Aug. 14, 1962 J. V. PESHIN ET AL 3,049,457

TRANSFER PAPER

Filed June 5, 1958

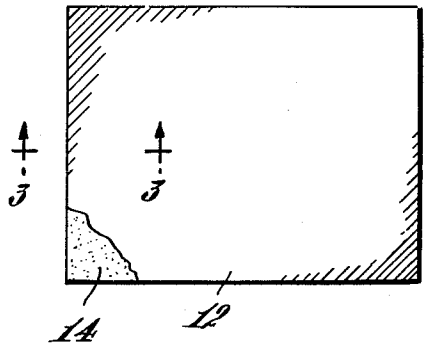


Fig. 1

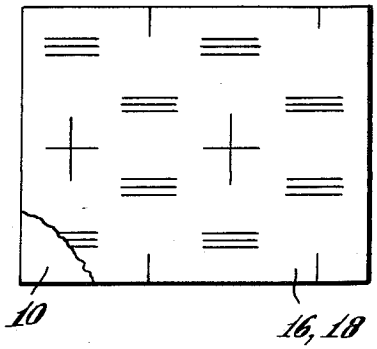


Fig. 2

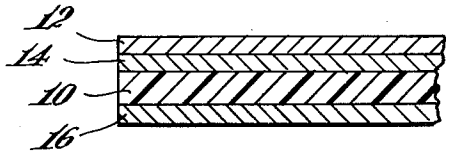


Fig. 3

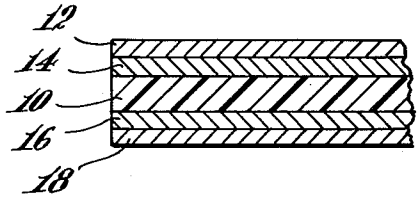


Fig. 4

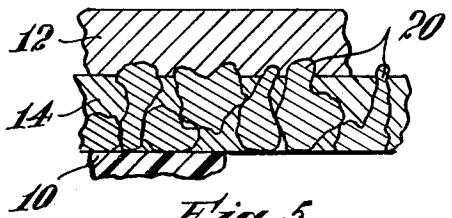


Fig. 5

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United States Patent Office 3,049,457 Patented Aug. 14, 1962

3,049,457
TRANSFER PAPER

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Filed June 5, 1958, Ser. No. 740,098
5 Claims. (Cl. 154—46.8)

This invention relates to transfer paper and has for its principal objects the following: to provide a plastic transfer sheet which can be packaged without adjacent sheets sticking together; to provide a plastic transfer sheet which will be sufficiently tractive to be readily manipulatable by the platen rolls of a typewriting machine; to provide a plastic transfer sheet which is extremely tough and will absorb multiple blows of a typewriter key on the same area without deleterious effect; to provide a plastic transfer sheet which has a transfer layer that will not flake or rub off during handling or become degraded during long storage; to provide a plastic transfer sheet which can be used repeatedly for several original and copying operations without noticeable difference in definition of the printed character; to provide a plastic transfer sheet which may be manufactured at a practical commercial cost and without special equipment and to provide a plastic transfer sheet which can be supplied in a single all-purpose or universal weight.

As herein illustrated, the transfer paper comprises a base or carrier sheet, a transfer coating and a binder layer attaching the transfer coating to the base sheet. The base sheet is a plastic sheet material; for example, polyethylene terephthalate of about ½ mil. thickness, having a high degree of impermeability, toughness and elasticity and one side of which is provided with a surface which provides traction and limits the build-up of static charge. The binder layer is in the form of a matrix of material which is substantially impervious to the migration of the constituents of the transfer coating containing occluded particles which are absorptive of constituents in the transfer layer. The bond between the binder layer and the transfer coating is proportional to the number of occluded particles in the matrix. The preferred constituents of the binder layer are polyvinyl butyral and silica gel, together with a small amount of coloring matter. The transfer coating may be a non-carbon composition of a pigment of suitable color together with a binder and oils and waxes for improving the contrast; it may be a conventional carbon paper ink consisting of pigments, oils and waxes or it may be a plastisol, consisting of resin, plasticizer and coloring matter.

The invention will now be described in greater detail with reference to the accompanying drawings wherein:

FIG. 1 is a plan of the top side of the transfer sheet, showing the transfer coating with a part broken away to show the underlying binder layer;

FIG. 2 is a plan of the bottom side of the transfer sheet showing the tractive coating with a part broken away to show the base sheet;

FIG. 3 is an enlarged section taken on the line 3—3 of FIG. 1;

FIG. 4 is a similar section of modified structure; and

FIG. 5 is a fragmentary section of the binder layer to much larger scale showing the distribution of the silica gel particles therein.

