United States Patent

Ehrhardt et al.

[15] **3,653,944**

[45] **Apr. 4, 1972**

[54] **PRESSURE SENSITIVE IMAGE TRANSFER MEDIA**

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[22] Filed: **Dec. 11, 1969**

[21] Appl. No.: **884,202**

[52] **U.S. Cl.**.....**117/36.1**, 117/158, 106/31

[51] **Int. Cl.**.....**B41m 5/10**

[58] **Field of Search**.....117/36.1

[56] **References Cited**

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[57] **ABSTRACT**

Improved pressure sensitive image transfer media wherein the transfer coating is formed by the aged residue of a hot melt applied dispersion of a hard wax base material, fillers and pigments and a multi-component composite plasticizing oil.

8 Claims, 4 Drawing Figures

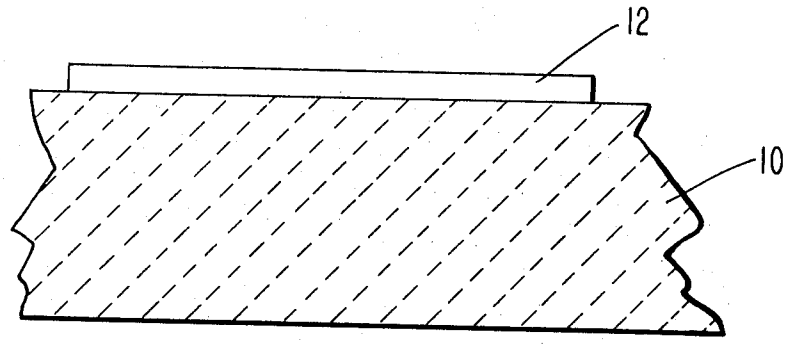
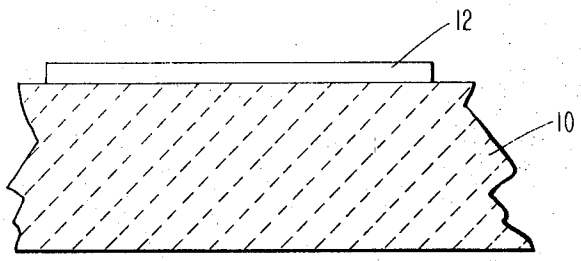


Fig. 1



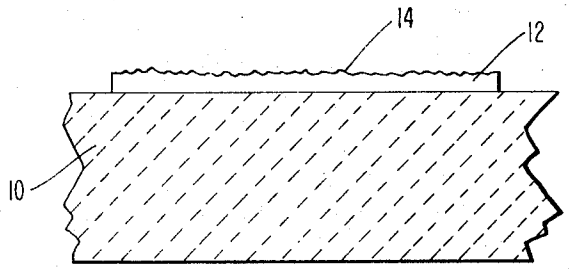
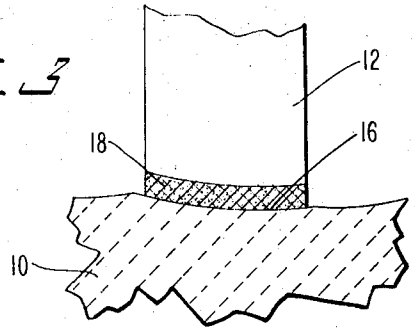


Fig. 2

Fig. 3



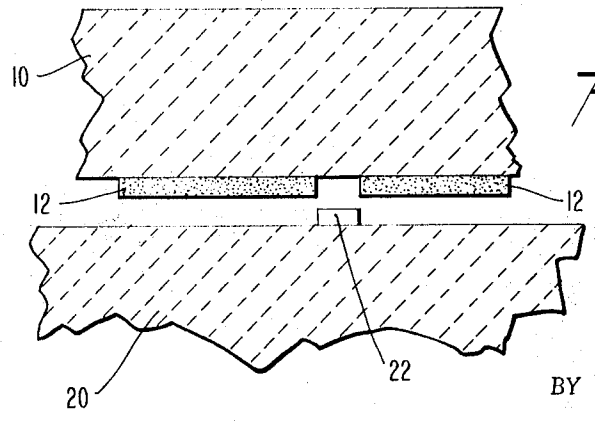


Fig. 4

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PRESSURE SENSITIVE IMAGE TRANSFER MEDIA

This invention relates to image transfer media and particularly to an improved pressure sensitive image transfer media adapted for multiple copy utilization.

