

Nov. 10, 1959

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PRESSURE-SENSITIVE TRANSFER ELEMENT FOR
PLACING SMUDGE-RESISTANT MARKS
Filed Oct. 11, 1957

2,912,344

Fig. 1

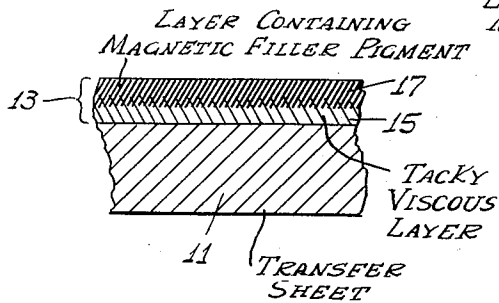


Fig. 2

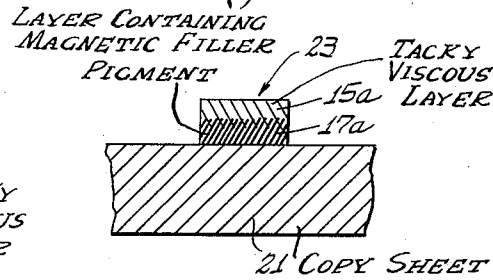


Fig. 3

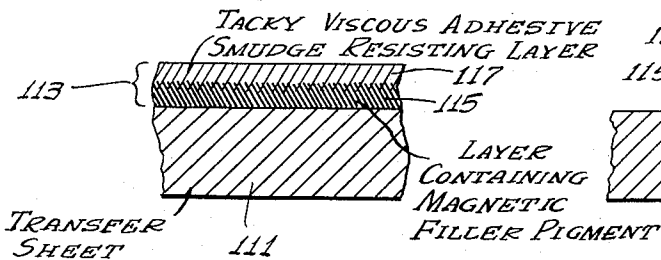
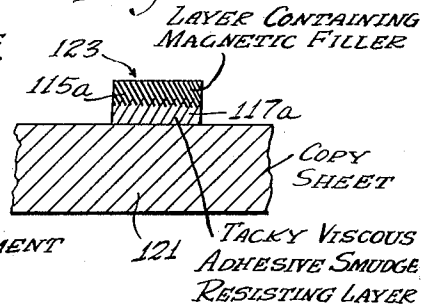


Fig. 4



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PRESSURE-SENSITIVE TRANSFER ELEMENT FOR PLACING SMUDGE-RESISTANT MARKS

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Application October 11, 1957, Serial No. 689,635

7 Claims. (Cl. 117—36)

This invention relates to transfer writing and particularly to the placing of marks and indicia by means of printing or writing pressure or a type blow, acting through a pressure-sensitive transfer sheet of the carbon paper type.

Transfer sheets of the carbon paper type have, of course, been known and used for many years. Lately, however, the placing of various types of record marks on copy sheets or cards to be handled and sensed by data processing equipment has become a matter of increasing interest, and the use of carbon paper sheets or typewriter ribbons as the medium for placing spots of the required properties has been suggested, one such suggestion appearing in the patent to Mumma, No. 2,744,031.

It has been found, however, that most of the pressure transfer layers, as currently prepared, are lacking in certain respects when an attempt is made to adapt them to data processing use. While the marks made are of adequately permanent nature considered in the sense of ordinary carbon copy use and will remain sufficiently legible under most conditions, it has been found that there is a slight tendency to smudge and spread if the marked sheet is handled a great deal, or used with the ordinary sheet or card feeding and handling equipment encountered in data processing machinery. When this smudging occurs, the reliability with which the mark can be automatically sensed is severely impaired, even though the impairment is sometimes comparatively slight by visual standards.

It is an object, therefore, of the present invention to provide a transfer element of such character that the transferred spot or image when formed will be substantially proof against smudging and such that the marked card or sheet will pass readily through ordinary handling equipment without the spot's sustaining any change sufficient to affect the accuracy of the sensing operation.