As herein illustrated, the transfer paper is comprised of a base or carrier sheet **10**, a transfer coating **12** and a binder layer **14**, connecting the transfer coating to the base in such fashion that the transfer coating will not degrade during storage, flake or rub off prior to use and will provide for several transfers of substantially the same intensity from the same area.

To obtain the foregoing characteristics and others, which will appear hereinafter, the components of which the several layers are made will now be described.

The carrier sheet **10** (FIG. 3) is a flat film or ply, as distinguished from paper, of oriented polyethylene terephthalate sold under the trade name of "Mylar." The material is available in sheets, rolls and tapes with the following specifications:

(1) Thickness: .00025" to .0075".
(2) Specific gravity: 1.39 to 1.40.
(3) Tensile strength: 16,827 to 27,900 p.s.i.
(4) Break elongation: 70–130%.
(5) Bursting strength: 45 p.s.i. Mullen (for .001" film).
(6) Water absorption: Less than 0.5%.
(7) Water vapor permeability: 110 g./100 m.²/hr. (for .001" film).
(8) Resistance to heat: Up to 300° F.
(9) Resistance to cold: Down to —80° F.
(10) Thermal coefficient of linear expansion, 70–120° F.: 15×10^{-6} in./in./°F.

For the purposes of this invention, a carrier sheet of "Mylar" .00025 to .0015 inch in thickness has been found to be most suitable because it can be procured and processed at a practical cost.

The binder layer **14** is preferably a formulated resin adhesive applied from a solvent system. A typical formula is:

(1) 7.5 parts polyvinyl butyral resin.
(2) 4 parts of silica gel.
(3) 2 parts of oleic acid-nigrosine dye-fat.

In the above formula, part (1), which is a polyvinyl butyral resin is B76–1, Shawinigan Resin Co., having a low viscosity and a low hydroxyl content. Other polyvinyl resins such as polyvinyl acetal and polyvinyl formal may be substituted for B76–1 with suitable formula adjustments. Under part (2) above, the silica gel used was Davison Chemical Company's Syloid 244, which is a porous, pure silica gel. Other porous, pure silica gels, such as Monsanto's "Santocel" may be used. Under part (3), oleic acid and nigrosine base dye are combined to form a dye-fat which tints the binder layer and the carrier sheet. Sulphonated castor oil, castor oil fatty acid and other similar oils may also be used to form the dye fat with nigrosine base dye or other base dyes.

An alternative formulation may be:

(1) 50 parts cyclicized rubber.
(2) 5 parts silica gel.
(3) 3 parts dye-fat.
(4) 100 parts toluol.

In part (1) above, we have used Pliolite S–7 which is a thermoplastic copolymer of cyclicized rubber. The other parts correspond to those described in the previous formula.

The binder layer **14**, as formulated and applied to the base or carrier sheet **10**, provides a matrix having a thickness in the order of .0001 to .00016", in which there are distributed particles of silica gel 20 (FIG. 5) of irregular size and shape, which are predominantly of a larger size than the thickness of the matrix, so that portions of the particles project upwardly from the surface of the matrix forming tooth. The resinous composition, which constitutes the matrix, is substantially non-porous and is impervious to the oils, waxes and other components of the transfer coating and hence resists migration thereof from the transfer coating into the binder layer. This slows down degradation of the transfer coating sufficiently so that even over long periods of time the transfer paper does not lose its definition. The projecting portions of the silica gel particles are rough and porous and they operate to hold the transfer coating both by clinging of the latter

to the irregular exterior surfaces of the particles and by penetration of the coating into the pores of the particles which are highly absorptive. The combined effect of the irregular shape and absorptive properties of the particles is to anchor a transfer layer which is of sufficient thickness so that the paper can be used a number of times with good original or copy even though impressions are made several times over the same area and to prevent flaking or chipping and therefore cleaner use.

Other inorganic absorbent material of low density and having an affinity for the oil constituents of the transfer coating may be employed in lieu of the silica gel.

The transfer coating **12**, as applied, is in the order of .0002" thick and is variously referred to in the trade as "carbon ink" or "dope," which contains in the case of conventional practice carbon waxes and oils; in the case of "carbonless dope," molybdated and tungstated toners, waxes, oils and solvents; and in the case of plastisol or organisol, "dopes," resins, plasticizers and solvents.

