

March 13, 1934.

W. C. GOOKIN ET AL

1,950,982

MANIFOLDING SHEET

Filed April 20, 1932

Fig. 1.

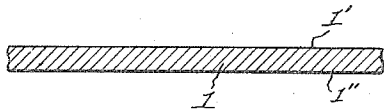


Fig. 4.

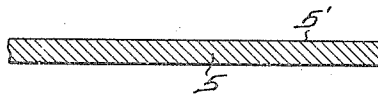


Fig. 2.

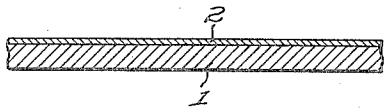


Fig. 5.

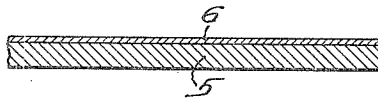


Fig. 3.

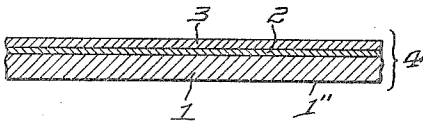


Fig. 6.

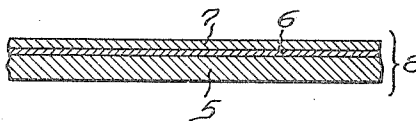
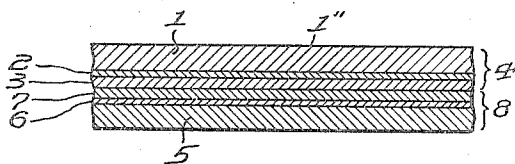


Fig. 7.



WITNESS

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1,950,982

MANIFOLDING SHEET

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Application April 20, 1932, Serial No. 606,390

11 Claims. (Cl. 282—26)

Our invention relates to systems of manifold-
ing and more particularly to those systems or
methods wherein the use of the ordinary carbon
paper is dispensed with and the back of the
5 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 con-
taining some of the ingredients of an ink com-
10 position and a surface of the second or duplicate
or copy sheet is provided with a composition
which contains the complemental or other in-
gredients which unite with the inky ingredients
on the first sheet, to form a visible ink on the
15 surface of the second sheet upon the applica-
tion 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 type-
writing machine, thereby producing, on the sec-
20 ond sheet, a copy in ink of the matter written
or printed upon the face of the original sheet.

Briefly, our invention relates to that type of
manifolding forming the subject-matter of Let-
ters Patent of the United States, No. 1,781,902,
25 granted November 18, 1930 to Edward R. Gill,
Jr. and the present invention comprises a sub-
stantial improvement therein.

We have discovered that it is very difficult,
if not impossible, to provide the surface of a
30 sheet of paper with a dry powder, such as gallic
or tannic or gallo-tannic acid. When the pow-
der is applied to a smooth calendered sheet too
little of the powder is retained on the sheet and
when the surface of the paper is rough or un-
35 even or uncalendered, then the quantity of the
powder retained on the sheet varies greatly in
different parts of the sheet. A little of the
powder may adhere to the high points on the
paper and much may be retained in the pits or
40 depressions in the surface of the paper, with the
result that the character of the duplicate writing
or printing or drawing which may appear on the
face of the second sheet will vary greatly, that
is to say, one letter may be too faint and the
45 next too dark, or like variations may appear
even in the same character.

We have also discovered that when such com-
positions containing inky ingredients are applied
50 directly to the surface of the paper in a liquid
state as a solution or emulsion, or as a damp
cream or paste, the paper absorbs the liquid or
a substantial part of it and the sheet becomes
saturated. It is difficult to dry such sheets for
practical usages, and, as a general rule, the paper
55 so impregnated, contains much more of the inky

ingredients than is necessary to produce a good
copy, and the sheets smutch under a relatively
light pressure. The ink mark formed on the
second sheet penetrates too deeply into the fiber
of the paper on the second sheet, or the writing
60 appears on the back of the first or original or
ribbon sheet. Moreover, the copy or duplicate
writing appearing on the second sheet may not
be clean or clear cut, that is to say, it is dif-
65 ficult to obtain a copy which is clear cut and
clean on the second sheet when the papers have
been saturated by the application thereto of the
solutions or emulsions carrying the inky compo-
nents.

It is to overcome these difficulties and objec-
70 tions and to attain uniform and dependable re-
sults that the present invention is particularly
directed.

Briefly, it is the object of this invention to
75 apply to the sheets of paper, the components
of an inky composition, in the form of a solu-
tion or emulsion or wet paste and to prevent
the paper from absorbing moisture therefrom by
first providing the surface of the paper with a
80 film or coating of water resisting material which
holds and supports on its surfaces the film con-
taining the components of the inky composition
and to preserve the film of inky material from
deterioration due to the absorption of moisture
85 therefrom by the sheet of paper.