It is a feature of the present invention that the foregoing object is brought about by constructing the transfer sheet with a coating having at least two distinct layers or strata, simultaneously transferable from the carrier sheet in a substantially stenciling fashion, in which the stratus or layer nearest the carrier sheet is one having smudge-resistant properties. These properties may be due either to the absence from the layer of material to which the sensing device will react, so that even though the layer is partially displaced by handling, the displaced portion will not affect the sensing means, or to the character of the layer as being relatively hard and of low adhesiveness so that even though charged with a type of material to which the sensing device in question will react, it is not subject to ready displacement from the spot where applied, or both.

By reason of the placement of this smudge-resistant layer adjacent the carrier sheet, the image formed when the coating is transferred by pressure from the carbon paper to the copy sheet has an exposed surface which normal contact with handling devices does not seriously affect, so that, even though the sheet has been fed and handled, there is assured a reaction at the sensing means

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which is the same as that which the spot would have brought about in its freshly-transferred condition.

It will be readily appreciated that the principles of the invention can be applied whether the transfer layers are arranged to deposit spots suitable for sensing by photoelectric means, by magnetic means, by electrical contact means or by any other means sensitive to special material in the coating. Examples of various types will appear as the description proceeds.

In the drawing:

Figure 1 is a fragmentary diagrammatic section to an enlarged scale of a pressure-sensitive transfer element according to one form of the invention.

Fig. 2 is a fragmentary diagrammatic section to an enlarged scale of a copy sheet having thereon a spot formed by transfer from the element of Fig. 1.

Fig. 3 is a fragmentary diagrammatic section to an enlarged scale of a pressure-sensitive transfer element according to another form of the invention.

Fig. 4 is a fragmentary diagrammatic section to an enlarged scale of a copy sheet having thereon a spot formed by transfer from the element of Fig. 3.

Referring to the drawing, the transfer element of the present invention comprises a carrier sheet or strip 11 of paper, regenerated cellulose, cellulose acetate, or a similar thin, flexible material. On one surface of the sheet or strip 11 is formed a transfer coating 13 which is characterized particularly by the fact that it is made up of two strata or layers 15 and 17. The base layer 15 which lies next to the carrier 11 is the layer of material having smudge-resistant properties as hereinbefore mentioned and defined, and has placed on its surface the top layer 17 which is so constituted as to firmly bond to the base layer 15. Preferably the layers 15 and 17 are somewhat commingled adjacent their meeting surfaces to effect this bond, as indicated by the character of the cross-hatching in Fig. 1. However, this commingling is not essential and may be dispensed with providing an adequate bond is furnished in any suitable manner whereby the two layers may cling together and act as a unit. The nature of the composite layer 15, 17, i.e. the coating 13, is such that when the carrier 11 is impressed by a stylus or struck by a type, substantially all of the material of coating 13 in the area pressed or struck will be transferred to an adjacent copy sheet, leaving little, if any, on the transfer carrier. In other words, the coating has the property known in the art as "stenciling." The dual character of the coating 13 lends itself very well to this purpose since the layer 15 can be formulated to have a particular degree of adhesiveness for the carrier 11 to promote ready release under pressure without division of the coating, and the layer 17 may be formulated to have a more pronounced adhesiveness for the copy paper or receiving sheet normally used whereby to bring about the stenciling transfer. While, in most cases, it is preferable to have the layer 15 separate from the foundation 11 almost entirely, this is not always essential, and the term "stenciling" is understood to include cases where only a portion of layer 15 may be transferred, so long as it is sufficient to be effective for the purposes intended.

The Fig. 1 form is at present found most useful in systems employing visual reading, or for automatic photoelectric or magnetic sensing. For visual use or for photoelectric sensing a pigment having light reflecting or absorption value may be carried in the top layer 17, and the same would be so colored as to contrast sharply with the color of the cards or copy sheets on which it is to be used. Carbon black, for example, would serve effectively if used on light colored cards. The layer 15 is compounded with little or no pigment and so as to be substantially transparent.

