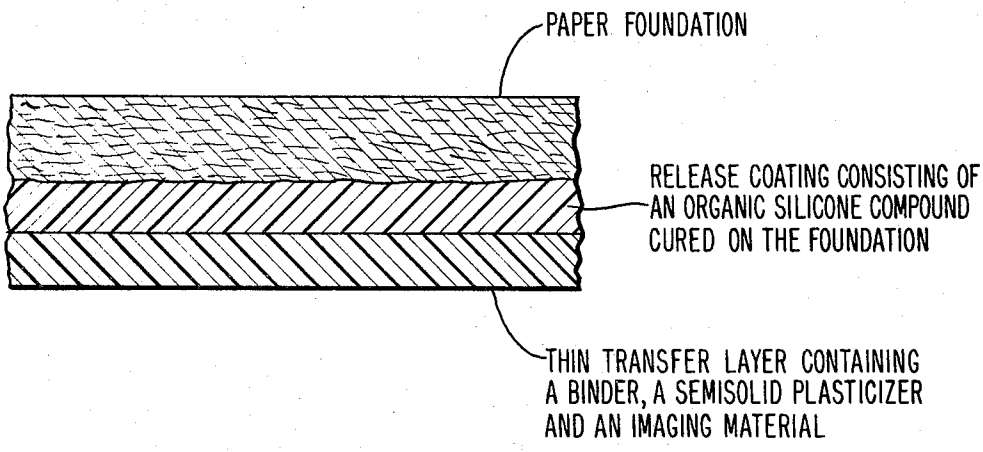

INVENTORS.
JOHN J. Mc DERMOTT
JOSEPH C. CLAUSI
BY
AGENT

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SILICONE RELEASE COATING TRANSFER PAPER

John J. McDermott, Northvale, and Joseph C. Clausi, River Vale, N.J., assignors to Burroughs Corporation, Detroit, Mich., a corporation of Michigan

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ABSTRACT OF THE DISCLOSURE

The combination of a flexible paper foundation, an organic silicone compound coating cured on the foundation, and an ink transfer layer releasably adhered to the cured silicone coating. The ink transfer layer contains a wax or non-wax binder, a semi-solid plasticizer and a magnetic or non-magnetic imaging material. The combination may be used, for example, as a high quality, inexpensive "carbon paper."

This invention relates to improvements in the art of making transfer paper, and more particularly to such paper having a release layer and an imaging layer thereon, transferable by pressure.

With the advent of manifolded forms and interleaved "one-time" carbon paper, there has been a vast increase in the amount of transfer paper used in the business world. These interleaved sheets of carbon paper become part of the blank form itself, and upon a single use, are torn out and thrown away. It is, therefore, apparent that such transfer paper must make a legible imprint; that it must not "bleed" or smudge while on the shelf; that the transfer paper should be of the lightest practicable weight to avoid bulkiness in the forms; and that economically there should be the least possible waste of imaging material consistent with good intensity of transfer.

In the past, it has been necessary to waste a great deal of imaging materials, such as carbon inks, in order to get a good single impression. There has also been an unfortunate tendency toward smudging or bleeding of the inks due to the use of liquid plasticizers in the inking layer. To compensate for absorption of the inking layer into the base of the transfer paper, heavier and more expensive papers have had to be used than would otherwise have been necessary.

It is, therefore, an object of this invention to improve the quality of transfer paper.

It is a further object of this invention to reduce the amount of imaging material on transfer paper required for a given intensity of transfer.

It is a still further object of this invention to reduce smudging in "one-time use" transfer paper.

It is an additional object of this invention to provide a transfer paper utilizing an inexpensive, lightweight, porous paper base.

In pursuit of these objects, applicant has discovered that a cured release layer consisting essentially of silicone rubber polymers in a film on a flexible foundation can be coated with a very thin imaging layer, utilizing semisolid, hot-melt plasticizers, to provide a nonsmudging transfer element of minimum weight for a given intensity of transfer.

The single figure of the drawing is a self-descriptive illustration of one embodiment of applicants' novel transfer element.

Many types of transfer layers can be used with applicants' silicone release film with reduction in amount of imaging content of up to 75% over transfer papers of the prior art. Nonmagnetic and magnetic inks, including wax, nonwax, and a combination of wax and nonwax

other rapidly evaporable vehicles to make the coating

Applicants' transfer paper can be used on any flexible foundation base commonly used for carbon papers, such as paper or film. Moreover, the silicone release film also acts as a barrier layer, making practicable the use of lightweight, porous, inexpensive papers. Kraft papers of 5½ to 7½ lb. weights have been found particularly satisfactory for use as a base with our silicone release layer. binders, can be utilized.