The demands posed by the ever increasing utilization of high speed output printers in electronic data processing equipment and for multiple record copies have accentuated the need for transfer media of improved character and reduced cost. Carbon papers of the type wherein special transfer inks are coated directly on the carrier substrate are normally characterized by being somewhat dirty to handle or by an inability to produce multiple copies of satisfactory character depending upon the softness or hardness of the transfer film. Generally, if the transfer film is sufficiently soft to produce the required number of copies, it will be characterized by a tendency to smudge or cause undesirable offsetting on the underlying copy and to progressively lose definition of the transferred image in the higher order copies, all contributing to an undesirable appearance. Antithetically, if the transfer film is made sufficiently hard to avoid such undesirable characteristics, the number of satisfactory copies that may be obtained is markedly reduced. In addition to the foregoing, transfer sheets in the nature of carbonized bond products adapted to receive a transferred image on the obverse surface thereof generally require utilization of relatively expensive opaque and dense base paper as the carrier substrate to limit penetration thereof by the carbonizing ink as well as desirably possessing a highly smooth and fairly nonabsorbent surface for transferred image reception.

This invention may be briefly described, in its broad aspects, as an improved image transfer media characterized by carrier substrate having one surface thereof constituted so as to accept printed or transferred indicia and an improved transfer coating on its obverse surface incorporating a wax base material of poor or low oil retentivity and preferably of a hard rather than a soft material, filler and pigments of poor or low oil retentivity and a composite plasticizing oil constituted by a high viscosity oil component and an associated low molecular weight-low viscosity plasticizer component. Also included within the subject invention is a method of forming such improved product comprising the steps of forming the transfer coating material as a hot melt, applying the same to a selected carrier substrate at elevated temperatures and then aging the cooled coated product for a predetermined time prior to rendering the same available for use.

Among the manifold advantages attendant the subject invention is the permitted use of hot melt type coating equipment operating in a temperature range of below 230° F. in the application of the transfer coating to a wide range of carrier substrates including, for example, either relatively expensive high density substrates or low priced sheets such as ground wood papers to produce transfer sheets of superior appearance that are extremely clean to handle and which provides an increased number of satisfactory copies in multiple copy operation.

A particular advantage of this invention is the provision of a low cost transfer media particularly adapted for use in high speed output printers for electronic data processing machines to provide legible copies for six or even more part forms and possessed of sufficient stiffness and rigidity as to facilitate subsequent decollation, refolding and separation thereof. Transfer sheets fabricated in accord with the teachings of this invention permit the making and utilization of multiple part forms at markedly lower costs than those attendant the making of such forms with conventional interleaved one-time carbon paper with a concomitant avoidance of carbon sheet disposal and possible inadvertent disclosure of information disposed thereon.

A still further advantage of the subject invention is the provision of an improved carbonized bond transfer sheet having improved surface characteristics obtained without specialized preparation thereof that readily accepts printing or otherwise applied indicia with a minimum of transfer coating pick-off from the obverse side thereof.

Still further advantages of the subject invention is the provision of an improved low cost carbonized bond paper transfer sheet that is characterized by effectively, if not almost entirely, complete release of the transferred images to its mating sheet in response to selective pressure application whether by typewriter, high speed output printers of the types referred to earlier, pencil or even ballpoint pen and production of as many as six copy images that are sharper than those obtainable from conventional interleaved carbon papers and are singularly free from smudges and excessive blurs.

The object of this invention is the provision of an improved pressure sensitive transfer media having the advantageous properties set forth above.

Other objects and advantages of the subject invention will become apparent from the following specification which sets forth, in accordance with the mandate of the patent statutes, the principles of the invention together with illustrative examples presently contemplated by the inventors of carrying out and embodying such principles.

In the drawings:

FIG. **1** is a sectional view, on a greatly enlarged scale, of the transfer film constituted in accord with the principles of this invention as freshly applied to a carrier substrate.

FIG. **2** is a sectional view of the unit of FIG. **1** after aging of the applied transfer coating.

FIG. **3** is a greatly enlarged schematic sectional view of a portion of the transfer coating-carrier substrate interface; and

FIG. **4** is an enlarged schematic sectional view of image transfer from a transfer sheet constituted in accord with the principles of this invention.

Referring to the drawings and particularly to FIGS. **1** and **2**, there is provided a carrier substrate **10** which may be suitably constituted by an inexpensive ground wood paper or by more expensive papers having greater opacity, density and smoother nonabsorbent surface characteristics. Disposed on one surface thereof is a thin transfer coating or layer **12** comprising a wax base material of low oil retentivity, filler and pigments of low oil retentive character and a composite plasticizing oil constituted by a high viscosity oil component and an associated low molecular-weight low viscosity plasticizer component.

As noted above, the subject invention employs a hard wax base material characterized by poor or low oil retention as one of its major constituents, in contradistinction to conventional hot melt practice. One of such materials preferentially comprises a hard wax having poor oil retention characteristics constituting about 15 to 30 percent of the melt, desirably montan wax. Additionally, certain oxidized synthetic waxes having the necessary property of poor or low oil retention, such as Bareco. WB-2, WB-5, WB-7, may be used. For example, paraffin wax having having melting points in the range 132° to 155° F. may be substituted for montan wax in amounts up to 15 percent of the melt as can limited quantities of soft waxes, provided they are characterized by poor or low oil retentive properties.

The melt also includes appreciable quantities of a filler and white type pigment again of necessary poor or low oil retentivity and which may be of unitary or composite character. Suitable materials comprise Kaolin clay, barium sulfate, silica, calcium carbonate and titanium dioxide, all characterized by very low oil retention. Amounts of the white type pigment may vary from 10 to 25 percent of the melt and anatase form of titanium dioxide of 85–99 percent purity and with a particle diameter of 0.15 to 0.23 has been found to be particularly suitable. Amounts of the filler component may vary from 5 to 25 percent and Kaolin clay having a specific gravity of from 2.3 to 3.0 and an acidity in the range of 4.0 to 6.5 has been found to be suitable for use.

The coloring pigments, which suitably comprise about 4 to 10 percent of the melt may be any of the well known pigments such as carbon black, iron blue or other materials normally used in carbon paper. However, the pigments employed must again be characterized by poor or low oil retention properties

since, for example, use of a highly oil retentive carbon black results in a marked decrease in write performances and increase in the dirtiness of the sheet. In general, carbon blacks having a relatively large particle size are preferred and such material having a particle diameter (EM) of 70–300 milicrons, a Nigrometer blackness of 90–120 and an oil absorption of 20–80 cc./100 grams has been found to perform in a satisfactory manner.

The fillers and pigments of low oil retentivity thus constitute about 15 to 60 percent of the melt.

With the above described combination of low oil retentivity or absorbency materials, some of which have been employed in carbon paper inks in the past, we employ a composite plasticizing oil, one component of which functions as a plasticizer normally characterized by a high viscosity and poor flow properties, and the other component of which functions as a solvent characterized by a high boiling point and low viscosity.

The high viscosity plasticizer component of the composite plasticizing oil constitutes about 10 to 30 percent of the melt and may suitably comprise high molecular weights paraffinic or naphthenic base mineral oil having an API gravity of about 14 to 25 with a minimum flash point of 400° F. and a viscosity of at least 250 SU's up to about **2,500** SU's with a viscosity of about 1,000 SU's being the most satisfactory. By way of further and specific example, the Texas Company's Arcturus process oil, the American Oil Company's M-125 Industrial Oil and the Humble Oil Company's No. 5569 Ink Oil may be employed as the high viscosity plasticizer component.

The second component of composite plasticizing oil constitutes about 5 to 25 percent of the melt and may suitably comprise a low viscosity plasticizer in the form of a high boiling point solvent of essentially low molecular weight component having a viscosity of from about 35 to 60 SU's with a viscosity of about 45 SU's being preferred. Suitable high boiling point solvents may comprise oils that are predominantly paraffinic or naphthenic in composition having an API gravity of about 35–45 at **60°** F., a flash point of 220° **to** 285° F. (COC) and a distillation range with an initial boiling point of 400° F., a 50 percent point at 580° F. and an ASTM end period of 460°–660° F. By way of further and specific example, the American Oil Company's Mineral Seal Oil, The Humble Oil Company's Mentor NO. **28** and the Texas Company's 420–300 Oil may be advantageously employed as the high boiling point solvent constituent.

In the practice of the subject invention, the above enumerated materials, as for example in the following amounts

Component	A	B
Montan Wax	20 %	25%
High Viscosity Plasticizer	20%	15%
High Boiling Point Solvent	15%	20%
Carbon Black	5%	5%
Titanium Dioxide	20%	15%
Kaolin Clay	20%	20%

are combined and dispersed at temperatures below the boiling point of the high boiling point solvent (low viscosity plasticizer) component after which the hot melt is applied by conventional coating methods to any of the various carrier substrates mentioned earlier. When the ink melt is first applied to the carrier 10, the solidified transfer film 12 is quite smooth as shown in FIG. **1** but is very dirty and the write characteristics so poor as to render the product effectively completely unacceptable for any use. As the product is allowed to age or condition in either planar or roll form which usually occurs in 2–3 days, there is a definite migration of the low viscosity plasticizer component of the plasticizer oil into the fibers of the carrier substrate and a concomitant migration toward the exposed surface wherein the same evaporates into the air from the exposed surface thereof. Such migration produces a much harder transfer film surface that contributes to exceptional handling properties of the product and also results in the production of an irregular surface **14** that provides more tooth with which to promote adhesive joinder to the surface of the copy sheet.

FIG. **3** schematically illustrates the interface **16** of the transfer film **12** which is adjacent to the carrier sheet **10**. As there illustrated, a zone **18** directly in contact with the carrier tends to lose about 60 percent of its low viscosity low molecular-weight plasticizer component therefore rendering this interfacial portion of the ink film **12** considerably more brittle than it was previously. Since the low molecular weight low viscosity plasticizer component which has migrated into the carrier paper **10** acts as a lubricant on the fibers thereof, the adhesiveness of the ink film **12** to the carrier is considerably reduced. Upon execution of the form, the ink film **12** readily releases from the carrier **10** at the embrittled area described above. The high viscosity plasticizer component does not migrate significantly into the fibers, and therefore this component can be viewed as a residual plasticizer remaining within the ink film **12** itself.

The fact that this residual plasticizer remains in the ink film **12** system permits the transfer to be effected since, if only the low viscosity, low-molecular weight plasticizer were present in the film **12**, the write characteristics would be unsatisfactory, while if only the residual high molecular weight high viscosity plasticizer were present, the resulting film **12** would not only be very dirty to handle, but would provide very poor release from the carrier **10**.

As will be apparent from the foregoing, the composite plasticizing oil provides one component, i.e., the high viscosity - high molecular weight plasticizing oil, that functions as a residual plasticizer distributed essentially uniformly throughout the film and a second component, i.e., the low viscosity-low molecular weight plasticizer that selectively migrates in two directions to modify the surface characteristics of the film **12** both at its exposed surface and at the carrier interface to respectively promote a toothed dry surface and exceptionally complete release characteristics.

The above described migration characteristics are permitted by the use, in contradistinction to conventional practice of hard wax base material of poor oil retentivity such as Montan Wax as the principal hard wax component and oil carrying ingredient. Other waxes which have higher oil retentivity will not permit the necessary migration to occur, and therefore the carbon will not perform satisfactorily. Carnauba Wax, Polyethylene Waxes, Microcrystalline Waxes and the like, for example, do not permit this migration. Montan Waxes characteristically do not have exceptional oil holding power or gel strength, and therefore they function to permit the migration of the low viscosity oil as aging progresses. Certain oxidized microcrystalline waxes such as the Bareco WB-7 wax, also may be used because they also have a poor oil retentivity and straight chain paraffins may be used to extend the hard wax percentages.

Another characteristic feature of the improved transfer incorporating this invention is a phenomenon which may be described as "compression darkening." As shown in FIG. **4**, upon application of pressure to the coating, there is a compression of the ink film **12** which effects a noticeable darkening of the transferred images. Although not clearly understood, it is believed that due to the reflection of more light and to the spongy effect of the carbonized surface, the mass-tone of the coated sheet **20** appears to be much lighter in color than the actual dark mass tone of the compressed image **22**. Inasmuch as the imprinted image **22** has been subjected to pressure in being transferred to a receptive sheet **20**, there is actually produced a darker write than is found in the uncompressed untransferred ink film **12** on the original sheet **10**.

This effect is accentuated by the effectively complete release of the ink film **12** from the carrier sheet **10**.

Having thus described our invention, we claim:

1. An improved pressure sensitive image transfer medium consisting of

a planar fibrous carrier substrate and

a thin transfer coating selectively disposed on at least one surface thereof,

said transfer coating comprising the aged residue of a hot melt applied dispersion of

15 to 30 percent of a hard wax base material of low oil retentivity selected from the group consisting of montan wax and oxidized synthetic wax,

15 to 60 percent of fillers and pigments of low oil retentivity,

and a composite plasticizing oil including

10 to 30 percent of a high molecular weight, high viscosity oil selected from the group consisting of paraffinic and naphthenic base mineral oils having a viscosity of from 250 to 2,500 SUS and an API gravity of from 14 to 25, and

5 to 25 percent of a low molecular weight low viscosity migratable oil selected from the group consisting of paraffinic and naphthenic oils having a distillation range with an initial boiling point of about 400° F., a 50 percent point at about 560° F. and an ASTM end point of about 460°–660° F. and having a viscosity of from about 35 to 60 SUS.

2. The image transfer medium as set forth in claim **1** wherein

the portion of the transfer coating

selectively dispersed at the carrier substrate interface is of embrittled character.

3. The image transfer media as set forth in claim **2** wherein

the exposed surface of the transfer coating is essentually dry and of roughened character.

4. The image transfer media as set forth in claim **1** wherein said hard wax base material is Montan wax.

5. The image transfer media as set forth in claim **4** wherein pigments include a coloring pigment and a white pigment.

6. The image transfer media as set forth in claim **5** wherein said filler and white pigments are selected from the group consisting of Kaolin clay, barium sulfate, silica, calcium carbonate and titanium dioxide.

7. The image transfer material as set forth in claim **1** wherein said hard wax material is replaced in amounts up to 15 percent by weight of the melt by a member selected from the group consisting of paraffin wax having melting points in the range of 132° to 155° F. and soft waxes of low oil retentivity.

8. The image transfer material of claim **1** wherein said high viscosity oil has a minimum flash point of 400° F. and said low viscosity migratable oil has a flash point of 220° to 285° F. (COC).

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