Dissolable Solid Coating Containing Pressure-Rupturable Capsules

Coating with Liquid Solvent-Containing Pressure-Rupturable Capsules

Supporting Web (Paper)

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This invention relates to a pressure-sensitive transfer record sheet, said sheet including a preferably porous supporting web, like tissue paper, having a first coating on a surface thereof, which first coating includes a profusion of minute pressure-rupturable capsules containing a liquid material which can be released by rupture of the capsules, and said first coating having applied thereon, and in contact therewith, a normally substantially solid second coating, which is soluble in the liquid material of the capsule contents and which second coating contains coloring material which is rendered sufficiently mobile by said liquid to render the second coating and coloring material transferable.

If the novel transfer sheet is placed, coated side down, on a receiving sheet, such as paper, and pressure is applied to the back uncoated surface of the transfer sheet by a marking instrument, the capsules are ruptured in those areas to which pressure is applied by the marking instrument, releasing the liquid contents thereof locally to form a paste of the second coating containing the coloring material which paste, by the applied pressure, which ruptures the capsules, is transferred to the receiving sheet, there to make a mark of the configuration corresponding to the areas to which pressure was applied. The supporting web, which was said to be porous in the preferable form of the invention, absorbs excess liquid which escapes from the ruptured capsules, so that the solvent effect of the released liquid will not spread sideways in the color-containing coating, thus keeping the transferred mark, or marks, definitely delineated.

In the preferred form of the invention, the coloring material is a dye, such as azo-oil-blue-black "B," which has been dissolved together with a chlorinated rubber in a suitable solvent such as diethyl-benzene, carbon-tetra-chloride, dichloro-ethane, toluene, and xylene, or mixtures thereof. Suitable chlorinated rubber may be obtained in a solid powder under the name of "Parkon," manufactured and sold by the Hercules Powder Company, having its principal office in Wilmington, Delaware, of the United States of America. This chlorinated rubber is mixed with a sufficient amount of solvent and coloring material to form a coating material with the necessary viscosity to enable it to be coated over the first coating of capsules. The capsule coating may be made according to the process described in United States Patent No. 2,800,457, which issued on the application of Barrett K. Green and Lowell Schleicher on July 23, 1957, and in which is disclosed a process whereby water-insoluble materials may be microscopically encapsulated in a hydrophilic-colloid wall-forming material, the capsules so made being adapted to be applied as a dispersion to a supporting web. The capsule coating is first applied to the supporting web and dried, and, thereafter, the chlorinated rubber and accompanying coloring material is coated thereover and allowed to dry, such coatings being applied by any of the well-known coating procedures such as rolling, brushing, spraying, or spreading it out with a blade or an air-knife. A preferred embodiment of the invention will be described with reference to the drawing, which shows the novel transfer sheet in a diagrammatic cross-section, greatly enlarged, to portray the relative placement of the layers on the supporting web.

The drawing shows a supporting web of paper having, as a first coating, the pressure-rupturable capsules overlaid with the second coating of dissolvable solid material carrying, or consisting of, coloring material.

In the preferred embodiment of the invention, a supporting sheet of tissue paper, such as that used as a supporting web in carbon transfer sheets, has applied thereto a coating of a liquid dispersion of microscopic solid-walled capsules, each capsule being pressure-rupturable, by pressures encountered in marking and printing, and each capsule containing a readily-evaporable solvent liquid of the monohardened type. The capsules are made, as disclosed in the patent, in an aqueous medium, en masse, by the process to be described. Keeping the ingredients at 50 degrees centigrade, 20 grams of gum arabic is dissolved in 160 grams of water, and into this is emulsified 80 grams of diethylbenzene. A second sol is made of 20 grams of pork skin gelatin, having its isoelectric point at pH 8, and 160 grams of water. The emulsion and the sol are then mixed together and diluted with water, by the drop-by-drop addition thereof with constant stirring, until coacervation of the polymer material has been initiated. Coacervation is a separation out of the aqueous mixture of a colloid-rich phase, which deposits on the individual droplets of diethylbenzene as seed points. The coacervation by water-dilution is continued until the desired amount of colloid material has been deposited around the droplets. At this point, the diethylbenzene droplets each are coated with a colloid-rich liquid wall of the complexes formed by interaction of the gum arabic and gelatin molecules. The resulting aqueous dispersion of liquid-walled capsules then is cooled, to gel the gelable components of the polymer material, so that the liquid walls become solid, and the capsule walls then may be hardened by a substantially water-insoluble and able to withstand drying temperatures that formerly would have softened them. The hardening is brought about by treating the dispersion of solid-walled capsules with an aqueous solution of formaldehyde, such being accomplished by pouring in about 20 grams of a 37%, by weight, solution of formaldehyde in water, adjusted to pH 9 to 11, with an accompanying adjustment in the pH of the whole dispersion to that range, the hardening taking, at least, about ten minutes. Enough water is added to or removed from the resulting capsule dispersion to obtain the desired coating viscosity, and the aqueous dispersion of capsules then may be coated on a supporting sheet of tissue paper and dried by any of the known procedures of hot gas or hot roller drying, enough of the coating being applied so as to leave a coating thickness of about .0006 of an inch. The second color-containing coating then is applied and dried. The novel transfer sheet so made, when placed coated side down upon a paper receiving sheet, will be responsive to the marks of an applied writing instrument such as a pen, a pencil, or type, and be evidenced by the rupture of the capsules in the coating next to the supporting paper or plastic film. This rupturing releases the diethylbenzene solvent to form a paste with the materials of the color coating directly in contact therewith, the so-formed paste being transferred, by the same pressure which causes the rupture of the capsules, to the receiving sheet.

It will be appreciated that the novel transfer sheet is smudge-proof under ordinary handling conditions and remains so until the capsules are ruptured selectively by the selectively-applied marking pressures, whereupon a
pasty or semi-liquid condition of the color coating is brought into being, which causes transfer of a relatively large amount of material to the receiving sheet without smudging.

A number of solvents have been named for the capsule contents, but any comparable liquid-volatile solvent may be used.

If the coloring material is a dye that is soluble in the liquid expelled from the capsules, it is carried by such liquid into the fibers of the receiving sheet, if such sheet is of a fibrous nature such as paper, whereas, if the colored material is an insoluble pigment, the pigment would be left on the surface of the copy sheet and there be subjected to smudging action. In the event the transferred binder is of a protective material, such as the chlorinated rubber, it may keep the transferred pigment from smudging. If it happens that the receiving sheet is of a non-absorbent nature, the evaporation of the solvent expelled from the capsules will leave the dye dispersed and encased in the chlorinated rubber, and the dye will not be subjected to smudge by any shearing forces applied thereto. There may be selectively substituted for the azo-oil-blue-black-“B” dye in whole, or in part, any other oil-soluble dyes of proper tinctorial power, alone or in combination, such as Sudan III and Rhodamine “B” base, such being well-known and readily-available ink-like dyes.

In addition to using the transfer sheet with a paper copy sheet, it may be used with non-porous sheets, such as the polymer film-forming sheets made of cellulose-acetate, vinyl acetate, cellulose nitrate, and copolymer materials of similar characteristics.

What is claimed is:

1. A pressure-sensitive transfer sheet having on a surface thereof an undercoating and an overcoating, said coatings being in contact, the undercoating including a profusion of microscopic pressure-rupturable capsules, each capsule containing a liquid solvent, and the overcoating including a normally solid mixture of a marking material and a binder, the mixture being soluble in the solvent, the capsules and the mixture being present in such a ratio that when the transfer sheet is laid on a receiving surface, the capsules may be ruptured in selected areas, by pressure applied to the back of the transfer sheet by a marking instrument, to release enough solvent to make a paste of the marking material and binder in those areas, the pressure transferring the thus-formed marking paste to the receiving surface.

2. A pressure-sensitive transfer sheet, including a base web of paper having, on the surface thereof, an undercoating and an overcoating, the undercoating including a profusion of microscopic pressure-rupturable capsules, each containing a volatile liquid solvent, and the overcoating including a solid deposit obtained by drying a liquid coating onto said undercoating, the liquid coating being a solution of a solid marking material and a solid binder, said dried coating being soluble in the encapsulated liquid solvent, and said solvent being expressed from the capsules by rupture thereof when marking pressures are applied to the back of the transfer sheet by a marking instrument in contact with the receiving sheet, the liquid from the capsules causing a paste to form by solution of the overcoating in juxtaposition thereto so that it is easily transferred to the receiving sheet by the same pressures by which the capsules were ruptured.

3. The transfer sheet of claim 1 in which the overcoating is an oil-soluble dye mixed with a chlorinated rubber binder, and being formed into a paste by liquid solvent expressed from the capsules.

4. The transfer sheet of claim 1 in which the marking material is a solid pigment not soluble in the binder or encapsulated solvent.

References Cited in the file of this patent

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<thead>
<tr>
<th>Patent Number</th>
<th>Invention Description</th>
<th>Date</th>
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<tbody>
<tr>
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<td>Green</td>
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