An organosilicone release film is formed on the flexible foundation base. This release layer is formed by dissolving a silicone compound ranging from 10% to 50%, by weight, in a solvent in the amount of 48% to 90%, and forming a slurry with a catalyst in the amount of 0.1% to 2%, which is coated on the base by conventional means. The amount of silicone compound will depend on the desired viscosity of the final mixture.

Preferably, the silicone compound is a mixture containing a major fraction of dimethylsiloxane polymers and a minor fraction of methylhydrogensiloxane polymers in a total of about 30% by weight, of the mixture, with approximately 70% xylene. Other solvent types of emulsion and organic silicones, including those dilutable by water, may be used. The disclosures included in Patent No. 2,588,393 are made of reference as teaching, in considerable detail, various combinations of polymers resulting in a silicone compound which is satisfactory for practicing applicants' invention.

The solvent may be an aromatic, such as toluene, or other rapidly exaporable vehicles to make the coating slurry. These vehicles include aliphatics, such as heptane, or chlorinated solvents, such as perchloroethylene. The catalyst can be any of those set out in Patent No. 2,588,393, but especially metal salts of an organic acid. The diorgano tin salt of carboxylic acid is preferred.

Our silicone release film is too thin to be measured accurately by standard micrometers, but may range in weight from substantially ½ oz. to 5 oz. per ream of 8½ x 13 in. paper. The amount varies with the smoothness and absorbency of the base stock being coated.

The coating can be air dried tack free or, preferably, it can be thermoset by oven-curing, for example, at 350° F. for 30 seconds. A 250° oven for 2 minutes is also recommended. The solvents are driven off and the silicone material is deposited in a dry film state.

The following are two examples of typical formulas for applicants' release coating which have proved quite satisfactory:

EXAMPLE 1

	Parts by weight
Organosilicone polymer	12.0
Solvent	87.8
Metal salt on an organic acid	0.2

EXAMPLE 2

Mixture of dimethylsiloxane silicone polymers and methylhydrogensiloxane polymers in xylene	33.3
Toluene	66.1
Diorgano tin salt of carboxylic acid	0.6

An imaging layer is formed on the silicone release layer. The imaging layer typically includes a binder or binders, semisolid plasticizers, and imaging material. In nonmagnetic inks, the binders may constitute, by weight, 20% to 60%, semisolid plasticizers 5% to 50%, and imaging material 10% to 40%. However, in magnetic types of inks, the imaging material, such as magnetic oxide of iron pigment, will constitute a larger percentage of the layer, such as 30% to 60%. Special reference will be made hereinafter to nonmagnetic soluble dyes of which the imaging material need not exceed 5% and the plasticizer 3% of the transfer layer, by weight.

In nonmagnetic inks utilizing a wax binder, vegetable waxes, such as carnauba, ouricury, etc., mineral waxes, such as montan, animal waxes, such as beeswax, and paraffin, or microcrystalline waxes, or combinations of the above, may be used. The amount of binder will vary depending on the intensity and smudge properties desired in the finished product.

In nonmagnetic inks utilizing nonwax types of binders, fatty acids and their derivatives are particularly advantageous, such as stearic acid and stearone.

With either wax or nonwax binders, nonmagnetic imaging materials such as carbon blacks, shale black pigments, nigrosine base, organic toners, inorganic toners, and lakes, may be used.

In nonmagnetic inks with either wax or nonwax binders, semisolid hot-melt plasticizers, such as lanolin, lanolin derivatives, petrolatum, and long-chain aliphatic glyceride, are utilized.

Applicants' silicone release layer has been found to have particularly unexpected results with nonmagnetic soluble dyes. Satisfactory transfer intensity is achieved with a minimum of dye never before contemplated. In such dyes, the binder constitutes from 75% to 95%, by weight, the semisolid plasticizer 3% to 20%, and the imaging material only 0.5% to 5%.

In nonmagnetic inks utilizing soluble dyes, either wax or nonwax binders, as heretofore described, or combinations of both, may be used. The imaging materials may be direct dyes, acid dyes, or base dyes of the soluble type. The same semisolid plasticizers are used as in other nonmagnetic types of inks.

