

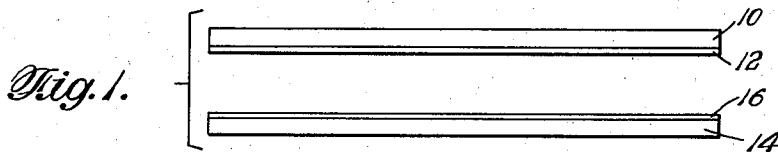
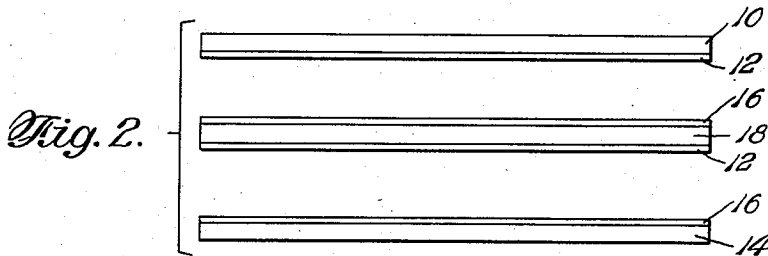
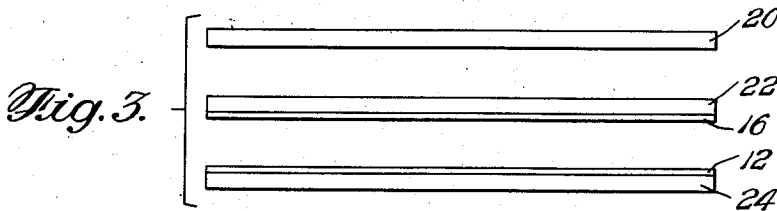
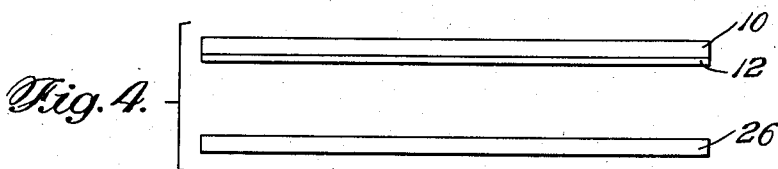
Jan. 20, 1959

E. R. GILL, JR

2,870,040

COATED MANIFOLDING SHEETS AND METHOD OF MAKING THEM

Filed Aug. 6, 1957



INVENTOR

Edwin R. Gill, Jr.

BY

KARL W. FLOCKS

ATTORNEY

1

2,870,040

COATED MANIFOLDING SHEETS AND METHOD OF MAKING THEM

Edwin R. Gill, Jr., Millerton, N. Y.

Application August 6, 1957, Serial No. 676,642

12 Claims. (Cl. 117—36)

This invention relates to systems of manifolding and more particularly to those systems or methods wherein two or more copies may be made by a single impression.

Heretofore the usual method of securing a plurality of copies at a single writing has been to provide a sheet of carbon paper, which has one or both of its surfaces coated with an ink which is capable of being transferred by contact pressure to the surface of a blank sheet of paper to produce a duplicate of the original writing. Such a method is universally used in connection with typewriting machines and is also very extensively used in connection with hand written documents of various kinds, for example, orders for goods, sales slips, shipping receipts, etc.

Such a method produces satisfactory copies or duplicates, but is open to the objection that carbon paper is expensive and its handling in order to place or arrange it in proper relation to the various sheets upon which copies are to be produced requires considerable time and soils the fingers.

This invention relates to a system or method wherein the use of the ordinary carbon paper is dispensed with and the back of the first or letter or ribbon sheet, upon which the original imprint or writing is made, is provided with a composition which contains preferably a colorless or nearly colorless composition containing some of the ingredients of an ink composition and a surface of the second or duplicate or copy sheet is provided with a composition which contains the complementary or other ingredients which unite with the inking ingredients on the first sheet, to form a visible ink on the surface of the second sheet upon the application of pressure to the front or face of the first sheet as by writing or drawing thereon, or by striking the same with the type bar of a typewriting machine, thereby producing, on the second sheet, a copy in ink of the matter written or printed upon the face of the original sheet.

Such systems have not been entirely successful for several reasons. The most notable reasons are that the ink forming ingredients are unstable and change spontaneously from an active to inactive condition after relatively short periods of time. Secondly, the coatings have not lent themselves to uniform application over the entire surface of the sheet, and in some cases the coatings have penetrated to too great a depth in the sheet.

It is therefore an object of the present invention to provide improved compositions for application to the sheets of paper which, when activated, yield an ink impression.

A further object of the present invention is to provide an improved duplicating process wherein a combination of the complementary inking compounds on the adjacent faces of two superposed sheets is effected on the face of the second sheet without the necessity of external heat or moisture to develop the color of the ink and the visibility of the writing.

A still further object of the present invention is to

2

provide a method of obtaining sheets which contain smooth homogeneous films of uniform thickness that are relatively stable and have a long shelf life.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a elevation showing a first and second sheet suitably prepared for carrying out the invention;

Fig. 2 is a similar view of a three-sheet arrangement;

Fig. 3 is a similar view of a modified three-sheet arrangement; and

Fig. 4 is a similar view of a two-sheet modification.

The present invention may be obtained in a number of ways, as by applying to the rear surface of the first sheet, that is, the sheet upon which the written impression is to be made by the typewriter or the pencil or pen of the user, and to the front surface of the second sheet, which, in use, underlies the first sheet, chemical reagents which are relatively stable apart, and when brought into intimate contact with each other, will react to form an ink. Each sheet is ordinarily made of paper and the reagents to be used will be described hereafter. The number of copies of the original writing can be increased as desired by treating the rear as well as the front surface of the second sheet, as shown in Fig. 2, and placing it in contact with a third sheet to the front face of which a reagent has been applied which is capable of reacting with that on the rear face of the second sheet to form an ink.

Referring to Fig. 1, the rear surface of the first sheet 10, which may be ordinary typewriter paper or writing paper preferably not highly calendered, is provided with a reagent 12, and the front surface of the second sheet 14, also of paper similar to that of sheet 10, is provided with a reagent 16, which when brought into intimate contact with reagent 12 will react therewith to form an ink.

In accordance with this invention, particularly desirable results have been obtained by applying to the rear surface of sheet 10 an alkaline gallate which has been acidified to a pH of less than 7. Sodium gallate acidified with gallic acid has been found to yield a particularly stable composition. The gallic acid, which is itself unstable, is remarkably stable when used to acidify the sodium gallate and acts as an excellent stabilizer for the sodium gallate, preventing absorption of oxygen from the air or enzymic hydrolysis. Other stabilizers may be used alone or in conjunction with the gallic acid. For example, a few drops of phenol added thereto inhibits hydrolysis.

The acidified sodium gallate crystallizes from an aqueous solution in extremely small colorless crystals. When paper is treated with such a solution, the crystals crystallize out and attach themselves to the fibers of the paper with a firm bond until loosened by the pressure of a pencil, pen or typewriter to cause local disengagement.

A solution should be made up that is saturated or near saturated as this promotes quicker crystallization, smaller crystal size, and prevents excessive penetration into the surface.

Gallic acid is not very soluble in water—one part requiring 100 parts of cold and 3 parts of boiling water for solution. The alkaline metal gallate is somewhat more soluble at room temperature than the acid.

It is important that the reagent does not penetrate to an ineffective depth into the fabric of the paper wherein the crystals will not be released onto the ink forming surface of the second sheet. A penetration onto the paper of 0.5 mil, more or less, is efficient and satisfactorily effective.

It is likewise important that the density of a gallate

reagent coating be uniform over the paper surface. If the coating is unevenly distributed, the copy will come out darker in some sections than in others.

These requirements have been met by applying the gallate reagent in several light coats rather than as a single heavier coat, drying each coat as applied at a temperature of from 150° to 200° F. Three such coats yield a perfectly uniform crystal deposit. The application of the gallate coating can be made at room temperature or the solution may be used warm.

The reagent for sensitizing the front surface or face of the second sheet is a non-crystallizable salt of iron. Particularly good results have been obtained using ferric lactate as the salt. A suitable coating can be obtained by dissolving ferric lactate in a small quantity of water, to which is then added glycerine and a gum, such as gum dextrine, gum arabic or gum tragacanth. Other gums can be used; however those mentioned were found most satisfactory. This mixture forms a gelatinous film which becomes integrated with the cellulose fibers of the paper. A single coat is sufficient.

Another satisfactory reagent may be made by combining one part, by weight, of lactic acid syrup with three parts of ferrous lactate crystals dissolved in 36 to 42 parts of hot water to which is then added the glycerine and gum in the desired proportions to yield a gelatinous film. Approximately 25 to 50% by volume of the glycerine is added, and enough gum to cause a detectable thickening. Approximately an ounce of gum per pint of solution was found satisfactory.

When the mixture of ferrous lactate and lactic acid in solution is filmed out on paper, a large area is exposed to the action of the air, and oxygen reacts to convert the ferrous lactate to ferric lactate in situ.

The ferric lactate, as well as the lactic acid tenaciously retains a certain modicum of water, which is necessary to the ink forming reaction. Neither can be crystallized. The glycerine assists in the retention of the solvent and to impart or improve the plasticity. The gum is added to promote the viscosity, thereby preventing too deep a penetration into the body of the paper. The viscosity should be adjusted to cause a penetration of the iron into the paper of at least about $\frac{1}{3}$ mil but not in excess of $\frac{1}{3}$ the thickness of the sheet.

When the first and second sheets are superimposed with the active surfaces in contact, no action takes place; however, when pressure is applied to the top sheet as in typing or writing, the fine silky crystals of the first sheet are released at the point of the distortion due to the pressure. These crystals react with the iron salt present in the surface fibers of the second sheet to generate an ink. The ink so produced is not a deposit on the surface of the paper but within the fibers of the second sheet. The color of the ink is black, having, initially, a dark blue or violet cast, which rapidly darkens. This ink is permanent and waterproof and not subject to bleaching by light.

In case it is desired to make more than one duplicate of the writing upon the first sheet 10, the rear surface of the second sheet 18 is provided with reagent 12, its front surface being provided with reagent 16, the reagents 12 and 16 of Fig. 2 being the same as those of Fig. 1 and applied in the same manner. In addition a third sheet 14 is provided which is identical with the second sheet 14 of Fig. 1 and has the same kind of reagent 16.

Fig. 3 shows the application of the invention to a three-sheet combination in which 20 is an ordinary sheet of paper without any ink-forming reagent, 22 is a sheet of transparent paper provided with the reagent 16 as previously described upon its rear surface, and 24 is a third sheet of paper having upon its front surface the reagent 12, applied as heretofore described.

In this modification, the bottom sheet is the chemical ink copy with the middle sheet receiving the mirror image on its back surface, which image will be seen in correct

aspect from the front due to the transparency of the sheet.

In Fig. 4, the first sheet 10 with the reagent 12 is the same as in Figs. 1 and 2, and the second sheet 26 is a sheet of paper within which the iron salt has been incorporated during its manufacture in sufficient quantity to produce the desired result.

In actual practice, in order to avoid the use of sheets of differing character, necessitating the work of keeping them in separate containers or drawers and putting them together as used, sheets may be used which are all alike, for example, the sheet 18 of Fig. 2 having reagent 16 on its front surface and reagent 12 on its rear surface. Such sheets may be superposed upon each other to produce the desired number of copies.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. In a transfer copying system, an original sheet provided with a uniform coating of an acidified solution of an alkali metal gallate dried thereon and a copy sheet provided with a gelatinous coating of an iron lactate salt, said sheets being arranged with the coated surfaces in contiguous relationship.

2. In a transfer copying system, an original sheet provided with a uniform coating of an acidified solution of an alkali metal gallate dried thereon and a copy sheet provided with a gelatinous coating of ferric lactate, said sheets being arranged with the coated surfaces in contiguous relationship.

3. In a transfer copying system, an original sheet provided with a uniform coating of an acidified solution of an alkali metal gallate dried thereon and a copy sheet provided with a gelatinous coating of ferrous lactate and lactic acid, said sheets being arranged with the coated surfaces in contiguous relationship.

4. In a transfer copying system, an original sheet provided with a uniform coating of an acidified solution of an alkali metal gallate dried thereon and a copy sheet provided with a gelatinous coating of ferric lactate, glycerine and a gummy material, said sheets being arranged with the coated surfaces in contiguous relationship.

5. In a transfer copying system, an original sheet provided with a uniform coating of an acidified solution of an alkali metal gallate dried thereon and a copy sheet provided with a gelatinous coating of ferrous lactate, lactic acid, glycerine and a gummy material, said sheets being arranged with the coated surfaces in contiguous relationship.

6. In a transfer copying system in accordance with claim 1, wherein the coating on said original sheet comprises three light contiguous coats.

7. A sheet of paper suitable for use in a transfer copying system having a uniform coating on one surface of an acidified solution of an alkali metal gallate dried thereon and a gelatinous coating on its other surface of an iron lactate salt.

8. A sheet of paper suitable for use in a transfer copying system having a uniform coating on one surface of a solution of sodium gallate and gallic acid having a pH less than 7 dried thereon and a gelatinous coating on its other surface of ferric lactate.

9. A method of preparing a transfer copying system which comprises applying a uniform coating of an acidified solution of an alkali metal gallate onto the rear surface of an original sheet, drying said coating, applying a gelatinous coating of an iron lactate salt to the upper surface of a copy sheet, and arranging said sheets whereby the coated surfaces are in contiguous relationship.

10. A method of preparing a transfer copying system which comprises applying onto the rear surface of an original sheet a light coat of a solution of sodium gallate acidified with gallic acid, drying said coat, applying a

5

second light coat of the same solution thereon, drying said coat, applying a third light coat of said solution thereon, drying said coat, applying a gelatinous coating of a substance selected from the group consisting of ferric lactate and ferrous lactate combined with lactic acid onto the upper surface of a copy sheet, and arranging said sheets whereby the coated surfaces are in contiguous relationship.

11. In a transfer copying system, an original sheet provided with a uniform coating of a solution of sodium gallate and gallic acid having a pH less than 7 dried thereon and a copy sheet provided with a gelatinous coating of ferric lactate, said sheets being arranged with the coated surfaces in contiguous relationship.

6

12. In a transfer copying system, an original sheet provided with a uniform coating of a solution of sodium gallate and gallic acid having a pH less than 7 dried thereon and a copy sheet provided with a gelatinous coating of ferrous lactate and lactic acid, said sheets being arranged with the coated surfaces in contiguous relationship.

References Cited in the file of this patent

UNITED STATES PATENTS

1,781,902	Gill	Nov. 18, 1930
2,168,098	Groak	Aug. 1, 1939
2,643,130	Kornei	June 23, 1953