When the pressure transfer has been effected in the

normal way, a product as seen in Fig. 2 will result, having an image 23, the pigmented layer 17a of which lies against and is adhered to a copy sheet 21, and the transparent layer 15a which is exposed at the surface so that the layer 17a is visible through it. It will be seen that the layer 15a protects the layer 17a effectively against being disturbed or spread. This is true whether the layer 15a is itself soft enough to be disturbed or spread by random contact with feeding or handling devices, or so hard as to be substantially impervious to such spreading, for, even though spread, it has no pigment to blur the effect of the mark, and the layer 17a remains in its original position precisely as placed. Whether the layer 15a is unencumbered with possibly deleterious pigment, or hard enough to resist displacement, or both, it is clearly compounded to be smudge-resistant as the term is defined above and used throughout this description.

Included in the term "pigment," of course, are pulverulent materials of all kinds whether used for their light response or not. In case the pigment is of magnetic particles, iron oxide for example, the image or mark 23 will be capable of being sensed by magnetic means, and in this instance the layer 15a may also be pigmented if desired, so long as the pigment used is non-magnetic and so that the layer 15a, relative to the magnetic sensing means to be used, will be fully smudge-resistant.

Examples of mixtures suitable for preparing a transfer sheet in accordance with Fig. 1 are as follows:

Example I

(Formula 1.) Base layer:

Ingredients—	Parts by weight
Carnauba wax.....	45.0
Ceresin	4.0
Lanolin	6.0
Mineral oil.....	20.0

(Formula 2.) Top layer:

Ingredients—	Parts by weight
Carnauba wax.....	45.0
Lanolin	6.0
Mineral oil.....	20.0
Carbon black.....	12.0

Example II

(Formula 3.) Base layer:

Ingredients—	Parts by weight
Carnauba wax.....	45.0
Ceresin	4.0
Lanolin	6.0
Mineral oil.....	20.0
Titanium dioxide.....	10.0

(Formula 4.) Top layer:

Ingredients—	Parts by weight
Carnauba wax.....	45.0
Lanolin	6.0
Mineral oil.....	20.0
Magnetic iron oxide.....	18.0

The above examples are formulated for use particularly in connection with carrier sheets of paper of a type known in the art as carbonizing kraft.

If a coating similar to Example I or II were to be used for placing on a smooth film carrier such as regenerated cellulose, then the base layer 15 would preferably have a slightly different formulation, e.g. as follows:

(Formula 5.) Base layer:

Ingredients—	Parts by weight
Carnauba wax.....	45.0
Ceresin	4.0
Lanolin	6.0
Mineral oil.....	15.0
Pigment (if any).....	10.0

In the case of application of the coating 13 to a relatively smooth, non-absorptive carrier, it may sometimes prove advantageous, in lieu of changing the formulation,

to pretreat the surface of the carrier with an extra conditioning coating as taught in U.S. Patent No. 2,508,725.

As a slight modification of the form of the invention shown in Figs. 1 and 2, in some instances it is found desirable to make only the base layer 15 of a normally transferable composition, while the top layer 17 is a tenacious, non-adhesive film which, of itself, would not transfer. However, the characteristics of the base layer 15 override those of the layer 17, and in transferring under pressure, the image portion of the layer 15 aids in the breaking away of a similar portion of the layer 17 and effects the adhesive attachment of the same to the copy sheet 21, perhaps either by pressure permeation of the image layer 15a into and through the layer 17a, or perhaps by marginal extrusion of the layer 15a into contact with the surface of the copy sheet 21.

Examples of mixtures operating in this fashion are as follows:

Example III

Base layer: Formula 1 as given above.

(Formula 6.) Top layer:

Ingredients—	Parts by weight
XYSG polyvinyl butyrate.....	30
Methanol	510
Nigrosine base.....	3
Carbon black.....	27

Example IIIA

Base layer: Formula 1 as given above.

(Formula 6a.) Top layer:

Ingredients—	Parts by weight
Carbon tetrachloride.....	100
Gilsonite	10

In this example the gilsonite acts not only as the binder and film former but as the coloring agent as well. However, additional pigment in reasonable amounts may be added to the formula if desired.

Example IV

Base layer: Formula 1 as given above.

(Formula 7.) Top layer:

Ingredients—	Parts by weight
XYSG polyvinyl butyrate	30
Methanol	510
Nigrosine base	3
Magnetic iron oxide	27

Example IVA

Base layer: Formula 1 as given above.

(Formula 7a.) Top layer:

Ingredients—	Parts by weight
Carbon tetrachloride	100
Gilsonite	10
Magnetic iron oxide	5

Fig. 3 illustrates a form of the invention in which a carrier sheet 111 carries a coating 113 including a base layer 115 and a top layer 117. The base layer 115 is so constituted that if and when exposed to normal abrasion and rubbing it will not be displaced or spread. This means that the mixture is compounded to be relatively hard and, in the dry state, to have a low degree of tackiness or of adhesiveness for most other surfaces.

When applied, it is rendered fluid by reason of heat or a volatile liquid dispersion medium, so that in drying and setting either by cooling or evaporation it attaches itself to the carrier sheet with tenacity sufficient for ordinary purposes, and will readily release therefrom. The base layer 115 includes a pigment intermixed therewith, which may be of the types heretofore mentioned which are sensed with light-responsive or magnetic means. In addition, in this form a properly compounded coating which includes electroconductive pigmentary material, e.g. silver powder, aluminum powder or finely divided

graphite, may be used to actuate eventually an electric sensing means, e.g. by closing a circuit between feeler brushes.

Inasmuch as the layer 115 is prepared so as to be hard and normally to have low adhesiveness for other surfaces, it will not ordinarily transfer particularly well by itself under most conditions. The top layer 117 is applied thereover and is so compounded as to be somewhat softer and more adhesive than the layer 115. It will be thoroughly connected to layer 115 in the manner heretofore explained for layers 15 and 17, and will provide a surface having sufficient adhesiveness to cause local pressure transfer to a receiving copy sheet, taking the adjacent portion of layer 115 with it. It is largely immaterial whether layer 117 has pigment or not, but pigment may be included for the purpose of intensifying the effect of the pigment used in the layer 115 if desired.

When pressure transfer has been effected in the normal way, a product as seen in Fig. 4 will result, having an image or mark 123, the pigmented layer 115a of which is on the exposed surface. This layer, however, is of such a hard, non-adhesive character that it will resist normal abrasion or contact displacement, and hence is smudge-resistant, even though containing the pigment to be sensed. The layer 117a next to the copy sheet firmly anchors the entire mark 123 in place.

If the pigment used to prepare the layer 115 is electroconductive, the layer is also preferably compounded using ingredients which will render the particles mutually contacting so that a continuing conductive relationship extends throughout the layer. Illustrative examples of mixtures suited to this purpose are as follows:

(Formula 8.) Base layer:

Ingredients—	Parts by weight
Carnauba wax -----	45.0
Ceresin -----	4.0
Lanolin -----	6.0
Mineral oil -----	15.0
Silver powder -----	12.0

(Formula 9.) Base layer:

Ingredients—	Parts by weight
Ethyl cellulose N7 -----	8.5
Methanol -----	91.5
Aluminum powder (450 mesh) -----	15.0
Water -----	3.0

Examples of mixtures suitable for preparing a transfer sheet in accordance with Fig. 3 are as follows:

Example V

Base layer: Formula 8 or 9 as given above.

(Formula 10.) Top layer:

Ingredients—	Parts by weight
Carnauba wax -----	45.0
Indopol H-300 (tacky viscous liquid mixture of polymerized butene isomers) -----	6.0
Beeswax -----	6.0
Mineral oil -----	20.0
Pigment, if desired -----	10.0 to 20.0

Example V represents a coating for producing spots 123 especially for sensing by electrical contact means.

Example VI

(Formula 11.) Base layer:

Ingredients—	Parts by weight
Carnauba wax -----	45.0
Ceresin -----	4.0
Lanolin -----	6.0
Mineral oil -----	15.0
Carbon black -----	12.0

Top layer: Formula 10 as given above.

Example VI represents a coating for producing spots 123 especially for sensing by light-sensitive means.

Example VII

(Formula 12.) Base layer:

Ingredients—	Parts by weight
Carnauba wax -----	45.0
Ceresin -----	4.0
Lanolin -----	6.0
Mineral oil -----	15.0
Magnetic iron oxide -----	18.0

Top layer: Formula 10 as given above

Example VII represents a coating for producing spots 123 especially for sensing by magnetic means.

The coatings of Examples V to VII are formulated for use particularly in connection with carrier sheets of carbonizing kraft, but the base layer formulation may be suitably varied as previously indicated to provide for use with carrier sheets of a smooth film if desired.

It will be understood that the examples given above are illustrative only and that various types of formulations may be employed within the scope of the present invention. For example, the compositions for the various layers may be based primarily on the type of oil and wax hot melt mixture which is conventionally used to prepare pressure sensitive transfer sheets, or may be compounded as resinous base mixtures rendered fluid for coating by being suspended in volatile solvent liquids as shown in copending applications Serial No. 503,830, filed April 25, 1955; Serial No. 411,272, filed February 18, 1954; and Serial No. 431,100, filed May 20, 1954, now Patent No. 2,810,661 granted October 22, 1957. In this connection it should be pointed out that, in general, the layers cast from a mixture of a resinous base suspended in volatile solvent, when properly compounded, perform especially well as the layer 115 which is designed to be resistant to mechanical spreading or displacement, or as the harder form of layer 17 typified by Formula 6, and that layers cast from a waxy or wax-oil hot melt mixture, when properly compounded, serve especially well as the transfer-promoting layers, although it will be understood that either type of layer can evolve from either base material by appropriate compounding.

Integration of the layers at the interface may be effected by various suitable treatments, such as the softening of the surface of the base layer by solvent treatment just prior to depositing the top layer, or preferably by subjecting the coated sheet to controlled heating just after the top layer has been placed.

From the foregoing description it can be seen that a novel coated, pressure-sensitive transfer element of the carbon paper type has been provided in which the coating comprises a base layer and a top layer which are simultaneously transferable in stenciling fashion from the carrier to an adjacent copy sheet, and in which the base layer, by virtue of its properties, either of lack of pigmentation effective on the sensing device to be used, or of hardness and resistance to mechanical displacement, is thoroughly smudge-resistant. A transfer element of this character is capable of producing novel images and spots in which the transfer sheet layers are inverted and which accordingly have a high degree of resistance to smudging so as to perform reliably in data processing equipment in spite of the feeding and handling to which they will normally be subjected prior to sensing.

The term "sheet" as used herein applies to flexible foundation membranes of any sort in coated or uncoated conditions, whether of limited length or of extended length, and in this connection includes items sometimes referred to as webs, strips, or ribbons.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

We claim:

1. As a new article of manufacture, a pressure-sensitive transfer element of the carbon paper type comprising a flexible foundation sheet having thereon two mutually

adhering layers which are simultaneously locally transferable from the foundation to a copy sheet in a substantially stenciling manner in response to a blow or pressure, the base layer adjacent the surface of the sheet being unpigmented and having readily releasable contact therewith and being of smudge resistant character, and at least the layer remote from the surface of the sheet being charged with pigment designed for automatic sensing.

2. As a new article of manufacture, a pressure-sensitive transfer element of the carbon paper type comprising a flexible foundation sheet having thereon two mutually adhering layers which are simultaneously locally transferable from the foundation to a copy sheet in a substantially stenciling manner in response to a blow or pressure, the base layer adjacent the surface of the sheet being unpigmented and having readily releasable contact therewith and being of smudge resistant character, and at least the layer remote from the surface of the sheet being charged with magnetic pigment.

3. As a new article of manufacture, a pressure-sensitive transfer element of the carbon paper type comprising a flexible foundation sheet having thereon two mutually adhering layers which are simultaneously locally transferable from the foundation to a copy sheet in a substantially stenciling manner in response to a blow or pressure, the top layer being charged with pigment designed for automatic sensing and the base layer adjacent the surface of the sheet having readily releasable contact therewith and being free of said pigment to provide a surface on the images transferred from said element for holding the imaged portions of the top layer transferred to said copy sheet in response to said blow or pressure.

4. As a new article of manufacture, a pressure-sensitive transfer element of the carbon paper type comprising a flexible foundation sheet having thereon two mutually adhering layers which are simultaneously locally transferable from the foundation to a copy sheet in a substantially stenciling manner in response to a blow or pressure, the top layer being charged with magnetic pigment and the base layer adjacent the surface of the sheet having readily releasable contact therewith and being free of said magnetic pigment to provide a surface on the images transferred from said element which will not give false indications even if somewhat disturbed, the base layer supplying an adhesive bond for holding the imaged portions of the top layer transferred to said copy sheet in response to said blow or pressure.

5. As a new article of manufacture, a pressure-sensitive transfer element of the carbon paper type comprising a flexible foundation sheet having thereon two mutually adhering layers which are simultaneously locally trans-

ferable from the foundation to a copy sheet in a substantially stenciling manner in response to a blow or pressure, the top layer including a pigment designed for automatic sensing, and being sufficiently tenacious and free from adhesiveness to be normally, of itself, non-transferable under a blow or pressure, the base layer adjacent the surface of the sheet having readily releasable contact therewith and being relatively soft and adhesive and therefore subject to possible displacement by physical contact, whereby to provide for local transfer of said top layer and carry the same with it at the time of its own transfer, and being unpigmented so as to prevent false indication if disturbed after it becomes the exposed surface of a transferred image.

6. As a new article of manufacture, a pressure-sensitive transfer element of the carbon paper type comprising a flexible foundation sheet having thereon two mutually adhering layers which are simultaneously locally transferable from the foundation to a copy sheet in a substantially stenciling manner in response to a blow or pressure, the top layer including a magnetic pigment, and being sufficiently tenacious and free from adhesiveness to be normally, of itself, non-transferable under a blow or pressure, the base layer adjacent the surface of the sheet having readily releasable contact therewith and being relatively soft and adhesive and therefore subject to possible displacement by physical contact, whereby to provide for local transfer of said top layer and carry the same with it at the time of its own transfer, and being unpigmented so as to prevent false indication if disturbed after it becomes the exposed surface of a transferred image.

7. A record-carrying element for use with automatic sensing equipment comprising a foundation sheet, and a local sensible carbon paper mark thereon containing two mutually adhering layers, the one nearest the foundation including a pigment designed for automatic sensing, and being sufficiently tenacious and free from adhesiveness to be normally, of itself, non-transferable under a blow or pressure, the other layer lying farthest from the foundation being relatively soft and adhesive and therefore subject to possible displacement, but providing for transfer to said foundation of said one layer and carrying the same with it at the time of its own transfer, and overlying and protecting the same thereafter, and being devoid of said pigment so as to prevent false indications if disturbed by physical contact.

References Cited in the file of this patent

UNITED STATES PATENTS

2,744,031	Mumma	May 1, 1956
2,762,715	Newman	Sept. 11, 1956
2,777,781	Kordig	Jan. 15, 1957