A further object of this invention is to provide
the sheet of paper with a very thin homogeneous
film of substantially unvarying thickness and to
permanently retain said film thereon by a water
90 resistant carrier, film or coating disposed be-
tween the paper and the film containing the com-
ponents of the inky composition.

A further object of our invention is to pro-
95 vide a duplicating process wherein an instant
union or combination of the complemental inky
compounds on the adjacent faces of two super-
posed sheets is effected or formed on the face of
the second or copy sheet without the necessity
of any further application of external heat or of
100 moisture or steam to develop the color of the ink
and the visibility of the duplicate writing or
drawing.

A further object of our invention is to provide
105 the coating surfaces of the original and the copy
sheets respectively with smooth homogeneous
films of uniform thickness which are not affected
by the water absorptive properties of the paper
and wherein the components of the inky material
110 contained in the films on the coating sheets are

protected from deterioration due to contact with the air.

A further object of our invention is to provide the back of the original or face sheet of the film of such a character that some of the material thereof is transferred to the face of the second sheet by the pressure applied to the front of the original sheet, in writing or printing thereon, and to provide the face of the second sheet with a complemental film which is retained thereon and is not transferred to the film on the back of the first sheet, whereby the back of the original sheet remains clear, and the duplicate of the writing or other markings made on the first sheet appears in inky characters on the face of the second or copy sheet only.

Further objects of this invention will appear in the specification and claims below.

The drawing forming a part of this specification and in which the same reference characters are employed to designate the same parts, are diagrammatic merely and the dimensions are greatly exaggerated. Thus

Fig. 1 represents a sheet of paper in cross-section.

Fig. 2 represents the same sheet of paper provided with the water repellent carrier film and Fig. 3 shows or indicates the third step of making the original sheet and shows the film containing one part or fraction of an inky composition suitable for the practice of the processes and/or method superposed on the carrier film. Fig. 3 may be said to show in cross-section and diagrammatically, a fragment of a completed original sheet.

Fig. 4 indicates another piece of paper which may be similar to the paper shown in Fig. 1, but it is the paper used to prepare the second or copy sheet.

Fig. 5 indicates that this sheet of paper shown in Fig. 4 has been provided with a protective or carrier film and Fig. 6 indicates that upon this carrier film has now been spread a film of composition containing the complemental inky ingredients which, when united with the inky ingredients in the surface film of the sheet shown in Fig. 3 instantly forms an ink composition.

Fig. 7 shows or indicates, in vertical cross-section, the original or ribbon sheet shown in Fig. 3 superposed upon the sheet shown in Fig. 6 with the film containing the inky ingredients in contact with each other as the two sheets will be used in making a copy by writing with a pen or pencil or the type of a typewriting machine applied to the front or upper surface of the original sheet shown in Fig. 3.

Referring now to Figs. 1 to 3 inclusive, the highly calendered very smooth surface 1' of a sheet of paper 1, suitable for forming the original or ribbon sheet, is first preferably provided with a film 2 of water resisting or water repellent material or sizing, preferably containing a gum or casein. This film 2 is preferably applied by a suitable coating machine, although it may be applied by hand.

After this film 2 has dried, it should be of even thickness and provide a smooth upper surface, to which is next applied a film 3 containing preferably colorless materials which comprise one or more of the ingredients of an inky composition. This film 3 is also applied in a fluid or damp paste form, and to attain the best results, i. e., a smooth homogeneous film of uniform thickness, it is preferably applied by mechanical means, such as a good commercial coating machine. Since the

films we use in the practice of our invention are only from 5 to 10 thousandths of an inch in thickness, small variations in thickness are substantial in dealing with thin films.

Referring now to Figs. 4 to 6, to the smooth preferably calendered surface 5' of a sheet of paper 5, suitable for a second or copy or duplicate sheet, is applied a film 6 of water-repellent material, which may be a size like that forming the film 2 on sheet 1. After this sizing material has dried, there is applied thereto and thereon or thereover, a film 7 which contains inky or ink forming substances which, if mixed with the ink forming substance contained in film 3 of sheet 4 would form an ink. The completed, original or ribbon sheet 4 is shown in Fig. 3.

Since the compositions of which the carrier films 2 and 6 and the inky composition films 3 and 7 may be varied, we are setting forth below the formulae for six (6) compositions which we have found to be highly satisfactory for the purpose of the practice of our invention. These formulae are given letters respectively, so that they may be easily identified when referred to by letter below.

The formulae are as follows:

Formula A

	Parts
Glue or gelatine.....	2
Water.....	2
Magnesium chloride.....	3
Glycerine.....	4

Formula B

Ferric chloride.....	4 parts or
Ferric sulphate.....	4 parts or
Ferric potassium sulphate.....	4 parts
Magnesium chloride.....	4 parts
Glycerine.....	6 parts

Formula C

Gallic acid.....	1 part or
Tannic acid.....	1 part
Magnesium chloride.....	1 part
Glycerine.....	8 parts

Formula D

Sodium ferro-cyanide.....	1 part
Magnesium chloride.....	1 part
Glycerine.....	4 parts
Water.....	2 parts

Formula E

Casein.....	1 part
Water.....	12 parts
Ammonia.....	1 part

Formula F

Lanum, anhydrous, 33 to 50 per cent of the weight of B, C or D	135
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The proportions of the mixtures above given are by weight. The quantity of lanum to be used can only be indicated by stating it generally, that the quantity is from 33 per cent to 50 per cent of the weight of the compositions of Formula B, C or D with a slight reduction in the quantity of the glycerine from that given in the said formulae, for when lanum is substituted for the composition of Formula A, as will be disclosed below, the lanum might be considered as a substitute for the glycerine, or, from another angle, the glycerine of the formulae is replaced by lanum temperatured or softened with a sufficient amount of glycerine to make the lanum readily miscible with the other ingredients of Formula B, C or D.

The original or letter sheet

For the paper 1 of the original sheet 4, a paper having a smooth calendered surface should be employed and to it should preferably be applied first a thin film 2 of even thickness, preferably composed of the materials above specified in Formula E and in substantially the proportions given. It is preferably applied by the use of a coating machine in order to insure an even thin coating on the sheets. After the size has been applied it should be allowed to dry until the odor of ammonia disappears whereupon it forms a water-repellent film 2. When the film 2 is dry, then the film 3 is next applied thereto, preferably by a coating machine which insures the production of a film of uniform thickness and an even distribution of the material over the surface of the supporting film 2. For the film 3 we preferably use the composition of Formula C when a black ink copy is to be produced or Formula D when the copy is to be in blue ink. We preferably first mix the composition of Formula C, or of Formula D, dependent upon the color desired, with the composition of Formula A or of Formula F, using by weight, one (1) part of Formula A (or F) and two (2) parts of the composition Formula C (or D).

The second or duplicate sheet

For this second or copy sheet a suitable paper 5 is selected but it should have smooth calendered surface 5' and to this smooth surface is preferably applied a film 6 of size which may be and preferably is like the film 2 of the sheet 4, that is to say, the composition of Formula E. When this film 5 has dried, then a composition preferably Formula B is used, but composition of Formula B is preferably mixed with the composition of Formula A or F in the proportions by weight of one part of composition of Formula B to two parts of composition Formula A or Formula F and this is evenly spread as a coating 7 superposed on the film 6, and allowed to dry. After the sheets have dried, the composition sheets 4 and 8 are ready for use.

Method of manifolding

In order to obtain a duplicate, for instance, of the writing to be made on the uncoated surface 1" of the sheet 1, the sheet 4 is laid on the sheet 8 with the films 3 and 7 carrying the inky forming ingredients in contact with each other, something in the same way that sheets are arranged for placement in a typewriting machine, and the pressure on the surface 1" of sheet 4 by pencil (in writing) or the blow struck by the type of a typewriter forces the material 3 on sheet 4 immediately under the point of the pencil or the lines of the type, hard against the ink carrying film 7 of sheet 8. This pressure is applied only where the type or the pencil point is actually in immediate engagement with the paper. The pressure thus applied to the sheet forces some of the ink ingredients upon sheet 4 into intimate contact with the ink ingredients on sheet 8, and both being in a finely dispersed solution in the menstruum.

As comparing Formula A with Formula F, there are certain advantages connected with the use of the lanum. It makes the films 3 and 7 more sensitive; it retains the solutions of the inky ingredients; it substantially seals the film at the surface so that the surface of the film is dry to the touch but holds within itself the water

solutions, which are essential to the instantaneous formation of the ink. When the films are superposed and are subjected to the pressure as under a lead pencil in writing, the wet or damp inky ingredients of the letter sheet are forced into intimate contact with the damp ink forming ingredients in the film on the copy sheet and the duplicate writing instantly appears on the copy sheet only.

The glue or gum component of the copy sheet (Formula A) holds the film 6 firm on the film 5 of the copy sheet, particularly when the lanum (Formula F) be used in the film 3 on the original sheet 4.

While we have above described the preferred form of our invention, it will be understood that the process may be varied within reasonable limits without departing from the spirit and scope of the invention. Thus the composition of Formula A might be dispensed with in the making of either the letter or the copy sheet if the lanum (Formula F) is used therewith. But whenever lanum is mixed with the composition of Formula B or C or D, the composition of Formula E must be used to retain the sensitive film on the paper.

In making the copy sheets with an iron solution (Formula B mixed with the substance of Formula A), it may not be necessary to use the size Formula E, the water resisting size being in the composition so applied, but in making the original or letter sheets with the gallic acid solution, wherein the substance of Formula C may be mixed with that of Formula A or Formula F, it is necessary to use the size Formula E.

Since we have described several modified ways of making our improved manifold sheets with different materials having different chemical properties, it becomes necessary to group and generally define these different compositions and formulae in order to briefly refer to them in the claims.

Thus the composition of Formula A is generally a composition which gives body and adhesiveness or glueyness to the composition with which it may be mixed, the magnesium chloride therein is the hygroscopic material, and the glue or gelatine is the water retaining material which holds the composition firmly in place on the sheet and gives body to the mixture.

Formula B defines a composition containing the ferric salts as ink making ingredients, and these are complementary to the ink making ingredients of Formulae C and D. This composition is used with which to coat the copy sheets or second sheets or duplicates when admixed with either the adhesive composition (Formula A) or lanum (Formula F).

The composition of Formulae C and D are for use in coating the backs of the original sheets when admixed with compositions A or F. The inky ingredients therein react with the ferric salts to form inks of black and blue colors respectively.

The composition of Formula E is that which is first applied to the smooth surfaces of the paper to render the surfaces impervious to water. When applied to the paper it forms a water repellent or water resistant film upon which, when dry, is spread the films containing the ink forming ingredients. It supports the active superposed film. It prevents the absorption by the paper of the moisture in the active film and it is the sizing material mentioned in the claim.

The lanum of Formula F partakes of the nature of several of the ingredients above referred to.

If used instead of Formula A, it prevents the absorption of moisture from the active film by the paper. It constitutes a body making material, it is sufficiently adhesive to retain the films on the sheets, although not as tenaciously as the adhesives of Formula A and hence it is preferably used in the composition which is applied to the back of the original sheet whereby under the pressure of the pencil or type bar, small quantities of the film may be transferred from the composite sheet 4 and driven into the surface of sheet 8 to form an inky mark on sheet 8 and to leave the sensitive surface 3 of sheet 4 clean and without marks on it. It also well retains the solution of ink making ingredients in a moist or damp condition and to prevent the films becoming hard or brittle. In this respect its action is similar to that of the glycerine.

The lanum, when used, also appears to seal the exposed surface of the films and effectively retain the moisture within the film. When, however, the composition of Formula A is used in lieu of lanum (Formula F), then the ink forming ingredients of the film are still maintained in a damp condition (practically in a solution form) by reason of the hygroscopic characteristics of the magnesium chloride and of the glycerine.

By the use of the ingredients above specified in the manner described, the composition of the films is maintained in usable condition over relatively long periods of time with the inky ingredients in practically a solution form so that whenever the films are pressed together they instantly form a visible ink.

Instead of the size above described (Formula E) any other good surface size such as rosin size may be used but the size must be applied as a surfacing sheet or film and not as a tub size, the latter being a size mixed with the pulp during the process of making the paper.

Since in ordinary office practice it is common to use a colored sheet for the copy sheet and a white sheet for the original or ribbon sheet, it is desirable that the inky making ingredients in the film 3 on the back of the original sheet 4 be colorless, it is not so essential that the inky ingredients in the film 7 on the face of the copy sheet 8 be colorless, and the ingredients may be chosen to impart a pale color thereto, so that one may readily distinguish the copy sheets from the original sheets.

From the foregoing, it will be now apparent that the inky ingredients contained in the films 3 and 7 respectively, are kept at all times in a solution or a liquid or a damp form, so that when the complementary ink ingredients of the respective films are brought together under pressure, a visible ink is immediately formed, but neither the paper containing these films nor the films themselves are wet or damp to the touch for the carrier films 2 and 6 respectively hold the composition separated from the paper sheets 1 and 5 and the solutions of ink ingredients are within the body of the film when the water in the exposed surfaces of the films has evaporated.

Having thus described our invention, what we claim and desire to protect by Letters Patent of the United States is:

1. In a manifolding system, superposed contacting sheets, the contacting faces of which are provided, on one sheet with a solution of ink making ingredients dispersed in a moisture retaining medium and separated from direct contact with the sheet by a water-resisting film, and the other

sheet being provided with a solution of complementary ink making ingredients which, under pressure, will unite with the ink making ingredients of the film on the first-mentioned sheet to form an ink, and dispersed in a water retaining medium and separated from actual contact with said second sheet by a water resisting film.

2. In a manifolding system, superposed contacting sheets, the contacting surfaces of which are each provided with a film having a substantially dry surface and containing, in solution, ink making ingredients, the ink making ingredients in the film of one sheet being complementary to the ink making ingredients in the film on the other sheet, said films also containing a water-soluble gum.

3. In a manifolding system, superposed contacting sheets, the contacting surfaces of which are each provided with a film having a substantially dry surface and containing, in solution, ink making ingredients, the ink making ingredients in the film of one sheet being complementary to the ink making ingredients in the film on the other sheet, said films also containing lanum.

4. In a manifolding system, superposed contacting sheets, the contacting surfaces of which are respectively provided with a film having a substantially dry surface and containing, in solution, ink making ingredients, the ink making ingredients in the film of one sheet being complementary to the ink making ingredients in the film on the other sheet, one of said films also containing an adhesive ingredient, a hygroscopic ingredient and a water retaining ingredient.

5. In a manifolding system, a sheet of smooth calendered paper having a water resistant surface and a film containing ink ingredients superposed thereon, said film containing ink ingredients comprising a mixture of a ferric salt, a hygroscopic salt, glycerine, a gluey ingredient and water.

6. In a manifolding system, a sheet of smooth calendered paper having a water repellent surface and a film superposed thereon containing ink ingredients which react with the ferric salt to form an ink, said film containing ink ingredients comprising a mixture of said ink ingredients with a hygroscopic salt, glycerine, a gluey ingredient and water.

7. In a manifolding system, a sheet of smooth calendered paper having a water repellent surface and a film superposed thereon containing ink ingredients which react with the ferric salt to form an ink, said film containing ink ingredients comprising a mixture of said ink ingredients with a hygroscopic salt, glycerine and lanum.

8. In a manifolding system, a sheet of smooth calendered paper having a water-resisting surface and an even film containing ink ingredients superposed thereon, said film containing ink ingredients comprising a ferric salt, a hygroscopic salt, glycerine and water, and a cooperating sheet of similar material having on its face a film containing ink ingredients complementary to those in the sheet first above described whereby when the sheets are superposed with the respective films in contact, the pressure incident to writing on one of said sheets effects an immediate combination of the ink ingredients and only at the points where said pressure is so applied.

9. In a manifolding system, a sheet of smooth calendered paper having a water-resisting surface and provided with a thin coating consisting of a solution of ink-making ingredients, and a body making ingredient capable of absorbing and retaining water, and a second sheet of smooth cal-

ended paper also provided with a water-resisting surface and provided with a similar thin coating containing a solution of ink-making ingredients complementary to those contained in the film of the first above-mentioned sheet and also mixed with a body material capable of retaining the water of said solutions, said coatings providing substantially dry films of substantially uniform thickness and evenly covering said surfaces of said sheets, and in which the ink-making ingredients are retained in a moist condition and in which the exposed surfaces are dry to the touch.

10. In a manifolding system, a sheet of smooth calendered paper having a water-resisting surface and superposed thereon a film containing a water-resisting medium and a solution of some of the ingredients of an ink dispersed therein, a second smooth calendered sheet of paper similarly provided with a water-resisting surface and superposed thereon, a coating material containing the complementary ingredients of said ink also dissolved in water and dispersed in a water retaining-medium, said water-resisting surface being operative to prevent the water in said films from being absorbed out of the films by the sheets of paper upon which the films are carried, whereby when the sheets are superposed with the com-

plemental films of ink containing ingredients in contact, and when written matter is impressed on the outer surface of one sheet, the ink ingredients of contacting films are pressed into intimate relationship and immediately produce on the second sheet a duplicate in ink of the impressions as they are made on the first-mentioned sheet.

11. In a manifolding system, a sheet of smooth calendered paper having a water-resisting surface and an even film containing ink ingredients superposed thereon, said film containing ink ingredients comprising a ferric salt, a hygroscopic salt, glycerine and water, and a cooperating sheet of similar material having on its face a film containing ink ingredients which when pressed into intimate contact with the ink ingredients of the sheet first above described unite to form an ink, whereby, when said sheets are superposed with the films on the respective sheets in contact, the pressure incident to writing on one of said sheets effects an immediate union of the ingredients and only at the points where said pressure is so applied, to form a duplicate of said writing in ink on the other of said sheets.

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