The following are typical examples of nonmagnetic types of transfer layers:

EXAMPLE 3

	Parts by weight
Wax	28
Lanolin	37
Carbon black	35

EXAMPLE 4

Stearic acid	25
Stearone	28
Shale black pigment	25
Carbon black	10
Nigrosine base	2
Lanolin	10

EXAMPLE 5

Combined wax and fatty acid base	94
Lanolin	5
Nigrosine base	1

In each case taught above, the ink is ground in a steam-jacketed ball mill and applied to the silicone-coated side of the paper by a carbon coating machine in accordance with well-known procedures. The imaging coat may vary in thickness from 2 oz. to 1 lb. per ream of 8½ x 13 in. sheets.

Applicants' silicone release coating is also eminently satisfactory for magnetic type transfer paper. With magnetic type inks, the binder may range from 30% to 60%, the semisolid plasticizer from 5% to 20%, and imaging material from 30% to 60%. As imaging material, magnetic oxide of iron pigments are preferred. A typical formula for such inks would include:

EXAMPLE 6

	Parts by weight
Stearic acid binder	46
Semisolid plasticizer	10
Magnetic oxide of iron pigment	44

With magnetic inks, waxes, fatty acids and resins or combinations thereof are satisfactory binders. An example of a transfer layer utilizing such a binder is as follows:

EXAMPLE 7

	Parts by weight
Stearic acid	16.5
Stearone	14
Beeswax	4
Resin	3.5
Lanolin derivative	10
Blue dry dye	1
Magnetic oxide of iron pigment	51

In the preparation of a magnetic ink transfer layer, the same process of application and range of thickness of layer applies as in nonmagetic ink transfer layers.

It is obvious to those skilled in the art that the materials discussed above can be combined in an infinite number of formulas to provide transfer layers for use on applicants' silicone release film.

It was found that liquid plasticizers give a spotty effect when used with a silicone release layer, whereas semisolid plasticizers give a uniform coating.

Applicants' silicone release layer transfer paper has been found of particular usefulness in fanfolded forms, multiple bookkeeping rolls, magnetic ink character recognition applications, and optical character recognition devices.

We claim:

1. A pressure-sensitive transfer element comprising
   a flexible foundation,
   a cured silicone rubber polymer release coating adhered to said foundation, and
   a transfer layer separably adhered to said cured release coating, said transfer layer consisting essentially of a binder, a semisolid plasticizer and imaging material.

2. The pressure-sensitive transfer element of claim 1 wherein said silicone rubber polymer release coating consists essentially of a mixture of dimethylsiloxane polymers and methylhydrogensiloxane polymers.

3. The transfer element of claim 1 wherein said binder is selected from the group consisting of waxes, fatty acids and their derivatives, and resins.

4. The combination of claim 1 wherein said semisolid plasticizer is lanolin.

5. The transfer element of claim 1 wherein said flexible foundation is lightweight porous paper.

6. A pressure-sensitive nonmagnetic ink transfer element comprising
   a lightweight flexible base,
   a cured organosilicone rubber polymer film thermoset on said base in a weight of ½ oz. to 5 oz. per ream of 8½ x 13 in. base, and
   an imaging layer separably adhered to said base in a weight of 2 oz. to 1 lb. per said ream, consisting essentially of binder material 20% to 60%, semisolid plasticizers 5% to 50% and nonmagnetic imaging material 10% to 40%, by weight.

7. The transfer element of claim 6 wherein said organosilicone polymer film consists essentially of a major fraction of dimethylsiloxane polymers and a minor fraction of methylhydrogensiloxane polymers.

8. A pressure-sensitive ink transfer element comprising
   a foundation,
   a cured organosilicone film on said foundation, and
   a transfer layer releasably adhered to said film, said transfer layer consisting essentially of binders 75% to 95%, plasticizers semisolid at room temperatures 3% to 20% and non-magnetic soluble dyes 0.5% to 5% by weight.

9. The transfer element of claim 8 wherein said soluble dyes are selected from the group consisting of direct dyes, acid dyes and base dyes.

10. The transfer element of claim 8 wherein said binders are selected from the group consisting of waxes, fatty acids and fatty acid derivatives.

11. As an article of manufacture, the combination comprising

a flexible base,

a cured organosilicone rubber release coating adhered to said base, and

a magnetic ink transfer layer separably adhered to said cured release coating, said transfer layer consisting essentially of a binder, a semisolid plasticizer, and magnetic oxide of iron pigment.

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MURRAY KATZ, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,386,847 June 4, 1968

John J. McDermott et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, after line 72 insert -- binders can be utilized. --. Column 2, line 1, cancel "other rapidly evaporable vehicles to make the coating"; line 9, cancel "binders can be utilized"; line 30, "exaporable" should read -- evaporable --.

Signed and sealed this 31st day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents