

UNITED STATES PATENT OFFICE.

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MANIFOLD SHEET.

SPECIFICATION forming part of Letters Patent No. 376,764, dated January 24, 1888,

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To all whom it may concern:

Be it known that I, JACOB L. WORTMAN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in a Manifold Sheet, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention covers a manifold sheet coated with or containing an ink or dye, which sheet is more especially intended as a substitute for the ordinary "carbon" or lamp-black paper now in common use for producing duplicate copies, known as "carbon copies," which copies I will for convenience term "printed sheets."

Carbon-paper, as prepared ordinarily, is merely a mechanical mixture of lamp-black or soot ground with grease, which mixture, when applied to thin leaves of tissue-paper, forms a transferable coating thereon. This carbon-paper prepared in the manner described, or some similar method, gives, when used in the art of duplicating or manifolding merely an imprint of smut or soot, which is not as durable as the ordinary pencil-mark of the plumbago or graphite pencil. The particles of carbon or "carbon mixture" on a carbon copy are merely held lightly on the surface of the paper fiber, and by slight friction the text becomes fatally blurred or injured, thus rendering these carbon copies undesirable as a permanent record.

My improvement consists of a manifold ink-sheet having a coating or surface which, when transferred in manifolding, will not merely rest lightly on the surface of the printed sheet, but will be absorbed directly therein, so that it cannot intentionally or accidentally be rubbed off, like a pencil-mark, but will be incorporated into the paper, like ordinary writing-fluid. In other words, the vital distinction between my manifold ink-sheet and an ordinary carbon-sheet is that in the carbon-sheet the transferable surface does not dye, stain, or penetrate the printed sheet, but simply adheres to its surface, whereas in my manifold sheet the transferred coating enters, dyes, or stains the fabric or pores of the printed sheet, and consequently cannot be removed by rubbing without destroying the sur-

face of the sheet in the same manner as is done in erasing ordinary writing with a knife-eraser. To accomplish this permanent effect, I employ a transferable surface of ink, whereas the carbon surface is not an ink, but simply an insoluble pigment (carbon) mixed with grease to cause it to adhere to the surface of the printed sheet. The difference is obvious. "Ink," properly so called, becomes intimately absorbed by the fiber of the paper, while the marking medium with which it is compared is merely superficially laid upon the fiber. In the former case the nature of the composition causes it to become permanently fixed in the fiber. In the latter the permanence is matter of degree, depending upon other causes than the character of the composition, such as the amount of mechanical pressure exerted in applying it. Another important distinction is due to the matter of fluidity. While, as presently shown, the coating upon my manifold sheet is sufficiently dry to avoid smearing upon mere contact, it is yet sufficiently moist or permeating in its character to become absorbed by the fiber of the "printed" or transfer sheet upon being pressed against the latter. In the case of the carbon-paper the coating is absolutely dry, and its use does not require the characteristic of being permeant.

By the term "ink," as used throughout this specification, I mean a dye or coloring-matter of any kind in solution, or a pigment of any description held in suspension in a vehicle of sufficient fluidity (or a mixture of the two) which, when applied to the surface of a sheet, will enter the fibers or pores of the same and carry with it the dye, pigment, or coloring-matter, thereby leaving a mark or stain incorporated with the fiber or composition of the sheet. In case that portion of the ink which constitutes the dye, pigment, or coloring-matter is held in the solid state on the surface of the manifold ink-sheet by means of soap or other suitable material not in itself a vehicle of sufficient fluidity to carry the coloring-matter into the fiber of the paper, then, for the production of an ink as above described, it is necessary to supply a suitable solvent, which may be applied to the printed sheet either before or after printing, generally the latter.

I prefer to use as a vehicle any of the non-

drying oils, and as a dye I prefer aniline, although other dyes can be used. To make the ink, the aniline is ground with sufficient oil to make a paste, which is applied in a thin layer to one surface of the material to be used as the manifold sheet. When the ink is on the sheet, it should be sufficiently dry to avoid smudging the printed sheet, and at the same time should be sufficiently moist to print freely. I find from actual experience that the ink or dye can be held in a suitable manner on my manifold sheets in a variety of ways, and I will illustrate some of the methods, the products of which I have successfully employed on the type-writer and otherwise in the production of manifold copies.

The base or agent employed in holding the ink or dye on the surface of my manifold ink-sheet may be either an oil or an oil-bearing material, a soap or mixture containing soap, with or without the addition of glycerine, or what is known as "glycerine-jelly." I do not limit my invention, however, to these particular materials, as I consider that my invention and claims cover them and their equivalents, broadly.

I will now describe the production of my ink-sheets from a mixture of the dye or solid ink with saponaceous materials. I dissolve the dye or ink—for instance, aniline—in a suitable solvent—such, for example, as water, acetic acid, equal parts of chloroform and alcohol, &c. To this solution I add a small quantity of glycerine soap, to which, if necessary, I may add a certain quantity of pure glycerine. These compounds are thoroughly mixed and carefully ground with the ink or dye materials, with or without a mordant, as herein mentioned. I apply this mixture to the material to be used as the manifold sheet; but in any case the quantity of materials employed must be regulated according to the chemical nature of the ink or dye and the sheet upon which it is to be placed or applied.

In the use of oil as the medium for holding the ink on the surface of the manifold ink-sheet it acts as a vehicle for carrying the dye or dye and pigment into the fibers of the printed sheet, while at the same time the oil produces a pliant and non-drying manifold ink-sheet. The oil and aniline may be combined with oxychloride of tin, with tannic or gallic acid, or with other like mordants, the object of these agents being to permanently fix the aniline or dye in the fiber of the printed sheet. The dampening incidental to taking

press copies from the printed sheet dissolves the surface ink or dye, and the mordant, if such be used, and thus a permanent dye or ink is produced in the fibers of the printed or written sheet.

It is obvious that the sheet when printed may be used without further treatment, or the ink therein may be further fixed or developed by being simply dampened or moistened with water, alcohol, or any solvent of the dye or coloring-matter used without press copying. In case the printed sheet is fixed or developed by the ordinary process of press-copying, it is evident that at the same time a good second or press copy can be obtained, the intensity, color, and nature of this press copy depending entirely on the composition of the manifold ink-paper employed. Another detail feature of this improvement is that by the use of a suitable pigment in combination with a soluble dye one can obtain more durable copies than by any manifold process known to me. For example, by the combined use of permanent pigments—such as ultramarine, cobalt, carbon, Berlin blue, chromes or galates of iron, or like materials, mixed with anilines or other dyes—I have obtained a good press copying printed copy, while at the same time the printed copy has as a base a pigment which forms a permanent ink.

In the event that the material used for the manifold sheet is so porous that the ink will pass through it the sheet can be backed with a non-porous coating, or by a non porous auxiliary sheet pasted thereon.

What I claim as my invention is—

1. A sheet for manifold copying carrying a coloring substance and a permeant vehicle therefor, as set forth.
2. A sheet for manifold copying having a facing containing the constituents of a soluble coloring substance and a permeant vehicle therefor, as set forth.
3. A sheet for manifold copying carrying the elements of a soluble color and an insoluble color and a permeant vehicle therefor, as set forth.
4. A sheet for manifold copying having a transferable printing-surface and a backing sheet, as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

J. L. WORTMAN.

Witnesses:

J. C. STODDARD,
J. H. CLEAR.