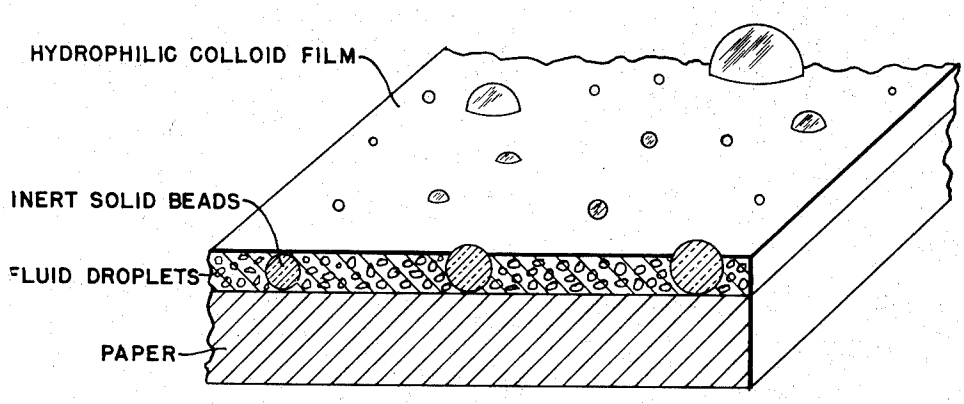
Oct. 13, 1953 R. W. SANDBERG 2,655,453

MANIFOLD SHEET HAVING A CRUSH-RESISTANT TRANSFER FILM

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MANIFOLD SHEET HAVING A CRUSH-RESISTANT TRANSFER FILM

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1 Claim. (Cl. 117—36)

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This invention relates to a manifold sheet having a crush-resistant rupturable film containing printing fluid, and more particularly pertains to such in which minute particles of hard, solid inert material are scattered in the film to prevent the crushing of it by broadly applied pressures encountered in storage or in ordinary handling as distinguished from the locally applied pressures of printing or writing. Before the use of such manifold sheets in printing or marking operations, they are commonly stacked in a pile or bound together in some manner which brings each film surface in contact with an under sheet on which a copy is to be made. In the product of this invention the hard, solid particles are scattered evenly and widely throughout the film so as to prevent the film from being crushed by the aforesaid broadly applied sort of pressure which is encountered in such storage or handling.

The drawing is a diagrammatic representation, on a large scale, of the record material of the invention.

In the manifolding art it is customary to provide two or more base web sheets each having, at least on one surface of the sheet, a film of transferable marking material or a film containing transferable marking material, so that printing or other marking pressures will transfer the marking material to an underlying sheet. Such printing or marking pressures are ordinarily very great, amounting to 100 pounds or more per square inch where the type or marking instrument is applied. This contrasts with the much lower average pressure encountered in storage where a maximum of 20 pounds per square inch may be expected.

This invention is particularly useful in connection with the kind of manifold sheets which contain microscopic marking-fluid inclusions in a rupturable film, such as are disclosed in United States Patent No. 2,374,862, which issued on the application of Barrett K. Green, and United States Patent No. 2,548,366, which issued on the application of Barrett K. Green and this applicant, Robert W. Sandberg. Those patents disclose manifold paper having on one side thereof a film, derived from a hydrophilic colloid material, having dispersed therein fluid droplets or inclusions containing marking material, or fluid droplets of marking fluid itself. When such sheets are stored in a stack under pressure or otherwise are subjected to prolonged heavy pressure the film, being made of easily rupturable material such as gelatin, may break down and release part of the fluid. This will cause discoloration or smudging of the adjacent sheet in the stack. The present invention is to prevent such an occurrence by providing throughout such a film a dispersion of hard, rounded, bead-like particles of inert solid material of such average diameter, and spaced apart in the film, so that storage and handling pressures supplied to broad areas of the sheets of a stack, so made, will not smudge the underlying sheets, yet will not prevent transfer of printing fluid to underlying sheets by the relatively great printing or writing pressures locally applied. The relatively large pressure of 100 pounds or more per square inch encountered at points of printing pressure or on lines of scribing or at places of other marking pressure is sufficient to deform the sheet so the film will be ruptured between the hard inert particles.

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It has been found that particles of an average diameter of one to three times the thickness of the film on a sheet, used in a quantity equal to ½% to 10% of the volume of the film, but preferably from 2% to 5% thereof, will give the necessary spacing to insure generally applied pressures applied to film will not crush it and, yet will not interfere with printing or marking sensitivity of the sheet. For instance, falling within the ranges noted above, in a film of .025 of a millimeter thick, rounded, bead-like spacing material having a diameter of .044 of a millimeter may be used in an amount of about 5% of the film by volume to get a spacing of the particles about five diameters apart, on the average, in the film.

Among the materials which are hard, solid, inert as to ordinary film-forming materials, marking dyes and ink materials, and which are preferred as crush-resistant fillers because of their whiteness or lack of color, may be mentioned glass beads, rounded white silica sand, casein particles and vinyl acetate polymer material particles. Each of these materials may be obtained in globular form or as well rounded beads or particles, such globularity or roundness being preferred so the film will have a smooth surface texture rather than a "sand-paper" surface texture.

Falling within the practical range, as to size, are particles which will pass a size 230 mesh United States standard sieve, and be retained on a size 325 mesh United States standard sieve. Smaller particles may be used, but they, preferably, should not be less in diameter than the intended film thickness, although they may be

greater in diameter than the film thickness by a factor of 3.

As an example, in making such manifold material, a sheet of paper .075 of a millimeter thick is coated so as to leave a dry film .025 of a millimeter thick with a coating made and applied in the following manner—one part, by weight, of animal gelatin, having an iso-electric point of pH 8 and a jelly strength of 275 grams as measured by the Bloom gelometer is mixed with three parts, by weight, of water heated to 150 degrees Fahrenheit. Into four parts, by weight, of gelatin solution there is dispersed, or emulsified, three parts, by weight, of a colorless solution of crystal violet lactone, which is 3,3-bis(p-dimethylamino-phenyl)-6-dimethylamino phthalide, mixed with an equal weight of bis(p-dimethylaminophenyl)-methane.

The solution of crystal violet lactone and the methane compound is made by dissolving one and one-half parts, by weight, of crystal violet lactone and one and one-half parts, by weight of the methane compound in 97 parts, by weight, of chlorinated diphenyl, which has a chlorine content averaging 48% by weight. This solution is heated to the temperature of the gelatin solution before it is added thereto and emulsified. To this emulsion, while still hot, is added three-tenths part, by weight, of glass beads having an average particle size of about .044 millimeter, that is to say, those that will be retained on a 325 mesh screen, specified above, but which will pass a size 230 sieve screen. The emulsion with the glass beads therein is applied to the paper, while still hot, or if allowed to cool, after reheating to 150 degrees Fahrenheit and is dried either under normal atmospheric conditions or by artificial means such as a hot air blast or a drying drum such as is commonly used in paper coating machines. The coating is applied in such thickness that, upon drying, the gelatin film will be approximately .025 millimeter in thickness. The glass beads will be spaced about five diameters apart on the average and will protrude more or less from the surface of the film and act to prevent any substantial contact between it and an underlying sheet in a stack of such sheets, until printing or writing pressures are applied, whereupon the type or marking instrument, being of small dimensions with respect to its contact with the paper surface will distort the paper so that the gelatin film will be ruptured locally and the film-enclosed droplets of printing fluid will escape onto the underlying receiving sheet.

Crystal violet lactone may be made by the process described in United States Letters Patent Re. 23,024, which is a re-issue of a patent which issued on the original application of Clyde S. Adams. The crystal violet lactone in the chlorinated diphenyl, when applied to a paper sheet sensitized by being coated with exposed particles of attapulgite clay, will turn to a dark blue color, as is disclosed in the aforesaid United States Patent 2,548,366, which issued on the application of Barrett K. Green and this applicant, Robert W. Sandberg.

Other dye-stuffs, such as analine dyes, oily pigmented inks, etc. may be used for the internal phase of the above emulsion to provide fluid inclusions of ink instead of a colorless color-reactant such as is provided by the use of crystal violet lactone. The type of marking fluid used in the film is not a critical factor in the invention and further examples of marking fluids or compounds will not be given here. However, reference is again made to Patent 2,374,862, which as before mentioned, issued on the application of Barrett K. Green, for manifold record material in which the film has inclusions of oily marking fluids containing such coloring or marking ingredients as carbon black and Sudan IV dye.

Although not as efficient in evenly dispersing the particle material, as is the method of mixing it in with the solution of the film-forming material, the particle material may be sprinkled on the surface of a coating of the film-forming material while still wet whereby it may sink and be embedded or implanted by virtue of its weight.

Although paper is the preferred and most widely used web material for use in making transfer or manifold sheets, pliable films of non-fibrous cellulose derivatives and synthetic resins also may be used.

The invention also is applicable to hot-melt types of manifolding transfer coating, such as ordinary wax carbon paper coatings by sprinkling the material over the surface of a coated sheet while the coating is in a melted condition.

What is claimed is:

Record material including, in combination, a paper sheet; and a coating on the sheet including a film of hydrophilic colloid material rupturable by printing pressures and having dispersed therein a profusion of microscopic droplets of printing fluid and also having dispersed in that part of the film not occupied by the droplets a plurality of beads of hard inert material having a diameter of from one to three times the thickness of the film and being spaced apart in the film a distance equal to about five times the average particle diameter, said particles constituting ½ per cent. to 10 per cent. of the solids of the film by volume.

ROBERT W. SANDBERG.

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