Polyethylene terephthalate such as Du Pont's "Mylar" in sheet form caries a very high static charge which makes it so difficult to handle that it is not used extensively for manufacturing purposes. Another object of this invention is to overcome or at least minimize the ever present highly static charged condition of "Mylar" which has restricted its use. This is achieved by shielding that side of the plastic carrier sheet, which in the final article is to be the back side, by applying to it a layer or coating **16**, thus protecting the carrier sheet from direct rubbing contact, which contact would have induced a positive electrostatic charge upon the carrier sheet or by applying to the carrier sheet a layer or coating containing metallic constituents which will conduct away any accumulated positive electrostatic charge or by coating the carrier sheet with a layer or coating combining both of the foregoing static preventive characteristics. Preferably the coating **16** is comprised of polyvinyl butyral resin which affords sufficient tooth to minimize the intimacy of surface contact between sheets, which is conducive to static sticking and which also affords sufficient tooth to make the finished article tractable between the platen rolls of a typewriting machine or the like. The addition of the metallic component is optional. Further antistatic agents such as cationic materials can be added to the coating **16**. The tooth surface on the back side of the sheet also provides a suitable footing for retaining printing ink, such as may be desirably applied for the purpose of identifying and/or advertising and may incorporate a distinctive color. The anti-static coating is preferably applied with an etched gravure roll.

Optionally, the plastic carrier sheet may be chemically or mechanically etched to provide the desired tooth.

As illustrated in FIG. 4, the toothed layer **16** may be further coated with metallic ink **18** containing cationic materials such as fatty amines to improve still further the antistatic and antisticking properties. The metallic ink is a vehicle for the cationic material and has the added advantage of making the carrier sheet opaque.

In the preferred procedure, the antistatic traction treatment is first applied to the carrier sheet to facilitate its further manufacture.

As thus produced the transfer paper has a tough, elastic, substantially impervious plastic carrier sheet approximately .0005" thick, which has on one side a sufficiently toothed surface to be readily tractable in platen rolls and is free from static sticking, so that it can be handled during manufacture and use and which has on its other side a transfer coating, which may be an ordinary "carbon dope" or ink, a "carbonless dope" or ink or a plastisol or organisol "dope" or ink, which ink or "dope" is so bonded to the carrier sheet that it will not flake off or rub off and which has sufficient depth to afford multiple use of original or copying operations.

The invention thus far has been described in its application to the manufacture of transfer paper, however, it is within the scope of the invention to manufacture a ribbon by the same method. For example, a ribbon to be used one or more times on a typewriter by mounting it for reversible movement on spools carried by the machine and when used up, thrown away. Preferably in the manufacture of the ribbon a plastic carrier sheet having a thickness of .001" to .0015", such as Du Pont "Mylar," is used and a somewhat heavier coating of the transfer material is applied by employing a binding layer which has a higher percentage of silica gel. For the manufacture of ribbons, transfer coatings may consist of "carbon dopes," "carbonless dopes" or plastisol and organisol "dopes."

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

We claim:

1. A transfer paper comprising a carrier sheet, a transfer coating and a binder layer attaching the transfer coating to the carrier sheet, said binder layer comprising a matrix substantially impervious to migration of the components of the transfer coating and particles having one end embedded in the matrix and the other end projecting into the transfer coating distributed throughout the matrix, said particles being predominantly of larger dimensions than the thickness of the matrix.

2. Transfer paper comprising a polyethylene terephthalate carrier sheet, said carrier sheet having on one face an antistatic traction surface, a binder layer on the other side of said carrier sheet, and a transfer ink coating on said binder layer, said transfer coating including liquid components, said binder layer comprising a predominant amount of polyvinyl butyral matrix substantially impervious to said transfer coating and at least about 10% by weight of silica gel particles having dimensions predominantly larger than the thickness of said matrix and penetrating said coating.

3. A transfer paper as defined by claim 1 wherein the particles consist of porous silica gel.

4. A transfer paper comprising a polyethylene terephthalate carrier sheet, a transfer coating and a binder layer attaching said transfer coating to said carrier sheet, said transfer coating comprising a transferable colored mixture of waxy and oily materials, said binder layer comprising a predominant amount of a resin selected from the group consisting of polyvinyl butyral, polyvinyl acetal, polyvinyl formal, and cyclicized rubber, containing at least 10 percent by weight of porous silica gel particles embedded in said resin and projecting into said transfer coating sufficiently to bond said coating.

5. A transfer paper comprising a polyethylene terephthalate carrier sheet, a transfer coating and a binder layer attaching said transfer coating to said carrier sheet, said transfer coating comprising a transferable colored plastisol mixture of resin and plasticizer, said binder layer comprising a predominant amount of a resin selected from the group consisting of polyvinyl butyral, polyvinyl acetal, polyvinyl formal, and cyclicized rubber, containing at least 10 percent by weight of porous silica gel particles embedded in said resin and projecting into said transfer coating sufficiently to bond said coating.

References Cited in the file of this patent

UNITED STATES PATENTS

1,864,097	Sherman	June 21, 1932
2,337,737	Champion	Dec. 28, 1943
2,508,725	Newman	May 23, 1950
2,694,688	Hughes	Nov. 16, 1954
2,717,877	Vitalis	Sept. 13, 1955
2,776,235	Peck	Jan. 1, 1957